From:	Kyle Tisdel
To:	rklein@blm.gov; NMLeasesalecomments@blm.gov
Cc:	mames@blm.gov
Subject:	January 2017 Lease Sale, Draft EA Comments
Date:	Friday, September 2, 2016 1:19:12 PM
Attachments:	FFO Jan 2017 Lease_Draft EA_9.2.16.pdf

Mr. Klein,

Please find the attached comments on the Draft EA for the January 2017 Lease Sale (exhibits will be filed electronically in a subsequent email), filed on behalf of Amigos Bravos, Center for Biological Diversity, Chaco Alliance, Diné CARE, Friends of the Earth, Great Old Broads for Wilderness, Natural Resources Defense Council, Rainforest Action Network, San Juan Citizens Alliance, Sierra Club, and WildEarth Guardians. Should you have any questions please do not hesitate to contact me.

Regards.

_____

Kyle J. Tisdel
Attorney, Climate & Energy Program Director
Western Environmental Law Center
208 Paseo del Pueblo Sur, #602
Taos, New Mexico 87571
Ph: 575.613.8050

tisdel@westernlaw.org

www.westernlaw.org

Defending the West

_____

Northwest
1216 Lincoln Street
Eugene, Oregon 97401
(541) 485-2471

Rocky Mountains
103 Reeder's Alley
Helena, Montana 59601
(406) 443-3501

Southwest
208 Paseo del Pueblo Sur #602
Taos, New Mexico 87571
(575) 751-0351

Defending the West www.westernlaw.org

Western Environmental Law Center

September 2, 2016

Sent via Electronic Mail

U.S. Bureau of Land Management
Farmington Field Office
Attn: Ross Klein
6251 College Blvd., Suite A
Farmington, New Mexico 87402
Email: rklein@blm.gov
Email: NMLeasesalecomments@blm.gov

Re: Draft EA Comments – Farmington Field Office, January 2017 Oil & Gas Lease Sale

Dear Mr. Ames:

The Western Environmental Law Center, along with Amigos Bravos, Center for Biological Diversity, Chaco Alliance, Diné Citizens Against Ruining Our Environment, Friends of the Earth, Great Old Broads for Wilderness, Natural Resources Defense Council, Rainforest Action Network, San Juan Citizens Alliance, Sierra Club, and WildEarth Guardians (together "Citizens Groups"), submit the following Draft Environmental Assessment ("EA") Comments regarding the Bureau of Land Management ("BLM") Farmington Field Office ("FFO") January 2017 Oil and Gas Lease Sale, including four parcels and approximately 843 acres of Federal mineral estate in the Greater Chaco area, south of Counselor, NM.

These four parcels all involve Navajo Allotment lands, with a federal mineral estate administered by the FFO. These and similar parcels have already been deferred or postponed *three times* by the agency, having recognized the need for additional consultation and baseline landscape level review. These parcels were first included in the original group of 26 parcels proposed for BLM's October 2014 oil and gas lease sale, DOI-BLM-NM-F010-0154-EA, and were then amongst the five parcels included in the January 2015 lease sale, DOI-BLM-NM-F010-2014-0227-EA. Most recently, three parcels were included in the October 2016 lease sale, which was postponed this spring. Notably, these parcels were earlier "deferred until after the FFO Mancos Shale/Gallup Formation RMPA/EIS alternatives have been developed." Oct. 2014 Lease Sale EA at 14. Then, with the January 2015 lease sale, the parcels were deferred because "additional time is required to evaluate public comments regarding potential drainage, tribal consultation, and environmental justice." BLM Press Release, December 30, 2014. While the Mancos Shale Resource Management Plan Amendment (" Mancos RMPA") remains incomplete

and alternatives are still being developed, no formal tribal consolation has occurred, and environmental justice issues remain ever present, remarkably, the FFO has chosen to move forward with the sale of these Navajo allotment parcels in the Greater Chaco region *for a fourth time*.

Accordingly, Citizens Groups hereby incorporate by reference our prior administrative comments, protests, and exhibits submitted for these prior lease sales, including October 2014 Scoping Comments (March 24, 2014), Draft Environmental Assessment Comments (May 28, 2014), and Protest (August 14, 2014), January 2015 Draft Environmental Assessment Comments (September 23, 2014) and Protest (November 19, 2014), October 2016 Scoping Comments (March 14, 2016), and January 2017 Scoping Comments (June 17, 2016). Because the four parcels at issue here have previously been offered and deferred and/or postponed by the FFO, all prior administrative engagement is properly before the agency and should be considered and included in the administrative record for this lease sale. These incorporated comments and exhibits offer detailed technical information, expert reports, and legal analysis that the agency is required to consider in its decisionmaking process for the proposed action. *See Forest Guardians v. U.S. Fish and Wildlife Service*, 611 F.3d 692, 717 (10th Cir. 2010) ("The purpose behind NEPA is to ensure that the agency will only reach a decision on a proposed action after carefully considering the environmental impacts of several alternative courses of action and *after taking public comment into account*.").

Because the Mancos RMPA remains incomplete, the applicable land use plan for this action is the 2003 Farmington RMP, with "the analysis of projected surface disturbance impacts … based on well densities listed in the Reasonable Foreseeable Development (RFD) Scenario included in the 2003 Farmington RMP." However, as will be explained in further detail, reliance on the 2003 RMP and RFD fails to demonstrate that impacts associated with the proposed leasing will not be significant, or that leasing will otherwise sufficiently protect resources in the FFO. This is due to the fact that, by the BLM's own admission, the RMP and RFD do not account for the environmental impacts of horizontal drilling and multi-stage hydraulic fracturing of the Mancos Shale formation. Yet by leasing these parcels, the BLM is poised to facilitate just this kind of unforeseen development, despite any analysis as to the actual environmental impacts on both project and programmatic level.

The **Western Environmental Law Center** ("WELC") uses the power of the law to defend and protect the American West's treasured landscapes, iconic wildlife and rural communities. WELC combines legal skills with sound conservation biology and environmental science to address major environmental issues in the West in the most strategic and effective manner. WELC works at the national, regional, state, and local levels; and in all three branches of government. WELC integrates national policies and regional perspective with the local knowledge of our 100+ partner groups to implement smart and appropriate place-based actions.

Amigos Bravos is a statewide river conservation organization guided by social justice principles. Amigos Bravos' mission is to protect and restore the waters of New Mexico, and ensure that those waters provide a reliable source of clean water to the communities and farmers that depend on them, as well as a safe place to swim, fish, and go boating. Amigos Bravos works

locally, statewide, and nationally to ensure that the waters of New Mexico are protected by the best policy and regulations possible.

The **Center for Biological Diversity** ("Center") is a non-profit environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center also works to reduce greenhouse gas emissions to protect biological diversity, our environment, and public health. The Center has over one million members and activists, including those living in New Mexico who have visited these public lands in the FFO for recreational, scientific, educational, and other pursuits and intend to continue to do so in the future, and are particularly interested in protecting the many native, imperiled, and sensitive species and their habitats that may be affected by the proposed oil and gas leasing.

The **Chaco Alliance** is a grassroots citizens group dedicated to protecting and preserving Chaco Culture National Historical Park. We are interested in all threats to the park and its surrounding landscape, especially the threat created by energy development in the area.

Diné Citizens Against Ruining Our Environment ("Diné C.A.R.E.") is an all-Navajo organization comprised of a federation of grassroots community activists in Arizona, New Mexico and Utah who strive to educate and advocate for our traditional teachings derived from our Diné Fundamental Laws. Our goal is to protect all life in our ancestral homeland by empowering local and traditional people to organize, speak out, and determine the outlook of the environment through civic involvement and engagement in decision-making process relating to tribal development.

Friends of the Earth is a 501(c)(3) organization with over 33,000 members and 496,000 activists nationwide. Friends of the Earth fights to create a more healthy and just world. Our current campaigns focus on promoting clean energy and solutions to climate change, ensuring the food we eat and products we use are safe and sustainable, and protecting marine ecosystems and the people who live and work near them. Friends of the Earth advocates for an end to all new federal fossil fuel lease sales like the one planned for January 2017 from the BLM Farmington Field Office. Our members and activists have submitted comments during NEPA reviews of dozens of proposed coal, oil and gas lease sales, and 41,761 members sent petitions to President Obama to demand executive action to stop all new federal fossil fuel lease sales to protect public lands and waters and combat climate change.

Great Old Broads for Wilderness ("Broads") is a national grassroots organization that engages and ignites the activism of elders to preserve and protect wilderness and wild lands. With over 8,000 members and supporters, Broads gives voice to the millions of older Americans who want to protect their public lands for the benefit of future generations. Broads' work is fueled by 36 grassroots chapters, called "Broadbands", led by volunteer leaders across 16 states. New Mexico ranks among Broads' four most active states, with three active Broadband chapters and over 600 supporters. Our Broadband chapters and members across the country engage in public land planning processes (Resource Management Plans, Master Leasing Plans, etc.) at the local and regional level to ensure the ecological values of public lands and waters are protected. Broads supports a bipartisan call to action to minimize climate change impacts, reduce fossil fuel

consumption, and enhance national and global security. The organization works to make public lands part of the solution to climate change, not part of the problem.

The **Natural Resources Defense Council** ("NRDC") is a non-profit environmental membership organization with more than 440,000 members throughout the United States. Approximately 5,000 of these members reside in New Mexico. NRDC members use and enjoy public lands in New Mexico, including lands managed by the Bureau of Land Management within the Farmington Field Office planning area. NRDC members use and enjoy these lands for a variety of purposes, including: recreation, solitude, scientific study, and conservation of natural resources. NRDC has had a longstanding and active interest in the protection of public lands in New Mexico, the responsible development of oil and gas resources, and the protection of public health from environmental threats.

Rainforest Action Network campaigns for the forests, their inhabitants and the natural systems that sustain life by transforming the global marketplace through education, grassroots organizing and non-violent direct action.

Founded in 1986, **San Juan Citizens Alliance** ("SJCA") organizes people to protect our water and air, our lands, and the character of our rural communities in the San Juan Basin. SJCA focuses on four program areas, including the *San Juan Basin Energy Reform Campaign*, which ensures proper regulation and enforcement of the oil, gas, and coal industry and transitioning to a renewable energy economy. SJCA has been active in BLM and National Forest oil and gas issues in the San Juan Basin since the early 1990s, and has commented on virtually every multi-well drilling program, lease sale, and programmatic environmental review conducted in the region by the federal land management agencies since the early 1990s. SJCA's members live, work, and recreate throughout the San Juan Basin and San Juan Mountains. SJCA's members' health, use and enjoyment of this region is directly impacted by the decisions identified in this protest.

The **Sierra Club** was founded in 1892 and is the nation's oldest grassroots environmental organization. The Sierra Club is incorporated in California, and has approximately 600,000 members nationwide and is dedicated to the protection and preservation of the environment. The Sierra Club's mission is to explore, enjoy and protect the wild places of the earth; to practice and promote the responsible use of the earth's ecosystems and resources; and to educate and enlist humanity to protect and restore the quality of the natural and human environments. The Sierra Club has a New Mexico chapter, known as the Rio Grande chapter, with members that live in and use this area for recreation such as hiking, climbing, backpacking, camping, fishing and wildlife viewing, as well as for business, scientific, spiritual, aesthetic and environmental purposes.

WildEarth Guardians protects and restores wildlife, wild places, wild rivers, and the health of the American West. As part of its Climate and Energy Program, Guardians works to advance clean energy and expose the true cost of fossil fuels. Guardians works to protect and restore the San Juan Basin in northwestern New Mexico in order to safeguard its cultural heritage, natural values, communities, and open spaces.

I. The BLM Cannot Lease the Subject Parcels while the Mancos Shale/Gallup Formation RMP and EIS Remains Uncompleted.

As provided in Scoping Comments—and implicitly recognized by the agency's original decision to defer all the allotment parcels from the October 2014 lease sale—it is unlawful for the agency to move forward with the sale of oil and gas resources while work on the required Mancos RMPA and EIS is underway. *See* 40 C.F.R. § 1506.1(c). Specifically, the agency stated that allotment parcels—including the four parcels offered here—were being "deferred until after the FFO Mancos Shale/Gallup Formation RMPA/EIS alternatives have been developed." Oct. 2014 Lease Sale EA at 14. This decision is consistent with the agency's duty under NEPA "to stop actions that adversely impact the environment, that limit the choice of alternatives for the EIS, or that constitute an 'irreversible and irretrievable commitment of resources.'" *Conner v. Burford,* 848 F.2d 1441, 1446 (9th Cir. 1988). When an EIS is underway, as here, NEPA regulations established by the Council of Environmental Quality ("CEQ") prohibit an agency from taking any actions that could undermine that decision-making process. *See* 40 C.F.R. § 1506.1(c).

The FFO is now attempting to reverse course, and in so doing, violates NEPA. In deciding to proceed with the sale of these four parcels, the agency now claims "[t]hese parcels were considered for lease in the October 2014, January 2015, and October 2016 Competitive Oil and Gas Lease Sales, but deferred due to the need for additional Tribal consultation and Environmental Justice analysis." EA at 4. This fact does not obviate BLM's obligations under NEPA. The whole point of NEPA is to study the impact of an action on the environment *before* the action is taken. *See Conner,* 848 F.2d at 1452 (NEPA requires that agencies prepare an EIS before there is "any irreversible and irretrievable commitment of resources"). Where "[i]nterim action prejudices the ultimate decision on the program," NEPA forbids it. 40 C.F.R. §§ 1506.1(c)(1)-(3). Action prejudices the outcome "when it tends to determine subsequent development or limit alternatives." *Id.* Proceeding with the sale of these four allotment parcels—or any other major Federal action impacting resources in the planning area—is impermissible due to the inherent prejudice that this action will cause to the pending Mancos Shale RMP.

The agency cites regulations at 43 C.F.R. § 3162.2-2 to justify the sale, claiming: "They are being reconsidered for sale as the parcels have been recently identified as being drained or to be drained by offending wells as early as July 2017. Drainage is the uncompensated loss of hydrocarbons, inert gases or geothermal resources from wells on adjacent non-jurisdictional lands or jurisdictional lands resulting in revenue losses to the Federal government." EA at 4. Critically, however, these regulations provide that where uncompensated drainage of Federal mineral resources may be occurring, offering unleased lands for sale is only one of several options. Other options include: the execution of an agreement under which the United States would be compensated for the drainage; entering into a communitization agreement; or approval of a unit agreement "that provides for payment of a royalty on production attributable to unleased mineral resources." *See* 43 C.F.R. § 3162.2-2 (b), (c), (d). To suggest, as the agency does here, that offering these lands for lease is the only option to ensure that royalty revenues are not lost is patently incorrect. Indeed, these regulations do not mandate that the agency take any action at all, expressly qualifying every option as a step the agency *may* take. *See id.* Given the agency's NEPA obligation to avoid prejudice or limit alternatives, 40 C.F.R. § 1506.1(c), as well

as myriad other resource concerns identified herein, offering these lands for lease is the one option the agency should have avoided.

As acknowledged in the FFO's EA: "Once sold, the lease purchaser has the exclusive right to use as much of the leased lands as is necessary to explore and drill oil and gas within the lease boundaries." EA at 10. Once oil and gas lease rights are conveyed, lessees have a right to drill, and the impact on the environment from the exercise of those rights cannot be undone, which is exactly the situation NEPA disallows—allowing new activity that limits alternatives in the future. For example, once this lease sale is held, the agency will no longer be able to consider an alternative in the Mancos Shale RMP that disallows oil and gas development on these parcels, which the agency's subsequent analysis may deem as necessary.

Although the FFO consistently asserts that any impacts from the lease sale would be "linked to as yet undetermined future levels of lease development," it would be entirely disingenuous for the agency to attempt to segregate this lease sale from the "shale oil play" that has motivated the Mancos Shale RMP and RFD Amendment. For one thing, by the BLM's own admission, the entire purpose of offering the proposed leases for sale is to facilitate their development in order to address drainage of the Mancos Shale that is occurring from neighboring drilling and production activities. *See* EA at 46. Clearly development of the proposed leases for the purpose of developing the Mancos Shale for oil is not speculative. Indeed, it is the entire purpose for undertaking proposed leasing.

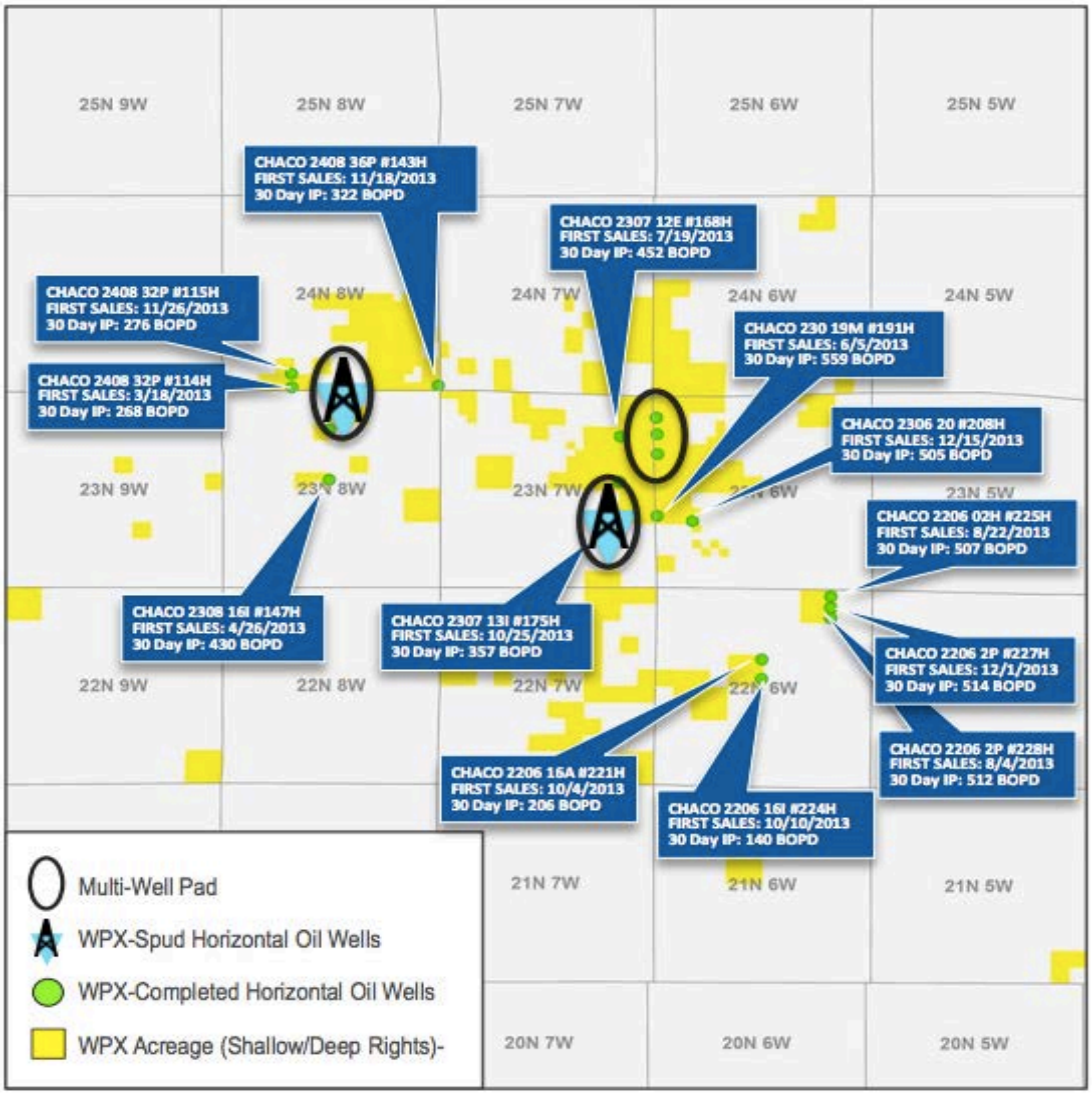
The agency's failure to anticipate the new "oil boom" in the San Juan Basin is precisely why updated planning documents are needed. The agency admits:

> [Oil and gas] development may include constructing a well pad and access road, drilling a well using conventional pit system or closed-loop system, hydraulically fracturing the well, installing pipelines and/or hauling produced fluids, regularly monitoring the well, and competing work-over tasks throughout the life of the well. In Farmington, typically, all of these actions are undertaken during development of an oil or gas well: it is reasonably foreseeable that they may occur on leased parcels.

EA at 16. By the agency's own admission it is foreseeable that the mere act of leasing these parcels will result in a significant levels of development. Moreover, all of these parcels are included in the planning area and reasonably foreseeable development analysis area for the Mancos RMPA. Therefore, proceeding with the leasing of these parcels will prejudice the pending Mancos Shale RMP and EIS process, in direct violation of NEPA.

The potential for foreseeable development is underscored by the fact that the BLM has already approved over 350 APDs in the area that clearly authorized the tapping of the Mancos Shale, and is weighing approval of many additional APDs in this area. Even the companies themselves are touting their development of the Mancos shale. Although now outdated, WPX also confirmed in a recent presentation that it has completed and spudded numerous Mancos

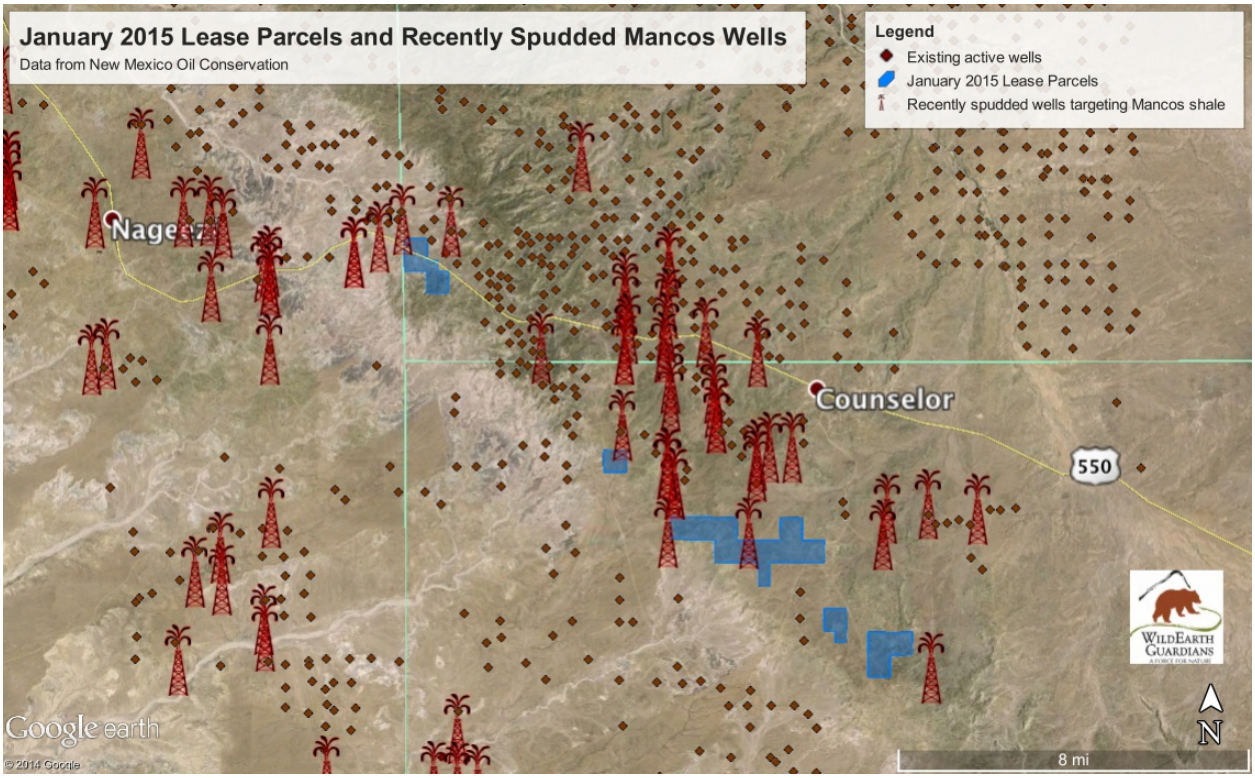
shale wells using horizontal drilling in the area of the proposed leases.[1] The map below, from page 11 of WPX's presentation, illustrates the extent of Mancos shale development in the area:



WPX Energy Map of Mancos Shale Development in the Area of the Proposed Leasing.

A simple map of this area prepared by WildEarth Guardians confirms that a number of wells that appear to clearly target the Mancos shale have been drilled in the vicinity of the proposed lease parcels. The map shows the lease parcels in blue and the proximity of wells that have been recently drilled by Encana, WPX, and LOGOS. This map further underscores that development of the proposed leases is not remotely speculative, and that the BLM has the means to fully analyze and assess impacts associated with Mancos shale drilling.

[1] *See* WPX Energy, *Operational update*, available at: http://www.wpxenergy.com/media/YE2013_EarningsPresentation_Final.pdf.



Map of Proposed Lease Parcels and Recently Drilled Mancos Shale Wells.
Map prepared using Google Earth using BLM and NMOCD Data.

As provided, while CEQ regulations require a moratorium on any further leasing until the Mancos Shale RMPA and EIS are completed, such a decision is also well within the discretion of the FFO. As provided in BLM Instruction Memorandum No. 2010-117 (May 17, 2010):

> As outlined in the Land Use Planning Handbook (H-1601-1), the Resource Management Plan (RMP) underlies fluid minerals leasing decisions. Through RMP effectiveness monitoring and periodic RMP evaluations, state and field offices will examine resource management decisions to determine whether the RMPs adequately protect important resource values in light of changing circumstances, updated policies, and new information (H-1601-1, section V, A, B). The results of such reviews and evaluations may require field office resource information updates and land use plan maintenance, amendment, or revision. In some cases state and field office staff may determine that the public interest would be better served by further analysis and planning prior to making any decision whether or not to lease.

(emphasis added). There can be no better example than the present situation of where the public interest would be better served by completing the Mancos Shale RMP and EIS *before* deciding whether it is appropriate to lease additional public lands. According to BLM oil and gas statistics, there are currently 5,027,750 acres of leased land that is "in effect" in New Mexico; but only approximately 70% of which is in production. *See* BLM, Oil and Gas Statistics by Year for Fiscal Years 1988–2012 (previously included as Scoping Exhibit 120). Indeed, 90% of available public lands in the FFO have already been leased. Before additional public lands are

sold to oil and gas industry and committed to development, the agency must understand the additional impacts of developing the Mancos Shale/Gallup formation.

II. The BLM Cannot Rely on the 2003 RMP EIS to Justify the Proposed Leasing or a Finding of No Significant Impact

While the FFO is to be commended for acknowledging the inability of the 2003 RMP/EIS and RFD to continue serving their necessary planning function, at the same time, the BLM cannot simultaneously rely on the 2003 RMP/EIS and RFD to justify the January 2017 lease sale. Indeed, BLM's EA explicitly tiers to the analysis contained in the 2003 RMP/EIS, *see* EA at 6, which, as explained in the agency's Federal Register Notice for the Mancos Shale RMP, is no longer capable of guiding such decision-making:

> As full-field development occurs, especially in the shale oil play, additional impacts may occur that previously were not anticipated in the RFD or analyzed in the current 2003 RMP/EIS, which will require an EIS-level plan amendment and revision of the RFD for complete analysis of the Mancos Shale/Gallup Formation.

79 Fed. Reg. 10548 (Feb. 25, 2014). However, the inability of the current RMP/EIS and RFD to support the proposed leasing, or to provide any reasonable analysis from which to tier, is further underscored by the details of its shortcomings.

For one thing, the 2003 Farmington RMP never contemplated commercially viable development of the Mancos shale, whether for oil or gas, utilizing horizontal drilling techniques. This is significant because all indications are that the proposed leases are meant to facilitate horizontal drilling of the Mancos shale. The RFD (which was actually prepared in 2001, two years prior to the adoption of the RMP) stated:

> Horizontal drilling is possible but not currently applied in the San Juan Basin due to poor cost to benefit ratio. If horizontal drilling should prove economically and technically feasible in the future, the next advancement in horizontal well technology could be drilling multi-laterals or hydraulic fracturing horizontal wells. Multilaterals could be one, two or branched laterals in a single formation or single laterals in different formations. Hydraulic fracturing could be a single fracture axial with the horizontal well or multiple fractures perpendicular to the horizontal well. These techniques are currently complex and costly, and therefore typically inappropriate for most onshore U.S. reservoirs. Comprehensive engineering and geologic research will be required in the near future in order for these techniques to become viable within the 20-year time frame anticipated by this RFD.[2]

[2] BLM, *Oil and Gas Resource Development for the San Juan Basin, New Mexico, a 20-year, Reasonably Foreseeable Development (RFD) Scenario Supporting the Resource Management Plan for the Farmington Field Office, Bureau of Land Management* (July 2, 2001) at 8.3.

In other words, at the time the RFD was prepared and the RMP finalized, horizontal drilling and fracking was not viable.

Although the RFD makes clear that viable shale gas and oil development using horizontal drilling would not occur within 20 years, the RFD nevertheless contemplated 300 Mancos shale gas and oil wells, including development and exploration wells. *See* RFD at 5.27. However, the RFD contemplated "behind pipe" access to Mancos shale reserves through vertically drilled wells into the Dakota formation. RFD at 5.27. In other words, the RFD considered access to the Mancos shale only as an afterthought to drilling vertical Dakota wells, and certainly did not contemplate horizontally drilled wells into the Mancos shale. To the extent that the RFD contemplated development only of the Mancos shale, it was only in a region called the "fractured Mancos oil play" in the southeastern portion of the Basin, which was described only as "probable" development. RFD at 5.27. Again, the RFD did not contemplate horizontal drilling, whether for development or exploration.

The company, WPX (formerly Williams Production), a major oil and gas producer in the San Juan Basin, has confirmed that the RFD never contemplated the impacts of horizontal drilling of the Mancos shale, whether for exploration or development. The company recently stated in its Middle Mesa development proposal that, "When the [RMP] FEIS was prepared, horizontal drilling had been attempted as an experimental technique in the San Juan Basin, but faced technical problems and not yet been proven economically viable[.]"[3] The BLM has concurred, noting that only the recent advancement in horizontal drilling technology that "has made Mancos stand-alone wells economically viable," explaining:

> [A]t the time of the RFD[S] report, horizontal drilling and multi-stage hydraulic fracturing was in its infancy, since then, the technology has evolved to be more efficient and less costly as in the past. Horizontal drilling and multi-stage fracturing is a common practice throughout the U.S. even though the RFD[S] only hinted at its future success and usage.[4]

Here, "hinting" at environmental impacts does not suffice to demonstrate that such impacts were fully analyzed and assessed as required under NEPA or that the RFD sufficiently considered the impacts of this practice or demonstrated that there would be no significant impacts. The RFD simply does not suffice to demonstrate that the BLM has adequately considered the cumulative impacts of Mancos shale oil or gas development, and in particular horizontal drilling and fracking to develop Mancos shale, in the FFO. In light of the shortcomings of the RFD, as well as significant new information demonstrating that the Mancos shale is being targeted for horizontal drilling for gas and oil, it is clear that both the RMP and EIS are now inadequate under NEPA.

---

[3] Williams Production Co., *Proposal for Rosa Middle Mesa Development* at 3 (previously included as Exhibit 1).

[4] BLM, *Unconventional gas reservoirs, hydraulic fracturing, and the Mancos Shale* (Nov. 30, 2011) at 6 (previously included as Exhibit 2).

Taken together with BLM's clear concession that the current RMP/EIS does not address the latest surge in Mancos shale development, it is clear that unless and until the RMP Amendment and EIS are completed, there exist no sufficient environmental considerations of horizontal drilling and fracking of the Mancos shale.[5] To this end, the BLM cannot rely on the 2003 RMP/EIS to support approval of the proposed leases or any determination that impacts will not be significant.

III. BLM Should Prepare a Programmatic EIS of its Oil and Gas Leasing Program and Use Its Broad Discretion Not to Lease the Proposed Parcels.

Several Citizens Groups, including WildEarth Guardians and Center for Biological Diversity, have submitted petitions to the U.S. Department of the Interior calling for an oil and gas leasing moratorium and programmatic review of the oil and gas leasing program.[6] Moreover, the White House Council on Environmental Quality ("CEQ"), the federal agency tasked with managing the federal government's implementation of NEPA, released *Final Guidance for Federal Department and Agencies on Consideration of Greenhouse as Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* (hereafter, "Final Guidance") (attached as Exhibit 3). CEQ's Final Guidance also states that "[i]n the context of long-range energy, transportation, and resource management strategies…it would be useful and efficient to provide an aggregate analysis of GHG emissions or climate change effects in a programmatic analysis and then incorporate by reference that analysis into future NEPA reviews." In particular, CEQ identifies "issuing leases for oil and gas drilling" as a "site-specific action[] that may benefit from being able to tier to a programmatic NEPA review."

Within this context, the BLM FFO has broad discretion and remove the four parcels from nomination. Given the proximity of these parcels to already deferred areas – which are not

[5] In light of this, we would submit that BLM must presume that the lands proposed for leasing are not "available" due to the failure of the current RMP/EIS to account for the significant impacts of horizontal drilling and fracking of Mancos shale. In this case, the BLM clearly made lands available for leasing based on its understanding of environmental considerations at the time the RMP/EIS was adopted. Given that horizontal drilling and fracking techniques were not accounted for, it would be absurd to believe that the RMP decision made lands available for leasing for the purpose of horizontal drilling of the Mancos shale. Indeed, BLM's Handbook on the issuance of oil and gas leases explicitly states that eligible lands are available for leasing only when all statutory requirements and reviews, "including compliance with the National Environmental Policy act (NEPA) of 1970," have been met. BLM Handbook, H-3101-1, Section I.A.1.

[6] *See* UC Irvine School of Law Environmental Law Clinic, on Behalf of WildEarth Guardians, *Petition Requesting a Programmatic Environmental Impact Statement Addressing the Bureau of Land Management's Oil and Gas Leasing Program and Formal Adoption of the Council on Environmental Quality's Guidance for Greenhouse Gas Emissions and Climate Change Impacts*, January 20, 2016 (attached as Exhibit 1); Center for Biological Diversity, *Petition for a Moratorium on the Leasing of Federal Public Land Fossil Fuels Under the Mineral Leasing Act, 30 U.S.C §§ 226, 241*, July 12, 2016 (attached as Exhibit 2).

divided by geography as much as they are by field office boundaries – deferral is the only reasonable option. As was true with the Taos Field Office parcels, the agency's chosen path of opening this area up to oil and gas development would threaten the water resources serving both the communities and the surrounding area – which is particularly true given the unique geology underlying the planning area. Quite simply, developing this area for oil and gas represents an unnecessary and avoidable risk that would threaten the area's other important multiple use resources, not least of which are local populations already forced to endure human health impacts and environmental degradation from existing oil and gas development and other extractive practices, as well as the areas rich cultural resources and heritage sites.

BLM has broad discretion – and often the responsibility, though too often ignored – not to lease public lands for minerals development to safeguard other multiple use, environmental, and human health resources and values. *See, e.g., Udall v. Tallman*, 380 U.S. 1 (1965); *Rocky Mountain Oil & Gas Association v. U.S. Forest Service*, 157 F.Supp.2d 1142 (D. Mont. 2000). BLM's authority to open these four parcels to oil and gas development is derived from the Mineral Leasing Act of 1920, 30 U.S.C. § 181 *et seq.* Nowhere does the Mineral Leasing Act ("MLA") mandate that any particular lands be offered for lease. Rather, the Act states generally that "[a]ll lands subject to disposition under this chapter which are known or believed to contain oil or gas deposits *may* be leased by the Secretary." 30 U.S.C. § 226(a) (emphasis added). The Ninth Circuit has held that the "permissive word 'may' in § 226(a) allows the Secretary to lease such lands, but does not require him to do so…. [T]he Secretary has discretion to refuse to issue any lease at all on a given tract." *Burglin v. Morton*, 527 F.2d 486, 488 (9th Cir. 1975). The Supreme Court reached the same conclusion in *Udall v. Tallman*, 380 U.S. 1, 4 (1965), in which the Court declared that the Mineral Leasing Act "left the Secretary discretion to refuse to issue any lease at all on a given tract." *See also Bob Marshall Alliance v. Hodel*, 852 F.2d 1223, 1230 (9th Cir. 1988) (providing that refusal to issue leases constitutes a "legitimate exercise of the discretion granted to the Interior Secretary"); *McDonald v. Clark*, 771 F.2d 460, 463 (10th Cir. 1985) ("While the statute gives the Secretary the authority to lease government lands under oil and gas leases, this power is discretionary rather than mandatory."); *McTiernan v. Franklin,* 508 F. 2d 885, 887 (10th Cir. 1975) (under § 226(a), the government "may refuse to issue any lease at all on a given tract"); *Pease v. Udall,* 332 F.2d 62, 63 (9th Cir. 1964) (Mineral Leasing Act "has consistently been construed as leaving to the Secretary, within his discretion, a determination as to what lands are to be leased thereunder"); *Pacific Legal Foundation v. Watt,* 529 F.Supp. 982, 991 n.14 (D. Mont. 1982) (under § 226(a), "the Secretary has discretion either to issue or refuse to issue oil and gas leases").

Indeed, BLM's discretion over oil and gas leasing is so great that courts have held that the agency may decide not to allow leasing even after the lands have been offered for lease and a qualified applicant selected. In *McDonald,* the Tenth Circuit Court of Appeals provided: "The fact that land has been offered for lease does not bind the Secretary to actually lease the land, nor is the Secretary bound to lease the land when a qualified applicant has been selected." *McDonald,* 771 F.2d at 463. The Court continued, saying "the Secretary may withdraw land from leasing at any time before the actual issuance of the lease, even if the offer was filed long before the determination not to lease was made." *Id.* (citing *Arnold v. Morton,* 529 F.2d 1101, 1106 (9th Cir. 1976); *Schraier v. Hickel*, 419 F.2d 663, 665-67 (D.C. Cir. 1969)).

Moreover, nothing in the Federal Onshore Oil and Gas Leasing Reform Act ("FOOGLRA") requires BLM to open lands at the behest of the oil and gas industry. The MLA, as amended by FOOGLRA in 1987, 30 U.S.C. § 181 *et seq*., simply requires BLM to *consider* oil and gas leasing on land consistent with the RMP. As identified above, just because land is identified for leasing does not mean that it must be leased. If review of a potential lease proposed for sale reveals problems, or that other resources and values should be protected, the agency can decide not to lease, period, and in fact, may be duty-bound, pursuant to laws such as FLPMA, not to lease to ensure that other resources and values are protected. For example, in *Marathon Oil Co.*, 139 IBLA 347 (1997), BLM removed parcels from a competitive lease sale for environmental reasons, even after they had been offered for sale pursuant to industry nomination. In that case, the IBLA held that "BLM enjoys considerable discretion to depart from its RMP in any specific case, and it may well be able to justify excluding these parcels from leasing for environmental purposes." *Id.* at 356.

The MLA and FOOGLRA do not in any way restrict the factors that BLM may consider when exercising its considerable discretion under § 226(a). Therefore, even if the BLM bases its decision entirely on the public's overwhelming opposition to oil and gas development in this area, it has the authority to do so. Indeed, it would be irresponsible for BLM's FFO to propose these four lease parcels for sale without first performing the necessary due diligence and environmental review to determine, on a site-specific basis, whether these lands should be conserved as is.

Based on this expansive authority and discretion, we implore BLM FFO to reconsider its assent to the nomination of the four parcels in January 2017 Oil and Gas Lease Sale, and remove these parcels from consideration.

IV. The BLM is Required to Prepare an EIS, and Failed to Provide a Convincing Statement of Reasons Why the Lease Sale will Impact the Environment No More than Insignificantly.

As Citizen Groups have consistently maintained, an environmental impact statement ("EIS") should be prepared before subject parcels can be offered at the January 2017 oil and gas lease sale. An EIS is required when a major federal action "significantly affects the quality of the human environment." 42 U.S.C. § 4332(2)(C); 40 C.F.R. § 1502.4. A federal action "affects" the environment when it "will or *may* have an effect" on the environment. 40 C.F.R. § 1508.3 (emphasis added); *Airport Neighbors Alliance v. U.S.,* 90 F.3d 426, 429 (10th Cir. 1996) ("If the agency determines that its proposed action *may* 'significantly affect' the environment, the agency must prepare a detailed statement on the environmental impact of the proposed action in the form of an EIS.") (emphasis added). Similarly, according to the Ninth Circuit:

> We have held that an EIS *must* be prepared if 'substantial questions are raised as to whether a project ... *may* cause significant degradation to some human environmental factor.' To trigger this requirement a 'plaintiff need not show that significant effects *will in fact occur*,' [but instead] raising 'substantial questions whether a project may have a significant effect' is sufficient.

Idaho Sporting Cong. v. Thomas, 137 F.3d 1146, 1149-50 (9th Cir. 1998) (citations omitted) (emphasis original). Given the magnitude of the proposed action and possible direct, indirect and cumulative impacts to both the natural environment and human communities, BLM's FONSI is completely unsupportable.

Critically, the FFO has also failed to "put forth a convincing statement of reasons' that explains why the project will impact the environment no more than insignificantly. This account proves crucial to evaluating whether the [agency] took the requisite 'hard look.' " *Ocean Advoc. v. U.S. Army Corps of Engrs*., 402 F.3d 846, 864 (9th Cir. 2005). Nowhere in BLM's EA and unsigned FONSI does there exist a convincing statement explaining the insignificance of impacts from this sale. To the contrary, BLM suggests that any real analysis of impacts can be pushed off until the APD stage—which, as described above, is wholly deficient. If BLM proceeds in its refusal to perform an EIS, it must provide a detailed accounting of each NEPA significance factor, as provided in 40 C.F.R. § 1508.27, explaining why the project will impact the environment no more than insignificantly. The cursory and evasive manner in which BLM has addressed these significance factors in the EA unsigned FONSI is insufficient to meet the agency's NEPA mandate.

V. BLM Impermissibly Relies on Mitigation Measures to Avoid a Finding of Significance.

Although it is possible that "some or all of the environmental consequences of oil and gas development may be mitigated through lease stipulations, it is equally true that the purpose of NEPA is to examine the foreseeable environmental consequences of a range of alternatives *prior* to taking an action that cannot be undone." *Montana Wilderness Ass'n v. Fry*, 310 F.Sup.2d 1127, 1145 (D.Mont., 2004) (citation omitted) (emphasis added); 40 C.F.R. § 1501.2. "[M]itigation measures, while necessary, are not alone sufficient to meet the [Agency's] NEPA obligations to determine the projected extent of the environmental harm to enumerated resources *before* a project is approved." *Northern Plains Resource Council v. Surface Transportation Board,* 668 F.3d 1067, 1085 (9th Cir. 2011) (emphasis in original). Consequently, if BLM discovers significant impacts at the APD stage, it may no longer be able to prevent them.

Here, BLM has relies on future, unspecified and general mitigation to avoid a finding of significance, in violation of the agency's NEPA mandate. The EA generically offers: "Site specific mitigation measures and Best Management Practices (BMPs) would be attached as Conditions of Approval (COAs) for each proposed exploration and development activity authorized on a lease." EA at 10. Unfortunately, very little additional specificity is provided elsewhere in the EA. And while the agency does provide a list of lease stipulations by parcel, these are "[s]tandard terms and conditions as well as lease stipulations from the BLM FFO 2003 RMP … and Lease Notices development through the parcel review and analysis [which] would apply to address site specific concerns or new information not identified in the land use planning process." EA at 5. In other words, these stipulations are not specifically aimed at mitigating any direct, indirect, or cumulative impact from the proposed action, nor are they linked to site-specific concerns. In fact, the type of detailed mitigation that NEPA calls for would be impossible without first analyzing the site-specific impacts of leasing and development, which the FFO expressly acknowledges has not been done.

The mitigation measures proposed by the agency must be reasonably developed, which, here, is not the case. "A 'perfunctory description,' or 'mere listing of mitigation measures, without supporting analytical data,' is insufficient to support a finding of no significant impact." *National Parks & Conservation Ass'n v. Babbitt*, 241 F.3d 722, 735 (9th Cir. 2001). The court, when determining the sufficiency of the mitigation measures, considers "whether they constitute an adequate buffer against the negative impacts that may result from the authorized activity. Specifically, [the court] examine[s] whether the mitigation measures will render such impacts so minor as to not warrant an EIS." *Id.; see also, Hill v. Boy,* 144 F.3d 1446, 1451 (11th Cir.1998) (explaining that where an agency relies on an assumption to reach a FONSI, the assumption must be supported by substantial evidence). Moreover, the proposed mitigation underlying the FONSI "must be more than a possibility" in that it is "imposed by statute or regulation or have been so integrated into the initial proposal that it is impossible to define the proposal without mitigation." *Wyoming Outdoor Council v. U.S. Army Corps of Eng'rs,* 351 F.Supp.2d 1232, 1250 (D.Wyo. 2005). Here, the agency offers nothing more than the statement that site-specific mitigation measures and BPMs would be attached as COAs—and fail to even offer a list what these potential measures might be.

Similarly, with regard to cumulative impacts, the agency must provide *some* explanation of how or why compensatory mitigation will reduce the cumulative adverse impacts on the resources in question to insignificance. Bare assertions of mitigation are insufficient. *O'Reilly v. U.S. Army Corps of Eng'rs,* 477 F.3d 225, 235 (5th Cir.2007) ("[A] bare assertion is simply insufficient to explain *why* the mitigation requirements render the cumulative effects of this project less-than-significant, when considered with the past, present, and foreseeable future development in the project area." (emphasis in the original)). Here, in describing the fluctuating cumulative impacts of oil and gas development, the agency offers generally: "Conserving as much land as possible and applying appropriate mitigation measures will alleviate the cumulative impacts." EA at 66. The FFO offers *nothing* else to address cumulative impacts. This type of vague and conclusory statement is entirely insufficient and fails to meet the FFO's obligations under NEPA.

VI. The BLM Failed to Take a "Hard Look" by Predetermining its NEPA Analysis.

As detailed below, NEPA "requires ... that an agency give a 'hard look' to the environmental impact of any project or action it authorizes." *Morris v. U.S. Nuclear Regulatory Commission,* 598 F.3d 677, 681 (10th Cir. 2010). This examination "must be taken objectively and in good faith, not as an exercise in form over substance, and not as a subterfuge designed to rationalize a decision already made." *Forest Guardians,* 611 F.3d at 712 (quoting *Metcalf v. Daley,* 214 F.3d 1135, 1142 (9th Cir. 2000)); *see also* 40 C.F.R. § 1502.2(g) ("Environmental impact statements shall serve as the means of assessing the environmental impact of proposed agency actions, rather than justifying decisions already made."); *id.* § 1502.5 ("The statement shall be prepared early enough so that it can serve practically as an important contribution to the decision-making process and will not be used to rationalize or justify decisions already made.").

By failing to perform the necessary analysis, the agency, in effect, is presupposing that any site-specific impacts from oil and gas development can be mitigated without significant, unacceptable impacts at the APD stage before even knowing what those site-specific impacts are.

The agency is also presupposing that oil and gas resources, if developed, outweigh non-oil and gas resources, like wildlife habitat, air quality, water quality protection, and human communities in the planning area.

As soon as BLM issues an oil and gas lease—particularly, as here, when the lease is sold without a no surface occupancy ("NSO") stipulation covering the entire parcel—that sale confers a guaranteed right to the leaseholder, which includes the right of occupancy. *See* EA at 10 ("Once sold, the lease purchaser has the exclusive right to use as much of the leased lands as is necessary to explore and drill oil and gas within the lease boundaries."). Without analyzing impacts from the lease sale itself, any subsequent analysis intrinsically shifts from *preventing* impacts (and managing lands for other resource values) to merely *mitigating* impacts (and allowing oil and gas lessees to exercise their surface use rights to the lease at the expense of other resource values). This approach is fundamentally incongruous with NEPA's mandate. In *Northern Plains* the Ninth Circuit warned: "In a way, reliance on mitigation measures presupposes approval. It assumes that—regardless of what effects construction may have on resources—there are mitigation measures that might counteract the effect without first understanding the extent of the problem. This is inconsistent with what NEPA requires." *Northern Plains,* 668 F.3d at 1084-85. In the present case, this presupposition is precisely what BLM has done in determining that actual NEPA analysis can wait until some future date while relying on generic lease stipulations and future mitigation to avoid a finding of significance.

BLM, in making this predetermined conclusion, creates an un-level playing field that benefits oil and gas leasing and drilling at the expense of other multiple use resources. There is a long line of cases that warn agencies against making a predetermined decision with respect to NEPA analysis. The Tenth Circuit has cautioned: "[I]f an agency predetermines the NEPA analysis by committing itself to an outcome, the agency likely has failed to take a hard look at the environmental consequences of its actions due to its bias in favor of that outcome and, therefore, has acted arbitrarily and capriciously." *Forest Guardians,* 611 F.3d at 713 (citing *Davis v. Mineta,* 302 F.3d 1104 (10th Cir. 2002). The Tenth Circuit further stated that "[w]e [have] held that ... predetermination [under NEPA] resulted in an environmental analysis that was tainted with bias" and was therefore not in compliance with the statute. *Id.* (citing *Davis,* 302 F.3d at 1112–13, 1118–26)).

While the threshold for finding agency predetermination is high—"occur[ing] only when an agency *irreversibly and irretrievably* commits itself to a plan of action that is dependent upon the NEPA environmental analysis producing a certain outcome, *before* the agency has completed that environmental analysis," *Forest Guardians*, 611 F.3d at 714 (emphasis in original)—here, BLM's misguided process has met that threshold. BLM made the express determination that an analysis of impacts is not necessary at the lease sale stage, which guarantees that a FONSI will be issued. That FONSI is based not on any actual analysis of impacts, but rather on the predetermined decision to perform the necessary NEPA analysis at a later stage. Indeed, by not performing any genuine analysis, it is impossible to reach any conclusion other than a FONSI. By playing this shell-game, BLM, at a minimum, creates an improper "inertial presumption" in favor of committing resources to oil and gas development before knowing the site-specific impacts. *Natl. Wildlife Fed. v. Morton*, 393 F.Supp 1286, 1292 (D.D.C. 1975).

By reaching, in effect, a predetermined decision—or at least creating a presumption in favor of oil and gas leasing and development—BLM not only violates NEPA, but also, by elevating development of oil and gas over other multiple use resources, violates the Federal Land Policy Management Act ("FLPMA"). As the Tenth Circuit has explained:

> It is past doubt that the principle of multiple use does not require BLM to prioritize development over other uses… Development is a *possible* use, which BLM must weigh against other possible uses – including conservation to protect environmental values, which are best assessed through the NEPA process.

New Mexico ex rel. Richardson, 565 F.3d at 710. BLM's presupposition of outcome is a direct affront to both NEPA and FLPMA, and cannot be sustained.

VII. The BLM Failed to Take a Hard Look at the Direct, Indirect and Cumulative Impacts of Oil and Gas Leasing and Development.

The National Environmental Policy Act ("NEPA"), 42 U.S.C. § 4321 *et seq*., and its implementing regulations, promulgated by the Council on Environmental Quality ("CEQ"), 40 C.F.R. §§ 1500.1 *et seq*., is our "basic national charter for the protection of the environment." 40 C.F.R. § 1500.1. Recognizing that "each person should enjoy a healthful environment," NEPA ensures that the federal government uses all practicable means to "assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings," and to "attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences," among other policies. 43 U.S.C. § 4331(b).

> NEPA regulations explain, in 40 C.F.R. §1500.1(c), that:
>
> Ultimately, of course, it is not better documents but better decisions that count. NEPA's purpose is not to generate paperwork – even excellent paperwork – but to foster excellent action. The NEPA process is intended to help public officials make decisions that are based on understanding of environmental consequences, and take actions that protect, restore, and enhance the environment.

Thus, while "NEPA itself does not mandate particular results, but simply prescribes the necessary process," *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989), agency adherence to NEPA's action-forcing statutory and regulatory mandates helps federal agencies ensure that they are adhering to NEPA's noble purpose and policies. *See* 42 U.S.C. §§ 4321, 4331.

NEPA imposes "action forcing procedures … requir[ing] that agencies take a *hard look* at environmental consequences." *Methow Valley*, 490 U.S. at 350 (citations omitted) (emphasis added). These "environmental consequences" may be direct, indirect, or cumulative. 40 C.F.R. §§ 1502.16, 1508.7, 1508.8. A cumulative impact—particularly important here—is defined as:

> the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future

> actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

40 C.F.R. § 1508.7.

Federal agencies determine whether direct, indirect, or cumulative impacts are significant by accounting for both the "context" and "intensity" of those impacts. 40 C.F.R. § 1508.27. Context "means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality" and "varies with the setting of the proposed action." 40 C.F.R. § 1508.27(a). Intensity "refers to the severity of the impact" and is evaluated according to several additional elements, including, for example: unique characteristics of the geographic area such as ecologically critical areas; the degree to which the effects are likely to be highly controversial; the degree to which the possible effects are highly uncertain or involve unique or unknown risks; and whether the action has cumulatively significant impacts. *Id.* §§ 1508.27(b).

Furthermore, the Federal Land Policy and Management Act ("FLPMA"), 43 U.S.C. § 1701 *et seq*., directs that "the public lands be managed in a manner that will protect the quality of [critical resource] values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use." 43 U.S.C. § 1701(a)(8). This substantive mandate requires that the agency not elevate the development of oil and gas resources above other critical resource values in the planning area. To the contrary, FLPMA requires that where oil and gas development would threaten the quality of critical resources, that conservation of these resources should be the preeminent goal. As detailed, below, for several critical resource values in the planning area, the proposed action conflicts with the BLM's mandate under FLMPA.

A. Because an irretrievable commitment of resources will occur at the lease sale stage, BLM must consider impacts prior to the sale.

BLM has stated its intent to postpone NEPA analysis to determine whether significant impacts exist until the APD stage, claiming: "The act of leasing the parcel would, by itself, have no impact on any resources in the FFO. All impacts would be linked to as yet undetermined future levels of lease development." EA at 47.

BLM has previously relied on *Park County Resource Council v. U.S. Department of Agriculture*, 817 F.2d 609 (10th Cir. 1987), to support its contention that site-specific NEPA analysis is not required until the APD stage. In *Park County*, the Court provided that "*with appropriate lease stipulations* aimed at protecting the environment, lease issuance itself, essentially a paper transaction, does not *usually* require prior preparation of an EIS." *Park County*, 817 F.2d at 621 (emphasis added). *Park County*, however, does not stand for the proposition—as BLM has implied—that there is a categorical rule exempting BLM from ever performing site-specific analysis at the lease sale stage. Indeed, the Ninth Circuit has consistently held that the sale of oil and gas leases is an irretrievable commitment of resources for which an

EIS must be prepared. *See, e.g., Conner v. Burford,* 848 F.2d 1441 (9th Cir.1988); *Bob Marshall Alliance v. Hodel,* 852 F.2d 1223, 1227 (9th Cir.1988). Further, *Park County* cannot be understood in a vacuum; as the Tenth Circuit more recently explained:

> [T]here is no bright line rule that site-specific analysis may wait until the APD stage. Instead, the inquiry is necessarily contextual. Looking to the standards set out by regulation and by statute, assessment of all 'reasonably foreseeable' impacts must occur at the earliest practicable point, and must take place before an 'irretrievable commitment of resources' is made. 42 U.S.C. § 4332(2)(C)(v); *Pennaco Energy v. U.S. Dept. of Interior*, 377 F.3d 1147, 1160 (10th Cir. 2004); *Kern v. U.S. Bureau of Land Management*, 284 F.3d 1062, 1072 (9th Cir. 2002); 40 C.F.R. §§ 1501.2, 1502.22. Each of these inquiries is tied to the existing environmental circumstances, not to the formalities of agency procedures. Thus, applying them necessarily requires a fact-specific inquiry.

New Mexico ex rel. Richardson, 565 F.3d at 717-18. The Court has unambiguously stated that "[t]he operative inquiry [is] simply whether all foreseeable impacts of leasing [are] taken into account before leasing [can] proceed." *Id.* at 717.

Indeed, in *Pennaco Energy,* the Court found: "A plan-level EIS for the area failed to address the possibility of [coal-bed methane ("CBM")] development, and a later EIS was prepared only after the leasing stage, and thus 'did not consider whether leases should have been issued in the first place.'" *New Mexico,* 565 F. 3d. at 717 (citing *Pennaco Energy,* 377 F.3d at 1152). Moreover, the Court held that "[b]ecause the issuance of leases gave lessees a right to surface use, the failure to analyze CBM development impacts before the leasing stage foreclosed NEPA analysis from affecting the agency's decision." *Id.* (citing *Pennaco Energy,* 377 F.3d at 1160).

Unlike *Park County* where site-specific impacts were difficult to anticipate, here, like in *Pennaco Energy*, the impacts of leasing parcels are reasonably foreseeable—approximately 90% of the FFO planning area has already been leased and expansive oil and gas development has already occurred. Moreover, the agency has identified the reasonably foreseeable impacts of development stemming from the lease of these parcels. *See* EA at 16. Thus, as in *Pennaco Energy*, an EIS assessing the specific effects of oil and gas development from this lease sale is required before leases are conferred to industry.

Moreover, irrespective of BLM's ultimate conclusion with regard to stipulations, an irretrievable commitment of resources will be conferred at the lease sale stage; oil and gas leases confer "the right to use so much of the leased lands as is necessary to explore for, drill for, mine, extract, remove and dispose of all the leased resource in a leasehold." 40 C.F.R. § 3101.1-2; *Sierra Club v. Hodel*, 848 F.2d 1068, 1093 (10th Cir. 1988) (agencies are to perform hard look NEPA analysis "before committing themselves irretrievably to a given course of action so that the action can be shaped to account for environmental values"); *see also* EA at n/a ("Once sold, the lease purchaser has the exclusive right to use as much of the leased lands as is necessary to explore and drill oil and gas within the lease boundaries.").

Yet, even if there were a NSO stipulation covering an entire parcel—which is not the case here—the mere issuance of the lease confers a right to the resources thereunder. Whether through directional drilling or some other method of extraction, the leaseholder has an exercisable interest as soon as the lease is conferred, which it then relies upon in proceeding with its development plan. Therefore, significant environmental impacts, based on those lease rights, may also occur once a lease is issued. Although it is true that "some or all of the environmental consequences of oil and gas development may be mitigated through lease stipulations, it is equally true that the purpose of NEPA is to examine the foreseeable environmental consequences of a range of alternatives *prior* to taking an action that cannot be undone." *Montana Wilderness Ass'n*, 310 F.Sup.2d at 1145; *see also* 40 C.F.R. § 1501.2.

Here, the BLM refused to perform site-specific analysis at the lease stage, and, once lease right are conferred, BLM's authority will thereafter be limited to imposing mitigation measures consistent with the terms of the lease. Consequently, if BLM discovers significant impacts at the APD stage, it may no longer be able to prevent them. Because BLM is irretrievably committing resources at the lease sale stage, it must consider the impacts of its decision to lease parcels before it can confer public resources to a private developer in a lease—analysis which would be inherently flawed if performed without the benefit of a completed Mancos Shale RMP and EIS.

While the EA purports to evaluate the sale of oil and gas lease parcels which will allow drilling, completion, and production components, the agency also contends that consideration of impacts from development stage activity will actually occur later once APDs are submitted. This is a classic example of segmentation that is prohibited by NEPA.

As NEPA provides, to adequately assess the environmental impacts of a proposed action, BLM must assess three types of actions: (1) connected actions, (2) cumulative actions, and (3) similar actions. 40 C.F.R. § 1508.25. Connected actions "are closely related and therefore should be discussed in the same impact statement. Actions are connected if they: (i) Automatically trigger other actions which may require environmental impact statements; (ii) Cannot or will not proceed unless other actions are taken previously or simultaneously; (iii) Are interdependent parts of a larger action and depend on the larger action for their justification." *Id.* Cumulative actions are those actions that "when viewed with other proposed actions have cumulatively significant impacts and should therefore be discussed in the same impact statement." *Id.* Similar actions are those actions that "when viewed with other reasonably foreseeable or proposed agency actions, have similarities that provide a basis for evaluating their environmental consequences together, such as common timing or geography. An agency may wish to analyze these actions in the same impact statement. It should do so when the best way to assess adequately the combined impacts of similar actions or reasonable alternatives to such actions is to treat them in a single impact statement." *Id.*

There are two steps necessary to drill this area: first, BLM's proposed action to lease the subject parcels, and, second, BLM's promise of separate NEPA for the review and approval of APDs. The second cannot be accomplished without the first, and the act of drilling does not have independent utility. Instead, they are, for all intents and purposes, interdependent parts of a single action—to drill this area for oil and gas—that has been improperly segmented into two pieces. As detailed above, BLM knows enough about current oil and gas development in the southern

San Juan Basin to look at the impacts that will occur if the lease sale occurs and oil and gas development commences. Among those impacts are immense amounts of nitrogen deliveries, the need for extensive storage, the need for ancillary development for oil that does not currently exist, flaring of natural gas and industrial infrastructure delivery development in rural, undeveloped areas, among others.

B. The BLM failed to analyze or take a "hard look" at cumulative impacts of the January 2017 lease sale.

A cumulative impact is the "impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." 40 C.F.R. § 1508.7. While BLM includes a "*Cumulative Impacts*" section in their EA, *see* EA at 50-52, BLM fails to actually conduct any cumulative analysis of those impacts. *See Natural Resources Defense Council v. Hodel*, 865 F.2d 288, 298 (D.C. Cir. 1988) (providing that section headings without the "requisite analysis" are insufficient); *see also* 40 C.F.R. § 1508.27(b)(7) (BLM must consider whether the proposed action is related to other actions that together may have cumulatively significant *impacts*. "Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.").

Here, the FFO's cumulative impacts analysis is remarkably insufficient. This is an area besieged by fossil fuel development. The FFO has over 23,000 active oil and gas wells, as well as two massive mine-to-mouth coal-fired power plant complexes—the Navajo Mine and Four Corners Power Plant, and the San Juan Mine and San Juan Generating Station. The impact of such development on the area's air, water, land, and human communities cannot be overstated. Yet, the FFO dismissively provides that "[c]onserving as much land as possible and applying appropriate mitigation measures will alleviate the cumulative impacts." EA at 66. Although BLM includes a cursory section of resource values cumulatively effected by the proposed action, the agency consistently avoids any actual cumulative analysis by claiming the scope of the lease sale is de minimis given the scale of the resource considered. For example, for air quality, BLM offers: "The very small increase in emissions that could result from approval of the action alternatives would not result in any county in the FFO area exceeding the NAAQS for any criteria pollutants." EA at 67. With regard to climate change, BLM states:

> The very small increase in GHG emissions that could result from approval of the Proposed Action Alternative would not produce climate change impacts that differ from the No Action Alternative. This is because climate change is a global process that is impacted by the sum total of GHGs in the Earth's atmosphere. The incremental contribution to global GHGs from the proposed action cannot be translated into effects on climate change globally or in the area of this site-specific action. It is currently not feasible to predict with certainty the net impacts from the proposed action on global or regional climate.

EA at 67. As stated by the CEQ in its Final Guidance:

> Climate change results from the incremental addition of GHG emissions from millions of individual sources, which collectively have a large impact on a global scale. CEQ recognizes that the totality of climate change impacts is not attributable to any single action, but are exacerbated by a series of actions including actions taken pursuant to decisions of the Federal Government. Therefore, a statement that emissions from a proposed Federal action represent only a small fraction of global emissions is essentially a statement about the nature of the climate change challenge, and is not an appropriate basis for deciding whether or to what extent to consider climate change impacts under NEPA. Moreover, these comparisons are also not an appropriate method for characterizing the potential impacts associated with a proposed action and its alternatives and mitigations because this approach does not reveal anything beyond the nature of the climate change challenge itself: the fact that diverse individual sources of emissions each make a relatively small addition to global atmospheric GHG concentrations that collectively have a large impact.

Although BLM provides a generalized discussion of anticipated climate impacts within the region encompassing a given lease sale, the EA failed to estimated the contribution of GHG emissions from lease sale to cumulative GHG emissions from past, present, and reasonably foreseeable GHG-emitting oil and gas activities on public lands. Nor did BLM analyze the climate impacts of cumulative GHG emissions from these activities. Instead, as noted above, BLM declined to analyze cumulative impacts of GHG emissions at the leasing stage on the basis that "[i]t is currently not feasible to predict with certainty the net impacts from the proposed action on global or regional climate." EA at 67.

BLM cites state and national emissions levels to conclude emissions from this particular lease sale represents only a small fraction of these emissions, and are therefore insignificant. (Notably, BLM makes this assertion without actually estimating resulting emissions). In so doing, however, BLM is defining the cumulative impacts area with respect to GHG emissions at a state and national scale. Using this baseline, the appropriate scope of the BLM's cumulative analysis must similarly be at this scale, which would include disclosing and considering the cumulative emissions from BLM's Oil and Gas Leasing Program—including emissions from all active producible wells managed by BLM—and the incremental contribution to these emissions from the proposed lease sale. BLM must not only disclose and quantify these emissions, but also consider the effect that these emissions will have to resource values and communities across the planning area, and to our nation as a whole.

BLM's estimates the direct GHG emissions from the sale, which alone do not provide the decisionmaker or the public with a context for understanding the effects to climate from BLM's proposed sale either individually or in the aggregate. Climate data and GHG quantification tools and methodologies, such as the Social Cost of Carbon, are readily available to BLM, easy to apply, and are already in widespread use throughout the Federal and private sectors, state and local governments, and globally. The Social Cost of Carbon estimates the cost to society of each additional ton of GHG pollution emitted into the atmosphere, thereby providing a fairly comprehensive estimate of climate change damage resulting from a project's GHG emissions.

There is no effort to identify, much less quantify, the myriad cumulative impacts that this lease sale will contribute to, as noted above. Indeed, such analysis is impossible while the Mancos Shale RMP and RFD remain uncompleted. As defined in the EA: "Cumulative impacts include the combined effect of past projects, specific planned projects and other reasonably foreseeable future actions." EA at 47 (emphasis added). And, as noted above, additional impacts from the shale oil play "were not anticipated in the RFD or analyzed in the current 2003 RMP/EIS." 79 Fed. Reg. 10548. Without the benefit of completed RMPA considering this new level of development, by BLM's own definition it is impossible to sufficiently determine what the cumulative impacts from the January 2017 lease sale might be.

Here, BLM attempts to satisfy their NEPA obligation for this resource solely by tiering to the Air Resources Technical Report for Oil and Gas Development ("ARTR"). Although the ARTR does broadly describe the air resource conditions and impacts for the New Mexico, Oklahoma, Texas and Kansas region, a document of this scope cannot satisfy the site-specific cumulative impacts to air resources stemming from this lease sale, which is the level of analysis NEPA demands. "Conclusory remarks," as are consistently provided throughout BLM's EA, "do not equip a decisionmaker to make an informed decision about alternative courses of action." *NRDC*, 865 F.2d at 298. "Perfunctory references do not constitute analysis useful to a decisionmaker in deciding whether, or how, to alter the program to lessen cumulative environmental impacts." *Id.* at 275. BLM's conclusory treatment of their cumulative impacts analysis fails to meet their hard look requirement under NEPA.

C. The BLM failed to take a "hard look" at impacts to air quality.

The BLM failed to take a hard look at the air quality impacts from oil and gas leasing and development in the planning area, and failed to consider the Citizen Groups detailed Scoping Comments on air quality resources, incorporated herein. 40 C.F.R. § 1506.6.

The FFO's air resources analysis is tiered to the existing 2003 RMP and EIS, which, as detailed above and functionally admitted by BLM, is no longer capable of guiding agency decision-making. The 2003 RMP/EIS is also fatally flawed specifically with regards to air quality. Indeed, significant new information demonstrates that emissions associated with oil and gas development are significantly higher than what the 2003 Farmington RMP contemplated. According to recent inventory data prepared by the Western Regional Air Partnership ("WRAP"), the 2003 Farmington EIS underestimates emissions of VOCs from oil and gas operations by nearly 30-fold. In 2003, BLM estimated that within 20 years, VOC emissions would amount to 2,008.5 tons/year. According to the most recent WRAP inventory, VOC emissions from oil and gas activities in San Juan and Rio Arriba Counties were estimated to be nearly 60,000 tons/year in 2006 and projected to be more than 55,000 tons per year by 2012.[7]

[7] *See* ENVIRON, *Final Report: Development of 2012 Oil and Gas Emissions Projections for the South San Juan Basin* (Dec. 2009) (prepared for Western Regional Air Partnership) (previously included as Exhibit 3); ENVIRON, *Final Report: Development of Baseline 2006 Emissions from Oil and Gas Activity in the South San Juan Basin* (Nov. 2009) (prepared for Western Regional Air Partnership) (previously included as Exhibit 4).

The table below illustrates this discrepancy between the amount of VOC emissions projected in 2003 and the most recent estimates.

Source of Emission Inventory	VOC Emission Estimate (tons/year)
RMP 20-Year Projection (RMP EIS at J-11)	2,008.5
WRAP Phase III 2006 Inventory for San Juan/Rio Arriba Counties	59,933
WRAP Phase III 2012 Projection for San Juan/Rio Arriba Counties	55,049

This discrepancy is significant because it indicates that BLM cannot reasonably tier to the 2003 RMP/EIS to justify that air quality impacts will not be significant. If anything, BLM must either prepare an EIS to address the air quality impacts of the proposed leases, supplement the 2003 RMP/EIS prior to moving ahead with the proposed leases, or, as discussed above, defer further leasing and development until the Mancos Shale RMP and EIS are completed.

This discrepancy also indicates that the emissions data presented in the EA, which shows dramatically lower VOC emissions in San Juan and Rio Arriba Counties, is flawed. *See* EA at 50. The EA indicates that EPA emission inventory data from 2011 was utilized in reporting overall emissions in San Juan and Rio Arriba Counties. However the EPA's inventory data does not reflect the actual emission inventory data presented by the WRAP as it relies solely on point source inventory data submitted by the New Mexico Environment Department.[8] Yet, as the WRAP data indicates, the vast majority of oil and gas-related VOC emissions are non-point source emissions.

In other words, the emissions data BLM presents in the EA fails to accurately account for oil and gas emissions, raising further concerns that the EA is inadequate and fails to justify a finding of no significant impact. BLM must revise the EA and analyze and assess impacts in terms of accurate emissions data for the oil and gas industry. Moreover, the agency admits that additional near-field air quality modeling is needed. The agency states: "Due to the close proximity of occupied buildings and residences to potential well sites on these lease parcels, information about the air quality impacts at these locations needs to be determined and disclosed as part of the NEPA analysis prior to decision making on the APDs for wells on these parcels." EA at 53. The agency later continues: "At the time of the lease sale, there is still not enough information available about how the lease will be developed to accurately determine the near-field air quality impacts." EA at 53. The agency also admits "Once sold, the lease purchaser has

---

[8] *See* EPA, *2011 National Emissions Inventory, version 1, Technical Support Document DRAFT* (Nov. 2013) at 160, available at: http://www.epa.gov/ttn/chief/net/2011nei/2011_neiv1_tsd_draft.pdf (previously included as Exhibit 5).

the exclusive right to use as much of the leased lands as is necessary to explore and drill oil and gas within the lease boundaries." EA at 10. In other words, regardless of what additional modeling tells us about impacts to air quality, once leases are sold, the agency cannot prevent development. This is precisely the type of scenario that NEPA forbids.

The FFO also incorporates in the EA broad technical information related to air resources from the ARTR for New Mexico, Oklahoma, Texas and Kansas, which is too general in scope to sufficiently analyze the site-specific impacts of oil and gas leasing and development from the proposed action. These documents, as well as the agency's assertion that "leasing the subject tracts would have no direct impacts to air quality[,]" and that "[a]ny potential effects to air quality from the sale of lease parcel would occur at such time that the lease is developed[,]" is the extent of BLM's analysis of air resources. EA at 49. With no analysis, quantified data, or reference to any of NEPA's significance factors, 40 C.F.R. § 1508.27, the agency has failed to satisfy their statutory mandate. The BLM's hard look analysis "must be taken objectively and in good faith, not as an exercise in form over substance, and not as a subterfuge designed to rationalize a decision already made." *Forest Guardians,* 611 F.3d at 712. What the agency offers in one-and-a-half pages fails to satisfy this obligation.

The EA also does not actually analyze or assess the impacts of developing the proposed leases to a number of national ambient air quality standards ("NAAQS"). We are especially troubled that the EA fails to analyze the direct, indirect, and cumulative air quality impacts in the context of NAAQS promulgated since the RMP was adopted. These NAAQS include the 1-hour nitrogen dioxide NAAQS (promulgated in 2010), the 1-hour sulfur dioxide NAAQS (also promulgated in 2010), the 8-hour ozone NAAQS (promulgated in 2008), the 24-hour $PM_{2.5}$ NAAQS (promulgated in 2006), and the annual $PM_{2.5}$ NAAQS (promulgated in 2012). We are particularly concerned over the impacts to the 1-hour NO_2 NAAQS given that short-term NO_2 concentrations are linked to near-field, near ground-level emissions, including compressor engines exhaust stacks and other combustion sources. Because the RMP does not analyze or assess impacts to these air quality standards, in particular the NO_2 NAAQS, the EA cannot reasonably tier to the analysis in the 2003 RMP/EIS or otherwise reasonably conclude that the direct, indirect, and cumulative impacts of the proposed leasing will not be significant.

The failure to analyze and assess impacts to air quality is especially hard to understand because the EA acknowledges the relevant NAAQS. *See* EA at 17 (Table 2). Yet nowhere in the EA does BLM attempt to analyze what the consequences of developing the proposed leases will be in terms of future air quality concentrations. Although the BLM cites current air quality monitoring data in support of its assertion that impacts to the NAAQS will not be significant, the fact that current monitoring does not indicate the region is violating any NAAQS does not mean that the NAAQS will never be violated. Moreover, the U.S. District Court for the District of Colorado in fact rejected a similar analysis prepared by the BLM in support of an oil and gas drilling plan in the Roan Plateau area of western Colorado. In that case, the BLM asserted that the lack of ozone violations indicated that future impacts would not be significant. In her ruling, Judge Krieger stated: "The mere fact that the area has not exceeded ozone limits in the past is of no significance when the purpose of the EIS is to attempt to predict what environmental effects are likely to occur in the future[.]" *Colo. Envtl. Coal. v. Salazar*, 875 F. Supp. 2d 1233, 1257 (D. Colo. 2012). This is particularly relevant here. BLM cites the "current design value of 0.071

ppm" for ozone as "well below the attainment value of 0.075 ppm" to support a conclusion that emissions from the "proposed lease sale are not expected to impact" air quality respective to ozone. EA at 50.

Critically, the BLM failed to consider the stricter EPA ozone standards that were recently finalized. By court order, EPA's new ozone standard was required to be finalized by October 1, 2015.[9] Therefore, EPA's new NAAQS standard for ozone was not only sufficiently foreseeable, but has been finalized well in advance of BLM's release of the EA, and therefore it should have been included in the agency's analysis of alternatives and should have guided consideration of the proposed project.

On schedule, on October 1, 2015, EPA published a final rule to revise NAAQS for ozone to 70 parts per billion (ppb) from the current 75 ppb.[10] This decision was driven by significant recent scientific evidence that the old standard of 75 ppb did not adequately protect public health. Although EPA faces ongoing challenges to the updated standard—including from industry group and state challenges of the stricter standard, and from citizens advocacy groups alleging that the standard is not protective enough, *Murray Energy Corp. v. EPA*, No. 15-1385 (D.C. Cir.) (and consolidated case Nos. 15-1392, 15-1490, 15-1491, 15-1494)—the current 70 ppb standard is still the relevant regulation BLM should have analyzed, here.

Compounding BLM's failure in the EA to actually analyze and assess air quality impacts is that BLM entirely fails to even address emissions impacts. Although the EA discloses 2008 emission data for the San Juan Basin, there is no actual analysis or assessment as to how emission levels would be affected by development of the proposed leases. Simply disclosing the affected environment does not amount to an analysis or assessment of reasonably foreseeable impacts. Particularly when the BLM asserts that future emissions will not be significant, a lack of any actual analysis of emissions impacts is especially troublesome. The EA must be revised to include an actual analysis of how development of the proposed leases will impact emission levels.

D. The BLM failed to take a "hard look" at climate change.

The BLM failed to take a hard look at the climate change impacts from oil and gas leasing and development in the planning area, and failed to consider the Citizen Groups detailed Scoping Comments on climate change and GHG emissions, incorporated herein. 40 C.F.R. § 1506.6. As with air quality, the FFO relies on the ARTR to satisfy the agency's NEPA obligations for climate change and GHG emissions. *See* EA at 50. As noted above, although the ARTR provides a broad overview of oil and gas emissions for a four state region, the document, in isolation, is incapable satisfying the type of site-specific NEPA analysis that is demanded here.

---

[9] *See* http://www.epa.gov/groundlevelozone/pdfs/20141125fs-requirements.pdf; *see also, Sierra Club v. EPA,* No. 13-2809 (N.D. Cal., Apr. 30, 2014).

[10] National Ambient Air Quality Standards for Ozone, EPA-HQ-OAR-2008-0699 (Oct. 1, 2015), "Internet version" available at: http://www3.epa.gov/ozonepollution/pdfs/20151001fr.pdf

The agency begins with the recognition that "increasing concentrations of GHGs are likely to accelerate the rate of climate change." EA at 20. Yet, the FFO attempts to avoid performing any actual analysis and consistently ignores its obligation to consider the direct, indirect and cumulative impacts of GHG emissions, in violation of NEPA. 40 C.F.R. §§ 1502.16(a), (b); 1508.25(c). The agency remarkably provides that "GHG emissions from consumption of oil and gas do not constitute a direct effect that is analyzed under NEPA. Nor is consumption an indirect effect of oil and gas production because production is not a proximate cause of GHG emissions resulting from consumption." EA at 50. Although the agency concedes that production emissions would be a direct impact, the agency states: "[l] easing the subject tracts under the Proposed Action Alternative would have no direct impacts to climate change as a result of GHG emissions. Any potential effects to air quality from sale of a lease parcel would occur at such time that the lease was developed." EA at 50-51. This type of evasive approach is inconsistent with the agency's obligations under NEPA and CEQ regulations. As noted above, this obfuscation contradicts the agency's earlier acknowledgment that full-scale oil and gas development "is reasonably foreseeable … [to] occur on leased parcels," EA at 16, which would otherwise compel the analysis of these reasonably foreseeable impacts. *See New Mexico ex rel. Richardson*, 565 F.3d at 718 (assessment of all "reasonably foreseeable" impacts must occur at the earliest practicable point). Perhaps more critically, however, is the scientific certainty that if we are to stem the impacts of climate change and manage for sustainable ecosystems, not only must the BLM take a hard look at GHG emissions from the proposed development, but its ultimate decision must be reflective of the challenges we face.

Here, the agency is perpetuating the inertial momentum of climate change by failing to take meaningful action on the site-specific contribution of GHG emissions from the proposed action. Although the agency does quantify the annual carbon dioxide equivalent ("CO_2e") emissions for the estimated12 oil wells developed on lease parcels at 1,181 metric tons of CO_2e per year the FFO attempts to diminish the significance of these emissions by comparing them on a scale to total U.S. GHG emissions, total U.S. emissions from oil and gas, and down the line to New Mexico and San Juan Basin GHG emissions from oil and gas.[11]

The only statement of assurance the FFO offers to mitigate these emissions is that "[t]he Field Office will work with industry to facilitate the use of the relevant BMPs for operations proposed on Federal mineral leases where such mitigation is consistent with agency policy." EA at 53. In other words, there is absolutely *no* commitment by BLM to do anything. Such a dismissive approach fails take these emissions in particular and, more broadly, the impacts climate change, seriously. These emissions contribution to climate change are precisely the type of "[cumulative] impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions" that must be considered by the agency. 40 C.F.R. § 1508.7; *Ctr. for Biological Diversity*, 538 F.3d 1172, 1217. Failure to do so would "impermissibly subject[s] the decisionmaking process contemplated by NEPA to 'the tyranny of small decisions.' " *Kern,* 284 F.3d at 1078 (citation omitted).

[11] However, San Juan Basin emission estimates are quantified based on 14,995 wells, which is only about 65% of the more than 23,000 current wells in the basin.

CEQ's Final Guidance explains the application of NEPA principals and practices to the analysis of GHG emissions and climate change, including, among others: (1) that agencies quantify a proposed action's projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools; (2) that agencies use projected GHG emissions as a proxy for assessing potential climate change effects when preparing a NEPA analysis; (3) where GHG emission tools, methodologies, or data inputs are not reasonably available, agencies include a qualitative analysis in the NEPA document and explain the basis for determining that quantification is not reasonably available; (4) analyze foreseeable direct, indirect, and cumulative GHG emissions and climate effects; (5) consider reasonable alternatives and the short- and long-term effect and benefits in the alternatives and mitigation analysis; (6) consider alternatives that would make the actions and affected communities more resilient to the effects of a changing climate; and (7) assess the broad-scale effects of GHG emissions and climate change, either to inform programmatic decisions, or at both the programmatic and project-level. BLM falls dramatically short of this level of analysis and consideration, as required by NEPA.

a. Social cost of carbon.

An EIS must do more than merely identify impacts. An EIS must also enable the agency and other interested parties to "evaluate the severity" of the effects. *See Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 352 (1989); *see also* 40 C.F.R. § 1508.27-(b) (a factor in assessing intensity or severity, and hence significance for NEPA purposes, is "the degree to which the proposed action affects public health or safety").

BLM's EA offers estimates of the amount of GHGs that will be emitted under the lease sale, but fails to include any meaningful discussion of the impacts of these emissions. Where information relevant to foreseeable adverse impacts is unavailable, agencies must nonetheless evaluate "such impacts based upon theoretical approaches or research methods generally accepted in the scientific community." 40 C.F.R. § 1502.22(b)(4).

One widely used approach to evaluating the impact of GHG emissions is to estimate the costs of those emissions to society. The federal Interagency Working Group on the Social Cost of Carbon has developed estimates of the present value of the future costs of carbon dioxide emissions as a proxy for the magnitude and severity of those impacts. The EPA has relied on a similar peer-reviewed estimate for the social cost of methane emissions, which adjusts the social cost of carbon dioxide to account for the different effects of methane on climate change and its greater global warming potential. These tools are easy to use by agencies, easy to understand by the public, and supported by years of peer-reviewed scientific and economic research. The EPA and other federal agencies have used these social cost protocols to estimate the effects of rulemakings on climate, and certain BLM field offices have used these tools in leasing level NEPA analysis. These protocols estimate the global financial cost of each additional ton of GHG pollution emitted to the atmosphere, taking into account factors such as diminished agricultural productivity, droughts, wildfires, increased intensity and duration of storms, ocean acidification, and sea-level rise.

Here, BLM included a social cost of carbon section in its EA, but states: "The BLM finds that including monetary estimates of the Social Cost of Carbon (SCC) in its NEPA analysis for this proposed action would not be useful. There is no court case or existing guidance requiring the inclusion of SCC in the NEPA context." EA at 20. The agency later continued: "Given the global nature of climate change, estimating SCC of an individual decision requires assessing the impact of the project on the global market for the commodity in question. While we are able to estimate the GHG emissions associated with the Proposed Action Alternative for this project, we have not estimated the net effect of this action on global GHG emissions or climate change." EA at 20. Although these statements attempt to insulate the agency from including such analysis, BLM misses the fundamental NEPA obligation that employing SCC would satisfy, which is acting as a proxy for the magnitude and severity of climate impacts. Instead, BLM states that it "presents a qualitative discussion of the environmental effects of climate change and their socioeconomic consequences," EA at 20, but no such analysis can be found. In fact, BLM later concludes that "[l]easing the subject tracts under the Proposed Action Alternative would have no direct impacts to climate change as a result of GHG emissions. Any potential effects to air quality from sale of a lease parcel would occur at such time that the lease was developed." EA at 50-51.

Simple calculations applying the SCC to GHG emissions from this lease sale offer a straightforward comparative basis for analyzing impacts, and identifying very significant costs. The agency recognizes that "Total Potential GHG Emissions from Oil and Gas Field Production at Full Development (12 wells)" is 1,181 metric tons of CO_2e. EA at 52. Applying the IWG central value of $43 per ton of CO_2 results in a SCC of $50,783 for 12 wells.[12]

Notably, BLM recognizes that "methane has a global warming potential that is 21-25 times greater than the warming potential of CO_2." EA at 51. Earlier, however, BLM stated that "[m]ethane is 34 times more potent at trapping greenhouse gas emissions than CO2 when considering a time horizon of 100 years (Intergovernmental Panel on Climate Change, 2013)." EA at 19. Despite this recognition, BLM still chose to apply outdated GWP figures and therefore significantly underestimate the climate impact of methane. Moreover, BLM offers no justification for relying on a 100-year time horizon. According to the same IPCC report (which BLM cited but failed to apply), the 20-year GWP for methane—which is the relevant timeframe for consideration if we are to stem the worst of climate change—is 87.[13] While BLM fails to quantify what percentage of stated GHG emissions from the project are from methane, EPA estimates provide that approximately 97% of emissions from oil production in the San Juan Basin are from methane. Accordingly, if the updated GWP of 87 for methane is applied, emissions of CO^2e from the project increase dramatically, to **4,745 metric tons for the 12 wells, or a SCC of $204,075.**

[12] It is important to note that, although the 2010 IWG SCC protocol did not address methane impacts, the 2013 IWG Technical Update explicitly addresses methane impacts. Thus, it is appropriate to calculate a SCC outcome that takes into account the full CO_2e emissions associated with the proposed leasing.

[13] *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *Working Group I Contribution to the IPCC Fifth Assessment Report Climate Change 2013: The Physical Science Basis,* at 8-58 (Table 8.7) (Sept. 2013) (included previously as Scoping Exhibit 68).

Critically, however, the agency only quantifies the estimated emissions from the projects *production*—rationalizing that "oil and gas leaves the custody and jurisdiction of the BLM after the production phase." EA at 51. The agency altogether fails to consider the indirect impacts of combustion, as NEPA demands. *See* 40 C.F.R. § 1508.25(c). The agency does recognize, however, that final consumption of oil represents 80% of CO_2e emissions. EA at 52. BLM assumes that an estimated 12 wells drilled on leased parcels would translate to 2,940,000 barrels of oil equivalent ("BOE") recovered from the leasehold. EA at 46. The EPA provides a conversion factor of 0.43 metric tons of CO_2 per barrel of oil consumed.[14] **This results in combustion emissions of 1,264,200 tons of CO_2e, or a SCC of $54,360,600.**

Instead of considering these costs, the agency attempts to evade the necessary NEPA analysis of the magnitude and severity of GHG emission impacts by erroneously concluding that "[i]t is currently not feasible to predict with certainty the net impacts from the proposed action on global or regional climate" EA at 67. As noted by Judge Jackson, the SCC protocol provides such a tool. *See High Country Conservation Advocates v. U.S. Forest Service,* 52 F.Supp.3d 1174, 1190 (D.Colo. 2014). By failing to consider the costs of GHG emissions from the Proposed Action, the agency's analysis effectively assumes a price of carbon that is $0. *See id.* at 1192 (holding that although there is a "wide range of estimates about the social cost of GHG emissions[,] neither the BLM's economist nor anyone else in the record appears to suggest the cost is as low as $0 per unit. Yet by deciding not to quantify the costs as all, the agencies effectively zeroed out the cost in its quantitative analysis."). The agency's failure to consider the SCC is arbitrary and capricious, and ignores the explicit directive of EO 12866.

An agency must "consider every significant aspect of the environmental impact of a proposed action." *Baltimore Gas & Elec. Co. v. Natural Resources Defense Council*, 462 U.S. 87, 107 (1983) (quotations and citation omitted). This includes the disclosure of direct, indirect, and cumulative impacts of its actions, including climate change impacts and emissions. 40 C.F.R. § 1508.25(c). The need to evaluate such impacts is bolstered by the fact that "[t]he harms associated with climate change are serious and well recognized," and environmental changes caused by climate change "have already inflicted significant harms" to many resources around the globe. *Massachusetts v. EPA*, 549 U.S. 497, 521 (2007); *see also id.* at 525 (recognizing "the enormity of the potential consequences associated with manmade climate change."). Among other things, the agency's analysis must disclose "the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity[,]" including the "energy requirements and conservation potential of various alternatives and mitigation measures." 42 U.S.C. § 4332(c); 40 C.F.R. § 1502.16(e). As explained by CEQ, this requires agencies to "analyze total energy costs, including possible hidden or indirect costs, and total energy benefits of proposed actions." 43 Fed. Red. 55,978, 55,984 (Nov. 29, 2978); *see also* Executive Order 13514, 74 Fed. Reg. 52,117 (Oct. 5, 2009) (requiring government agencies to disclose emissions information annually from direct and indirect activities). Failing to perform such analysis undermines the agency's decisionmaking process and the assumptions made.

[14] *See* EPA, *Calculations and References*, available at: http://www.epa.gov/cleanenergy/energy-resources/refs.html.

Moreover, BLM typically measures a project's GHG emissions against a baseline of national and/or global GHG emissions—thereby marginalizing the Proposed Actions contribution to our climate crisis while concluding the agency is powerless to avoid or mitigate such impacts. Here, the agency provides that "climate change is a global process that is impacted by the sum total of GHGs in the Earth's atmosphere. The incremental contribution to global GHGs from the proposed action cannot be translated into effects on climate change globally or in the area of this site-specific action." EA at 67. Indeed, the EPA has cautioned "against comparing GHG emissions associated with a single project to global GHG emission levels" because it erroneously leads to a conclusion that "on a global scale, emissions are not likely to change" as a result of the project.[15] As noted above, CEQ has offered similar guidance, recognizing that "the totality of climate change impacts is not attributable to any single action, but are exacerbated by a series of actions including actions taken pursuant to decisions of the Federal Government. Therefore, a statement that emissions from a proposed Federal action represent only a small fraction of global emissions is essentially a statement about the nature of the climate change challenge, and is not an appropriate basis for deciding whether or to what extent to consider climate change impacts under NEPA." Applying the SCC, as provided above, takes these abstract emissions and places them in concrete, economic terms. It also allows the agency to easily perform the cost-benefit analysis mandated by EO 12866, as well as BLM's own policy. Specifically, Instruction Memorandum No. 2013-131 (Sept. 18, 2013) is reflective of the BLM's attempt to internalize the costs of such emissions:

> All BLM managers and staff are directed to utilize estimates of nonmarket environmental values in NEPA analysis supporting planning and other decision-making where relevant and feasible, in accordance with the attached guidance. At least a qualitative description of the most relevant nonmarket values should be included for the affected environment and the impacts of alternatives in NEPA analyses….
>
> Nonmarket environmental values reflect the benefits individuals attribute to experiences of the environment, uses of natural resources, or the existence of particular ecological conditions that do not involve market transactions and therefore lack prices. Examples include the perceived benefits from hiking in a wilderness or fishing for subsistence rather than commercial purposes. The economic methods described in this guidance provide monetary estimates of nonmarket values. Several non-economic, primarily qualitative methods can also be used to characterize the values attributed to places, landscapes, and other environmental features. Guidance on qualitative methods for assessing environmental values, including ethnography, interviews, and surveys, is in preparation.
>
> Ideally, economic analysis for resource management should consider all relevant values, not merely those that are easy to quantify. Utilizing nonmarket values provides a more complete picture of the consequences of a proposed activity than market data alone would allow. The BLM's Land Use Planning

[15] *See* Light, 87 Tul. L. Rev. 511, 546.

> Handbook, Appendix D encourages inclusion of information on nonmarket values, but does not provide detail.

The agency simply cannot continue to ignore its obligation to consider the costs of GHG emissions in its decisionmaking, as it has done here.

Nor can the agency continue to tout the benefits of oil and gas development without similarly disclosing the costs. *See* 40 C.F.R. § 1502.23. In this case, BLM fails to mention *any* of the costs associated the Proposed Action, but is happy to discuss the anticipated economic benefits. In justifying its decision to not consider SCC, BLM states: "NEPA analysis for this proposed action does not include monetary estimates of any benefits or costs… Without any other monetized benefits or costs reported, monetized estimates of the SCC would be presented in isolation, without any context for evaluating their significance. This limits their usefulness to the decision maker." EA at 20-21. This is untrue. A few pages later, BLM applies a $50 per barrel to the 2,940,000 BOE recovered from the leasehold to conclude: "The Federal royalty on that would be $18.4 million which would be foregone without leasing." EA at 46-47. Ignoring for the moment that this figure pales in comparison to the $54,564,675 in total SCC for developing these resources, this type of misleading and one-sided analysis is expressly forbidden. *See Hughes River Watershed Conservancy v. Glickman*, 81 F.3d 437, 446-47 (4th Cir. 1996) ("it is essential that the EIS not be based on misleading economic assumptions); *Sierra Club v. Sigler,* 695 F.2d 957, 979 (5th Cir. 1983) (agency choosing to "trumpet" an action's benefits has a duty to disclose its costs).

Here, the agency violated NEPA by relying on analysis that partially disclosed the amount of GHG pollution from foreseeable oil and gas development, while also failing to take the essential next step required for a hard look: disclosing the costs and impacts that such pollution would have. An economic cost-benefit must be performed before the agency authorizes the proposed development. As detailed herein, such an analysis will reveal dramatically greater costs to people and the environment than anticipated benefits from the project, which seriously undermines the economic logic of proceeding with the proposed sale. At the very least, however, failing to provide any cost-benefit analysis is impermissible according to the agency's multiple legal obligations, including NEPA, EO 12866, as well as BLM's own policy IM No. 2013-131.

b. Methane emissions and waste.

By making absolutely no commitment on mitigation measures and BMPs to address the GHG emissions from oil and gas leasing and development, the FFO is missing a critical opportunity and, indeed, obligation, to address the serious issue of methane ("CH_4") emissions and waste. *See* EA at 53 ("The Field Office will work with industry to facilitate the use of the relevant BMPs for operations proposed on Federal mineral leases where such mitigation is consistent with agency policy."). As detailed in Scoping Comments, incorporated herein, there readily available and cost-effective mitigation technologies that can drastically reduce the amount of methane lost during production. And, as introduced above, the IPCC's new global warming potential ("GWP") estimates for methane—of 36 over a 100-year period, and 87 over a

20-year period[16]—underscores the importance of eliminating methane waste, which is a critical step the FFO can take *now* to reduce GHG emissions in the planning area. That the FFO failed to make the use of *any* methane mitigation technology a requirement for the future development of these parcels is inexcusable. Instead of making a specific commitment to address the serious waste of a harmful climate pollutant, BLM offers that "USEPA promulgated air quality regulations controlling VOC emissions at gas wells. These rules require air pollution mitigation measures that reduce the emissions of volatile organic compounds. These same mitigation measures have a co-benefit of reducing methane emissions." EA at 19.

To the agency's credit, BLM has finally acknowledged the methane "hot spot" that exists over the San Juan Basin, citing "pioneering research using space-borne (satellite and aircraft) determination of methane concentrations have indicated anomalously large methane concentrations may occur in the Four Corners region (Kort, Frankenberg, Costigan, Lindenmaier, Dubey, & Wunch, 2014)." EA at 19. Yet, in an apparent attempt to avoid taking action on the methane hot spot, BLM continues: "While space-borne studies can determine the pollutant concentration in a column of air, these studies cannot pinpoint the specific sources of air pollution. Further study is required to determine the sources responsible for methane concentrations in the Four Corners region; however, it is known that a significant amount of methane is emitted during oil and gas well completion (Howarth, Santoro, & A. Ingraffea, 2011)." EA at 19. This uncertainty is no longer the case. This summer, NASA released a study of methane emissions in the San Juan Basin identifying 250 large methane plumes emitted from well pads, storage tanks, pipelines, gas processing plants, and venting from the San Juan coal mine.[17] Together these sources make up roughly half of all basin-wide methane emissions, and all but one of these sources is from the oil and gas industry.

To comply with NEPA, the BLM must take a hard look at direct, indirect, and cumulative impacts, as discussed above. 40 C.F.R. §§ 1502.16(a), (b); 1508.25(c). In evaluating impacts, the agency must discuss "[e]nergy requirements and conservation potential of various alternatives and mitigation measures," "[n]atural or depletable resource requirements and conservation potential of various alternatives and mitigation measures," and "[m]eans to mitigate adverse environmental impacts (if not fully covered under 1502.14(f))." 40 C.F.R. §§ 1502.16(e), (f), (h). The FFO's EA fails to provide any such analysis or comparison.

We emphasize, again, the "heart" of the NEPA process: BLM's duty to consider "alternatives to the proposed action" and to "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources." 42 U.S.C. §§ 4332(2)(C)(iii), 4332(2)(E); 40 C.F.R. § 1502.14(a). Alternatives are critical because, "[c]learly, it is pointless to 'consider' environmental costs without also seriously considering action to avoid them." *Calvert Cliffs' Coordinating Comm., Inc. v. U.S. Atomic Energy Commn.*, 449 F.2d 1109, 1128 (D.C. Cir. 1971). Here, BLM considered only two alternatives: a "no action" alternative in which none

[16] *See* IPCC, *Fifth Assessment Report Climate Change 2013* at 8-58.
[17] Christian Frankenberg, et al., *Airborne methane remote measurements reveal heavy-tail flux distribution in Four Corners region*, PNAS, vol. 113 no. 25 (Aug. 30, 2016) (attached as Exhibit 4).

of the nominated parcels would be offered for sale, and the "proposed action" where four allotment parcels covering 843 acres are offered with standard terms and conditions as well as lease stipulations dating back to the obsolete and ineffective 2003 RMP and EIS. *See* EA 9-10 (discussing alternatives). None of these existing measures or stipulations addresses GHG emissions or methane waste.

With no analysis or context, the EA includes a section on Design Features where the following statement is made:

> The FFO purchased an infrared camera designed to detect natural gas leaks on and around well pad and pipeline facilities. FFO inspection personnel have been trained to operate the camera and FFO is currently developing a strategy to implement the use of the camera in cooperation with oil and gas operators to detect and eliminate natural gas leaks in well pad and pipeline infrastructure.

EA at 12.

The infrared camera was purchased as part of the 2003 RMP settlement in 2010 by BLM and several of the organizations on this comment letter. The FFO has failed to develop a strategy to implement the infrared camera program while the infrared camera (purchased at considerable expense) is mothballed in a BLM closet. If BLM has any data that shows that the infrared camera has been used in the field, we would be interested in being apprised of how and when it has been utilized. In the absence of such a demonstration, the agency's reliance on an otherwise nonexistent infrared camera program, here, fails to assuage Citizens Groups' concerns regarding harmful fugitive emissions and waste from the proposed action. Without a strategy, data, and analysis demonstrating the benefits of employing this technology to address the considerable impacts and waste of methane and other pollutant emissions in the planning area, it is disingenuous at best, and deceptive at worse, to tout this as a design feature that would mitigate impacts when developing these parcels—and furthermore fails to satisfy NEPA's hard look mandate.

Moreover, the FFO's EA fails to quantify the magnitude of methane pollution from oil and gas emissions sources within the planning area—which, given the agency's admission that these parcels will be developed in a business-as-usual manner—is directly relevant to the proposed sale. Oil and natural gas systems are the biggest contributor to methane emissions in the United States, accounting for over one quarter of all methane emissions, or 129.9 million metric tons of CO_2e each year (which does not include CH_4 that has been flared, captured, or otherwise controlled).[18] However, methane emission rates can differ quite dramatically from one oil and gas field to the next, and, depending on the type of mitigation and emission controls employed, emissions can range anywhere from 1% to 12% of production.[19] In order to

[18] *See* U.S. EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2012*, at 3-63 (April 2014) (included previously as Exhibit 12).

[19] *See, e.g.,* David T. Allen, et. al., *Measurements of methane emissions at natural gas production sites in the United States*, PNAS (Aug. 19, 2013) (finding emissions as low as 1.5%

sufficiently understand the scope of methane emission impacts expected from the proposed action, BLM should quantify estimated emission rates and analyze alternatives that would mitigate these impacts. However, even without specific data from the proposed action, we can assume leakage somewhere between these two extremes and, even at the low end, emissions reductions would not be trivial, particularly in a region containing the largest methane plume in the country. The agency's refusal to consider any mitigation measures that would reduce these emissions fails to satisfy BLM's NEPA obligations.

Even setting aside the issue of climate change, every ton of methane emitted to the atmosphere from oil and gas development is a ton of natural gas *lost*. Every ton of methane lost to the atmosphere is therefore a ton of natural gas that cannot be used by consumers. Methane lost from federal leases will also not yield royalties otherwise shared between federal, state, and local governments. This lost gas reflects serious inefficiencies in how BLM oil and gas leases are developed. Energy lost from oil and gas production – whether avoidable or unavoidable – reduces the ability of a lease to supply energy, increasing the pressure to drill other lands to supply energy to satisfy demand. 40 C.F.R. §§ 1502.16(e)-(f). In so doing, inefficiencies create indirect and cumulative environmental impacts by increasing the pressure to satisfy demand with new drilling. 40 C.F.R. §§ 1508.7, 1508.8(b).

c. Managing for community and ecosystem resiliency.

Critically absent from the FFO's analysis is any mention of the climate change impacts already effecting the planning area. As provided in Scoping Comments, and according to experts at the Government Accountability Office ("GAO"), federal land and water resources are vulnerable to a wide range of effects from climate change, some of which are already occurring. These effects include, among others, "(1) physical effects, such as droughts, floods, glacial melting, and sea level rise; (2) biological effects, such as increases in insect and disease infestations, shifts in species distribution, and changes in the timing of natural events; and (3) economic and social effects, such as adverse impacts on tourism, infrastructure, fishing, and other resource uses."[20] There is absolution no mention, much less analysis, in the EA of these growing impacts or the necessity to employ climate mitigation measures to ensure landscape and

---

of production at select cites) (included previously as Scoping Exhibit 66); Anna Karion, et. al., *Methane emissions estimate from airborn measurements over a western United States gas field*, GEOPHYSICAL RESEARCH LETTERS (Aug. 27, 2013) (finding emissions of 6 to 12 percent, on average, in the Uintah Basin) (included previously as Scoping Exhibit 67).

[20] GAO Report, *Climate Change: Agencies Should Develop Guidance for Addressing the Effects on Federal Land and Water Resources* (2007) (included previously as Scoping Exhibit 35); *see also* Committee on Environment and Natural Resources, National Science and Technology Council, *Scientific Assessment of the Effects of Global Climate Change on the United States* (2008) (included previously as Scoping Exhibit 36); Melanie Lenart, et. al. *Global Warming in the Southwest: Projections, Observations, and Impacts* (2007) (included previously as Scoping Exhibit 37) (describing impacts from temperature rise, drought, floods and impacts to water supply on the southwest).

human resiliency and their ability to adapt and respond to climate change impacts.

Beyond mitigating climate change by reducing contributions of GHG pollution to the atmosphere, the BLM can also help promote ecological resiliency and adaptability by reducing external anthropogenic environmental stresses (like oil and gas development) as a way of best positioning public lands, and the communities that rely on those public lands, to withstand what is acknowledged ongoing and intensifying climate change degradation. It is crucial for the BLM to close the gap in their decision-making regarding the cumulative contribution of oil and gas development authorized in the proposed action, particularly given the conflict between such authorization and the agency's responsibility to manage for healthy, resilient ecosystems. Although the FFO has recognized the threat of climate change, the agency's decision-making is not reflective of this harm and the agency fails to take the many necessary and meaningful steps to ameliorate the impacts to communities, landscapes, and species. The FFO's failure to even mention the relationship between climate change and these impacts is a fundamental deficiency in the EA.

E. The BLM failed to take a "hard look" at hydraulic fracturing.

The BLM failed to take a hard look at hydraulic fracturing (or "fracking") impacts from oil and gas leasing and development in the planning area, and failed to consider the Citizen Groups detailed Scoping Comments on fracking, incorporated herein. 40 C.F.R. § 1506.6.

The agency's EA acknowledges that it is foreseeable that hydraulic fracturing will occur on leased parcels, and that "[h]ydraulic fracturing is a common process in the San Juan Basin and applied to nearly all wells drilled." *See* EA at 58. And that it is "anticipated that with more wells being drilled, there will be an increase in the amount of wells being hydraulically fractured and completed." EA at 49. The agency also identifies impacts from fracking, such as: "Volatile organic compounds are emitted during the completion of hydraulically fractured wells," EA at 49; "a higher probability of dust particulates in the atmosphere from the increase in vehicular traffic due to hydraulically fracturing wells," EA at 49; impacts to special status species and wildlife, EA at 61; as well as impacts to nearby residents, EA at 64. However, in each instance the FFO either relies on vague and undefined future mitigation, attempts to explain why these impacts actually aren't that big a deal, or ignores these impacts altogether—all without ever providing the hard look analysis that NEPA demands. Although BLM included additional information in Appendix 1: Phases of Oil and Gas Development, it offers little more than a factual background on the hydraulic fracturing process without actually analyzing impacts to people and resource values in the planning area. EA at 78.

With regard to VOC emissions from fracked wells, the EA cites EPA promulgated air quality regulations for completion of hydraulically fractured gas wells, and states that "[t]hese rules require air pollution mitigation measures that reduce emissions of volatile organic compounds during gas well completions." EA at 50. However, the EA fails to provide what these mitigation measures actually are, or quantify how such measures "constitute an adequate buffer against the negative impacts [and] whether the mitigation measures will render such impacts so minor as to not warrant an EIS." *National Parks*, 241 F.3d at 735.

Critically, the agency also acknowledges impacts to nearby residents, who "may be disturbed while hydraulic fracturing or other completion and stimulation operations are occurring, as these activities involve many vehicles, heavy equipment, and a workover rig." EA at 49. In response, the FFO callously provides that "[t]hese impacts would be limited to the period of time during which drilling operations associated with hydraulic fracturing occur." EA at 49. Of course, these sensory impacts represent only some of the far broader effects that local residents will suffer from the proposed action, as detailed below. Plainly, however, the FFO cannot avoid a finding of significance simply because they allege that these impacts are limited in time, as the agency erroneously suggests. *See* 40 C.F.R. §§ 1508.8, 1508.27.

BLM does include a new lease stipulation, and provide that it was "developed to require modeling to determine 'near-field' air quality impacts (see Appendix 2). Due to the close proximity of occupied buildings and residences to potential well sites for these lease parcels, information about the air quality impacts at these locations needs to be determined and disclosed as part of the NEPA analysis prior to decision making on the APDs for wells on these parcels." EA at 65; Appendix 2 at 83. As noted above, however, a commitment to perform modeling at the drilling stage is too late, and a point where BLM is necessarily forced to mitigate impacts rather than preventing them altogether.

BLM and the New Mexico Oil & Gas Conservation Division's ("NMOCD") lack of inspection capacity also significantly undermines responsible oil and gas development in the state.[21] Currently, there are only 13 NMOCD field inspectors to oversee 53,000 producing wells—an impossible task.

F. The BLM failed to take a "hard look" at impacts to water resources.

The BLM failed to take a hard look at water resource impacts from oil and gas leasing and development in the planning area, and failed to consider the Conservation Groups detailed Scoping Comments on both water quality and quantity, incorporated herein. 40 C.F.R. § 1506.6. In addition to the water resource concerns raised in the Scoping Comments of both the Citizen Groups and the Center for Biological Diversity, the BLM has failed to consider a significant potential impact to ground and/or surface water associated with Mancos Shale drilling. It is well established that the Mancos Shale formation, and groundwater associated with Mancos Shale beds, contains high concentrations of pollutants including nitrate, selenium, and uranium.[22] Prior to authorizing leases that will foreseeably result in Mancos Shale drilling, the BLM must analyze the potential for drilling and related operations—including produced water and frack fluid storage and disposal, drilling mud and cuttings storage and disposal, cross-contamination of aquifers from induced fractures and/or wellbore communication—to result in contamination of ground and/or surface waters with selenium, uranium, or other Mancos Shale contaminants.

a. Groundwater

[21] *See* Earthworks, *Enforcement Report: New Mexico Oil & Gas Conservation Division* (May 2012) (attached as Exhibit 5).
[22] *See* U.S. Dep't of Energy, *Natural Contamination from the Mancos Shale*, LMS/S07480 (April 2011), http://energy.gov/sites/prod/files/S07480_NatContRpt.pdf.

BLM acknowledges: "Potential impacts to groundwater resources could occur from the proposed well bore, including groundwater depletion, contamination or cross-contamination of aquifers during drilling and completion phases." EA at 59. Nevertheless, BLM's chosen approach is to postpone actual analysis of these impacts until the APD stage, where "a BLM geologist would identify all potential subsurface formations that would be penetrated by the wellbore. This includes all groundwater aquifers and any zones that would present potential safety or health risks that may need special protection measures during drilling, or that may require specific protective well construction measures," after which "BLM would review the company's proposed casing and cementing programs to ensure well construction design is adequate to protect the surface and subsurface environment." EA at 59. As with other resource values, BLM's shell-game approach to NEPA analysis fails to satisfy the agency's explicit mandate to analyze all reasonably foreseeable impacts at the earliest practicable point, which, here, clearly requires assessment prior to the January 2017 lease sale. *See New Mexico ex rel. Richardson*, 565 F.3d at 718. Unspecified mitigation and unsupported conclusions fail to demonstrate an "adequate buffer against the negative impacts" and fail to determine "whether the mitigation measures will render such impacts so minor as to not warrant an EIS." *National Parks*, 241 F.3d at 735.

The agency also states "there are no drinking water sources located in or near the proposed parcels." EA at 34. Elsewhere, however, the agency recognizes the need for additional near-field air quality modeling "[d]ue to the close proximity of occupied buildings and residences to potential well sites on these lease parcels." EA at 53. The agency fails to explain the apparent contradiction that an occupied building or residence wouldn't also require a source of drinking water. Given the agency's admission that groundwater contamination could occur—as well as a recently published study demonstrating drinking-water well contamination from fracking[23]—the agency's conclusion that there is no possibility of impacts to groundwater remains unsupported.

b. Surface Water

BLM is remarkably silent with regard to potential impacts to surface waters. Although the agency offers that "[d]uring operation, pipelines could potentially leak or rupture, which could impact groundwater quality," EA at 60, there is no mention of how such accidents would impact surface waters. In fact, all BLM offers is that, "[i]n the event of a leak or rupture, the BLM and NMOCD would work collaboratively to clean up the spill and protect groundwater." EA at 60. In other words, rather than taking steps to mitigate or avoid such accidents, BLM simply commits to cleaning it up once it happens. There is no discussion of mitigation or any other explanation of how these impacts are otherwise so insignificant as to not warrant an EIS. Such a cursory approach by the agency fails to their NEPA obligations seriously.

[23] *See* Thomas H. Darrah, et al., *Noble gasses identify the mechanisms of fugitive gas contamination in drinking-water wells overlying the Marcellus and Barnett Shales*, PNAS (Aug. 12, 2014) (previously attached as Exhibit 13) (identifying "discrete clusters of fugitive gas contamination … that showed increased contamination through time" of drinking-water wells as a result of nearby hydraulic fracturing).

c. Water Quantity

The FFO's analysis of water quantity impacts is similarly devoid of detail. The limited extent of consideration in the EA provides: "The water used for hydraulic fracturing in the FFO generally comes from permitted groundwater wells, although surface water sources may occasionally be used. Because large volumes of water are needed for hydraulic fracturing, the use of groundwater for this purpose might contribute to the drawdown of groundwater aquifer levels. Groundwater use is permitted and managed by the NM OSE, and these water rights have already been designated." EA at 59. Whether or not BLM is responsible of allocation of water rights is beside the point of whether the agency has satisfied its obligations under NEPA. Here, the agency clearly has not. Notably, in an arid region already suffering from prolonged drought, substantial amounts of water—which will primarily come from groundwater sources—is required in developing these leases. "Approximately 1.02 million gallons (approximately 3.13 acre-feet) of water would be used for drilling and completions per well (Engler, et al., 2014)." EA at 59. Although BLM states that "[t]he use of groundwater for hydraulic fracturing is in compliance with all federal and state laws and regulations," EA at 59-60, BLM fails to take a hard look at how such water use will impact people and resources in the planning area, as NEPA requires. There is no discussion of how the groundwater drawdown from developing these oil wells will impact the land, wildlife, livestock, or human communities in the planning area, or how these impacts are further compounded in a drought-stricken southwest. There is no discussion of alternatives—such as the use of nitrogen fracking, which is already occurring in the area and which was referenced by the FFO in a scoping meeting handout for the Mancos Shale RMP—or the tradeoff between water savings and air quality impacts of employing these technologies. There is no discussion of how impacts to groundwater will be mitigated, let alone with a sufficient enough buffer to avoid significance. Quite simply, the agency's EA does not satisfy the hard look NEPA demands.

G. The BLM failed to take a "hard look" at induced seismic risks.

BLM arbitrarily and capriciously concluded that "there will be no induced seismic activity from the proposed action" without actually analyzing any existing subsurface conditions in the action area. EA at 35. For example, BLM did not look at whether there are active fault lines in the area, or fault lines that could be activated by wastewater injection. Instead, BLM summarily dismissed any such considerations and instead relied only on data regarding the number of past earthquakes in the area. Because there were not "any natural or induced earthquakes in the San Juan Basin from 1973-2012," EA at 34, BLM assumes that the chances of any earthquakes occurring in the action area, regardless of what activities may result directly or indirectly from the proposed action, are less than 1 percent. This assumption relies on a USGS map, Forecast for Damage from Natural and Induced Earthquakes in 2016, which merely looked at past activity rather than any site-specific existing subsurface conditions. In assuming so, BLM ignores USGS's disclaimer that "assessment of induced earthquake hazard was dependent on the assumption that past earthquake rates will remain constant over the next year of the forecast. While this assumption will not hold for areas of injection over long periods, recent studies…indicate that assessing earthquake rates observed over short time windows of a year or less are currently the best method available for forecasting the next year's rate of induced

earthquakes. This model, however, does not account for increased, reduced, or new induced activity in 2016."[24] BLM failed to consider the growing body of scientific evidence showing that increases in wastewater injections might increase seismic activity in the area.[25]

That the action area is more than 150 miles from the "three main areas in New Mexico (Dagger Draw, Raton, and Socorro) that have seismic activity," EA at 34, is irrelevant because even one new injection well could push stable faults past their tipping points and induce earthquakes.[26] Pore-pressure models have demonstrated that a combination of brine production and wastewater injection near faults in Azle, Texas, for example, generate subsurface pressures sufficient to induce earthquakes on near-critically stressed faults in the area.[27] But earthquake swarms have been observed to be associated with extraction as well, not just injection.[28] Induced seismicity is often associated with subsurface pressure changes, and extensional stresses will concentrate on the boundary of the fluid draw-down region, promoting normal faulting.[29] Contrary to BLM's assumptions, the fact that there has not yet been much seismic activity in the area does not preclude the possibility that more oil and gas activity will lead to earthquakes.

As the Center has already explained in its scoping comments, BLM is required to look at the region's fault environment by identifying and characterizing all faults in these areas based on sources including but not limited to the USGS Quaternary Fault and Fold database. In its analysis, BLM should assess its ability to identify all faults in these areas, including strike-slip faults and deep faults that can be difficult to detect. BLM should also consider the background seismicity of oil- and gas-bearing lands including the history of earthquake size and frequency, fault structure (including orientation of faults), seismicity rates, failure mechanisms, and state of stress of faults, as well as the geology of oil- and gas-bearing lands including pore pressure, formation permeability, and hydrological connectivity to deeper faults. As the Center has stated in its previous comments, BLM must analyze the potential for fracking and wastewater disposal to induce earthquakes, and the possible risks of induced seismicity in the specific areas for lease, including structures in the area that are at risk. Moreover, many of the archeological features in the region, including the delicately balanced walls of Pueblo Bonito and other Great Houses

---

[24] USGS. 2016. One-Year Seismic Hazard Forecast for the Central and Eastern United States from Induced and Natural Earthquakes, Open-File Report 2016–1035 (2016) ("USGS 2016)" at 12, available at http://pubs.usgs.gov/of/2016/1035/ofr20161035.pdf.

[25] Ellsworth, W.L. Injection-Induced Earthquakes, 341 Science 1225942 (2013) ("Ellsworth 2013"); Keranen, Katie et al., Potentially Induced Earthquakes in Oklahoma, USA: Links Between Wastewater Injection and the 2011 Mw5.7 Earthquake Sequence, Geology doi:10.1130/G34045.1 (March 26, 2013) ("Keranen 2013").

[26] Lamont-Doherty Earth Observatory, Columbia University. Distant Quakes Trigger Tremors at U.S. Waste-Injection Sites, Says Study. July 11, 2013, available at: https://www.ldeo.columbia.edu/news-events/distant-quakes-trigger-tremors-us-waste-injection-sites-says-study .

[27] Hornbach, Matthew J. et al., Causal Factors for Seismicity near Azle, Texas, Nature Communications 6:6728 (April 21, 2015), 1, available at: http://www.nature.com/ncomms/2015/150421/ncomms7728/full/ncomms7728.html.

[28] *Id*. at 5-6.

[29] *Id*.

associated with Chaco Culture National Historical Park and outlying sites, are particularly susceptible to seismic activity. Limiting its analysis to only past seismic activity in the area, which provides no information at all on the potential impacts of the proposed action, does not meet NEPA requirements.

H. The BLM failed to take a "hard look" at impacts to human health.

The BLM failed to take a hard look at human health impacts from oil and gas leasing and development in the planning area, and failed to consider the Conservation Groups detailed health concerns, as raised throughout the Scoping Comments, incorporated herein. 40 C.F.R. § 1506.6.

The FFO generally identifies health impacts throughout the EA, but fails to ever offer the hard look that NEPA demands. For example, health concerns due to air quality are raised in the discussion of the Air Quality Index ("AQI") and National Air Toxics Assessment ("NATA"), EA at 18, but the agency erroneously assumes its obligations are satisfied by these references alone, and fails to acknowledge their independent responsibility to analyze these impacts under NEPA before an irretrievable commitment of resources is made.

The consideration of impacts adverse to human health are also acknowledged in the affected environment section as an obligation with regard to the agency's environmental justice review, EA at 41, but there is, typically, *no* subsequent analysis of those impacts. *See* EA at 64. As with other resource values, BLM acknowledges the potential impacts to communities and human health without ever analyzing those impacts, as NEPA demands. EA at 64 ("While the act of leasing federal minerals itself would result in no social impacts, subsequent development of a lease may generate impacts to people living near or using the area in the vicinity of the lease. Oil and gas exploration, drilling, or production could create a disruption to these people due to increased traffic and traffic delays, air pollution, noise and visual impacts."); EA at 80 ("To ensure that hydraulic fracturing is conducted in a safe and environmentally sound manner, the BLM approves and regulates all drilling and completion operations, and related surface disturbance on Federal public lands. Operators must submit Applications for Permit to Drill (APDs) to the agency. Prior to approving an APD, a BLM Field Office geologist identifies all potential subsurface formations that would be penetrated by the wellbore. This includes all groundwater aquifers and any zones that would present potential safety or health risks that may need special protection measures during drilling, or that may require specific protective well construction measures.").

None of these references to the human health impacts of oil and gas leasing and development include any actual analysis. The FFO's shell-game approach to NEPA fails to satisfy the agency's explicit mandate to analyze all reasonably foreseeable impacts at the earliest practicable point, which, here, clearly requires assessment prior to the January 2017 lease sale. *See New Mexico ex rel. Richardson*, 565 F.3d at 718.

The EA's failure to take a hard look at the potential health impacts of oil and gas activities on these leases is especially concerning given the EA's acknowledgement of the likelihood that there will be "close proximity of occupied buildings and residences to potential well sites on these lease parcels." EA at 11. In response, the agency has imposed a lease

stipulation for the four parcels requiring no surface occupancy ("NSO") within 660 feet of occupied residences. EA at 11. This setback is insufficient to ensure that health impacts will be avoided, and, critically, the agency has failed to provide any justification or data supporting this decision. For example, Colorado's oil and gas commission recently passed new rules imposing a 500-foot setback for residences, but a buffer zone setback of 1,000-feet wherein mitigation and COGCC approval is required. *See* 2 C.C.R. § 404-1. Notably, however, current Colorado ballot Initiative 88 seeks a 2,000-foot setback from the nearest occupied structure. Here, the agency has failed to justify its decision and has failed to take a hard look, in violation of NEPA.

Scientific research continues to raise concerns about the health risks of living in close proximity to oil and gas wells. In addition to the information raised in the Scoping Comments, there are at least two notable scientific papers BLM should consider in this context. First, a recent review identified 15 different components of unconventional oil and gas development, everything from trucks and tanks to chemicals and venting, which can present a chemical, physical and/or safety hazard.[30] Second, a recent study found that babies whose mothers lived in close proximity to multiple oil and gas wells were 30% more likely to be born with defects in their heart than babies born to mothers who did not live close to oil and gas wells.[31] Rather than merely noting that health impacts may occur, BLM must now take a hard look at the reasonably foreseeable health impacts of its actions.

I. The BLM failed to take a "hard look" at impacts to human communities, cultural values, and environmental justice.

The FFO attempts to avoid taking a hard look while at the same time acknowledging impacts to human communities, providing: "While the act of leasing federal minerals itself would result in no social impacts, subsequent development of a lease may generate impacts to people living near or using the area in the vicinity of the lease." EA at 64. The agency recognizes a number of different impacts to local residents, including: "Oil and gas exploration, drilling, or production could create a disruption to these people due to increased traffic and traffic delays, air pollution, noise and visual impacts[;]" and that "nearby residents may be disturbed while hydraulic fracturing or other completion and stimulation operations are occurring, as these activities involve many vehicles, heavy equipment, and a workover rig[;]" and that "[c]reation of new access roads into an area could allow increased public access and exposure of private property to vandalism." EA at 64. Yet, the agency is dismissive of all these concerns, concluding that "[f]or leases where the surface is privately owned and the subsurface is BLM managed, surface owner agreements, standard lease stipulations, and BMPs could address many of the concerns of private surface owners." EA at 64. Not only does BLM's vague reference to non-specific mitigation measures fail to satisfy the agency's NEPA obligations for these identified

[30] John L. Adgate *et al.*, *Potential Public Health Hazards, Exposures and Health Effects from Unconventional Natural Gas Development*, 48 ENVIRONMENTAL SCIENCE & TECHNOLOGY 8307 (Feb. 24, 2014) (previously included as Exhibit 14).

[31] Lisa M. McKenzie *et al.*, *Birth Outcomes and Maternal Resident Proximity to Natural Gas Development in Rural Colorado*, 122 ENVIRONMENTAL HEALTH PERSPECTIVES 412 (April 2014) (previously included as Exhibit 15).

impacts to communities, but the agency also ignores whole host of foreseeable impacts, the consideration of which should be fundamental to the agency's decision-making process for the subject lease sale—considerations that are particularly critical, here, given the Navajo allotted lands included in the sale. Critically, as noted above, occupied buildings and residences are in close proximity to well sites on these lease parcels, raising the specter impacts to human communities—not just from poor air quality, but myriad other impacts from hydraulic fracturing. Recently, on July 11, 2016, a massive fire broke out at a fracking site operated by WPX Energy that was approved by the FFO, setting off several explosions and closing Highway 550.[32] Approximately 36 storage tanks caught fire and burned, local residents were evacuated, and numerous domestic animals and livestock were killed. The massive fire took several days to burn itself out.[33]

Moreover, there are excellent sources the FFO should consider in their assessment and consideration of impacts to human communities and, particularly, native communities, many of which are outlined in a recent article in THE ATLANTIC.[34] Among the concerns and impacts to native communities raised in this article—and in particular the social and cultural impacts experienced on the Fort Berthold Indian Reservation, located in the heart of North Dakota's Bakken formation—include:

> [North Dakota's U.S. Attorney] noticed a peculiar pattern emerging from Fort Berthold. Many of his filings – a surprising number of them – involved non-Indian perpetrators. "We had five or six in a month," he told me. "Why was this? We realized it's non-enrolled folks moving to the oil patch."
>
> The immediate side-effects are the obvious ones, and they come with any boom: limited jail space, an overworked police force, a glut of men with cash in their pockets. In 2012, the tribal police department reported more murders, fatal accidents, sexual assaults, domestic disputes, drug busts, gun threats, and human trafficking cases than in any year before. The surrounding counties offer similar reports.
>
> But there is one essential difference between Fort Berthold and the rest of North Dakota: The reservation's population has more than doubled with an influx of non-Indian oil workers – over whom the tribe has little legal control.

---

[32] Chow, L. Massive Fracking Explosion in New Mexico, 36 Oil Tanks Catch Fire, EcoWatch, July 13, 2016, available at http://www.ecowatch.com/massive-fracking-explosion-in-new-mexico-1919567359.html.

[33] *See* Letter from Diné CARE, *et al*., to Secretary Sally Jewell*, et al.*, RE: Mancos Shale Oil Drilling, Public Participation, and WPX Energy Explosion, July 26, 2016 (attached as Exhibit 6).

[34] Sierra Crane-Murdoch, *On Indian Land, Criminals Can Get Away With Almost Anything*, THE ATLANTIC (Feb. 22, 2013), available at: http://www.theatlantic.com/national/archive/2013/02/on-indian-land-criminals-can-get-away-with-almost-anything/273391/ (previously included as Exhibit 16).

> In 2011, the U.S. Justice Department did not prosecute 65 percent of rape cases reported on reservations. According to department records, one in three Native American women are raped during their lifetimes – two-and-a-half times the likelihood for an average American woman – and in 86 percent of these cases, the assailant is non-Indian.
>
> Between 2009 and 2011, federal case filings on North Dakota reservations rose 70 percent.

With oil and gas industry predicting a new oil boom for the San Juan Basin[35]—with an estimated 30 billion barrels of oil trapped in the Mancos Shale—the impacts described above threaten to compound those already experienced by the native and non-native communities in the planning area. BLM's failure to articulate and analyze such impacts represents a fundamental deficiency of the EA, and overlooks critical information weighing on the conclusions reached therein, in violation of NEPA.

The BLM attempts to characterize impacts to National Forest land on the Taos Field office BLM boundary and on Navajo Allotments. These areas are rural, remote and undeveloped. The industrial activities needed to drill, operate and deliver oil and gas resources from these proposed lease parcels would fundamentally and significantly alter communities and public lands in the region. One only needs to visit the Jicarilla Ranger District of the Carson National Forest to see how oil and gas development has destroyed the forest. By necessity, these remote lease areas could be populated by man camps, itinerant workers, numerous contractors and subcontractors bound to facilitate development of the leases with unknown regard for the communities. BLM should clearly prepare an EIS to assess the significant impacts that could occur to landowners, allottees and the public if leasing for oil and gas occurs.

VIII. The BLM Failed to Sufficiently Analyze All Reasonable Alternatives.

Through the January 2017 lease sale NEPA process, the FFO required to "estimate and display the physical, biological, economic, and social effects of implementing each alternative considered in detail. The estimation of effects shall be guided by the planning criteria and procedures implementing [NEPA]." 43 C.F.R. § 1610.4-6. Incumbent to any NEPA process is a robust analysis of alternatives to the proposed action. Consideration of reasonable alternatives is necessary to ensure that the agency has before it and takes into account all possible approaches to, and potential environmental impacts of, a particular project. NEPA's alternatives requirement, therefore, ensures that the "most intelligent, optimally beneficial decision will ultimately be made." *Calvert Cliffs' Coordinating Comm., Inc. v. U.S. Atomic Energy Comm'n,* 449 F.2d 1109, 1114 (D.C. Cir. 1971).

[35] Staci Matlock, *New oil boom coming to San Juan Basin*, THE NEW MEXICAN (March 13, 2014), available at: http://www.santafenewmexican.com/news/local_news/new-oil-boom-coming-to-san-juan-basin/article_665ff2f2-bd6c-54fd-9dd8-238092c73917.html (previously included as Exhibit 17).

"[T]he heart" of an environmental analysis under NEPA is the analysis of alternatives to the proposed project, and agencies must evaluate all reasonable alternatives to a proposed action." *Colorado Environmental Coalition*, 185 F.3d at 1174 (quoting 40 C.F.R. § 1502.14). An agency must gather "information sufficient to permit a reasoned choice of alternatives as far as environmental aspects are concerned." *Greater Yellowstone*, 359 F.3d at 1277 (citing *Colorado Environmental Coalition*, 185 F.3d at 1174); *see also Holy Cross Wilderness Fund v. Madigan*, 960 F.2d 1515, 1528 (10th Cir. 1992). Thus, agencies must "ensure that the statement contains sufficient discussion of the relevant issues and opposing viewpoints to enable the decisionmaker to take a 'hard look' at environmental factors, and to make a reasoned decision." *Izaak Walton League of America v. Marsh,* 655 F.2d 346, 371 (D.C. Cir.1981) (citing *Kleppe v. Sierra Club,* 427 U.S. 390, 410 n. 21 (1976)).

Here, BLM considered only two alternatives: a "no action" alternative in which none of the nominated parcels would be offered for sale, and the "proposed action" where four parcels covering 843 acres are offered with standard terms and conditions as well as lease stipulations dating back to the obsolete and ineffective 2003 RMP and EIS. *See* EA at 9-10 (discussing alternatives). In other words, the FFO failed to consider any alternative that would limit or mitigate the impacts of oil and gas development, or consider oil and gas development on equal footing to other multiple use values in the planning area.

FLPMA does not mandate that every use be accommodated on every piece of land; rather, delicate balancing is required. *See Norton v. S. Utah Wilderness Alliance*, 542 U.S. 55, 58 (2004). "'Multiple use' requires management of the public lands and their numerous natural resources so that they can be used for economic, recreational, and scientific purposes without the infliction of permanent damage." *Public Lands Council v. Babbitt*, 167 F.3d 1287, 1290 (10th Cir. 1999) (citing 43 U.S.C. § 1702 (c)). As held by the Tenth Circuit, "[i]f all the competing demands reflected in FLPMA were focused on one particular piece of public land, in many instances only one set of demands could be satisfied. A parcel of land cannot both be preserved in its natural character and mined." *Rocky Mtn. Oil & Gas Ass'n v. Watt,* 696 F.2d 734, 738 n. 4 (10th Cir.1982) (quoting *Utah v. Andrus,* 486 F.Supp. 995, 1003 (D.Utah 1979)); *see also* 43 U.S.C. § 1701(a)(8) (stating, as a goal of FLPMA, the necessity to "preserve and protect certain public lands in their natural condition"); *Pub. Lands Council,* 167 F.3d at 1299 (citing § 1701(a)(8)). As further provided by the Tenth Circuit:

> BLM's obligation to manage for multiple use does not mean that development *must* be allowed on [a particular piece of public lands]. Development is a *possible* use, which BLM must weigh against other possible uses – including conservation to protect environmental values, which are best assessed through the NEPA process. Thus, an alternative that closes the [proposed public lands] to development does not necessarily violate the principle of multiple use, and the multiple use provision of FLPMA is not a sufficient reason to exclude more protective alternatives from consideration.

New Mexico ex rel. Richardson, 565 F.3d at 710. This type of analysis is entirely absent from the FFO's EA, which has elevated oil and gas above the area's other multiple use resources, in violation of NEPA. *See* 43 C.F.R. § 1610.4-6.

IX. FLPMA: Unnecessary and Undue Degradation

Pursuant to the Federal Land Policy and Management Act ("FLPMA"), 43 U.S.C. § 1701 *et seq.*, "[i]n managing the public lands," the agencies "shall, by regulation or otherwise, take any action necessary to prevent unnecessary or undue degradation of the lands." 43 U.S.C. § 1732(b). Written in the disjunctive, BLM must prevent degradation that is "unnecessary" and degradation that is "undue." *Mineral Policy Ctr. v. Norton*, 292 F.Supp.2d 30, 41-43 (D. D.C. 2003). This protective mandate applies to agencies planning and management decisions, and should be considered in light of its overarching mandate that the FFO employ "principles of multiple use and sustained yield." 43 U.S.C. § 1732(a); *see also, Utah Shared Access Alliance v. Carpenter*, 463 F.3d 1125, 1136 (10th Cir. 2006) (finding that BLM's authority to prevent degradation is not limited to the RMP planning process). While these obligations are distinct, they are interrelated and highly correlated. The Bureau must balance multiple uses in its management of public lands, including "recreation, range, timber, minerals, watershed, wildlife and fish, and [uses serving] natural scenic, scientific and historical values." 43 U.S.C. § 1702(c). It must also plan for sustained yield—"control [of] depleting uses over time, so as to ensure a high level of valuable uses in the future." *Norton v. S. Utah Wilderness Alliance,* 542 U.S. 55, 58 (2004).

"Application of this standard is necessarily context-specific; the words 'unnecessary' and 'undue' are modifiers requiring nouns to give them meaning, and by the plain terms of the statute, that noun in each case must be whatever actions are causing 'degradation.' " *Theodore Roosevelt Conservation Partnership v. Salazar*, 661 F.3d 66, 76 (D.C. Cir. 2011) (citing *Utah v. Andrus,* 486 F.Supp. 995, 1005 n. 13 (D. Utah 1979) (defining "unnecessary" in the mining context as "that which is not necessary for mining"—or, in this context, "for oil and gas development"—and "undue" as "that which is excessive, improper, immoderate or unwarranted.")); *see also Colorado Env't Coalition,* 165 IBLA 221, 229 (2005) (concluding that in the oil and gas context, a finding of "unnecessary or undue degradation" requires a showing "that a lessee's operations are or were conducted in a manner that does not comply with applicable law or regulations, prudent management and practice, or reasonably available technology, such that the lessee could not undertake the action pursuant to a valid existing right.").

Here, that action is the oil and gas development authorized by the FFO through the January 2017 lease sale. The inquiry, then, is whether the agency has taken sufficient measures to prevent degradation unnecessary to, or undue in proportion to, the development the proposed action permits. *See Theodore Roosevelt Conservation Partnership*, 661 F.3d at 76. For example, methane waste and pollution may cause "undue" degradation, even if the activity causing the degradation is "necessary." Where methane waste and pollution is avoidable, even if in the process of avoiding such emissions lessees or operators incur reasonable economic costs that are consistent with conferred lease rights, it is "unnecessary" degradation. 43 U.S.C. § 1732(b).

Therefore, drilling activities may only go forward as long as unnecessary and undue environmental degradation does not occur. This is a *substantive* requirement, and one that the BLM must define and apply in the context of oil and gas development authorized through the

lease sale. In other words, the FFO must define and apply the substantive UUD requirements in the context of the specific resource values at stake.

Further, these UUD requirements are distinct from requirements under NEPA. "A finding that there will not be significant impact [under NEPA] does not mean either that the project has been reviewed for unnecessary and undue degradation or that unnecessary or undue degradation will not occur." *Ctr. for Biological Diversity,* 623 F.3d at 645 (quoting *Kendall's Concerned Area Residents,* 129 I.B.L.A. 130, 140 (1994)). In the instant case, BLM must specifically account for UUD in its NEPA analysis for the January 2017 lease sale, which is distinct from its compliance under NEPA, and is also actionable on procedural grounds.

X. Conclusion

The Conservation Groups appreciate your consideration of the information and concerns addressed herein, as well as the information included in the attached exhibits. In general, we are alarmed at the fatal deficiencies of the EA analysis and the numerous issues overlooked and/or marginalized in the EA. The boilerplate EA continues the trend of BLM rushing oil and gas lease documents to meet prescribed lease sale schedules, rather than performing the analysis required by NEPA and its implementing regulations. Please insure that you incorporate our comments and information (including Exhibits) in any revisions for the January 2015 lease sale EA.

Should you have any questions, please do not hesitate to contact me.

Sincerely,

Kyle Tisdel
WESTERN ENVIRONMENTAL LAW CENTER
208 Paseo del Pueblo Sur, Unit 602
Taos, New Mexico 87571
575.613.8050
tisdel@westernlaw.org

Along with:

Rachel Conn
AMIGOS BRAVOS
PO Box 238
Taos, NM 87571
rconn@amigosbravos.org

My-Lihn Le
CENTER FOR BIOLOGICAL DIVERSITY
1212 Broadway St. #800
Oakland, CA 94612
mlle@biologicaldiversity.org

Anson Wight
CHACO ALLIANCE
4990 SW Hewett Blvd.
Portland, OR 97221
ansonw@comcast.net

Carol Davis
DINÉ CARE
10A Town Plaza PMB #138
Durango, CO 81301
caroljdavis.2004@gmail.com

Marissa Knodel
FRIENDS OF THE EARTH
1101 15th St. NW, Floor 11
Washington, D.C.
mknodel@foe.org

Shelley Silbert
GREAT OLD BROADS FOR WILDERNESS
PO Box 2924
Durango, CO 81302
shelley@greatoldbroads.org

Amy Mall
NATURAL RESOURCES DEFENSE COUNCIL
1152 15th Street, N.W., Suite 300
Washington, D.C. 20005
amall@nrdc.org

Ruth Breech
RAINFOREST ACTION NETWORK
425 Bush St. Ste 300
San Francisco, CA 94108
ruth@ran.org

Mike Eisenfeld
SAN JUAN CITIZENS ALLIANCE
PO Box 6655
Farmington, NM 87499
mike@sanjuancitizens.org

Eric Huber
SIERRA CLUB
1650 38th St. Ste. 102W
Boulder, CO 80301
eric.huber@sierraclub.org

Jeremy Nichols
WILDEARTH GUARDIANS
1536 Wynkoop St., Ste. 301
Denver, CO 80202
jnichols@wildearthguardians.org

From: Kyle Tisdel
To: rklein@blm.gov; NMLeasesalecomments@blm.gov
Cc: mames@blm.gov
Subject: Re: January 2017 Lease Sale, Draft EA Comments
Date: Friday, September 2, 2016 1:28:13 PM
Attachments: Exhibit 1_O&G PEIS APA Petition FINAL.pdf
Exhibit 2_Petition for a Moratorium on the Leasing of Federal Fossil Fuels.pdf
Exhibit 3_CEQ_Final climate guidance.pdf
Exhibit 4_PNAS-2016-Frankenberg.pdf
Exhibit 5_NM-OCD-Enforcement-Report.pdf
Exhibit 6_Letter to BLM_7.26.16.pdf

Please find the attached exhibits, as included in Citizen Groups' Draft EA Comments.

_____

Kyle J. Tisdel
Attorney, Climate & Energy Program Director
Western Environmental Law Center
208 Paseo del Pueblo Sur, #602
Taos, New Mexico 87571
Ph: 575.613.8050

tisdel@westernlaw.org

www.westernlaw.org

Defending the West

_____

From: Kyle Tisdel <tisdel@westernlaw.org>
Date: Friday, September 2, 2016 at 11:18 AM
To: <rklein@blm.gov>, <NMLeasesalecomments@blm.gov>
Cc: <mames@blm.gov>
Subject: January 2017 Lease Sale, Draft EA Comments

Mr. Klein,

Please find the attached comments on the Draft EA for the January 2017 Lease Sale (exhibits will be filed electronically in a subsequent email), filed on behalf of Amigos Bravos, Center for Biological Diversity, Chaco Alliance, Diné CARE, Friends of the Earth, Great Old Broads for Wilderness, Natural Resources Defense Council, Rainforest Action Network, San Juan Citizens Alliance, Sierra Club, and WildEarth Guardians. Should you have any questions please do not hesitate to contact me.

Regards.

_____

Kyle J. Tisdel
Attorney, Climate & Energy Program Director
Western Environmental Law Center
208 Paseo del Pueblo Sur, #602

Taos, New Mexico 87571
Ph: 575.613.8050

tisdel@westernlaw.org

www.westernlaw.org

Defending the West

_____

UNIVERSITY OF CALIFORNIA, IRVINE
BERKELEY • DAVIS • IRVINE • LOS ANGELES • MERCED • RIVERSIDE • SAN DIEGO • SAN FRANCISCO SANTA BARBARA • SANTA CRUZ

Environmental Law Clinic
UC Irvine School of Law

PO Box 5479
Irvine, CA 92616-5479
(949) 824-9660

BEFORE THE SECRETARY OF THE INTERIOR

PETITION TO THE UNITED STATES BUREAU OF LAND MANAGEMENT, AN AGENCY OF THE DEPARTMENT OF INTERIOR

Filed on behalf of WildEarth Guardians

Petition Requesting a Programmatic Environmental Impact Statement Addressing the Bureau of Land Management's Oil and Gas Leasing Program and Formal Adoption of the Council on Environmental Quality's Guidance for Greenhouse Gas Emissions And Climate Change Impacts	)	*Submitted Jan. 20, 2016*

I. INTRODUCTION

In 2014, President Obama described climate change as an "urgent and growing threat . . . that will define the contours of this century more dramatically than any other."[1] Pope Francis expressed similar concern in his recent encyclical, stating "[t]he climate is a common good, belonging to all and meant for all," and that climate change "represents one of the principal challenges facing humanity in our day."[2] It is a "moral imperative [to] assess[] the impact of our every action . . . on the world around us."[3] "There is an urgent need to develop policies so that, in the next few years, the emission of carbon dioxide and other highly polluting gases can be drastically reduced."[4] Recognizing this need, 195 nations recently agreed "that climate change represents an urgent and potentially irreversible threat to human societies and the planet."[5]

[1] White House, Office of the Press Secretary, *Remarks by the President at U.N. Climate Change Summit* (Sept. 23, 2014), *archived at* perma.cc/9U8K-KUTT.
[2] Pope Francis, Encyclical Letter, Laudato Si', On Care For Our Common Home ¶¶ 23, 25 (May 24, 2015), *archived at* perma.cc/K8XL-EPMT.
[3] *Id.* at ¶ 208.
[4] *Id.* at ¶ 26.
[5] United Nations Framework Convention on Climate Change, Adoption of the Paris Agreement, Nov. 30–Dec. 11, 2015, *archived at* perma.cc/D76U-BDR4. A copy of this Agreement is attached to this Petition as Exhibit ("Ex.") 1.

In his final, historic State of the Union address, President Barack Obama reiterated his commitment to fighting climate change.[6] Committing "to accelerate the transition away from old, dirtier energy sources," President Obama made a powerful promise "to change the way we manage our oil and coal resources so that they better reflect the costs they impose on taxpayers and our planet."[7] Three days later, the U.S. Department of the Interior ("DOI" or "Interior") announced the launch of a programmatic environmental review of its federal coal leasing program under the National Environmental Policy Act ("NEPA"), 42 U.S.C. § 4321 *et seq.*[8] Citing the looming threat of climate change, along with declining coal prices and the socioeconomic impacts of Interior's coal leasing program, Secretary Jewell further ordered a moratorium on new coal leases while the review is underway, stating that "we're taking the prudent step to hit pause on approving significant new leases so that decisions about those leases can benefit from the recommendations that come out of the review."[9]

The climate change rationale for programmatic review of Interior's coal leasing program applies with an equally great urgency to the agency's oil and gas leasing program. The scope of the Bureau of Land Management's ("BLM's" or "Bureau's") oil and gas leasing program is unrivaled, spanning 258 million surface acres of land managed by the Bureau, 57 million surface acres where the minerals are federally owned but the surface is under non-federal (mostly private) ownership,[10] and 385 million acres whose surface is managed by other federal agencies.[11] BLM estimates that about half of these 700 million subsurface acres contain oil and/or natural gas[12]—both primary targets in our Nation's battle against climate change.

BLM's oil and gas leasing program's significant contribution to climate change reflects the program's broad geographic reach. From 2008–2010, GHG emissions from onshore federal oil and gas reserves extracted by private leaseholders resulted in the release of 612,309,429 metric tons of carbon dioxide equivalent ("$MTCO_2e$").[13] By comparison, from 2008–2010, the combined GHG emissions from Belize, Costa Rica, El Salvador, Guatemala, Honduras,

---

[6] White House, Office of the Press Secretary, *Remarks of President Barack Obama—State of the Union Address As Delivered* (Jan. 13, 2016), *archived at* https://perma.cc/NH5E-UTUW.
[7] *Id.*
[8] U.S. Dep't of the Interior ("DOI"), Office of the Secretary, *Secretary Jewell Launches Comprehensive Review of Federal Coal Program* (Jan. 15, 2016), *archived at* https://perma.cc/E6T6-477W; *see also* DOI, Order No. 3338: Discretionary Programmatic Environmental Impact Statement to Modernize the Federal Coal Program (Jan. 15, 2016), *archived at* https://perma.cc/UVX4-YMBW. A copy of Secretary Jewell's order requiring the Bureau of Land Management to undertake a PEIS of the federal coal program (Order No. 3338) is attached to this Petition as Ex. 2.
[9] DOI, *Secretary Jewell Launches Comprehensive Review of Federal Coal Program*, *supra* note 8.
[10] Land where the minerals are federally owned but the surface is non-federally owned is called "split-estate" land. *See* Bureau of Land Management ("BLM"), Split Estate, *archived at* perma.cc/VW2D-HUV6.
[11] *Id.*
[12] *Id.*
[13] STRATUS CONSULTING, GREENHOUSE GAS EMISSIONS FROM FOSSIL ENERGY EXTRACTED FROM FEDERAL LANDS AND WATERS: FINAL REPORT 13 (2012) ("2012 Stratus Report"), *archived at* perma.cc/4LWM-CY3V; *see also* § II.D., *infra*. This figure includes the release of 49,885 metric tons of methane ("$MTCH_4$"), 612,240,176 metric tons of carbon dioxide ("$MTCO_2$"), and 9,684 metric tons of nitrous oxide ("MTN_2O") into the atmosphere. 2012 Stratus Report at 13. A copy of the 2012 Stratus Report is attached to this Petition as Ex. 3.

Nicaragua, and Panama resulted in the release of 549,760,000 $MTCO_2e$.[14] In other words, during these years, BLM's oil and gas leasing program contributed more annual GHG emissions to the atmosphere than all of the approximately 40 million people of Central America combined.

Experts project little change to this emissions profile in the foreseeable future. With the advent of novel, and controversial, fracking and oil drilling technologies, the United States is experiencing an unprecedented oil and gas boom. According to Interior's own estimates, oil and gas production on federal lands soared 81 percent between 2008–2014.[15] The softening demand for coal only deepens the federal government's support for domestic oil and gas production—the assumed replacement fuels for coal.[16] And, the recent Congressional agreement to end the nation's forty-year-old crude oil export ban fuels speculation in favor of this market trend over the long term. Any one of these factors, taken alone, leads to the same conclusion—a federal commitment to expanded oil and gas production, leading to increased GHG emissions and frustrating the nation's recent international commitment to reduce GHG emissions—one of Interior's justifications for its programmatic review of coal.[17]

Unsurprisingly, the sudden and dramatic increase in domestic oil production has contributed to the recent plunge in oil prices, which have dipped to their lowest level in more than a decade. This market shift, in turn, raises serious questions about the economic benefit of Interior's oil and gas leasing program to the American taxpayer.[18] In announcing Interior's regulatory efforts to modernize its oil and gas royalty scheme, Secretary Jewell acknowledged that "[i]t's time to have a candid conversation about whether the American taxpayer is getting the right return for the development of oil and gas resources on public lands."[19] Citing the similarly declining value of coal, Interior chose to address its identical concerns about coal's "fair return" to the American taxpayer in its programmatic review order.[20] No rational distinction may be drawn for Interior's oil and gas program, which demands the same programmatic treatment. And, just as Interior ordered for its coal leasing program, programmatic review of Interior's oil and gas program requires a thorough cost-benefit analysis that accurately accounts for the social cost of carbon.[21] Programmatic review of Interior's oil and gas leasing program

[14] World Resources Institute, CAIT Climate Data Explorer, Historical Emissions Data (2015), *archived at* https://perma.cc/9YV6-7ECN. An Excel spreadsheet with 2008–2010 emissions data from these countries (from the CAIT Explorer) is attached to this Petition as Ex. 4.
[15] BLM, *Interior Department Seeks Public Dialogue on Reform of Federal Onshore Oil and Gas Regulations* (Apr. 17, 2015) (last accessed Jan. 17, 2016), *archived at* https://perma.cc/WAQ3-DGZ9.
[16] *Id*. at 5 ("As reported by EIA, between 2008 and 2013, United States' coal production fell by 16 percent, as declining natural gas prices and other factors made coal less competitive as a fuel for generating electricity."); *see also* White House, *Remarks of President Barack Obama—State of the Union Address As Delivered*, *supra* note 6 ("Gas under two bucks a gallon ain't bad, either.").
[17] DOI, *Secretary Jewell Launches Comprehensive Review of Federal Coal Program*, *supra* note 8.
[18] Oil and Gas Leasing; Royalty on Production, Rental Payments, Minimum Acceptable Bids, Bonding Requirements, and Civil Penalty Assessments, 80 Fed. Reg. 22148 (proposed Apr. 21, 2015) (to be codified at 43 C.F.R. pt. 3100), *archived at* https://perma.cc/D8XM-9G4R.
[19] BLM, *Interior Department Seeks Public Dialogue on Reform of Federal Onshore Oil and Gas Regulations*, *supra* note 15.
[20] DOI, Order No. 3338, *supra* note 8, at 7–8.
[21] *Id*. at 8.

will go a long way toward addressing the need "to change the way we manage our oil and coal resources so that they better reflect the costs they impose on taxpayers and our planet."[22] Finally, while an update of Interior's programmatic review of its coal leasing program is long overdue, the fact that Interior has *never* conducted a comprehensive PEIS of its oil and gas leasing program cannot be overlooked. In short, Interior's acknowledged "obligation . . . to ensure the federal coal program . . . takes into account its impacts on climate change"[23] makes the case for concurrent programmatic review of its oil and gas program all the more compelling.

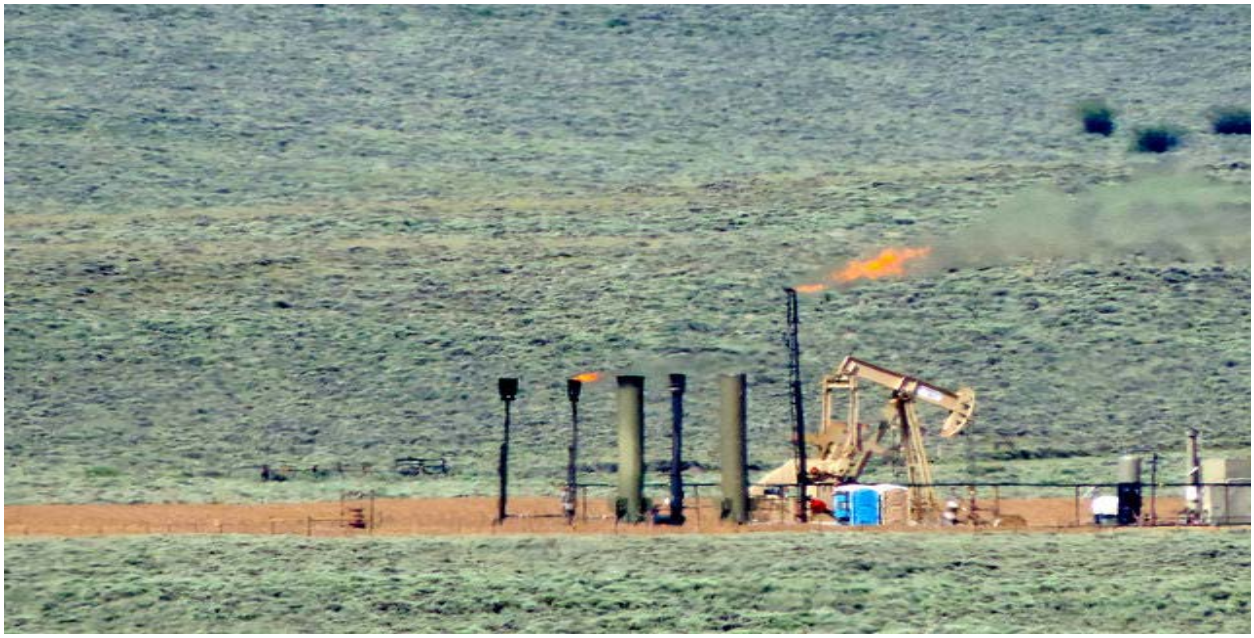


Photo Credit: WildEarth Guardians

In light of the above, and as further discussed below, WildEarth Guardians hereby petitions BLM for the completion of a PEIS evaluating the direct, indirect, and cumulative impacts of BLM's oil and gas leasing program on climate change, including a quantification of GHG emissions from burning extracted oil and gas. WildEarth Guardians simultaneously petitions BLM to evaluate the programmatic non-climate impacts of its oil and gas leasing program, including increased seismic activity related to fracking, public health and safety impacts associated with fracking, and environmental impacts associated with large numbers of improperly abandoned and unplugged and unreclaimed wells. Consistent with Interior's approach to coal leasing, pending completion of the PEIS WildEarth Guardians requests a moratorium on all new oil and gas leasing and approvals of applications for permits to drill ("APDs"). This moratorium is a "prudent step . . . so that decisions about those leases can benefit from the recommendations that come out of the review."[24] Pursuant to Administrative Procedure Act ("APA") section 553(e), WildEarth Guardians further requests that the DOI amend its NEPA regulations to incorporate the Council on Environmental Quality's ("CEQ") 2014 revised draft

[22] White House, *Remarks of President Barack Obama—State of the Union Address As Delivered*, *supra* note 6.
[23] DOI, *Secretary Jewell Launches Comprehensive Review of Federal Coal Program*, *supra* note 8.
[24] DOI, *Secretary Jewell Launches Comprehensive Review of Federal Coal Program*, *supra* note 8.

guidance for GHG emissions and climate change ("2014 Guidance").[25] Lastly, due to the critically important and accelerating effects of climate change, WildEarth Guardians, consistent with APA section 555(e) and 43 C.F.R. § 14.3, requests a prompt response to this Petition.

II. ARGUMENT

A. WildEarth Guardians Holds a Constitutional Right to Petition an Agency, as Codified in the APA, Which Also Guarantees a Prompt Agency Response.

The First Amendment guarantees "the right of the people . . . to petition the Government for a redress of grievances."[26] "The right to petition is cut from the same cloth as the other guarantees of the First Amendment, and is an assurance of a particular freedom of expression."[27] This right "is implicit in '[t]he very idea of government, republican in form.'"[28] Through the First Amendment, "people 'may communicate their will' through direct petitions to [the government]."[29]

The APA, 5 U.S.C. § 500 *et seq.*, codifies the First Amendment right to petition the government. APA section 553(e) provides that "[e]ach agency shall give an interested person the right to petition for the issuance, amendment, or repeal of a rule." The rulemaking provisions of the APA "were designed to ensure fairness and mature consideration of rules of general application."[30] "Section 553 is designed to ensure that affected parties have an opportunity to participate in and influence agency decision making."[31] The APA also ensures that a federal agency's judgment is well informed and based upon good information. As the Fifth Circuit has stated,

> Congress realized that an agency's judgment would be only as good as the information upon which it drew. It prescribed [APA] procedures to ensure that the broadest base of information would be provided to the agency by those most interested and perhaps best informed on the subject of the rulemaking at hand.[32]

Further, the requirements of the APA "are fundamental to due process."[33] WildEarth Guardians, therefore, holds a constitutional right to petition BLM, as codified in the APA.

---

[25] Should CEQ release a final version of its guidance by the time of the proposed rulemaking, DOI may incorporate that guidance instead of the current draft guidance.
[26] U.S. Const. amend. I; *McDonald v. Smith*, 472 U.S. 479, 482 (1985).
[27] *McDonald*, 472 U.S. at 482.
[28] *Id.* (quoting *United States v. Cruikshank*, 92 U.S. 542 (1876)).
[29] *McDonald*, 472 U.S. at 482 (quoting James Madison in congressional debate on the amendment, 1 Annals of Cong. 738 (1789)).
[30] *N.L.R.B. v. Wyman-Gordon Co.*, 394 U.S. 759, 764 (1969).
[31] *U.S. Steel Corp. v. U.S. E.P.A.*, 595 F.2d 207, 214 (5th Cir. 1979).
[32] *Brown Exp., Inc. v. U.S.*, 607 F.2d 695, 701 (5th Cir. 1979).
[33] *Bell Lines, Inc. v. U.S.*, 263 F.Supp. 40, 46 (S.D.W.Va. 1967).

The APA also guarantees WildEarth Guardians the right to a prompt response to its petition. Pursuant to APA section 555(e),

> Prompt notice shall be given of the denial in whole or in part of a written application, petition, or other request of an interested person made in connection with any agency proceeding. Except in affirming a prior denial or when the denial is self-explanatory, the notice shall be accompanied by a brief statement of the grounds for denial.

DOI's regulations reiterate the requirement of a prompt response. 43 C.F.R. § 14.3 provides that a petition for rulemaking "will be given prompt consideration and the petitioner will be notified promptly of action taken."

The importance and ongoing effects of climate change further necessitate a timely response. The most recent report by the Intergovernmental Panel on Climate Change ("IPCC") has identified the following climate change-associated risks with high confidence:

i) Risk of death, injury, ill-health, or disrupted livelihoods in low-lying coastal zones and small island developing states and other small islands, due to storm surges, coastal flooding, and sea level rise;
ii) Risk of severe ill-health and disrupted livelihoods for large urban populations due to inland flooding;
iii) Systemic risks due to extreme weather events leading to breakdown of infrastructure networks and critical services such as electricity, water supply, and health and emergency services;
iv) Risk of mortality and morbidity during periods of extreme heat, particularly for vulnerable urban populations and those working outdoors in urban or rural areas;
v) Risk of food insecurity and the breakdown of food systems linked to warming, drought, flooding, and precipitation variability and extremes, particularly for poorer populations in urban and rural settings;
vi) Risk of loss of rural livelihoods and income due to insufficient access to drinking and irrigation water and reduced agricultural productivity, particularly for farmers and pastoralists with minimal capital in semi-arid regions;
vii) Risk of loss of marine and coastal ecosystems, biodiversity, and the ecosystem goods, functions, and services they provide for coastal livelihoods, especially for fishing communities in the tropics and the Arctic; and
viii) Risk of loss of terrestrial and inland water ecosystems, biodiversity, and the ecosystem goods, functions, and services they provide for livelihoods.[34]

[34] IPCC, Summary for Policymakers, in CLIMATE CHANGE 2014: IMPACTS, ADAPTATION, AND VULNERABILITY 13 (2014). Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, *archived at* perma.cc/AKZ7-PPK7. A copy of this summary is attached to this Petition as Ex. 5. For further discussion of the consequences of climate change, see § II.E., *infra*.

Marshall Islands | Photo Credit: Al Jazeera America

This list is not exhaustive and the consequences of climate change are neither remote nor speculative. They are real, immediate, and already are being felt throughout the world, including in the United States. In the words of Secretary of the Interior Sally Jewell:

> I see the costs of a changing climate everywhere I go. In Kivalina, Alaska, coastal erosion threatens to wipe out an entire village, and it's one of several that are in danger. In the Marshall Islands, they have to sandbag the airport runway to keep the rising ocean from washing it away. And across the country, communities are facing more extreme wildfires, bigger storms, devastating droughts, disappearing wildlife and rising economic damages.[35]

As detailed above, climate change poses an ongoing and accelerating threat that requires immediate action. Therefore, WildEarth Guardians requests that BLM act on this Petition without delay.

B. NEPA Requires BLM to Consider the Effects of its Oil and Gas Leasing Program on Climate Change.

NEPA is our basic national charter for protection of the environment.[36] It is designed to promote full disclosure and comprehensive consideration of potential environmental effects on

[35] DOI, *Secretary Jewell Offers Vision for Balanced, Prosperous Energy Future* (Mar. 17, 2015), *archived at* perma.cc/H2S7-9RWM.
[36] 40 C.F.R. §1500.1(a).

the human environment[37] resulting from proposed federal agency actions, and to provide decisionmakers with alternatives to mitigate these effects.[38] NEPA ensures that agencies take account of environmental effects as an integral part of the agency's own decisionmaking process before decisions are made.[39] It informs decisionmakers by ensuring agencies consider environmental consequences of a proposed action as they decide whether to proceed with the action and, if so, how to take appropriate steps to eliminate or mitigate adverse effects.[40] NEPA analysis should be conducted "at the earliest possible time to insure that planning and decisions reflect environmental values."[41] NEPA also informs the public, promoting transparency of and accountability for consideration of environmental effects.[42] For these reasons, NEPA reviews "must be of high quality."[43] "Accurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing NEPA."[44] Importantly, a better decision, rather than better—or even excellent—paperwork is the goal of NEPA analysis.[45]

NEPA also created a Council on Environmental Quality ("CEQ") within the Executive Office of the President[46] and charged CEQ with ensuring that federal agencies meet their obligations under NEPA. To that end, CEQ has promulgated implementing regulations for NEPA and has provided guidance to federal departments and agencies on compliance with NEPA's requirements.[47]

On December 18, 2014, CEQ released revised draft guidance for public comment that describes how federal departments and agencies should consider the effects of GHG emissions and climate change in their NEPA reviews.[48] The 2014 Guidance supersedes the draft GHG and climate change guidance released by CEQ in February 2010. Importantly, unlike the 2010 draft guidance, the 2014 Guidance applies to all proposed federal agency actions, "including land and resource management actions."[49]

The 2014 Guidance recognizes that "[c]limate change is a fundamental environmental issue, and the relation of federal actions to it falls squarely within NEPA's focus."[50] "Focused

[37] 40 C.F.R. § 1508.14 ("Human environment" shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment.).
[38] Council on Envtl. Quality ("CEQ"), Revised Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts 5 (2014) ("2014 Guidance"). A copy of the 2014 Guidance is attached to this Petition as Ex. 6. *See also* 40 C.F.R. § 1500.1(b).
[39] 2014 Guidance, *supra* note 38, at 5.
[40] *Id.*
[41] 40 C.F.R. §1501.2.
[42] 2014 Guidance, *supra* note 38, at 5.
[43] 40 C.F.R. § 1500.1(b).
[44] *Id.*
[45] 40 C.F.R. § 1500.1(c).
[46] 42 U.S.C. § 4342.
[47] CEQ's implementing regulations for NEPA can be found at 40 C.F.R. § 1500 *et seq*.
[48] 2014 Guidance, *supra* note 38.
[49] *Id.* at 1 n.2 ("The CEQ 2010 draft guidance had carved out the question of how land and resource management actions should be considered in NEPA reviews. That distinction is no longer retained.")
[50] *Id.* at 2.

and effective consideration of climate change in NEPA reviews," the 2014 Guidance notes, "will allow agencies to improve the quality of their decisions."[51] This focused consideration of climate change in NEPA reviews will improve environmental outcomes "by identifying important interactions between a changing climate and the environmental impacts from a proposed action, and can contribute to safeguarding federal infrastructure against the effects of extreme weather events and other climate related impacts."[52] "This guidance will help [f]ederal agencies ensure their analyses of GHG emissions and climate change in an EA or an EIS are useful by focusing on assessing those proposed actions that involve emissions, or that have a long lifespan such that a changing climate may alter the environmental consequences associated with the proposed action."[53]

The 2014 Guidance counsels agencies to include a discussion of the direct, indirect, and cumulative impacts of a proposed action's reasonably foreseeable emissions and effects.[54] Further, the Guidance discusses "the consideration of reasonable alternatives and [informs agencies of] the need to consider the short-term and long-term effects and benefits [of a project] in the alternatives analysis and mitigation to lower emissions."[55] Finally, the 2014 Guidance provides that "[a]gencies should consider the following when addressing climate change: (1) the potential effects of a proposed action on climate change as indicated by its GHG emissions; and (2) the implications of climate change for the environmental effects of a proposed action."[56]

Moreover, as the 2014 Guidance notes, actual estimates of emissions are required even when they are uncertain and can at best be "projected";[57] there is a presumption that climate emissions are quantitatively evaluated.[58] The "reasonably foreseeable effects" on our climate that must be analyzed under NEPA include those that come from "using the resource."[59] Downstream emissions should be accounted for in NEPA analysis.[60] Thus, the analysis of emissions from the combustion of oil and gas must be included in the PEIS, as it is a reasonably foreseeable, and intended, downstream effect.[61]

As the 2014 Guidance makes clear, climate change is a fundamental environmental issue that falls squarely within NEPA's ambit. A focused consideration of climate change will allow BLM to improve the quality of its decisions and improve environmental outcomes. In particular, a programmatic NEPA review would identify the interactions between climate change and BLM's oil and gas leasing program, including the effects its program has on climate change and vice versa. BLM's oil and gas leasing program unquestionably contributes to GHG emissions

[51] *Id.*
[52] *Id.*
[53] *Id.* at 3.
[54] *Id.* at 4.
[55] *Id.*
[56] *Id.*
[57] *Id.* at 8.
[58] *Id.* at 16.
[59] *Id.* at 12.
[60] *Id.* at 11.
[61] *See* § II.I., *infra*.

and is a program with "a long lifespan such that a changing climate may alter the environmental consequences associated with [it]."[62] The discussion of climate change in BLM's NEPA review should include the direct, indirect, and cumulative impacts and emissions associated with its oil and gas leasing program.

C. BLM's Oil and Gas Leasing Activities Constitute a Program Under NEPA.

BLM's oil and gas leasing activities constitute a program under NEPA for two reasons: First, BLM's oil and gas leasing activities are "systematic and connected agency decisions allocating agency resources to implement a specific statutory program" and thus meet the definition of "program" under NEPA's implementing regulations; and second, BLM's oil and gas leasing activities include multiple, independent permitting decisions that have overlapping, shared, and cumulative impacts, thus requiring a PEIS.

1. BLM's Oil and Gas Leasing Activities Are Systematic and Connected Agency Decisions Allocating Agency Resources to Implement a Specific Statutory Program

NEPA's implementing regulations provide the contours of programmatic NEPA review. NEPA's implementing regulations define a "program" as "a group of concerted actions to implement a specific policy or plan; systematic and connected agency decisions allocating agency resources to implement a specific statutory program or executive directive."[63]

BLM's oil and gas leasing activities fall within this definition of a program because they are "connected agency decisions allocating agency resources to implement" the Mineral Leasing Act of 1920, 30 U.S.C. § 181 *et seq.*, and the Mineral Leasing Act for Acquired Lands of 1947, 30 U.S.C. § 351 *et seq*. (collectively "Mineral Leasing Acts"), for the purpose of exploration or development of oil and natural gas resources.[64] The Mineral Leasing Act of 1920 authorizes and governs leasing of public lands for developing deposits of coal, petroleum, natural gas and other hydrocarbons, in addition to phosphates, sodium, sulfur, and potassium. Section 13 of the Mineral Leasing Act provides that the "Secretary of the Interior is hereby authorized . . . to grant to any applicant qualified under this Act a prospecting permit . . . to prospect for oil or gas . . . wherein such deposits belong to the United States." Similarly, the Mineral Leasing Act for Acquired Lands extended the provisions of the Mineral Leasing Act and the authority of the Secretary of the Interior over mineral extraction operations to federal "acquired lands." In the words of BLM,

> The [Mineral Leasing Acts], as amended, give the [BLM] responsibility for oil and gas leasing on about 564 million acres of BLM, national forest, and other

[62] 2014 Guidance, *supra* note 38, at 3.
[63] 40 C.F.R. § 1508.18.
[64] *Id.*

> Federal lands, as well as State and private surface lands where mineral rights have been retained by the Federal Government.[65]

Each leasing decision must be consistent with the provisions of the Mineral Leasing Acts, and each leasing decision must be consistent with the applicable BLM district's resource management plan ("RMP"). Indeed, the tiered structure of BLM's oil and gas leasing program, discussed below, amply demonstrates the interconnectedness of the Bureau's program.

Also, the 2014 Guidance confirms the programmatic character of BLM's oil and gas leasing program. The Guidance notes that NEPA reviews can address different geographic scales that can range from the programmatic or landscape level, to the site- or project-specific level.[66] It further provides that "[p]rogrammatic NEPA review is appropriate when a decision is being made that is subject to NEPA, such as establishing formal plans, establishing agency programs, and approving a suite of similar projects."[67] Programmatic review provides a "useful and efficient" analysis of broad agency plans and programs and also allows for the agency to incorporate by reference that analysis into future NEPA reviews.[68]

BLM's oil and gas leasing program is highly structured and follows a well-defined process that is suited to the tiered review contemplated by NEPA's implementing regulations and the 2014 Guidance. Development of onshore federal oil and natural gas resources occurs in five phases: (1) land use planning; (2) parcel nominations and lease sales; (3) well permitting and development; (4) operations and production; and (5) plugging and reclamation.[69] BLM further subdivides each phase into multiple steps. For example, at the land use planning phase, BLM creates RMPs that "establish which areas are open to oil & gas leasing and which are closed."[70] At the parcel nomination and lease sale phase, parcels in areas identified as open for leasing in an RMP may be nominated for leasing "by sending a written expression of interest to the BLM State Office for the area where the lands are located."[71] However, nominated parcels are not automatically placed on sale; BLM first reviews each nomination to ensure that the parcels are available under the RMP and that stipulations from that RMP, if any, are attached before the lease is placed on sale.[72] Then, leases are placed for sale at competitive auctions that, by law, are held quarterly by each BLM State Office.[73] Successful bidders "obtain[] the right to explore and drill for, extract, remove, and dispose of deposits of oil and gas (except helium) found on the lease."[74] The leaseholder must file an APD and a surface use plan of operations, which happens during phase three of the oil and gas leasing process, before the leaseholder may begin extracting

---

[65] BLM, Questions and Answers About Leasing, *archived at* perma.cc/Q36K-VWC4.
[66] 2014 Guidance, *supra* note 38, at 29.
[67] *Id.*
[68] *Id.*
[69] BLM, Leasing of Onshore Federal Oil and Gas Resources, *archived at* perma.cc/X6RK-C2QU.
[70] BLM, Land Use Planning, *archived at* perma.cc/2YBJ-L3GP.
[71] BLM, Competitive Leasing, *archived at* perma.cc/3BYY-XXE7.
[72] *Id.*
[73] *Id.*
[74] *Id.*

oil and gas.[75] This highly structured, tiered process evidences the "systematic and connected agency decisions" that constitute BLM's oil and gas leasing program. Moreover, it is clear that BLM's leasing decisions allocate agency resources, including time, money, and minerals, to implement the directives of the Mineral Leasing Acts.

Tellingly, BLM expressly refers to its oil and gas leasing activities as a program. For example, BLM claims that its "Oil and Gas Management program is one of the most important mineral leasing programs in the Federal government."[76] BLM notes that "[d]omestic production from over 63,000 Federal onshore oil and gas wells accounts for 11 percent of the Nation's natural gas supply and five percent of its oil."[77] BLM also states that "[t]he Oil and Gas program also processes applications for the permits required to develop leased resources. The most common of these is the [APD]."[78]

By any reasonable measure, BLM's oil and gas leasing activities constitute a program under NEPA. BLM's leasing decisions are "systematic and connected agency decisions allocating agency resources to implement a specific statutory program"—a program of oil and gas leasing authorized by the Mineral Leasing Acts.[79]

2. NEPA Requires the Preparation of a PEIS Where Multiple Projects Share Similar or Cumulative Effects

BLM's oil and gas leasing activities also constitute a program under NEPA because those activities encompass multiple projects that share similar and cumulative effects. NEPA expressly contemplates preparation of a PEIS where an agency faces multiple, independent permitting decisions that have overlapping, shared, and cumulative impacts.[80] It is unquestionable that distinct land and mineral leases and approvals of APDs all contribute to climate change and non-climate impacts, and together have a cumulative impact greater than the sum of each individual lease. And, as CEQ's 2014 Guidance makes clear, "[a]gencies are required to consider direct, indirect, and cumulative effects when analyzing any proposed Federal actions and projecting their environmental consequences."[81] Combustion of oil and gas extracted through BLM leases and approved APDs emits carbon dioxide and other GHGs into the atmosphere, exacerbating climate change and its dire consequences. Thus, NEPA requires the development of a PEIS for the federal oil and gas leasing program.

---

[75] BLM, Environmental Review and Permitting, *archived at* perma.cc/6N4F-UPBV.
[76] BLM, Oil and Gas, *archived at* perma.cc/X2QQ-W46D.
[77] *Id.*
[78] *Id.*
[79] 40 C.F.R. § 1508.18.
[80] *See Native Ecosystems Council v. Dombeck*, 304 F.3d 886 (9th Cir. 2002) ("A single NEPA review document is required for distinct projects when . . . the projects are 'connected,' 'cumulative,' or 'similar' actions . . .").
[81] 2014 Guidance, *supra* note 38, at 10.

D. BLM's Oil and Gas Leasing Program is a Significant Contributor to Climate Change, Triggering NEPA's EIS Requirement.

Under NEPA, the requirement to prepare an EIS is triggered by a finding that the proposed action will have "significant" environmental effects.[82] NEPA's implementing regulations define significance by both "context" and "intensity."[83] Context "means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality."[84] Furthermore, "both short- and long-term effects are relevant" to context.[85] Intensity "refers to the severity of impact" and includes consideration of the following:

- Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial;
- The degree to which the proposed action affects public health or safety;
- The degree to which the effects on the quality of the human environment are likely to be highly controversial;
- The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks;
- The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration;
- Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts; and
- The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.[86]

The 2014 Guidance sheds light on these considerations as applied to climate change. At the outset, the Guidance provides that "when assessing the potential significance of the climate change impacts of their proposed actions, agencies should consider both context and intensity, as they do for all other impacts."[87] Thus, 40 C.F.R § 1508.27 guides the significance determination in the context of climate change as well. The Guidance notes that agencies must also consider the direct, indirect, *and* cumulative effects of an action on climate change;[88] cumulative impact is

[82] *See* 42 U.S.C. § 4332(2)(C) ("[A]ll agencies of the Federal Government shall include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment . . ."); 40 C.F.R. § 1502.3 (setting forth the statutory requirements for EISs).
[83] 40 C.F.R. § 1508.27.
[84] *Id.* at 1508.27(a).
[85] *Id.*
[86] *Id.* at 1508.27(b)(1)–(10).
[87] 2014 Guidance, *supra* note 38, at 10.
[88] *Id.* at 11 ("After identifying and considering the direct and indirect effects, an agency must consider the cumulative impacts of its proposed action and reasonable alternatives.") (emphasis added); *see also* CEQ

defined in CEQ's regulations as the "impact on the environment that results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (Federal or non-federal) or person undertakes such other actions."[89] In other words, BLM must consider the impact on the environment that results from its oil and gas leases when companies burn fossil fuels extracted pursuant to the leases, an entirely foreseeable (and intended) consequence of BLM's leasing program.[90]

Analysis of the context and intensity of BLM's oil and gas leasing program makes clear that the program significantly affects human health and the environment. First, climate change alters the environment on a global scale, and a PEIS that addresses climate change should address the environmental effects of BLM's oil and gas leasing program at a regional, national, and global scale.[91] Further, as CEQ's regulations make clear, both the short- and long-term effects of the program are relevant to the context analysis.[92] Second, BLM's oil and gas leasing program contributes significant amounts of GHGs into the atmosphere, thereby posing a threat to public health and safety.[93] As discussed below, these public health and safety impacts are well-documented. BLM's past and current implementation of its program carries precedential impact on all future RMP's, leases, and APDs issued pursuant to this program, thereby satisfying another above-listed intensity factor supporting a finding of significance.[94] Moreover, it is reasonably foreseeable that BLM's various leasing and APD approvals, when viewed together, will have a cumulative impact much greater than the individual impacts of each lease and APD. As CEQ's regulations make clear, this cumulative impact alone triggers a significance finding.[95] Finally, climate change, and BLM's significant contributions to it, have also already caused endangered species to shift their ranges and will likely continue to adversely affect protected species, thereby increasing the severity of the program's impact on the last intensity factor listed above.[96]

Data collected on BLM's oil and gas leasing program show that it contributes significant amounts of carbon dioxide and carbon dioxide equivalent into the atmosphere. Stratus

---

Memorandum to Heads of Federal Agencies, "Guidance on the Consideration of Past Actions in Cumulative Effects Analysis," June 24, 2005, *archived at* perma.cc/D89K-6T8F.

[89] 40 C.F.R. § 1508.7.

[90] 43 C.F.R. § 46.30; *see also* § II.I., *infra*.

[91] 40 C.F.R. § 1508.27(a).

[92] *Id.*

[93] *Id.* at 1508.27(b)(2). More frequent wildfires, longer droughts, an increase in the number, duration, and intensity of tropical storms, and sea level rise are only a small fraction of the projected effects of climate change that threaten public health and safety. *See* § II.E, *infra*.

[94] *Id.* at 1508.27(b)(6).

[95] *Id.* at 1508.27(b)(7) ("Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment.")

[96] *See* Javier Monzón et al., *Climate Change and Species Range Dynamics in Protected Areas*, 61 BIOSCIENCE 752, 752 (2010) ("[T]hreatened species are moving out of protected areas."); Erin E. Seney, *Climate Change, Marine Environments, and the U.S. Endangered Species Act*, 27 CONSERVATION BIOLOGY 1138, 1140 (2013) ("Many climate-related ecological effects, including range shifts and potentially some extinctions, have already been documented."). A copy of the Monzón et al. article is attached to this Petition as Ex. 7. A copy of the Seney article is attached to this Petition as Ex. 8.

Photo Credit: WildEarth Guardians

Consulting prepared a report for The Wilderness Society calculating the GHG emissions from fossil fuels extracted from federal lands and waters for the years 2008–2010.[97] The Stratus Report found that in 2008 GHG emissions from extracted onshore oil by private leaseholders resulted in the release of 2,618 metric tons of methane ("$MTCH_4$"), 50,715,803 metric tons of carbon dioxide ("$MTCO_2$"), and 2,792 metric tons of nitrous oxide ("MTN_2O"), for a total release of 51,613,257 $MTCO_2e$.[98] That same year, GHG emissions from extracted onshore natural gas by private leaseholders resulted in the release of 15,709 $MTCH_4$, 173,153,676 $MTCO_2$, and 576 MTN_2O, for a total release of 173,718,049 $MTCO_2e$.[99]

Similar data is available for 2009 and 2010. In 2009, GHG emissions from extracted onshore oil by private leaseholders resulted in the release of 2,617 $MTCH_4$, 50,710,929 $MTCO_2$, and 2,800 MTN_2O, for a total release of 51,610,868 $MTCO_2e$.[100] GHG emissions from extracted onshore natural gas by private leaseholders in 2009 resulted in the release of 12,756 $MTCH_4$, 139,473,656 $MTCO_2$, and 466 MTN_2O, for a total release of 139,931,411 $MTCO_2e$.[101]

[97] 2012 Stratus Report, *supra* note 13.
[98] *Id.* at 13.
[99] *Id.*
[100] *Id.*
[101] *Id.*

Finally, in 2010 GHG emissions from extracted onshore oil by private leaseholders resulted in the release of 2,390 $MTCH_4$, 46,141,874 $MTCO_2$, and 2,543 MTN_2O, for a total release of 46,959,493 $MTCO_2e$.[102] GHG emissions from onshore natural gas extracted by private leaseholders in 2010 resulted in the release of 13,795 $MTCH_4$, 152,044,238 $MTCO_2$, and 507 MTN_2O, for a total release of 152,540,230 $MTCO_2e$.[103] Thus, for only three years BLM's oil and gas leasing program contributed a total of 49,885 $MTCH_4$, 612,240,176 $MTCO_2$, and 9,684 MTN_2O into the atmosphere, for a total release of 612,309,429 $MTCO_2e$. To put this into perspective, the threshold that triggers the application of the EPA's GHG Reporting Rule is 25,000 $MTCO_2e$.[104] This is the same threshold CEQ adopted in its 2010 draft guidance[105] and retained in its 2014 Guidance[106] despite criticisms of the threshold in public comments on the 2010 draft guidance.[107] CEQ notes that 25,000 $MTCO_2e$ emissions on an annual basis is an "appropriate reference point" that allows agencies to focus their attention on projects with large GHG emissions.[108] BLM's oil and gas leasing program contributes on average over eight thousand times that amount on an annual basis.

The amount of GHGs released by BLM's oil and gas leasing program from 2008–2010 represents the rule, not the exception. As an update to its 2012 report, Stratus Consulting released new data in December 2014 quantifying the GHG emissions associated with fossil fuels extracted from federal lands by private leaseholders in 2012.[109] GHG emissions from onshore oil by private leaseholders in 2012 resulted in the release of 2,999 $MTCH_4$, 56,346,510 $MTCO_2$, and 2,985 MTN_2O, for a total release of 57,311,142 $MTCO_2e$.[110] GHG emissions from onshore natural gas extracted by private leaseholders in 2012 resulted in the release of 12,358 $MTCH_4$, 144,135,798 $MTCO_2$, and 480 MTN_2O, for a total release of 144,587,927 $MTCO_2e$.[111] Thus, in 2012 BLM's oil and gas leasing program resulted in the release of 201,899,069 $MTCO_2e$. Once again, these more recent emissions exceed CEQ's "appropriate reference point" by more than eight thousand times.[112]

BLM's failure to disclose these GHG emissions in a PEIS compounds other important disclosure and reporting failures. As the Stratus Report notes, the figures for 2008–2010 were not

[102] *Id.*
[103] *Id.*
[104] 40 C.F.R. § 98.2.
[105] CEQ, Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions 2 (2010).
[106] 2014 Guidance, *supra* note 38, at 18.
[107] Revised Draft Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in NEPA Reviews, 79 Fed. Reg. 77801 (proposed Dec. 24, 2014), *archived at* perma.cc/59Y6-HYVS.
[108] 2014 Guidance, *supra* note 38, at 18.
[109] STRATUS CONSULTING, GREENHOUSE GAS EMISSIONS FROM FOSSIL ENERGY EXTRACTED FROM FEDERAL LANDS AND WATERS: AN UPDATE (2014) ("2014 Stratus Report"), *archived at* perma.cc/59G3-Z3BX. A copy of the 2014 Stratus Report is attached to this Petition as Ex. 9.
[110] *Id.* at 10.
[111] *Id.*
[112] 2014 Guidance, *supra* note 38, at 18.

included in CEQ's April 2011 first-ever *Greenhouse Gas Emissions Inventory for the Federal Government*, which presented the total estimated GHG emissions resulting from federal government agencies' operations, including emissions from building electricity and water consumption, employee travel, and numerous other activities.[113] According to the federal government's incomplete inventory, these emissions totaled approximately 66.4 million $MTCO_2e$ in 2010.[114] However, that inventory did not account for emissions associated with a range of activities that are under federal government control but are conducted by private entities, including BLM's oil and gas leasing program.[115] Omitting GHG emissions from federal government leasing of oil and gas, and for that matter coal, results in a gross underestimation of GHG emissions associated with federal agency operations.[116] As is evident from the Stratus Report, BLM's onshore oil and gas leasing program contributed nearly *two hundred million* $MTCO_2e$ into the atmosphere in 2010, more than three times the sixty-six million $MTCO_2e$ listed by CEQ in April 2011 as representing the emissions resulting from federal government agencies' operations in the same year. Had BLM properly disclosed the GHG emissions of its oil and gas leasing program, CEQ could have released a more accurate picture of the GHG emissions resulting from federal government agencies' operations.

BLM's GHG disclosure lapse is particularly stark given the agency's existing data on the amount of oil and gas extracted from leased lands and the economic benefits from such extraction.[117] Leaseholders must report the volume of oil and gas produced from leased land and pay royalties based on that production volume. Therefore, BLM receives quantitative data on the amount of oil and gas extracted pursuant to its oil and gas leasing program. Just as BLM, based on that data, can and does quantify the economic benefits derived from the oil and gas extracted under its leasing program, BLM can and must calculate the amount of carbon dioxide equivalent released by the extracted oil and gas and report it to the public in a PEIS.

E. Climate Change is an Existential Threat to Human Health and the Environment.

No serious scientific dispute exists that climate change threatens human health and the environment. The science of climate change and its consequences are well documented. The potential future effects of global climate change likely include more frequent wildfires, longer periods of drought in some regions, and an increase in the number, duration, and intensity of tropical storms.[118] Climate change is having an observable impact on the environment. Glaciers have shrunk, plant and animal ranges have shifted, ice on rivers and lakes has been thawing more quickly, and trees have been flowering earlier in spring.[119] Further, the earth is experiencing the

[113] 2012 Stratus Report, *supra* note 13, at 1.
[114] *Id.*
[115] *Id.*
[116] *Id.*
[117] *See* BLM, Oil & Gas Statistics, *archived at* perma.cc/UVS8-5P4G.
[118] Nat'l Aeronautics & Space Admin., *The Current and Future Consequences of Global Climate Change*, *archived at* perma.cc/6FCR-2AGH.
[119] *Id.*

scientific community's long-predicted effects of global climate change, including accelerated sea level rise and longer, more intense, heat waves.[120]

The effects of global climate change reach beyond the states in which BLM conducts oil and gas leasing, and carry observable regional consequences. The following are some of the impacts that are ongoing throughout the U.S. and will continue to affect these regions, according to the Third National Climate Assessment Report,[121] released by the U.S. Global Change Research Program ("USGCRP"):

Photo Credit: Minnesota Department of Agriculture

Northeast: Heat waves, heavy downpours, and sea level rise pose growing challenges to many aspects of life in the Northeast. Infrastructure, agriculture, fisheries, and ecosystems will be increasingly compromised. Many states and cities are beginning to incorporate climate change into their planning.[122]

Northwest: Changes in the timing of streamflow reduces water supplies for competing demands. Sea level rise, erosion, inundation, risks to infrastructure, and increasing ocean acidity pose major threats. Increasing wildfire, insect outbreaks, and tree diseases are causing widespread tree die-off.[123]

Southeast: Sea level rise poses widespread and continuing threats to the region's economy and environment. Extreme heat will affect health, energy, agriculture, and more. Decreased water availability will have economic and environmental impacts.[124]

Midwest: Extreme heat, heavy downpours, and flooding will affect infrastructure, health, agriculture, forestry, transportation, air and water quality, and more. Climate change will also exacerbate a range of risks to the Great Lakes.[125]

---

[120] *Id.*
[121] U.S. GLOBAL CHANGE RESEARCH PROGRAM (USGCRP), CLIMATE CHANGE IMPACTS IN THE UNITED STATES: THE THIRD NATIONAL CLIMATE ASSESSMENT (2014), *archived at* perma.cc/CWE6-FVYE. A copy of this report is attached to this Petition as Ex. 10.
[122] *Id.* at Chapter 16: Northeast, *archived at* perma.cc/X36D-QANY.
[123] *Id.* at Chapter 21: Northwest, *archived at* perma.cc/LF28-YQKV.
[124] *Id.* at Chapter 17: Southeast, *archived at* perma.cc/DTF5-2NHT.
[125] *Id.* at Chapter 18: Midwest, *archived at* perma.cc/2M8P-YNUE.

Southwest: Increased heat, drought, and insect outbreaks, all linked to climate change, have increased wildfires. Declining water supplies, reduced agricultural yields, health impacts in cities due to heat, and flooding and erosion in coastal areas are additional concerns.[126]

The IPCC, which includes more than 1,300 scientists from the United States and other countries, forecasts a temperature rise of 2.5 to 10 degrees Fahrenheit over the next century.[127] The IPCC predicts that increases in global mean temperature of less than 1.8 to 5.4 degrees Fahrenheit (1 to 3 degrees Celsius) above 1990 levels will produce significant negative effects on many regions.[128]

Further, global climate change will have a disproportionate impact upon coastal communities. The National Oceanic and Atmospheric Administration ("NOAA"), for example, released a technical report that global climate change will "continue to threaten the health and vitality of U.S. coastal communities' social, economic and natural systems."[129] The report "examines and describes climate change impacts on coastal ecosystems and human economies and communities, as well as the kinds of scientific data, planning tools and resources that coastal communities and resource managers need to help them adapt to these changes."[130] NOAA notes that

> A key finding in the report is that all U.S. coasts are highly vulnerable to the effects of climate change such as sea-level rise, erosion, storms and flooding, especially in the more populated low-lying parts of the U.S. coast along the Gulf of Mexico, Mid-Atlantic, northern Alaska, Hawaii, and island territories. Another finding indicated the financial risks associated with both private and public hazard insurance are expected to increase dramatically.[131]

The U.S. Geological Survey ("USGS") has also documented the effects of climate change and its impacts on coastal tribes and indigenous communities.[132] Doug Beard, acting associate director of the USGS Climate and Land Use program, notes that "[t]ribes and indigenous cultures and communities across the nation are already being challenged by drought, sea level rise, coastal erosion, altered snow regimes and more frequent and severe storms."[133] And, in March 2015,

---

[126] *Id.* at Chapter 20: Southwest, *archived at* perma.cc/TRB2-TD55.
[127] INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC), Summary for Policymakers, in CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY 17. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (Cambridge Univ. Press 2007), *archived at* perma.cc/3HFL-MJF7. A copy of this summary is attached to this Petition as Ex. 11.
[128] *Id.*
[129] Nat'l Oceanic & Atmospheric Admin., *Climate Change Impacts to U.S. Coasts Threaten Public Health, Safety and Economy* (Jan. 28, 2013), *archived at* perma.cc/3R5D-7E95.
[130] *Id.*
[131] *Id.*
[132] U.S. Geological Survey, *Climate Change, Coastal Tribes and Indigenous Communities* (2015) *archived at* perma.cc/FE77-4V6P.
[133] *Id.*

U.S. Secretary of the Interior, Sally Jewell, announced that the Interior Department would make monies available to fund projects that promote tribal climate change adaptation and ocean and coastal management planning through its Tribal Climate Resilience Program.[134] That BLM has not yet conducted a PEIS studying the significant climate change impacts of its oil and gas leasing program, is legally and morally untenable.

Finally, CEQ's 2014 Guidance documents the urgency of climate change and reaffirms NEPA's role in addressing climate change. CEQ begins by noting that, in its first Annual Report in 1970, it discussed climate change and concluded that "[m]an may be changing his weather."[135] "At that time," CEQ notes, "the mean level of atmospheric carbon dioxide had been elevated to 325 parts per million (ppm). Since 1970, the concentration of atmospheric carbon dioxide has increased at a rate of about 1.6 ppm per year (1970–2012) to approximately 395 ppm in 2014 (current globally averaged value)."[136] CEQ states

> It is now well established that rising global atmospheric GHG emission concentrations are significantly affecting the Earth's climate. These conclusions are built upon a scientific record that has been created with substantial contributions from the [USGCRP], formerly the Climate Change Science Program, which informs our response to climate and global change through coordinated Federal programs of research, education, communication, and decision support. Studies have projected the effects of increasing GHGs on water availability, ocean acidity, sea-level rise, ecosystems, energy production, agriculture and food security, and human health.[137]

Based upon the scientific assessments of the USGCRP and the National Research Council, the U.S. Environmental Protection Agency has found that global climate change "endanger[s] public health and welfare."[138] Finally, reiterating the conclusions reached by the IPCC and the USGCRP, CEQ provides

> Broadly stated, the effects of climate change observed to date and projected to occur in the future include more frequent and intense heat waves, more severe wildfires, degraded air quality, more heavy downpours and flooding, increased drought, greater sea-level rise, more intense storms, harm to water resources, harm to agriculture, and harm to wildlife and ecosystems.[139]

---

[134] *Id.*
[135] 2014 Guidance, *supra* note 38, at 6.
[136] *Id.* (citing U.S. Dep't of Commerce, Nat'l Oceanic & Atmospheric Admin. Earth Sys. Research Lab., *archived at* perma.cc/LKN8-XR9P).
[137] 2014 Guidance, *supra* note 38, at 6–7.
[138] *Id.* at 7.
[139] *Id.* at 7–8.

Climate change poses an immediate and accelerating existential threat to human health and the environment, and BLM must, under NEPA, consider and mitigate the climate change impacts of its oil and gas leasing program.

F. Non-climate Impacts of BLM's Oil and Gas Leasing Program Also Should Be Evaluated in the PEIS.

In addition to GHG emissions, onshore oil and gas extraction is linked to a host of other environmental impacts that should also be evaluated in the PEIS. As described below, these impacts include: seismic activity linked to hydraulic fracturing ("fracking"); public health and safety impacts associated with fracking; and environmental harm related to improperly abandoned and unplugged and unreclaimed wells.

1. Fracking Increases Seismic Activity

The PEIS should evaluate the impacts of underground injection of fracking wastewater and fracking itself on increased seismic activity. Fracking is on the rise as the method of choice for oil and gas extraction. As BLM notes, "There are more than 100,000 oil and gas wells on federally managed lands. Of wells currently being drilled, over 90 percent use hydraulic fracturing."[140] This practice is linked to increased seismic activity in Oklahoma, Texas, Ohio, Pennsylvania, and California, resulting in fracking restrictions in some of those areas.[141] A recent study published in the journal "Science Advances" examined the correlation between increases in seismicity and fracking saltwater disposal in Oklahoma.[142] The authors note that "[t]he number of small- to moderate-sized earthquakes in much of the central and eastern United States began to increase markedly around 2009 . . . [and] some of this seismicity appears to be associated with increases in saltwater disposal that originates as 'flow-back' water after multistage hydraulic fracturing operations."[143] Because flow-back water is usually quite saline, the authors note, it is often disposed of through injection into class II underground injection control ("UIC") wells.[144] Class II UIC wells are also used to inject "produced water," or saline pore water that is coproduced with oil and then injected into deeper sedimentary formations.[145] "Increased pore pressure at depth resulting from fluid injection can trigger slip on preexisting,

---

[140] BLM, *Interior Department Releases Final Rule to Support Safe, Responsible Hydraulic Fracturing Activities on Public and Tribal Lands* (Mar. 20, 2015), *archived at* perma.cc/8TD2-3TPQ.
[141] For a discussion of pending, passed, or defeated fracking-related legislation and restrictions, see JACQUELYN PLESS, NAT'L CONFERENCE OF STATE LEGISLATURES, NATURAL GAS DEVELOPMENT AND HYDRAULIC FRACTURING: A POLICYMAKER'S GUIDE (Revised June 2012), *archived at* perma.cc/WVZ6-LFKK. A copy of this report is attached to this Petition as Ex. 12.
[142] F. Rall Walsh III and Mark D. Zoback, *Oklahoma's Recent Earthquakes and Saltwater Disposal*, 1(5) SCI. ADVANCES (June 5, 2015). A copy of this article is attached to this Petition as Ex. 13.
[143] *Id.* at 1.
[144] *Id.* Class II wells are used to inject fluids associated with oil and natural gas production. EPA, Class II Wells – Oil and Gas Related Injection Wells, *archived at* perma.cc/Z6YV-LU62. Most of the injected fluid is saltwater, which is brought to the surface in the process of extracting oil and gas. *Id.* In addition, saltwater and other fluids are injected to enhance oil and gas production. *Id.*
[145] *Id.*

already-stressed faults," the authors note.[146] In other words, saline produced water from wells alters active fault lines when it is injected into deeper sedimentary formations. Through three study areas that encompass the vast majority of recent seismic activity in Oklahoma, the authors show that "the increases in seismicity follow 5- to 10-fold increases in the rates of saltwater disposal."[147] Similarly, the authors conclude, "[a]djacent areas where there has been relatively little saltwater disposal have had comparatively few recent earthquakes."[148]

The link between fracking and increased seismic activity is well supported and affirmed by other studies. For example, M. Weingarten (et al.) examined the relationship between wastewater injection and U.S. mid-continent seismicity using a newly assembled injection well database for the central and eastern United States.[149] They conclude that "the entire increase in earthquake rate is associated with fluid injection wells. High-rate injection wells (>300,000 barrels per month) are much more likely to be associated with earthquakes than lower-rate wells."[150] The impacts of BLM's oil and gas leasing program on fracking-induced seismicity should be evaluated in the PEIS.

2. Fracking Carries Public Health and Safety Impacts

Photo Credit: WildEarth Guardians

The PEIS should also evaluate the public health and safety impacts associated with fracking. A new, extensive report conducted by Concerned Health Professionals of New York and Physicians For Social Responsibility outlines scientific, medical, and media findings demonstrating the risks and harms of fracking.[151] This compendium is "a fully referenced compilation of the evidence outlining the risks and harms of fracking."[152] As the compendium points out, evidence to date indicates that fracking operations pose severe threats to human health and the environment, both from water pollution and air pollution.[153] It states:

[146] *Id.*
[147] *Id.*
[148] *Id.*
[149] M. Weingarten et al., *High-rate Injection is Associated With the Increase in U.S. Mid-Continent Seismicity*, 348 SCIENCE 1336 (2015). A copy of this article is attached to this Petition as Ex. 14.
[150] *Id.* For an additional, thorough treatment of fracking-induced seismicity, see STATES FIRST, POTENTIAL INJECTION-INDUCED SEISMICITY ASSOCIATED WITH OIL & GAS DEVELOPMENT (2015), *archived at* perma.cc/5LVV-UWN3. A copy of this report is attached to this Petition as Ex. 15.
[151] CONCERNED HEALTH PROFESSIONALS OF N.Y. AND PHYSICIANS FOR SOCIAL RESPONSIBILITY, COMPENDIUM OF SCIENTIFIC, MEDICAL, AND MEDIA FINDINGS DEMONSTRATING RISKS AND HARMS OF FRACKING (UNCONVENTIONAL GAS AND OIL EXTRACTION) (Third Ed. Oct. 14, 2015), *archived at* perma.cc/L6R3-ML7T. A copy of this compendium is attached to this Petition as Ex. 16.
[152] *Id.* at 2.
[153] *Id.* at 4.

> In the United States, more than two billion gallons of fluid are injected daily under high pressure into the earth with the purpose of enabling oil and gas extraction via fracking or, after the fracking is finished, to flush the extracted wastewater down any of the 187,570 disposal wells across the country that accept oil and gas waste. All of those two billion daily gallons of fluid is toxic, and it all passes through our nation's groundwater aquifers on its way to the deep geological strata below where it can demonstrably raise the risk for earthquakes. In the air above drilling and fracking operations and their attendant infrastructure, researchers have measured strikingly high levels of toxic pollutants, including the potent carcinogen benzene and the chemical precursors of smog. In some cases, concentrations of fracking-related air pollution in communities where people live and work far exceed federal safety standards. Research shows that air emissions from fracking can drift and pollute the air hundreds of miles downwind. With more than 15 million Americans already living within a mile of a fracking well that has been drilled since 2000, and with more than 50,000 new wells fractured per year over the past 15 years, the potential for exposure and accompanying adverse impacts is significant.[154]

For this compendium, the authors collected and compiled findings from articles from peer-reviewed medical and scientific journals, investigative reports by journalists, and reports from or commissioned by government agencies.[155] As noted above, extensive studies have demonstrated air and water pollution from fracking activities. These serious health hazards should be studied and mitigated in the PEIS.

3. Abandoned, Unplugged and Unreclaimed Oil Wells Cause Environmental Impacts

Third, the PEIS should also evaluate the environmental impacts of improperly abandoned and unplugged and unreclaimed wells. Pursuant to 43 C.F.R. § 3162.3-4, well operators must properly plug and abandon a well once it is no longer producing in paying quantities. Lease owners and well operators must, by regulation, plug the well, remove related facilities and equipment, recontour disturbed sites, administer stored topsoil to the area and revegetate the site to near natural vegetation.[156]

The reasons to return non-productive well sites and other associated energy land disturbance activities to near natural surface conditions are numerous, and implicate both environmental and multiple use concerns. For example, plugging prevents potential spills, soil and water contamination, and the release of volatile hydrocarbons. Reclamation prevents invasive weeds and fugitive dust, provides new forage for wildlife and livestock, reduces soil erosion, and provides a more scenic setting for humans. Thus, proper reclamation improves air and water quality, reduces erosion, provides wildlife and livestock more forage and cover,

[154] *Id.* at 4–5.
[155] *Id.* at 5.
[156] 43 C.F.R. § 3162.3-4.

prevents the release of radiant energy into the atmosphere, and provides for greater carbon sequestration.

To this end, BLM instructs its employees to conduct an idle-well review and data entry into the Automated Fluid Minerals Support System to document wells with more than 7 years of non-production.[157] However, a report conducted by a former BLM employee, named Stan Olmstead, at the Vernal, UT Field Office, found large numbers of unplugged, unreclaimed wells in Utah.[158] Mr. Olmstead notes that while working at the Vernal Field Office he, along with other BLM employees, "developed concern over the lack of priority placed on the plugging of non-producing energy wells and upon conducting appropriate and final reclamation."[159] According to Mr. Olmstead, a number of wells that sat idle in 1992 were still not producing in 2012 and "[Vernal Field Office] management was not requiring the operator to plug and reclaim these non-productive locations with the appropriate interest to serve the American public."[160] As a result of Mr. Olmstead's concerns, he conducted several Freedom of Information Act ("FOIA") requests to the Vernal, Moab, and Price Field Offices and the Utah State Office. His findings are concerning. "Using an estimate (sic) four acres for each well site and its related infrastructure, [he] calculated that, based on the 2013 FOIA responses from the three Field Offices, there were an estimated 2,888 acres of un-reclaimed land in Utah for wells more than 10 years in non-production at that time."[161] This figure includes a reported 355 wells without production for 10 or more years over approximately 1,420 acres of unreclaimed public lands within the jurisdiction of the Vernal Field Office, 304 wells over approximately 1,216 acres within the jurisdiction of the Moab Field Office, and 63 wells over approximately 252 acres within the jurisdiction of the Price Field Office.[162] Based on a 2015 FOIA response from the Utah State Office, Mr. Olmstead calculated that, using the estimated four acres for each well site, there are currently an estimated 2,228 acres of unreclaimed land in Utah for wells in non-production for more than 10 years.[163]

Thus, there are thousands of acres of unreclaimed public land with unreclaimed wells in Utah alone, despite BLM's obligations to ensure the plugging and reclamation of oil and gas wells that have not been producing in paying quantities for ten years. Professional land managers are obligated to fulfill their public trust responsibility not only to authorize land use and development for energy-related resources, but also to assure the reclamation of public lands for the American public after the extraction of subsurface oil and gas resources.

---

[157] BLM, Instructional Memorandum No. 2012 – 181 (2012), *archived at* perma.cc/9EGT-3TED.
[158] STAN OLMSTEAD, REPORT OF OIL & GAS WELL ABANDONMENT AND RECLAMATION ON FEDERAL LANDS ADMINISTERED BY BLM-UTAH 4–5 (Mar. 14, 2015), *archived at* perma.cc/QPH3-RYR9. A copy of this report is attached to this Petition as Ex. 17.
[159] *Id.* at 1.
[160] *Id.* at 1–2.
[161] *Id.* at 4.
[162] *Id.* at 4–5. Note that the Moab and Price Field Offices provided information only on federal wells and, consequently, the number of other land management agency wells overseen by BLM is unknown. *Id.*
[163] *Id.* at 4. Mr. Olmstead also documented other irregularities from his FOIA requests, including varying degrees of cooperation amongst offices, different information and documents provided by each office, and differences in prices charged for the FOIA requests. *Id.* at 3. These irregularities indicate a lack of consistency in applying FOIA's mandates. *Id.* at 3 n.2.

In sum, the PEIS should also evaluate and mitigate the non-climate related environmental impacts associated with BLM's oil and gas leasing program, including seismic activity linked to fracking, public safety and health impacts associated with fracking, and environmental harm stemming from improperly abandoned and unplugged and unreclaimed wells.

G. BLM's Tiered Oil and Gas Leasing Approvals Would Benefit From Programmatic Overlay.

NEPA encourages agencies to tier their EISs to eliminate repetitive discussions of the same issues and to focus on the actual issues ripe for decision at each level of environmental review.[164] A PEIS allows for a broader discussion of impacts from tiered activities.

The organization of BLM's oil and gas leasing program supports tiered review under NEPA. As noted in section II.C above, BLM organizes its oil and gas leasing program into five separate, well-defined phases, and each phase is further subdivided into subparts. Such a structure is well suited for tiering. Project or site-specific EAs or EISs can incorporate by reference or tier a PEIS. BLM could, thus, create a PEIS for its oil and gas leasing program addressing the direct, indirect, and cumulative effects of the program on climate change and climate change's impact on the program and then incorporate by reference or tier to that PEIS when addressing climate change in site-specific EAs or EISs.

CEQ's 2014 Guidance recognizes the importance of tiering and its usefulness for land and resource management:

> A tiered, analytical decision-making approach using a programmatic NEPA review is used for many types of Federal actions and can be particularly relevant to addressing proposed land, oceanic, and resource management plans. Under such an approach, a broad-scale programmatic NEPA analysis is conducted for actions such as USDA Forest Service land and resource management plans, Bureau of Land Management resource management plans, or Natural Resources Conservation Service conservation programs. Subsequent NEPA analyses for site-specific decisions—such as projects that implement land, oceanic, and resource management plans—are tiered from the broader programmatic analysis, drawing upon its basic framework analysis to avoid repeating analytical efforts for each tiered decision.[165]

Further, CEQ provides that:

> In the context of long-range energy, transportation, and resource management actions, for example, an agency may decide that it would be useful and efficient to

[164] 40 C.F.R. § 1502.20.
[165] 2014 Guidance, *supra* note 38, at 29.

> provide an aggregate analysis of GHG emissions or climate change effects in a programmatic analysis and then incorporate by reference that analysis into future NEPA reviews.[166]

Indeed, CEQ expressly contemplates a PEIS for BLM's oil and gas leasing program:

> Examples of project- or site-specific actions that can benefit from a programmatic NEPA review include: constructing transmission towers; conducting prescribed burns; approving grazing leases; granting a right-of-way; *authorizing leases for oil and gas drilling*; authorizing construction of wind turbines; and approving hard rock mineral extraction.[167]

Thus, the 2014 Guidance creates an expectation that BLM would undertake a PEIS of its oil and gas leasing program. Further, where an agency has chosen to ignore programmatic analysis in favor of site-specific climate analysis, it is required to "set forth a reasoned explanation" for doing so.[168]

BLM has previously recognized the value of PEISs and tiering in NEPA reviews. For example, BLM issued a PEIS associated with the designation of energy corridors on federal lands in eleven Western states.[169] In it, BLM stated that:

> Individual project analyses, reviews, and approvals and denials may tier off the PEIS, thus using and referencing the information, analyses, and conclusions presented in the PEIS to supplement the project-specific reviews and analyses. However, individual project-specific decision making will not be supplanted by the PEIS.[170]

Similarly, discussion of climate change impacts in individual RMPs, land leases, and approvals and denials of APDs may tier off a PEIS that addresses the impacts BLM's oil and gas leasing program has on climate change. This tiering can supplement project-specific reviews and analyses.

In fact, Interior has long recognized the value and importance of PEISs, and has conducted them for other energy-related decisions. For example, Interior has conducted PEISs for geothermal resources leasing,[171] oil shale and tar sands resources,[172] alternative energy

---

[166] *Id.*
[167] *Id.* at 29–30 (emphasis added).
[168] *Id.* at 4.
[169] BLM, WEST-WIDE ENERGY CORRIDOR PROGRAMMATIC EIS (2008), *archived at* perma.cc/QC6F-NWJ7.
[170] *Id.* at Chapter 1: Why Are Federal Agencies Proposing to Designate Energy Corridors In the West? 21, *archived at* https://perma.cc/7PBP-4A8Q.
[171] BLM, FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT FOR GEOTHERMAL LEASING IN THE WESTERN UNITED STATES (last updated Oct. 20, 2009), *archived at* perma.cc/HJ6Q-FD3T.
[172] BLM, 2012 OIL SHALE AND TAR SANDS FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT (2012), *archived at* https://perma.cc/9JJ4-2ENY.

development and production on the outer continental shelf,[173] and coal.[174] In light of Interior's longstanding use of PEISs for energy development and production projects, it is unusual that BLM has *not* conducted a PEIS of its onshore oil and gas leasing program. WildEarth Guardians' request to BLM to correct this untenable oversight is, thus, entirely reasonable and comports with Interior's history of conducting programmatic review of energy development and production programs.

H. A PEIS Will Not Be Duplicative, a Reason for Delay, or Speculative.

1. A PEIS Will Not Be Duplicative

A PEIS of BLM's oil and gas leasing program will not be duplicative. BLM has yet to conduct an overarching PEIS of the program and its ill effects on climate change. While BLM is able to conduct an analysis of climate change in environmental reviews at the RMP, lease, or APD stages, it has not adequately done so and there are compelling reasons for conducting such an analysis as early in the process as possible.

First, BLM has not conducted a meaningful review of the direct, indirect, and cumulative impacts of its oil and gas leasing program on climate change in its RMPs. For example, a review of the final EIS ("FEIS") accompanying the RMP for the oil rich BLM district of Vernal, UT, yields two small sections discussing climate change.[175] Combined, the sections entail six paragraphs that span less than two full pages. Chapter 3 (Affected Environment) Section 2 (Air Quality) has a four-paragraph discussion of climate change that provides a short, mechanical recitation of the science behind climate change before concluding with a perfunctory statement:

> The BLM recognizes the importance of climate change and the potential effects it may have on the natural environment. Several activities occur within the planning area that may generate emissions of climate changing pollutants. For example, oil and gas development, large fires, and recreation using combustion engines, can potentially generate CO2 and methane. Wind erosion from disturbed areas and fugitive dust from roads along with entrained atmospheric dust has the potential to darken glacial surfaces and snow packs resulting in faster snowmelt.[176]

In its final sentence, BLM attempts to ameliorate these "potential" ill effects on climate change by adding that "[o]ther activities may help sequester carbon, such as managing vegetation to

---

[173] BUREAU OF OCEAN ENERGY MGMT., OCS ALTERNATIVE ENERGY FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT (2007), *archived at* https://perma.cc/894D-44YE.
[174] BLM, FINAL ENVIRONMENTAL IMPACT STATEMENT SUPPLEMENT FEDERAL COAL MANAGEMENT PROGRAM (1985), *archived at* https://perma.cc/HTD9-AKN9.
[175] BLM VERNAL FIELD OFFICE, PROPOSED RESOURCE MANAGEMENT PLAN AND FINAL ENVIRONMENTAL IMPACT STATEMENT (2008), *archived at* perma.cc/9GV9-DQNT.
[176] *Id.* at 3–9, *archived at* perma.cc/8L2P-U726. Given that the Stratus Reports have quantified the amount of CO_2 and methane released from onshore oil and gas development by private leaseholders, BLM's statement that "oil and gas development, large fires, and recreation using combustion engines, *can potentially generate* CO2 and methane" seems particularly disingenuous.

favor perennial grasses and increase vegetative cover, which may help build organic carbon in soils and function as 'carbon sinks.'"[177]

Chapter 4 (Environmental Consequences) Section 2 (Air Quality) contains a two-paragraph discussion of climate change that is even more equivocal. "The assessment of climate-changing pollutant emissions and climate change is in its formative phase," BLM states, "therefore, it is not yet possible to know with confidence the net impact to climate."[178] BLM also states that "[t]he lack of scientific tools designed to predict climate change on regional or local scales limits the ability to quantify potential future impacts. Currently BLM does not have an established mechanism to accurately predict the effect of resource management-level decisions from this planning effort on global climate change."[179] As with section 3.2, BLM devotes a few sentences to possible impacts from its program.

Such a cursory treatment of climate change does not comport with the letter or spirit of NEPA. For major federal actions significantly affecting the quality of the human environment NEPA requires the completion of "a detailed statement" that considers the environmental impact of, adverse environmental effects of, and alternatives to the proposed action, as well as the relationship between short-term uses of the environment versus its long-term maintenance and enhancement and any irreversible and irretrievable commitments of resources involved in the proposed action.[180] BLM has provided no such "detailed statement" addressing these requirements in the eight paragraphs it devotes to climate change in its Vernal, UT RMP/FEIS. As a threshold matter, BLM has failed to quantify the program's emissions, let alone "[r]igorously explore and objectively evaluate] all reasonable alternatives" that could mitigate the adverse climate change effects of its program[181] or "[d]evote substantial treatment to each alternative considered in detail . . . so that reviewers may evaluate their comparative merits."[182] Nor do these eight paragraphs include discussions of the direct and indirect effects of the program and their significance to climate change[183] or the environmental effects, energy requirements, and mitigation potential of alternatives and mitigation measures.[184] These requirements are mirrored in Interior's NEPA implementing regulations, all of which BLM ignores in its failure to conduct a PEIS that analyzes the effects of its oil and gas leasing program on climate change.[185] BLM's eight-paragraph treatment of climate change in its Vernal, UT RMP/FEIS falls short of the "focused and effective consideration of climate change in NEPA reviews" CEQ contemplates.[186]

---

[177] *Id.*
[178] *Id.* at 4–8, *archived at* https://perma.cc/NL3J-3KY5.
[179] *Id.*
[180] 42 U.S.C. § 4332(2)(C)(i)–(v).
[181] 40 C.F.R. § 1502.14(a).
[182] *Id.* at 1502.14(b).
[183] *Id.* at 1502.16(a)–(b).
[184] *Id.* at 1502.16(d)–(e).
[185] See 43 C.F.R. § 46.415 (providing the required content of EISs and informing drafters that the statement must be "in accordance with 40 C.F.R. § 1502.10").
[186] 2014 Guidance, *supra* note 38, at 2.

Unfortunately, BLM's superficial treatment of climate change in its Vernal, UT RMP/FEIS represents the rule rather than the exception. For example, BLM provided the same level of review of climate change in its RMP/FEIS for the Taos Field Office in New Mexico.[187] There, climate change was given one subsection of seven paragraphs over less than two pages[188] with a few additional mentions of climate change sprinkled throughout when discussing, for example, the impacts of drought on soils and fish.[189] Especially when compared to the treatment of other categories of impact studied in that 517-page document, BLM did not give climate change the requisite attention under NEPA.[190]

BLM also fails to adequately address climate change at the leasing stage of its oil and gas program. Illustrative is an environmental assessment ("EA") prepared by the Vernal, UT Field Office for a November 2015 oil and gas lease sale.[191] Climate change receives *even less* attention there than at the RMP stage. Climate change is addressed in two sections, each a paragraph long and titled "Greenhouse Gas."[192] No scientific data or background is provided, and no GHG emissions impacts associated with the lease are discussed. In fact—and most troubling—both paragraphs contain the following: "Drilling and development activities as a result of the proposed leasing are anticipated to release a negligible amount of greenhouse gases into the local air-shed."[193] Thus, the EA appears to deny that the studied oil and gas lease sale will contribute to climate change in any significant way. By denying any significant contribution to climate change from individual lease sales while providing nothing more than perfunctory and conclusory statements in its EISs at the RMP stage, BLM shirks its disclosure obligations at every implementation stage of its oil and gas leasing program, in violation of NEPA.[194]

As noted in section II.D above, BLM's oil and gas leasing program contributed 612,309,429 $MTCO_2e$ into the atmosphere over the span of three years—an average of 204,103,143 metric tons a year. These emissions are anything but "negligible." BLM's failure to determine the impacts of its oil and gas leases on climate change at the leasing or RMP stages is precisely the reason why BLM should and must conduct this review on a broad, programmatic level. Moreover, by neglecting to conduct its review of the program's impact on climate change at the programmatic level and by failing to recognize and assess its cumulative impacts, BLM's approach is impermissibly myopic.

---

[187] BLM TAOS FIELD OFFICE, PROPOSED TAOS RESOURCE MANAGEMENT PLAN AND FINAL ENVIRONMENTAL IMPACT STATEMENT (2011), *archived at* perma.cc/G5T4-TVFR.
[188] *Id.* at 485–86.
[189] *Id.* at 487–88.
[190] See 40 C.F.R. Part 1502 (setting forth the requirements for EISs).
[191] BLM VERNAL FIELD OFFICE, ENVIRONMENTAL ASSESSMENT: NOVEMBER 2015 LEASE SALE DOI-BLM-UT-G010-2015-089-EA (2015), *archived at* perma.cc/EG93-AS32.
[192] *Id.* at 32–33, 43.
[193] *Id.*
[194] See 42 U.S.C. § 4332(2)(C) (All agencies of the Federal Government shall prepare an EIS for all "major Federal actions significantly affecting the quality of the human environment."); 2014 Guidance at 8 ("Federal agencies, to remain consistent with NEPA, should consider the extent to which a proposed action and its reasonable alternatives contribute to climate change through GHG emissions and take into account the ways in which a changing climate over the life of the proposed project may alter the overall environmental implications of such actions.").

CEQ's 2014 Guidance specifically counsels against BLM's myopic analytical approach, which only serves to obscure the full, cumulative climate change impacts of its expansive and coordinated oil and gas leasing program. In its 2014 Guidance, CEQ states:

> CEQ recognizes that many agency NEPA analyses to date have concluded that GHG emissions from an individual agency action will have small, if any, potential climate change effects. Government action occurs incrementally, program-by-program and step-by-step, and climate impacts are not attributable to any single action, but are exacerbated by a series of smaller decisions, including decisions made by the government. Therefore, the statement that emissions from a government action or approval represent only a small fraction of global emissions is more a statement about the nature of the climate change challenge, and is not an appropriate basis for deciding whether to consider climate impacts under NEPA. Moreover, these comparisons are not an appropriate method for characterizing the potential impacts associated with a proposed action and its alternatives and mitigations. This approach does not reveal anything beyond the nature of the climate change challenge itself: the fact that diverse individual sources of emissions each make relatively small additions to global atmospheric GHG concentrations that collectively have huge impact.[195]

Thus, BLM cannot rely on statements such as "[d]rilling and development activities as a result of the proposed leasing are anticipated to release a negligible amount of greenhouse gases into the local air-shed."[196] While each individual lease many only contribute small amounts of GHGs into the atmosphere, collectively the program contributes significant amounts of GHGs into the atmosphere. As the 2014 Guidance notes, "diverse individual sources of emissions each make relatively small additions to global atmospheric GHG concentrations that collectively have huge impact."[197] Moreover, when the cumulative impact of multiple leasing decisions is undeniably large, limiting focus to relatively small individual leasing actions "is *not* an appropriate basis for deciding whether to consider climate impacts under NEPA."[198] CEQ thus counsels BLM to properly conduct a NEPA review of its oil and gas leasing program's effects on climate change instead of continuing to provide inadequate reviews that to date have "concluded that GHG emissions from an individual agency action will have small, if any, potential climate change effects."[199]

Second, a review of BLM's oil and gas leasing program's effects on climate change should be conducted on a programmatic level at the outset of the program and not down the line at the RMP, leasing, or APD stages. As CEQ notes, "The primary purpose of an [EIS] is to serve as an action-forcing device to insure that the policies and goals defined in [NEPA] are infused

[195] 2014 Guidance, *supra* note 38, at 9.
[196] ENVIRONMENTAL ASSESSMENT: NOVEMBER 2015 LEASE SALE, *supra* note 191 at 32–33, 43.
[197] 2014 Guidance, *supra* note 38, at 9.
[198] *Id.*
[199] *Id.*

into the ongoing programs and actions of the Federal Government."[200] EISs are intended to "be used by Federal officials in conjunction with other relevant material to plan actions and make decisions."[201] Thus, as an "action-forcing device" to be used by federal officials to "plan actions and make decisions," including actions to mitigate adverse environmental effects, EISs are best used early on at the outset of a program where these actions and decisions can be taken and made *before* the program is already underway and causing the harm to human health and the environment NEPA is intended to force officials to consider and mitigate. 40 C.F.R. § 1502.5 requires the EIS "be prepared early enough so that it can serve practically as an important contribution to the decisionmaking process and will not be used to rationalize or justify decisions already made (§§ 1500.2(c), 1501.2, and 1502.2)." Section 1502.5(a) also provides that "For projects directly undertaken by Federal agencies the environmental impact statement shall be prepared at the feasibility analysis (go-no go) stage and may be supplemented at a later stage if necessary." This timing fulfills NEPA's goals of "promot[ing] disclosure and consideration of potential environmental effects on the human environment resulting from proposed actions [and providing] decisionmakers with alternatives to mitigate these effects."[202] This timing also fulfills NEPA's goal of "ensur[ing] that agencies take account of environmental effects as an integral part of the agency's own decision-making process *before decisions are made*."[203]

Moreover, review of the oil and gas leasing program's effects on climate change should be conducted on a programmatic level because climate change is by nature transboundary and thus not well suited for fragmented review at the RMP, leasing, or APD stages. EISs at the RMP stage cover environmental impacts within the individual BLM district for which the RMP is being developed. Due to the nature of climate change, the environmental impacts of GHG emissions associated with oil and gas leasing in Wyoming or Montana can have significant effects on coastal communities in Alaska or Washington. Those effects cannot as easily be addressed in environmental impact statements at the RMP stage, much less environmental impact statements or environmental assessments at the leasing or APD stages, which are even narrower in scope and application. Moreover, the necessary expertise clearly does not reside in state and field offices that have thus far failed to analyze climate emissions or impacts, and in some cases, even denied climate change's scientific consensus as recently as this year. Rather, the impacts of BLM's oil and gas leasing program on climate change are best addressed at the national, programmatic level.

Finally, Interior's move to implement reforms to BLM's oil and gas leasing program underscores the need and opportunity for a PEIS.[204] As a practical matter, any reforms must be supported by comprehensive environmental review to ensure the best decisions are rendered. It makes sense for Interior to prepare a PEIS as it moves forward with reforms to ensure that, like

[200] 40 C.F.R. § 1502.1.
[201] *Id.*
[202] 2014 Guidance, *supra* note 38, at 5.
[203] *Id.* (emphasis added).
[204] *See* BLM's Advanced Notice of Proposed Rulemaking & Extension of Comment Period, Oil and Gas Leasing; Royalty on Production, Rental Payments, Minimum Acceptable Bids, Bonding Requirements, and Civil Penalty Assessments, 80 Fed. Reg. 31560 (proposed June 3, 2015), *archived at* https://perma.cc/A6RP-XMCS.

the federal coal program, BLM's oil and gas program is managed consistent with our nation's climate objectives.

2. A PEIS Will Not Be A Reason For Undue Delay

A PEIS would serve to streamline the oil and gas leasing program's environmental review process and thus will not cause undue delays in the leasing process. Because project, or site-specific, EISs can tier off an overarching PEIS, conducting a PEIS now may save time down the line. CEQ encourages agencies to tier their EISs and expressly provides that, when tiering an EIS or EA to a broader PEIS, agencies need only summarize the issues discussed in the broader statement and incorporate discussions from the broader statement by reference.[205] Such incorporation by reference will "cut down on bulk," allowing BLM to conduct NEPA review more efficiently at the RMP, leasing, and APD stages.[206]

CEQ also reassures agencies that the science behind climate change need not cause undue delay. CEQ provides

> [A]gencies need not undertake exhaustive research or analysis of potential climate change impacts in the project area or on the project itself, but may instead summarize and incorporate by reference the relevant scientific literature. Incorporation by reference is of value in considering GHG emissions where an agency is considering the implications of climate change for the environmental effects of the proposed action. For example, agencies may summarize and incorporate by reference the major peer-reviewed assessments from the USGCRP and underlying technical reports such as their Synthesis and Assessment Products. Particularly relevant are the reports on climate change impacts on water resources, ecosystems, agriculture and forestry, health, coastlines, and arctic regions in the United States.[207]

Thus, BLM may ease the administrative burden of a programmatic review of its oil and gas leasing program by incorporating the relevant scientific literature on climate change.

Conducting a PEIS of BLM's oil and gas leasing program consistent with the 2014 CEQ Guidance may also minimize controversy and reduce delays and costs associated with litigation. As the Guidance points out, "[m]ore consistent and appropriately proportioned NEPA reviews can help agencies minimize controversy, thereby avoiding potential project delays. This guidance should also reduce the risk of litigation driven by uncertainty in the assessment process as it will provide a clearer expectation of what agencies should consider and disclose."

[205] 40 C.F.R. § 1502.20.
[206] 40 C.F.R. § 1502.21.
[207] 2014 Guidance, *supra* note 38, at 26–27.

3. A PEIS Will Not Be Speculative

As described above, an indisputable and ever-growing body of scientific literature confirms the existence and consequences of climate change, thereby eliminating uncertainty on the subject. Just as Stratus Consulting did for its report,[208] BLM is similarly able to calculate the amount of carbon dioxide and carbon dioxide equivalent released under this program based on the amount of oil and gas extracted from leases authorized by BLM. This information will better allow BLM, other agencies, and the public to assess the climate change impact of BLM's actions, consistent with NEPA, its implementing regulations, and CEQ's 2014 Guidance.

I. The PEIS Should Include Quantification of Downstream Combustion and a Calculation of the Program's Social Cost of Carbon.

The PEIS should include a quantification of emissions from the combustion of the extracted oil and natural gas. As CEQ's 2014 Guidance makes clear, actual estimates of emissions are required even when they are uncertain and can at best be "projected";[209] there is a presumption under NEPA that climate emissions will be quantitatively analyzed.[210] Moreover, this quantification must include the "reasonably foreseeable effects" of the program, including those that come from "using the [extracted] resource."[211] Downstream emissions should be accounted for in the NEPA analysis.[212]

Combustion of the oil and gas extracted by private leaseholders is a reasonably foreseeable, if not intended, consequence of BLM's oil and gas leasing program. The U.S. Energy Information Administration provides that "about 76% of the 6.97 billion barrels of petroleum products that were consumed in the United States in 2014 were gasoline (47% of total petroleum consumption; includes biofuels), heating oil and diesel fuel (21%), and jet fuel (8%)."[213] Similarly, the largest uses of natural gas in the United States are for electric power generation, industrial consumption, and residential consumption.[214] These primary uses of oil and gas require combustion of the fossil fuel, and this combustion releases significant amounts of GHGs. Thus, the combustion of extracted oil and gas is a reasonably foreseeable consequence of the program, and as such must be accounted for in the PEIS.

---

[208] 2012 Stratus Report, *supra* note 13, at 13–14.
[209] 2014 Guidance, *supra* note 38, at 8.
[210] *Id.* at 16.
[211] *Id.* at 12.
[212] *Id.* at 11.
[213] U.S. Energy Info. Admin. ("EIA"), *What are the products and uses of petroleum?* (last updated Sept. 21, 2015), *archived at* perma.cc/F7L3-YEY3.
[214] EIA, *Natural Gas Consumption by End Use* (last updated Dec. 31, 2015), *archived at* perma.cc/ZJK6-T9M2. The EIA defines "industrial consumption" as "[n]atural gas used for heat, power, or chemical feedstock by manufacturing establishments or those engaged in mining or other mineral extraction as well as consumers in agriculture, forestry, and fisheries. Also included in industrial consumption are generators that produce electricity and/or useful thermal output primarily to support the above-mentioned industrial activities." EIA, *Definitions, Sources and Explanatory Notes*, *archived at* perma.cc/U9GK-5N97. The EIA defines residential consumption as "[g]as used in private dwellings, including apartments, for heating, air-conditioning, cooking, water heating, and other household uses." *Id.*

The PEIS should also put the program's emissions into context using an evaluation of the program's social cost of carbon ("SCC"). An estimate of emissions presented without any context means little to decisionmakers or to the public. A ton or gigaton of CO_2e has little meaning to all but those most deeply steeped in climate science. The SCC evaluation is a simple tool that contextualizes emissions by translating tons of carbon into estimates of the costs to society of emitting that carbon. Proper consideration of the SCC is not only good governance and good stewardship of public resources, but is also legally required.

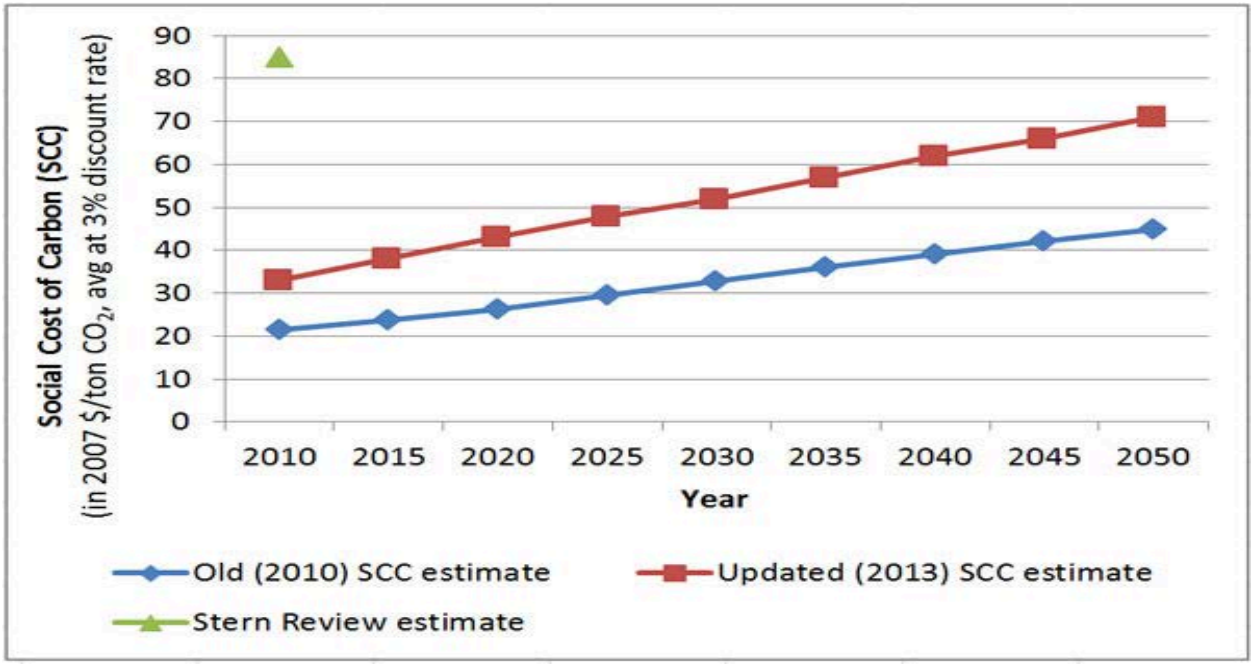


Photo Credit: Frack Check WV

The requirement to analyze the SCC is supported by the general requirements of NEPA and specifically supported in federal case law. NEPA requires agencies take a "hard look" at the consequences of proposed agency actions.[215] Consequences that must be considered include direct, indirect, and cumulative consequences.[216] Any NEPA analysis of BLM's oil and gas leasing program that fails to use the government-wide protocol for assessing the costs to society of carbon emissions from the proposed action has failed to take the legally required "hard look."

Courts have also ordered agencies to assess the SCC pollution, even before a federal protocol for such analysis was adopted. In 2008, the Ninth Circuit ordered the National Highway Traffic Safety Administration ("NHTSA") to include a monetized assessment of carbon emissions reductions in an EA prepared under NEPA.[217] NHTSA had proposed a rule setting corporate average fuel economy standards for light trucks. A number of states and public interest

[215] 42 U.S.C. § 4321 *et seq.*; *Morris v. U.S. Nuclear Regulatory Comm'n*, 598 F.3d 677, 681 (10th Cir. 2010).
[216] 40 C.F.R §§ 1502.16, 1508.7, 1508.8.
[217] *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1203 (9th Cir. 2008).

groups challenged the rule for, among other things, failing to monetize the benefits that would accrue from a decision that led to lower CO_2 emissions. NHTSA monetized the employment and sales impacts of the proposed action, but failed to monetize the benefits of reduced carbon emissions, arguing that valuing the costs of carbon emissions was too uncertain.[218] The court found this argument arbitrary and capricious, noting that while estimates of the value of carbon emissions reductions occupied a wide range of values, the correct value was certainly not zero.[219] The court noted that NHTSA had also monetized other uncertain benefits.[220]

More recently, a federal court required the U.S. Forest Service and BLM to monetize the cost of carbon emissions from a proposed coal lease modification in its cost-benefit analysis.[221] In the lease modification's EA, the agencies included a quantification of the project's benefits, but failed to include a quantification of the project's SCC. The agencies' decision to rely on the stated benefits of the project to justify its approval while wholly ignoring the societal costs that will accrue through climate change, the court held, was arbitrary and capricious.[222] An agencies' cost-benefit analysis cannot be misleading, and any such project approval would be based on a NEPA analysis with misleading economic assumptions, an approach long disallowed by courts throughout the country.[223]

Similarly, BLM has long touted the economic benefits of its oil and gas leasing program. It has not, however, used the SCC to monetize the costs to society of its program, creating a misleading picture of the program's costs and benefits. Putting the program's emissions into context using this useful, accepted tool better informs agency decisionmakers, the public, and comports with NEPA's requirement to take a "hard look" at the environmental consequences of agency action.

J. BLM Should Place a Moratorium On All New Oil and Gas Leasing and APDs.

WildEarth Guardians requests that a moratorium be placed on all new oil and gas leasing and approvals of APDs pending completion of the PEIS. Leasing and approval of APDs cannot continue absent adequate NEPA analysis. CEQ's NEPA implementing regulations instruct agencies to undergo NEPA review "at the earliest possible time to insure that planning and decisions reflect environmental values."[224] Interior's NEPA implementing regulations reiterate the requirement to apply NEPA early: "For any potentially major proposed Federal action that may have potentially significant environmental impacts, bureaus must coordinate, as early as feasible, with [other bureaus or Federal agencies, State, local, and tribal governments]."[225] Bureaus must also "solicit the participation of all those persons or organizations that may be

[218] *Id.* at 1199–1200.
[219] *Id.* at 1200.
[220] *Id.* at 1202.
[221] *High Country Conservation Advocates v. U.S. Forest Serv.*, 52 F.Supp. 3d 1174 (D. Colo. 2014).
[222] *Id.* at 1191, 1196.
[223] *Id.* at 1182.
[224] 40 C.F.R. § 1501.2.
[225] 43 C.F.R. § 46.200(a)(1)–(2).

interested or affected as early as possible."[226] CEQ's 2014 Guidance directs agencies to "take account of environmental effects as an integral part of the agency's own decisionmaking process before decisions are made."[227] NEPA is intended to "inform decisionmakers by ensuring agencies consider environmental consequences of a proposed action *as they decide whether to proceed with the action and, if so, how to take appropriate steps to eliminate or mitigate adverse effects*."[228] Thus, NEPA analysis is supposed to be conducted at the earliest possible opportunity, *before action is taken*.

BLM's oil and gas leasing program, however, is already being implemented without the required NEPA climate change analysis. As the legally insufficient discussions of climate change in BLM's current environmental impact statements at the RMP stage and environmental assessments at the land leasing and APD stages demonstrate, "planning and decisions [on the program are not] reflect[ing] environmental values."[229] Nor is BLM attempting to mitigate the adverse climate change impacts of its program in an EIS.

BLM cannot continue issuing land leases and permits to drill absent adequate NEPA analysis, as Interior recognized for the federal coal program. For that reason, and consistent with Interior's moratorium on the coal program, BLM should place a moratorium on all new oil and gas leasing and approvals of APDs pending completion of the PEIS.

III. CONCLUSION

Global climate change represents an immediate, existential threat to human health and the environment. The grave consequences of climate change have been extensively researched and thoroughly documented. Those impacts include: more frequent and intense heat waves; more severe wildfires; degraded air quality; more heavy downpours and flooding; increased drought; greater sea-level rise; more intense storms; harm to water resources; harm to agriculture; and harm to wildlife and ecosystems.[230] CEQ has made clear that climate change is a "fundamental issue," and that "the relation of Federal actions to it falls squarely within NEPA's focus."[231] It is undeniable that BLM's oil and gas leasing program contributes to the emission of GHGs and to climate change. BLM has admitted as much in its bare-bones discussions of climate change in its RMPs. Further, reports by Stratus Consulting documented and quantified the GHG emissions from fossil fuels extracted from federal lands.

The results of the Stratus Report are astonishing. Over just three years (2008–2010), extracted onshore oil and gas from federal lands by private leaseholders contributed a total of 49,885 $MTCH_4$, 612,240,176 $MTCO_2$, and 9,684 MTN_2O into the atmosphere, for a total release of 612,309,429 $MTCO_2e$. In light of this data and CEQ's directive requiring the consideration of

[226] *Id.* at 46.200(b).
[227] 2014 Guidance, *supra* note 38, at 5.
[228] *Id.* (emphasis added).
[229] 40 C.F.R. § 1501.2.
[230] 2014 Guidance, *supra* note 38, at 7–8.
[231] *Id.* at 2.

climate change under NEPA, BLM's failure to conduct a PEIS of its oil and gas leasing program is legally untenable. NEPA requires the preparation of a PEIS where multiple projects share similar or cumulative effects, and BLM's failure to conduct a PEIS for its program violates the letter and spirit of NEPA.

Moreover, a programmatic review of BLM's oil and gas leasing program would also benefit the agency. BLM's tiered oil and gas leasing approvals would benefit from a programmatic overlay. Tiering to a PEIS for its environmental reviews at the RMP, leasing, and APD stage would increase efficiency in the NEPA process and would allow BLM to eliminate repetitive discussions of the same issues and to focus on the actual issues ripe for decision at each level of environmental review.[232] Further, a PEIS will not be duplicative, a reason for delay, or speculative, and it may reduce litigation risks.

For all of the above reasons, WildEarth Guardians hereby petitions BLM to evaluate the direct, indirect, and cumulative impacts of its oil and gas leasing program on climate change in a PEIS. WildEarth Guardians also petitions BLM to evaluate the programmatic non-climate impacts of its oil and gas leasing program, including increased seismic activity related to fracking, public health and safety impacts associated with fracking, and environmental impacts associated with large numbers of improperly abandoned and unplugged and unreclaimed wells. Pending completion of the PEIS, and consistent with Interior's decision on its federal coal leasing program, WildEarth Guardians requests a moratorium on all new oil and gas leasing or approvals of APDs "so that decisions about those leases can benefit from the recommendations that come out of the review."[233] Pursuant to APA section 553(e), WildEarth Guardians further requests that DOI amend its NEPA regulations to incorporate CEQ's 2014 Guidance. Lastly, due to the critically important and accelerating effects of climate change, WildEarth Guardians, consistent with APA section 555(e) and 43 C.F.R. § 14.3, requests a prompt response to this Petition.

[232] *See* 40 C.F.R. § 1502.20.
[233] DOI, *Secretary Jewell Launches Comprehensive Review of Federal Coal Program*, *supra* note 8.

DATED: Jan. 20, 2016

Respectfully submitted,

Aaron A. Adams, Certified Law Student
Suma Peesapati, Visiting Assistant Professor
Michael Robinson-Dorn, Clinical Professor of Law
UNIVERSITY OF CALIFORNIA, IRVINE
ENVIRONMENTAL LAW CLINIC
P.O. Box 5479
Irvine, CA 92616-5479
speesapati@law.uci.edu
adamsaa.clinic@lawnet.uci.edu
Tel: (949) 824-9660; Fax: (949) 824-2747

On Behalf Of:

Timothy Ream
Climate & Energy Campaign Director
WILDEARTH GUARDIANS
P.O. Box 641672
San Francisco, CA 94164
tream@wildearthguardians.org
Tel: (541) 531-8541

CC: Timothy Ream
WildEarth Guardians

CERTIFICATE OF SERVICE

I hereby certify that a copy of this forgoing citizen petition was served on this ___ day of _____, 2016, by certified mail upon the parties listed below:

Sally Jewell, Secretary of the Interior
U.S. Department of the Interior
1849 C Street, N.W.
Washington, DC 20240

Hilary Tompkins, Solicitor
Office of the Solicitor
U.S. Department of the Interior
1849 C Street, N.W.
Washington, DC 20240

Bret Birdsong, Deputy Solicitor Land Resources
Office of the Solicitor
U.S. Department of the Interior
1849 C Street, N.W.
Washington, DC 20240

Neil Kornze, Director
Bureau of Land Management
U.S. Department of the Interior
1849 C Street, N.W., Rm. 5665
Washington, DC 20240

Mike Tupper, Acting Assistant Director, Resources and Planning
Bureau of Land Management
U.S. Department of the Interior
1849 C Street, N.W., Rm. 5644
Washington, DC 20240

George T. Frampton, Jr., Chair
Council on Environmental Quality
Executive Office of the President
722 Jackson Place, N.W.
Washington, DC 20503

Horst G. Greczmiel, Associate Director for NEPA Oversight
Council on Environmental Quality
Executive Office of the President
722 Jackson Place, N.W.

Washington, DC 20503

Dinah Bear, General Counsel
Council on Environmental Quality
Executive Office of the President
722 Jackson Place, N.W.
Washington, DC 20503

Aaron A. Adams

Before the
Secretary of the Interior

Petition for A Moratorium On the Leasing of Federal Fossil Fuels On Public Lands

July 2016

Petition for a Moratorium on the Leasing of Federal Public Land Fossil Fuels Under the Mineral Leasing Act, 30 U.S.C. §§ 226, 241

Before the United States Department of the Interior

July 12, 2016

"[U]ltimately, if we're going to prevent large parts of this Earth from becoming not only inhospitable but uninhabitable in our lifetimes, we're going to have to keep some fossil fuels in the ground rather than burn them and release more dangerous pollution into the sky." President Barack Obama[1]

I. Notice of Petition

To: Secretary of the Interior, U.S. Department of the Interior, Washington, DC 20240

Through this petition, the Center for Biological Diversity, on behalf of the undersigned petitioners listed below, request that the Secretary of the Interior issue an order pursuant to her authorities and obligations under 30 U.S.C. §§ 226 and 241 imposing an immediate moratorium on the new leasing of *all* federal public land fossil fuels. Specifically, in light of Secretarial Order No. 3338 which imposed a moratorium on the leasing of coal, the requested order should address all other onshore fossil fuels and halt the offering or issuance of any new leases of federal oil, gas, tar sands, and oil shale. The moratorium should remain in effect pending completion of a comprehensive review of all federal fossil fuel leasing programs, and development of policies to ensure any future leasing is consistent with a pathway to meeting the United States' goal of holding global warming "well below 2°C above pre-industrial levels" and pursuing efforts to "limit the temperature increase to 1.5ºC above pre-industrial levels," as articulated in the Paris Agreement adopted at the 2015 United Nations Framework Convention on Climate Change Conference of the Parties (Paris Agreement)."[2] Such action is necessary to address the serious threats to climate, health, safety, and biodiversity posed by greenhouse gas emissions from the continued extraction and combustion of fossil fuels from the federal mineral estate.

As detailed in this petition, and reflected in recent actions by the administration related to coal, the Secretary's legal authority to impose such a moratorium is clear. In light of the United States' international obligations under the U.N. Framework Convention on Climate Change and the acknowledged need to keep the vast majority of fossil fuels in the ground to have any realistic chance of avoiding the worst consequences of catastrophic warming, the scientific and ethical case for imposing the moratorium is equally clear.

On January 15, 2016, the Secretary issued Secretarial Order No. 3338, exercising her discretion under the Mineral Leasing Act and other applicable statutes in order to consider, *inter alia*, "how best to assess the climate impacts of continued Federal coal production and combustion and how to address those impacts in the management of the program to meet both the Nation's energy needs and its climate goals, as well as how best to protect the public lands

[1] The White House, Statement by the President on the Keystone XL Pipeline, Office of the Press Secretary (Nov. 6, 2015), https://www.whitehouse.gov/the-press-office/2015/11/06/statement-president-keystone-xl-pipeline

[2] *See* United Nations Framework Convention on Climate Change, Conference of the Parties Nov. 30-Dec. 11, 2015, Adoption of the Paris Agreement Art. 2, U.N. Doc. FCCC/CP/2015/L.9 (Dec. 12, 2015), available at http://unfccc.int/resource/docs/2015/cop21/eng/l09.pdf ("Paris Agreement").

from climate change impacts."[3] To this end, Order 3338 directed BLM to prepare a broad, "programmatic environmental impact statement.[4] Order 3338 found that "Continuing to conduct lease sales or approve lease modifications during this programmatic review risks locking in for decades the future development of large quantities of coal under current rates and terms that the PEIS may ultimately determine to be less than optimal."[5]

Here, Petitioners request the issuance of an additional Secretarial Order extending this moratorium to the sale and issuance of any future onshore federal fossil fuel leases (coal, oil and gas, oil shale, and tar sands) until and unless it can be demonstrated that resumption of such leasing is consistent with our national and international climate goals and obligations. Petitioners further request that BLM's analysis of these issues take the form of a programmatic environmental impact statement.

The right of an interested party to petition a federal agency is a freedom guaranteed by the first amendment: "Congress shall make no law … abridging the …right of people … to petition the Government for redress of grievances."[6] Under the Administrative Procedures Act (APA), all citizens have the right to petition for the "issuance, amendment, or repeal" of an agency rule.[7] A "rule" is the "whole or a part of an agency statement of general or particular applicability and future effect designed to implement, interpret, or prescribe law or policy."[8] This petition is filed pursuant to the rulemaking petition regulation of the Department of the Interior (DOI) at 43 C.F.R. § 14.2. DOI is required by its regulations and the APA to respond to this petition in a timely manner: "The petition will be given prompt consideration and the petitioner will be notified promptly of action taken."[9]

II. Petitioners

The Center for Biological Diversity ("the Center") submits this Petition on behalf of itself and the Petitioners listed in Attachment 1. The Center is a nonprofit environmental organization dedicated to the protection of imperiled species and their habitats through science, education, policy, and environmental law. The Center has over 991,000 members, supporters and activists dedicated to the conservation of endangered species and wild places, protection of human health and welfare, and combating climate change. The Center submits this Petition on its own behalf,

[3] U.S. Department of the Interior, Secretarial Order No. 3338 at 8 (Jan. 15, 2016).
[4] *Id.* at 6.
[5] *Id.*
[6] U.S. Const., Amend I. *See also United Mine Workers v. Illinois State Bar Ass'n*, 389 U.S. 217, 222 (1967) (right to petition for redress of grievances is among most precious of liberties without which the government could erode rights).
[7] 5 U.S.C. § 553(e); 43 C.F.R. §14.2 (Department of Interior regulation providing that "any person may petition for the issuance, amendment or repeal of a rule").
[8] 5 U.S.C. § 551(4).
[9] 43 C.F.R. §14.3; *see also* 5 U.S.C. § 555(e) ("Prompt notice shall be given of the denial in whole or in part of a written application, petition, or other request of an interested person made in connection with any agency proceeding.").

on behalf of its members and staff with an interest in protecting our national public lands and the wild habitats they encompass from the damages of further unnecessary fossil fuel extraction and the damages of climate change, and on behalf of the undersigned petitioners listed below in Attachment 1.

Any response and all correspondence related to this petition should be directed to the Center. The Center for Biological Diversity's mailing contact information for the purposes of this Petition is:

The Center for Biological Diversity
1536 Wynkoop Street, Suite 421
Denver, CO 80202
Tel: 303-915-8308

III. Introduction and Executive Summary

Petitioners formally request that pursuant to her discretionary authority over mineral leasing under of the Mineral Leasing Act of 1920, as amended, and the Mineral Leasing Act for Acquired Lands of 1947 (collectively MLA),[10] the Secretary of the Interior issue an order imposing an immediate moratorium on the leasing of *all* federal public land fossil fuels. Specifically, in light of Secretarial Order No. 3338 which imposed a moratorium on the leasing of coal, the requested order should address all other onshore fossil fuels and halt the offering or issuance of any new leases of federal oil, gas, tar sands, and oil shale. The moratorium should remain in effect pending completion of a comprehensive programmatic environmental review of the entire federal public lands leasing program, and until, following such review, any future leasing can be shown to be consistent with a pathway to meeting the United States' goal of limiting global warming to well below 2ºC and pursuing efforts to limit warming to 1.5°C above pre-industrial levels.

The requested moratorium is necessary to address the serious threats to climate, health, safety, and biodiversity posed by greenhouse gas emissions from the continued extraction and combustion of fossil fuels from the federal mineral estate, and to preserve a reasonable likelihood of limiting global warming to 1.5ºC above pre-industrial levels consistent with the Paris Agreement adopted at the 2015 United Nations Framework Convention on Climate Change Conference of the Parties (Paris Agreement).[11] The President has acknowledged that "this agreement sends a powerful signal that the world is firmly committed to a low-carbon future."[12]

---

[10] *See* 30 U.S.C. § 181-287.; *see also* Mineral Leasing Act for Acquired Lands of 1947, 30 U.S.C. § 351-360.

[11] The Paris Agreement commits all signatories to an articulated target to hold the long-term global average temperature "to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels." Paris Agreement Art. 2.

[12] See Paris Agreement; The White House, Statement by the President on the Paris Climate Agreement, Office of the Press Secretary (Dec. 12, 2015), https://www.whitehouse.gov/the-press-office/2015/12/12/statement-president-paris-climate-agreement.

The already severe impacts of global warming on the United States and the rest of the world from *current* atmospheric carbon dioxide (CO_2) levels highlight the urgency of staying below the 1.5°C target so as to avoid truly catastrophic impacts to people and planet.[13] As CO_2 levels continue to rise past 400 parts per million (ppm),[14] the consequent effects of global warming are becoming ever more apparent. Extreme weather events, such as severe droughts, floods, and heat waves, and other climate disruptions are responsible for an estimated 400,000 deaths globally each year on average, with hundreds of millions of additional people adversely affected.[15] Arctic sea ice loss, rising seas, growing food insecurity, bleaching of coral reefs, and biodiversity loss are mounting worldwide. The United States has experienced similar devastation at home, with coastal communities and the country's most vulnerable populations of the poor, the elderly, the sick and children bearing the brunt of public health effects, property damage, and food insecurity. Indeed, the Environmental Protection Agency (EPA) concluded in April 2009 that "the evidence provides compelling support for finding that greenhouse gas air pollution endangers the public welfare of both current and future generations. The risk and the severity of adverse impacts on public welfare are expected to increase over time."[16]

Immediate and aggressive greenhouse gas emissions reductions are necessary to limit warming to a 1.5°C rise above pre-industrial levels. Put simply, there is only a finite amount of CO_2 that can be released into the atmosphere without rendering the goal of meeting the 1.5°C (or even a 2°C) target virtually impossible. Globally, proven fossil fuel reserves, let alone additional recoverable resources,[17] if extracted and burned, would release enough CO_2 to exceed this limit

[13] A target of 1.5°C, while obviously more protective of the climate than a 2°C target, may itself be too high. Dr. James Hansen and colleagues have recommended limiting warming to 1°C to "stabilize climate and avoid potentially disastrous impacts on today's young people, future generations, and nature". *See* Hansen, J.M. *et al.*, Assessing "dangerous climate change": required reduction of carbon emissions to protect young people, future generations and nature, 8 PLoS ONE 8 e81648 (2013).

[14] *See* National Oceanic and Atmospheric Administration, Recent Monthly Average Mauna Loa CO_2, http://www.esrl.noaa.gov/gmd/ccgg/trends/ (Dec. 2015 concentration of 401.85 ppm).

[15] DARA and the Climate Vulnerability Forum. (2012) *Climate Vulnerability Monitor, 2nd Edition:* A Guide to the Cold Calculus of a Hot Planet. DARA Internacional, Madrid, 62 pp. http://www.daraint.org/wp-content/uploads/2012/10/CVM2-Low.pdf ("DARA").

[16] U.S. Environmental Protection Agency, Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66,496, 66,498-99 (Dec. 15, 2009) ("Final Endangerment Finding").

[17] According to the Congressional Research Service, "[p]roved reserves are those amounts of oil, natural gas, or coal that have been discovered and defined at a significant level of certainty, typically by drilling wells or other exploratory measures, and which can be economically recovered. In the United States, proved reserves are typically measured by private companies, who report their findings to the Securities and Exchange Commission because those reserves are considered capital assets. Because proved reserves are defined by strict rules, they do not include all of the oil or gas in a region, but only those amounts that have been carefully confirmed. . . . Undiscovered resources are amounts of oil and gas estimated to exist in unexplored areas. Estimates of undiscovered resources for the United States are made by the U.S. Geological Survey for resources on land, and by the U.S. Bureau of Ocean Energy Management, Regulation and Enforcement (formerly the Minerals Management Service) for resources offshore. These assessments are based on observation of geological characteristics similar to producing areas and many other factors. Reported statistics for undiscovered resources may vary greatly in precision and accuracy (determined retrospectively), which are directly dependent upon data availability, and their quality may differ for different fuels

several times over.[18] Consequently, the vast majority of fossil fuels must remain in the ground. The physical question of what amount of fossil fuels can be extracted and burned without negating a realistic chance of meeting a 1.5°C or even 2ºC target is relatively easy to answer. The question of what level of risk of not meeting the target is acceptable, along with the questions of *which* fossil fuels can be burned and by *whom*, are inherently political and ethical questions. But, as demonstrated below, under *any* formulation, the majority of United States fossil fuels, particularly federal fossil fuels, must stay in the ground.

The Fifth Assessment Report of the International Panel on Climate Change (IPCC) and other expert assessments have established global carbon budgets, or the total amount of remaining carbon that can be burned while maintain some probability of staying below a given temperature target. According to the IPCC, total cumulative anthropogenic emissions of CO_2 must remain below about 1,000 gigatonnes ($GtCO_2$) from 2011 onward for a 66% probability of limiting warming to 2°C above pre-industrial levels.[19] The Paris Agreement aim of limiting the temperature increase to 1.5°C requires a more stringent carbon budget of only 400 $GtCO_2$ from 2011 onward (of which more than 100 $GtCO_2$ has already been emitted)[20] for a 66% probability of limiting warming to 1.5°C above pre-industrial levels.[21] Increasing the odds of meeting these targets requires meeting even stricter carbon budgets.[22] Given that global CO_2 emissions in 2014 alone totaled 36 $GtCO_2$,[23] humanity is rapidly consuming the remaining burnable carbon budget needed to have even a 66% chance of meeting the 1.5°C temperature limit.

In order for the world to stay within a carbon budget consistent with a 1.5°C temperature limit, significant fossil fuels around the world need to be left in the ground. The United States alone contains enough recoverable fossil fuels, split about evenly between federal and non-federal resources, that if extracted and burned, would approach the entire global carbon budget

---

and different regions." Whitney, Gene et al., U.S. Fossil Fuel Resources: Terminology, Reporting and Summary. Cong. Research Serv., R40872 (2010)

[18] *See, e.g.*, IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change at 64 & Table 2.2 [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)] at 63-64 & Table 2.2. ("IPCC AR5 Synthesis Report"); Cimons, Marlene and Jeff Nesbit, Keep It In the Ground, Sierra Club et al. (Jan. 25, 2016) at 6

[19] IPCC,The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change; Summary for Policymakers (2013) at 27 ("IPCC AR5 Physical Science Basis"). *See also* IPCC AR5 Synthesis Report at 63-64 & Table 2.2. Higher probabilities of success require stricter carbon limits; to have an 80% probability of staying below the 2°C target, the budget from 2000 is 890 $GtCO_2$, with less than 430 $GtCO_2$ remaining. *See* Meinshausen, M. *et al.*, Greenhouse gas emission targets for limiting global warming to 2 degrees Celsius, 458 Nature 1158–1162 (2009) ("Meinshausen *et al.* 2009") at 1159; Carbon Tracker Initiative, Unburnable Carbon – Are the world's financial markets carrying a carbon bubble? (2011) ("Carbon Tracker Initiative 2013) available at http://www.carbontracker.org/wp-content/uploads/2014/09/Unburnable-Carbon-Full-rev2-1.pdf.

[20] From 2012-2014, 107 $GtCO_2$ was emitted (*see* Annual Global Carbon Emissions at http://co2now.org/Current-CO2/CO2-Now/global-carbon-emissions.html). Given additional emissions in 2015, the remaining carbon budget for 1.5°C would now be well below 300 $GtCO_2$ (approximately 450 Gt CO_2e)

[21] IPCC AR5 Synthesis Report at 64 & Table 2.2.

[22] *See* Meinshausen *et al.* 2009 at 1159; Carbon Tracker Initiative 2013.

[23] *See* Global Carbon Emissions at http://co2now.org/Current-CO2/CO2-Now/global-carbon-emissions html.

for a 2°C target, and exceed the remaining budget for a 1.5°C limit.[24] Clearly, even if the rest of the world somehow reduced its carbon emissions to near zero, the United States still could not safely burn all of its own fossil fuel resources. The majority of United States fossil fuels simply must be kept in the ground.

Recent analysis shows that the potential emissions from federal fossil fuel resources are between 349 and 492 $GtCO_2e$, with unleased fossil fuels comprising 91% of these potential emissions.[25] In other words, unleased federal fossil fuels, if extracted and burned, would consume between roughly 70 and 100% of a *global* budget of 450 $GtCO_2e$, the amount remaining at the start of 2016 under a budget scenario that itself has only a 66% chance of limiting temperature increase to 1.5°C.[26] Under a more cautionary budget (i.e., one with a higher probability of success), unleased federal fossil fuels alone could exceed the entire global budget. Continued leasing of these fossil fuels, without examining the climate consequences of such action, is incompatible with any reasonable domestic and international path to limiting warming to 1.5°C or even 2°C.

While the climate consequences of a gigatonne of CO_2 emitted from the combustion of a barrel of oil are the same regardless of whether it was extracted from federal or non-federal lands, the legal, political and economic hurdles of keeping federal fossil fuels in the ground are far simpler to overcome than for fossil fuels from non-federal lands; the Secretary of the Interior can simply refrain from issuing any new leases for their extraction.

The MLA, 30 U.S.C. §§ 181-287, together with the Mineral Leasing Act for Acquired Lands, 30 U.S.C. §§ 351-360*,* the National Environmental Policy Act, 42 U.S.C. §§ 4321-4370*,* and the Federal Land Policy and Management Act, 43 U.S.C. §§ 1701-1787*,* provides the Secretary the explicit legal authority to halt public lands fossil fuel leasing in order to respond to the threats posed by climate change. The Secretary has broad discretion under the MLA as to when, how, and if federal fossil coal,[27] oil and gas,[28] and oil shale and tar sands[29] may be offered

---

[24] *See* Mulvaney, Dustin *et al.*, The Potential Greenhouse Gas Emissions of U.S. Federal Fossil Fuels, EcoShift Consulting (2015) ("Mulvaney *et al.* 2015*"*) at 4.

[25] *Id*. Using a metric of CO_2e (which also includes the radiative or climate forcing potential of non-CO_2 greenhouse gases such as methane), Mulvaney *et al.*'s study calculated that extraction and combustion of total U.S. fossil fuels would produce 697 to 1070 $GtCO_2e$ of emissions, with federal fossil fuels responsible for between 349 and 492 $GtCO_2e$. The potential GHG emissions of unleased federal fossil fuel resources range from 319 to 450 492 $GtCO_2e$. *et al.*

[26] *Id*. The emission potential of unleased federal fossil fuels are estimated at 319-450 $GtCO_2e$. The global carbon budget at the start of 2015 for a 66% chance of limiting temperature increase to 1.5°C was approximately 300 $GtCO_2$ which is equivalent to ~450 $GtCO_2e$, meaning that the potential emissions of unleased federal fossil fuels would consume 70 to 100% of this global budget. There is no single universally applicable factor for converting between CO_2 and CO_2e because the ultimate radiative forcing potential of fossil fuel extraction and combustion depends on a number of assumptions regarding the production and use of those fuels. In this Petition we use a conversion factor of 1 $GtCO_2$ = 1.5 $GtCO_2e$ based on Table 1 in Meinshausen *et al.* 2009.

[27] 30 U.S.C. § 201(a)(1) (Secretary "shall, in his or her discretion," offer coal lands for leasing); *see* Arnold v. Morton, 529 F.2d 1101 (9th Cir. 1976*); WildEarth Guardians v. Salazar*, 783 F. Supp. 2d 61, 63 (D.D.C. 2011)

for lease. This discretion has been consistently upheld by the courts.[30]

On January 15, 2016, the Secretary issued Secretarial Order No. 3338, exercising her discretion under the MLA and other applicable statutes in order to consider, *inter alia*, "how best to assess the climate impacts of continued Federal coal production and combustion and how to address those impacts in the management of the program to meet both the Nation's energy needs and its climate goals, as well as how best to protect the public lands from climate change impacts."[31] Order 3338 found that "Continuing to conduct lease sales or approve lease modifications during this programmatic review risks locking in for decades the future development of large quantities of coal under current rates and terms that the PEIS may ultimately determine to be less than optimal."[32] This logic applies equally forcefully to federal oil and gas resources.

Through this petition, Petitioners seek issuance of an additional Secretarial Order extending this moratorium on coal leasing to the pause from issuance of *any* onshore federal fossil fuel leases (coal, oil and gas, oil shale, and tar sands) until and unless (a) the Department completes a Programmatic Environmental Impact Statement for the cumulative climate impacts of all federal fossil fuel leasing programs; and (b) it can be demonstrated that resumption of such leasing is consistent with our national and international climate goals and obligations.

(*quoting Indep. Petroleum Ass'n of Am. v. DeWitt*, 279 F.3d 1036, 1040 (D.C. Cir. 2002)) (Secretary is "permitted" but not require to lease particular tracts for coal mining); *see also*
U.S. Department of the Interior, Secretarial Order No. 3338 at 6 (Jan. 15, 2016).

[28] 30 U.S.C. § 226(a) ("[a]ll lands subject to disposition under this Act which are known or believed to contain oil or gas deposits *may* be leased by the Secretary") (emphasis added); *see also Udall v. Tallman*, 380 U.S. 1, 4 (1965); *United States ex rel. McLennan v. Wilbur*, 283 U.S. 414, 417 (1931); *McDonald v. Clark*, 771 F.2d 460, 463 (10th Cir. 1985); *McTiernan v. Franklin*, 508 F.2d 885, 887 (10th Cir. 1975); *Duesing v. Udall*, 350 F.2d 748, 750 (D.C. Cir. 1965); *Cont'l Land Res*., 162 I.B.L.A. 1, 7 (2004).

[29] 30 U.S.C. § 241(a)(1).

[30] *See, e.g. Krueger v. Morton*, 539 F.2d 235, 238-40 (D.C. Cir. 1976); *see also NRDC v. Hughes*, 437 F. Supp. 981, 983-85 (D.D.C. 1977).

[31] Secretarial Order No. 3338 at 8 .

[32] Secretarial Order No. 3338 at 8 .

IV. Statutory Background

Management of federal lands is governed by the Property Clause, Article IV, § 3, cl. 2, and executive authority is exercised within the statutory framework established by an interconnected system of laws including the Federal Land Policy and Management Act, National Forest Management Act, National Wildlife Refuge Administration Act, Mineral Leasing Act, Mineral Leasing Act for Acquired Lands, Federal Onshore Oil and Gas Leasing Reform Act, Surface Mining Control and Reclamation Act, and others.

A. The Mineral Leasing Act

The modern legal status of federal onshore oil, gas, coal, and shale oil begins with the Mineral Leasing Act of 1920.[33] Prior to the MLA, fossil fuels on federal lands were generally managed as "locatable" minerals under the General Mining Law of 1872. The MLA, by contrast, provides for the private extraction of fossil fuels through a leasing system, which does not confer a unilateral private right to acquisition by discovery, prospecting, or the like. The MLA governs federal leasing of onshore oil, gas, shale, tar sands, and coal, although the system governing coal leases is distinct from that governing other fossil fuels, and is subject to additional requirements under both the Federal Coal Leasing Amendments of 1976[34] and the Surface Mining Control and Reclamation Act of 1977. The Mineral Leasing Act for Acquired Lands makes lands acquired by the United States also subject to the leasing provisions of the MLA.[35]

From the enactment of the MLA until the mid-1980s, most federal oil, gas, and coal leasing was conducted on a noncompetitive basis, save within certain areas designated as "known geological structures."[36] The Federal Onshore Oil and Gas Leasing Reform Act (FOOGLRA) left the fundamental statutory provisions and leasing structure of the MLA in place, but imposed an initial competitive bidding requirement on all offered leases—although leases can later be sold noncompetitively if they receive no bid at auction—as well as giving the Forest Service authority to issue or withhold consent to leasing on National Forest System lands.[37] The Energy Policy Act of 2005 similarly left the basic leasing structure in place, with minor amendments.[38]

Federal coal leasing is principally governed by the MLA, 30 U.S.C. § 201, which authorizes the Secretary of the Interior to "in his discretion, upon the request of any qualified applicant or on his own motion, from time to time, offer such lands for leasing."[39] All Coal

---

[33] 30 U.S.C. §§ 181-287.
[34] See 30 U.S.C. § 201.
[35] 30 U.S.C. § 352 (acquired lands" may be leased by the Secretary under the same conditions as contained in the leasing provisions of the mineral leasing laws").
[36] *See* Beneke, Patricia J., The Federal Onshore Oil and Gas Leasing Reform Act of 1987: A Legislative History and Analysis, 4 J. Min. L. & Pol'y (1988).
[37] *See* 30 U.S.C. §§ 188, 195, 226.
[38] *See* 43 U.S.C. §§ 15927, 15942.
[39] 30 U.S.C. § 201(a)(1). *See also* Surface Mining Control and Reclamation Act of 1977, 30 U.S.C. §§ 1201-1328.

leasing today occurs not in formally designated coal-producing regions[40], but through a nomination process known as leasing-by-application.[41] The lease-by-application program, however, clearly preserves the Secretary's full statutory discretion to reject any lease, and indeed requires rejection if the issuance of the lease would be contrary to the public interest.[42] On January 15, 2016, the Secretary exercised this authority to pause most federal coal leasing in order to allow "the BLM to conduct a broad, programmatic review of the Federal coal program it administers."[43]

The equivalent statutory provisions governing discretion over federal oil, gas, tar sands, and oil shale leasing are 30 U.S.C. §§ 226(a) and 241, which provides simply that "[a]ll lands subject to disposition under [the MLA] which are known or believed to contain oil or gas deposits may be leased by the Secretary,"[44] and that "[t]he Secretary of the Interior is hereby authorized to lease to any person or corporation qualified under this chapter any deposits of oil shale, and gilsonite (including all vein-type solid hydrocarbons) belonging to the United States and the surface of so much of the public lands containing such deposits, or land adjacent thereto, as may be required for the extraction and reduction of the leased minerals, under such rules and regulations, not inconsistent with this chapter, as he may prescribe."[45]

The Bureau of Land Management (BLM) is the agency responsible for leasing all lands subject to disposition under the MLA, including Forest Service lands. FOOGLRA and its implementing regulations additionally require Forest Service consent prior to BLM leasing of National Forest System Lands.[46] Although the MLA states that, for oil and gas, "[l]ease sales shall be held for each State where eligible lands are available at least quarterly and more frequently if the Secretary of the Interior determines such sales are necessary,"[47] quarterly leasing is not required if no lands are "eligible" and "available" due to factors including withdrawal from the operation of the MLA under FLPMA, allocation decisions under an applicable land management plan, need for additional environmental review, or exercise of

[40] *See* U.S. Bureau of Land Management, Coal Operations, http://www.blm.gov/wo/st/en/prog/energy/coal_and_non-energy.html (accessed Apr 29, 2016) ("[B]ecause demand for new coal leasing in recent years has been associated with the extension of existing mining operation on authorized federal coal leases, all current leasing is done by application.")
[41] *See* 43 C.F.R. Subpart 3425.
[42] *See* 43 C.F.R. § 3425.1-8 ("An application for a lease shall be rejected in total or in part if the authorized officer determines that . . . leasing of the lands covered by the application, for environmental or other sufficient reasons, would be contrary to the public interest."); *see also Arnold v. Morton*, 529 F.2d 1101, 1105 (9th Cir. 1976) ("It is quite evident that the Secretary has no obligation to issue any lease on public lands."); *WildEarth Guardians v. Salazar*, 783 F. Supp. 2d 61, 63 (D.D.C. 2011) (*quoting Indep. Petroleum Ass'n of Am. v. DeWitt*, 279 F.3d 1036, 1040 (D.C. Cir. 2002)) (Secretary is "permitted" but not require to lease particular tracts for coal mining).
[43] U.S. D.O.I. Secretarial Order No. 3338 at 7.
[44] 30 U.S.C. § 226(a); *see also* 30 U.S.C. § 352 (acquired lands" may be leased by the Secretary under the same conditions as contained in the leasing provisions of the mineral leasing laws").
[45] 30 US.C. § 241(a)(1).
[46] *See* 30 U.S.C. §226(h); 43 C.F.R. §3101.7(c).
[47] 30 U.S.C. § 226(b)(1)(A).

Secretarial discretion.[48]

There is a long line of judicial decisions interpreting 30 U.S.C. § 226 as conferring on the Secretary discretion whether or not to offer any particular lands for lease.[49] FOOGLRA did not repeal or alter this authority. The one court to consider a claim that FOOGLRA reduced Secretarial discretion over the decision whether or not to lease rejected this argument, finding that the 1987 switch to a competitive bidding system did not alter the Secretary's fundamental discretion as to which leases she will offer up for bid.[50]

The sole appellate court to address the question squarely has held that a decision to reject or defer action on federal oil and gas leasing is within the bounds of valid Secretarial discretion.[51] In *Bob Marshall Alliance v. Hodel*, the Court of Appeals held:

> the Mineral Leasing Act gives the Interior Secretary discretion to determine which lands are to be leased under the statute. 30 U.S.C. § 226(a) (1982); see Mountain States, 499 F. Supp. at 391-92. We have held that the Mineral Leasing Act "allows the Secretary to lease such lands, but does not require him to do so . . . . The Secretary has discretion to refuse to issue any lease at all on a given tract." Burglin v. Morton, 527 F.2d 486, 488 (9th Cir. 1975) (citing Udall v. Tallman, 380 U.S. 1, 4, (1965)), cert. denied, 425 U.S. 973, (1976). Thus refusing to issue the Deep Creek leases, far from removing Deep Creek from the operation of the mineral leasing law, would constitute a legitimate exercise of the discretion granted to the Interior Secretary under that statute.[52]

The Department of the Interior has similarly previously, and repeatedly, utilized its

---

[48] *See* 43 C.F.R. § 3120.1-1; U.S. Bureau of Land Management, Oil and Gas Leasing Reform – Land Use Planning and Lease Parcel Reviews, Instruction Memorandum No. 2010-117, § III.A & n.viii (2010) ("Eligible lands include those identified in 43 CFR 3120.1-1 as being available for leasing (BLM Manual 3120, Competitive Leases). They are considered available for leasing when all statutory requirements have been met, including compliance with the NEPA, appropriate reviews have been conducted, and lands have been allocated for leasing in the RMP (BLM Handbook H-3101-1, Issuance of Leases).")

[49] See, e.g., *Udall v. Tallman*, 380 U.S. 1, 4 (1965); *United States ex rel. McLennan v. Wilbur*, 283 U.S. 414, 417 (1931); *McDonald v. Clark*, 771 F.2d 460, 463 (10th Cir. 1985); *McTiernan v. Franklin*, 508 F.2d 885, 887 (10th Cir. 1975); *Duesing v. Udall*, 350 F.2d 748, 750 (D.C. Cir. 1965); *Cont'l Land Res*., 162 I.B.L.A. 1, 7 (2004).

[50] *Western Energy Alliance v. Salazar*, 709 F.3d 1040, 1044 (10th Cir. 2013) ("Before the MLA was amended by the Federal Onshore Oil and Gas Leasing Reform Act of 1987 . . . it was well established that the Secretary had extremely broad discretion and was not obligated to issue any lease on public lands . . . . "[t]he MLA, as amended by the Reform Act of 1987, continues to vest the Secretary with considerable discretion to determine which lands are 'to be leased' under § 226(b)(1)(A)."); *compare Impact Energy Resources, LLC v. Salazar*, No. 2:09-CV-435, 2010 U.S. Dist. LEXIS 91095, at *16 (D. Utah Aug. 31, 2010), *aff'd on other ground*, 693 F.3d 1239 (10th Cir. 2012) (stating that it is "undisputed that…prior to a lease sale the Secretary has discretion to decide which lands will be offered for lease.")

[51] *See Bob Marshall Alliance v. Hodel*, 852 F.2d 1223, 1229-30 (9th Cir. 1988) (rejecting holdings in *Mountain States Legal Found. v. Hodel*, 668 F. Supp. 1466, 1474 (D. Wyo. 1987) (finding that delay in processing leasing proposals can constitute an impermissible withdrawal of public lands) and *Mountain States Legal Found. v. Andrus*, 499 F. Supp. 383, 391 (D. Wyo. 1980) (same)).

[52] *Bob Marshall Alliance*, 852 F.2d at at 1230.

discretionary authority over mineral leasing to impose a nationwide coal leasing moratorium.[53] Significantly, the District of Columbia Circuit upheld the validity of a 1970-76 moratorium on new coal leases, part of a series of various moratoria from 1970 to 1981.[54] Under the pre-1976 "preference right" coal leasing scheme, speculation on coal leases was widespread. Even prior to the enactment of the 1976 Coal Leasing Amendments and the Surface Mining Control and Reclamation Act, the Department of the Interior recognized widespread problems, and in 1973, the then Secretary issued Order No. 2952, which provided:

> In the exercise of my discretionary authority under Section 2(b) of the Mineral Leasing Act, as amended (30 U.S.C. § 201(b)), I have decided not to issue prospecting permits for coal under that section until further notice and to reject pending applications for such permits in order to allow the preparation of a program for the more "orderly" development of coal resources upon the public lands of the United States under the Mineral Leasing Act, with proper regard for the protection of the environment.
>
> Accordingly, no prospecting permits for coal under Section 2(b) of the Mineral Leasing Act, supra, shall be issued until further notice. All pending applications for such permits shall be rejected. . . .[55]

During this moratorium, the Interior Department undertook preparing a series of national and local Environmental Impact Statements (EISs) for coal leasing. Lease applicants, however, challenged the moratorium on two principal grounds: first, that the moratorium failed to implement the policy of the Mining and Minerals Policy Act of 1970[56] to "foster and encourage the development of coal resources," and second, that the Secretary arbitrarily and capriciously determined that the moratorium did not require preparation of an EIS under the National Environmental Policy Act ("NEPA), 42 U.S.C. § 4332. The court in *Krueger v. Morton*[57] rejected both of these claims, finding that "the Secretary had the right, before receiving or approving applications, to order a pause for refreshment of his judgment by further investigation, public input, comprehensive consideration, and rulemaking directed toward the hopefully better implementation of the Mineral Leasing Act in light of NEPA and other significant factors."[58]

Although the moratorium eventually ended and coal leasing resumed, the courts did require the Secretary through the EIS process to at least consider the alternative of *not* resuming the national coal leasing program.[59] Secretarial Orders 2952 and 3338 provide a clear model for

---

[53] *See NRDC v. Hughes*, 437 F. Supp. 981, 983-85 (D.D.C. 1977) (discussing history and reform of coal leasing).
[54] *See Krueger*, 539 F.2d 235, 238-40 (D.C. Cir. 1976); *see also NRDC v. Hughes*, 437 F. Supp., 983-85.
[55] United States Department of the Interior, Secretarial Order 2952 (Feb. 1973); *see also Krueger*, 539 F.2d at 237.
[56] 30 U.S.C. § 21a.
[57] *Krueger*, 539 F.2d 235 (D.C. Cir. 1976).
[58] *Id.* at 239.
[59] *See NRDC v. Hughes*, 437 F.Supp. at 990-91 (requiring DOI to address "the threshold question as to *whether* the proposed [coal leasing] policy is even *necessary*")

an approach to the national deferral of oil and gas leasing pending comprehensive review of the climate consequences of the federal fossil fuel leasing program and implementation of a national strategy to limit such impacts. As the court held in *Krueger*, the Secretary has the right pursuant to 30 U.S.C. §§ 201 and 226, to order a "pause for refreshment of her judgment" of the leasing program in order to ensure any renewed leasing program is consistent with our nation's climate goals.

On January 15, 2016, the Secretary issued Order No. 3338, again pausing the coal leasing program for review and reconsideration, explicitly including the impacts of climate change resulting from coal combustion:

> The United States has pledged to the United Nations Framework Convention on Climate Change (UNFCCC) to reduce its greenhouse gas (GHG) emissions by 26-28 percent below 2005 levels by 2025. The Obama Administration has made, and is continuing to make, unprecedented efforts to reduce GHG emissions in line with this target through numerous measures. Numerous scientific studies indicate that reducing GHG emissions from coal use worldwide is critical to addressing climate change.
>
> At the same time, as noted above, the Federal coal program is a significant component of overall United States' coal production. Federal coal represents approximately 41 percent of the coal produced in the United States, and when combusted, it contributes roughly 10 percent of the total U.S. GHG emissions.
>
> Many stakeholders highlighted the tension between producing very large quantities of Federal coal while pursuing policies to reduce U.S. GHG emissions substantially, including from coal combustion. Critics also noted that the current leasing system does not provide a way to systematically consider the climate impacts and costs to taxpayers of Federal coal development.
>
> ****
>
> With respect to the climate impacts of the Federal coal program, the PEIS should examine how best to assess the climate impacts of continued Federal coal production and combustion and how to address those impacts in the management of the program to meet both the Nation's energy needs and its climate goals, as well as how best to protect the public lands from climate change impacts.[60]

Congress has plainly conferred on the Secretary, and the courts have recognized, equivalent discretionary authority under 30 U.S.C. §§ 226 and 241 as to whether or not to issue leases for, oil, gas, tar sands, or oil shale under those sections. In order to permit a

[60] U.S. D.O.I. Secretarial Order No. 3338 at 4, 8.

comprehensive nationwide evaluation of and response to the threat of climate change, the Secretary can and should, via Secretarial Order, defer action all new and pending applications and nominations for such leases, in order to conduct a comprehensive review of the entire federal fossil fuel leasing program, and to promulgate rules and policies ensuring that any new federal coal, oil, gas, tar sand, and oil shale leasing, and the emissions resulting from the extraction and combustion of federal fossil fuels, are consistent with a pathway to limit warming to 1.5ºC above pre-industrial levels.

B. The National Environmental Policy Act

The National Environmental Policy Act (NEPA), 43 U.S.C. §§ 4331-4347, requires federal agencies to inform themselves and the public of the direct, indirect, and cumulative effects of all major federal actions, and to consider alternatives, including no action, to proposed actions.[61] The indirect and cumulative effects of federal public land leasing policy plainly include, as set forth below, a significant national and global contribution to greenhouse gas emissions.The Department of Interior can best satisfy its obligation to consider the cumulative impacts of fossil fuel gas leasing by preparing a Programmatic Environmental Impact Statement considering all onshore fluid mineral leasing. Indeed, the Council on Environmental Quality's recent "Guidance on Effective Use of Programmatic NEPA Reviews" explains that programmatic NEPA review is appropriate when agencies must evaluate "multiple actions," including "similar actions or projects in a region *or nationwide*.[62] The Department has already determined that a Programmatic Environmental Impact Statement is the appropriate method for evaluating the climate impacts of federal coal leasing.[63]

V. Reasons for Action on Petition

A. Climate Change Poses a Well-Documented Threat to the United States and the World

On December 12, 2015, nearly 200 governments, including the United States, agreed to the commitments enumerated in the Paris Agreement to "strengthen the global response to the threat of climate change"[64] The Paris Agreement codified the international consensus that the climate crisis is an urgent threat to human societies and the planet, with the parties recognizing that:

Climate change represents an *urgent and potentially irreversible threat to human*

[61] See, e.g., 40 C.F.R. §§ 1500.1(b), 1502.4, 1502.5, 1506.10, 1508.7 and 1508.25; *Center for Biological Diversity v. Nat'l Highway Traffic Safety Admin*., 538 F.3d 1172, 1221-23 (9th Cir. 2008)
[62] Council on Environmental Quality, Memorandum Re: Effective use of Programmatic NEPA Reviews 14 (Dec. 18, 2014), *available at https://www.whitehouse.gov/sites/default/files/docs/effective_use_of_programmatic_nepa_reviews_final_dec2014_searchable.pdf.*
[63] Secretarial Order 3338.
[64] Paris Agreement, Art. 2(1).

> *societies and the planet* and thus requires the widest possible cooperation by all countries, and their participation in an effective and appropriate international response, with a view to accelerating the reduction of global greenhouse gas emissions (emphasis added).[65]

Numerous authoritative scientific assessments have established that climate change is causing grave harms to human society and natural systems, and these threats are becoming increasingly dangerous. The Intergovernmental Panel on Climate Change, in its 2014 Fifth Assessment Report, stated that: "[w]arming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased" and that "[r]ecent climate changes have had widespread impacts on human and natural systems."[66]

The United States' 2014 Third National Climate Assessment, prepared by a panel of non-governmental experts and reviewed by the National Academy of Sciences and multiple federal agencies similarly stated that "[t]hat the planet has warmed is 'unequivocal,' and is corroborated though multiple lines of evidence, as is the conclusion that the causes are very likely human in origin"[67] and "[i]impacts related to climate change are already evident in many regions and are expected to become increasingly disruptive across the nation throughout this century and beyond."[68] The United States National Research Council similarly concluded that: "[c]limate change is occurring, is caused largely by human activities, and poses significant risks for—and in many cases is already affecting—a broad range of human and natural systems."[69]

The IPCC and National Climate Assessment further decisively recognize the dominant role of fossil fuels in driving climate change:

> While scientists continue to refine projections of the future, observations unequivocally show that climate is changing and that the warming of the past 50 years is primarily due to human-induced emissions of heat-trapping gases. These emissions come mainly from burning coal, oil, and gas, with additional contributions from forest clearing and some agricultural practices.[70]

---

[65] Paris Agreement, Decision, Recitals.
[66] IPCC AR5 Synthesis Report at 2.
[67] Melillo, Jerry M., Climate Change Impacts in the United States: The Third National Climate Assessment, Terese (T.C.) Richmond, and Gary W. Yohe, Eds., U.S. Global Change Research Program, doi:10.7930/J0Z31WJ2 (2014) (Third National Climate Assessment) at 61 (quoting IPCC, 2007:. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, and H. L. Miller, Eds., Cambridge University Press, 1-18.).
[68] Third National Climate Assessment at 10.
[69] National Research Council, Advancing the Science of Climate Change (2010), available at www nap.edu. ("Advancing the Science of Climate Change") at 2.
[70] Third National Climate Assessment at 2.

***

> CO_2 emissions from fossil fuel combustion and industrial processes contributed about 78% to the total GHG emission increase between 1970 and 2010, with a contribution of similar percentage over the 2000–2010 period (*high confidence*).[71]

These impacts emanating from the extraction and combustion of fossil fuels are harming the United States in myriad ways, with the impacts certain to worsen over the coming decades absent deep reductions in domestic and global GHG emissions. EPA recognized these threats in its 2009 Final Endangerment Finding under Clean Air Act Section 202(a), concluding that greenhouse gases from fossil fuel combustion endanger public health and welfare: "the body of scientific evidence compellingly supports [the] finding" that "greenhouse gases in the atmosphere may reasonably be anticipated both to endanger public health and to endanger public welfare."[72] In finding that climate change endangers public health and welfare, EPA has acknowledged the overwhelming evidence of the documented and projected effects of climate change upon the nation:

*Effects on air quality: "*The evidence concerning adverse air quality impacts provides strong and clear support for an endangerment finding. Increases in ambient ozone are expected to occur over broad areas of the country, and they are expected to increase serious adverse health effects in large population areas that are and may continue to be in nonattainment. The evaluation of the potential risks associated with increases in ozone in attainment areas also supports such a finding.*"*[73]

*Effects on health from increased temperatures: "*The impact on mortality and morbidity associated with increases in average temperatures, which increase the likelihood of heat waves, also provides support for a public health endangerment finding.*"*[74]

Increased chance of extreme weather events: "The evidence concerning how human induced climate change may alter extreme weather events also clearly supports a finding of endangerment, given the serious adverse impacts that can result from such events and the increase in risk, even if small, of the occurrence and intensity of events such as hurricanes and floods. Additionally, public health is expected to be adversely affected by an increase in the severity of coastal storm events due to rising sea levels."[75]

Impacts to water resources: "Water resources across large areas of the country are at serious risk from climate change, with effects on water supplies, water quality, and adverse effects from extreme events such as floods and droughts. Even areas of the country where an increase in water flow is projected could face water resource problems from the supply and water

[71] IPCC AR5 Synthesis Report at 46.
[72] Final Endangerment Finding, 74 Fed. Reg. at 66,497.
[73] Final Endangerment Finding, 74 Fed. Reg. at 66,497
[74] Final Endangerment Finding, 74 Fed. Reg. at 66,497
[75] Final Endangerment Finding at 66,497-98.

quality problems associated with temperature increases and precipitation variability, as well as the increased risk of serious adverse effects from extreme events, such as floods and drought. The severity of risks and impacts is likely to increase over time with accumulating greenhouse gas concentrations and associated temperature increases."[76]

Impacts from sea level rise: "The most serious potential adverse effects are the increased risk of storm surge and flooding in coastal areas from sea level rise and more intense storms. Observed sea level rise is already increasing the risk of storm surge and flooding in some coastal areas. The conclusion in the assessment literature that there is the potential for hurricanes to become more intense (and even some evidence that Atlantic hurricanes have already become more intense) reinforces the judgment that coastal communities are now endangered by human-induced climate change, and may face substantially greater risk in the future. Even if there is a low probability of raising the destructive power of hurricanes, this threat is enough to support a finding that coastal communities are endangered by greenhouse gas air pollution. In addition, coastal areas face other adverse impacts from sea level rise such as land loss due to inundation, erosion, wetland submergence, and habitat loss. The increased risk associated with these adverse impacts also endangers public welfare, with an increasing risk of greater adverse impacts in the future."[77]

Impacts to energy, infrastructure, and settlements: "Changes in extreme weather events threaten energy, transportation, and water resource infrastructure. Vulnerabilities of industry, infrastructure, and settlements to climate change are generally greater in high-risk locations, particularly coastal and riverine areas, and areas whose economies are closely linked with climate-sensitive resources. Climate change will likely interact with and possibly exacerbate ongoing environmental change and environmental pressures in settlements, particularly in Alaska where indigenous communities are facing major environmental and cultural impacts on their historic lifestyles."[78]

Impacts to wildlife: "Over the 21st century, changes in climate will cause some species to shift north and to higher elevations and fundamentally rearrange U.S. ecosystems. Differential capacities for range shifts and constraints from development, habitat fragmentation, invasive species, and broken ecological connections will likely alter ecosystem structure, function, and services, leading to predominantly negative consequences for biodiversity and the provision of ecosystem goods and services."[79]

In addition to these acknowledged impacts on public health and welfare generally, climate change is causing and will continue to cause serious impacts on natural resources that the

[76] Final Endangerment Finding at 66,498.
[77] Final Endangerment Finding at 66,498
[78] Final Endangerment Finding at 66,498
[79] Final Endangerment Finding at 66,498*see also* Third National Climate Assessment at 195-219.

Department of Interior is specifically charged with safeguarding.[80]

Impacts to Public Lands: Climate change is causing and will continue to cause specific impacts to public lands and resources. Although public lands provide a variety of public benefits, one recent Forest Service attempt at quantification estimates the public land ecosystem services at risk from climate change at between $14.5 and $36.1 billion annually.[81] In addition to the general loss of public land resources, irreplaceable species and aesthetic and recreational treasures are at risk of permanent destruction. High temperatures are causing loss of glaciers in Glacier National Park; the Park's glaciers are expected to disappear entirely by 2030, with ensuing warming of stream temperatures and adverse effects to aquatic ecosystems.[82] With effects of warming more pronounced at higher latitudes, tundra ecosystems on Alaska public lands face serious declines, with potentially serious additional climate feedbacks from melting permafrost.[83] In Florida, the Everglades face severe ecosystem disruption from already-occurring saltwater incursion.[84] Sea level rise will further damage freshwater ecosystems and the endangered species that rely on them.

Impacts to Biodiversity and Ecosystems: Across the United States ecosystems and biodiversity, including those on public lands, are directly under siege from climate change—leading to the loss of iconic species and landscapes, negative effects on food chains, disrupted migrations, and the degradation of whole ecosystems.[85] Specifically, scientific evidence shows that climate change is already causing changes in distribution, phenology, physiology, genetics, species interactions, ecosystem services, demographic rates, and population viability: many animals and plants are moving poleward and upward in elevation, shifting their timing of breeding and migration, and experiencing population declines and extirpations.[86] Because climate change is occurring at an unprecedented pace with multiple synergistic impacts, climate change is predicted to result in catastrophic species losses during this century. For example, the IPCC concluded that 20% to 30% of plant and animal species will face an increased risk of extinction if global average temperature rise exceeds 1.5°C to 2.5°C relative to 1980-1999, with an increased risk of extinction for up to 70% of species worldwide if global average temperature

---

[80] *See* Federal Land Policy and Management Act of 1976, 43 U.S.C. §§ 1701(a)(8), 1712(c)(1); Multiple-Use Sustained Yield Act of 1960, 16 U.S.C. § 528; National Environmental Policy Act of 1969, 42 U.S.C. §§ 4331-4332.

[81] Esposito, Valerie *et al.*, Climate Change and Ecosystem Services: The Contribution and Impacts on Federal Public Lands in the United States, USDA Forest Service Proceedings RMRS-P-64 at 155-164 (2011).

[82] U.S. Environmental Protection Agency, Climate Change and Public Lands: National Parks at Risk (1999).

[83] *See* National Climate Assessment at 48; MacDougall, A. H., *et al.*, Significant contribution to climate warming from the permafrost carbon feedback, 5 Nature Geoscience 719-721 (2012), doi:10.1038/ngeo1573.

[84] *See* National Climate Assessment at 592; Foti, R., M*et al.*, Signs of critical transition in the Everglades wetlands in response to climate and anthropogenic changes, 110 Proceedings of the National Academy of Sciences 6296-6300, (2013), doi:10.1073/pnas.1302558110.

[85] National Climate Assessment at 13.

[86] *See* Parmesan, C. and G. Yohe, A globally coherent fingerprint of climate change impacts across natural systems, 421 Nature 37 (2003); Root, T. *et al.*, Fingerprints of global warming on wild animals and plants, 421 Nature 57 (2003); Chen, I. *et al.*, Rapid range shifts of species associated with high levels of climate warming, 333 Science 1024 (2011).

exceeds 3.5°C relative to 1980-1999.[87]

In sum, climate change, driven primarily by the combustion of fossil fuels, poses a severe and immediate threat to the health, welfare, ecosystems and economy of the United States. These impacts are felt across the nation, including upon the public lands the Secretary of the Interior is charged with safeguarding. A rapid and deep reduction of emissions generated from fossil fuels is essential if such threats are to be minimized and their impacts mitigated.

B. The 2015 Paris Agreement and the Underlying U.N. Framework Convention on Climate Change Commit the United States to Addressing the Global Climate Emergency and Limiting Fossil Fuel Extraction

On December 12, 2015, 197 nation-state and supra-national organization parties meeting in Paris at the 2015 United Nations Framework Convention on Climate Change Conference of the Parties consented to an agreement (Paris Agreement) committing its parties to take action so as to avoid dangerous climate change. [88] As the United States is has signed the treaty on April 22, 2016[89] as a legally binding instrument through executive agreement,[90] the Paris Agreement commits the United States to critical goals—both binding and aspirational—that mandate bold action on the United States' domestic policy to rapidly reduce greenhouse gas emissions.[91]

The United States and other parties to the Paris Agreement recognized "the need for an effective and progressive response to the urgent threat of climate change on the basis of the best available scientific knowledge."[92] The Paris Agreement articulates the practical steps necessary to obtain its goals: parties including the United States have to "reach global peaking of greenhouse gas emissions *as soon as possible* . . . and to *undertake rapid reductions* thereafter in

---

[87] IPCC, Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change 48 [Core Writing Team, Pachauri, R.K and Reisinger, A.(eds.)] (2007). Other studies have predicted similarly severe losses: 15%-37% of the world's plants and animals committed to extinction by 2050 under a mid-level emissions scenario, s*ee* Thomas *et al.*, Extinction risk from climate change, 427 Nature 145 (2004)); the potential extinction of 10% to 14% of species by 2100 if climate change continues unabated, *see* Maclean, I. M. D. and R. J. Wilson, Recent ecological responses to climate change support predictions of high extinction risk, 108 Proc. Natl. Acad. Sci. 12337-12342 (2011); and the loss of more than half of the present climatic range for 58% of plants and 35% of animals by the 2080s under the current emissions pathway, in a sample of 48,786 species, *see* Warren, R. J. *et al.*, Increasing Impacts of Climate Change Upon Ecosystems with Increasing Global Mean Temperature Rise, 106 Climatic Change 141 (2011).

[88] Paris Agreement, Art. 2.

[89] For purposes of this Petition, the term "treaty" refers to its international law definition, whereby a treaty is "an international law agreement concluded between states in written form and governed by international law" pursuant to article 2(a) of the Vienna Convention on the Law of Treaties, 1155 U.N.T.S. 331, 8 I.L.M. 679 (Jan. 27, 1980).

[90] *See* United Nations Treaty Collection, Chapter XXVII, 7.d Paris Agreement, List of Signatories; U.S. Department of State, Background Briefing on the Paris Climate Agreement, (Dec. 12, 2015), http://www. state.gov/ r/pa/prs/ps/2015/12/250592 htm.

[91] Although not every provision in the Paris Agreement is legally binding or enforceable, the U.S. and all parties are committed to perform the treaty commitments in good faith under the international legal principle of *pacta sunt servanda* ("agreements must be kept"). Vienna Convention on the Law of Treaties, Art. 26.

[92] *Id.*, Recitals.

accordance *with best available science*,"[93] imperatively commanding that developed countries specifically "should continue taking the lead by undertaking economy-wide absolute emission reduction targets"[94] and that such actions reflect the "highest possible ambition."[95]

The Paris Agreement codifies the international consensus that climate change is an "urgent threat" of global concern,[96] and commits all signatories to achieving a set of global goals. Importantly, the Paris Agreement commits all signatories to an articulated target to hold the long-term global average temperature "to *well below 2°C* above pre-industrial levels and to *pursue efforts to limit the temperature increase to 1.5°C* above pre-industrial levels"[97] (emphasis added).

In light of the severe threats posed by even limited global warming, the Paris Agreement established the international goal of limiting global warming to 1.5°C above pre-industrial levels in order to "prevent dangerous anthropogenic interference with the climate system," as set forth in the UNFCCC, a treaty which the United States has ratified and to which it is bound.[98] The Paris consensus on a 1.5°C warming goal reflects the findings of the IPCC and numerous scientific studies that indicate that 2°C warming would exceed thresholds for severe, extremely dangerous, and potentially irreversible impacts.[99] Those impacts include increased global food and water insecurity, the inundation of coastal regions and small island nations by sea level rise and increasing storm surge, complete loss of Arctic summer sea ice, irreversible melting of the Greenland ice sheet, increased extinction risk for at least 20-30% of species on Earth, dieback of the Amazon rainforest, and "rapid and terminal" declines of coral reefs worldwide.[100] As scientists noted, the impacts associated with 2°C temperature rise have been "revised upwards, sufficiently so that 2°C now more appropriately represents the threshold between 'dangerous'

---

[93] *Id.*, Art. 4(1).
[94] *Id.*, Art. 4(4).
[95] Id, Art. 4(3).
[96] *Id.*, Recitals.
[97] *Id.*, Art. 2.
[98] *See* U.N. Framework Convention on Climate Change, Cancun Agreement. Available at http://cancun.unfccc.int/ (last visited Jan 7, 2015); United Nations Framework Convention on Climate Change, Copenhagen Accord. Available at http://unfccc.int/meetings/copenhagen_dec_2009/items/5262.php (last accessed Jan 7, 2015). The United States Senate ratified the UNFCC on October 7, 1992. *See* https://www.congress.gov/treaty-document/102nd-congress/38.
[99] *See* Paris Agreement, Art. 2(1)(a); U); U.N. Framework Convention on Climate Change, Subsidiary Body for Scientific and Technical Advice, Report on the structured expert dialogue on the 2013-15 review, No. FCCC/SB/2015/INF.1 at 15-16 (June 2015); IPCC AR5 Synthesis Report at 65 & Box 2.4.
[100] *See* Jones, C. et al, Committed Terrestrial Ecosystem Changes due to Climate Change, 2 Nature Geoscience 484, 484–487 (2009); Smith, J. B. *et al.*, Assessing Dangerous Climate Change Through an Update of the Intergovernmental Panel on Climate Change (IPCC) 'Reasons for Concern', 106 Proc. Natl. Acad. Sci. 4133, 4133–37 (2009); Veron, J. E. N. *et al.*, The Coral Reef Crisis: The Critical Importance of <350 ppm CO2, 58 Marine Pollution Bulletin 1428, 1428–36, (2009); Warren, R. J. *et al.*, Increasing Impacts of Climate Change Upon Ecosystems with Increasing Global Mean Temperature Rise, 106 Climatic Change 141 (2011); Hare, W. W. *et al.*, Climate Hotspots: Key Vulnerable Regions, Climate Change and Limits to Warming, 11 Regional Environmental Change 1, 1–13 (2011); Frieler, K. M. *et al.*, Limiting Global Warming to 2ºC is Unlikely to Save Most Coral Reefs, Nature Climate Change, Published Online (2013) doi: 10.1038/NCLIMATE1674; M. Schaeffer *et al.*, Adequacy and Feasibility of the 1.5°C Long-Term Global Limit, Climate Analytics (2013).

and 'extremely dangerous' climate change." [101] Consequently, a target of 1.5 ºC or less temperature rise is now seen a essential to avoid dangerous climate change and has largely supplanted the 2°C target that had been the focus of most climate literature until recently.

It has been widely agreed among the world's climate scientists that the vast majority of fossil fuels must stay in the ground in order to limit the global temperature rise to 2ºC of warming above pre-industrial levels.[102] As described above, it is also widely recognized that a limit of 2ºC of warming is woefully insufficient to protect the world's most vulnerable populations and natural systems, with an upper limit of 1.5 ºC or less warming required to reduce the risks and impact to human and ecological communities.[103] While staying "well below" 2ºC of warming will itself require immediate and ambitious measures, to meet the scientifically dictated and ecologically, economically and ethically required target of 1.5 ºC warming or less, measures even more ambitious than those aimed at a 2ºC target are necessary. That which is clearly required to meet a 2ºC target becomes an absolute imperative to meet a 1.5ºC target. One such measure, straightforward, practical, consistent with the Paris Agreement, and wholly within the authority of the executive branch of the United States government, is a moratorium on new fossil fuel leasing on federal lands.

C. Staying Below a 1.5 or 2°C Temperature Target Requires Adherence to a Strict Carbon Budget with the Vast Majority of Fossil Fuels Left in the Ground

Immediate and aggressive greenhouse gas emissions reductions are necessary to keep warming below a 1.5º or 2°C rise above pre-industrial levels. Put simply, there is only a finite amount of CO_2 that can be released into the atmosphere without rendering the goal of meeting the 1.5°C target virtually impossible. A slightly larger amount could be burned before meeting a 2°C became an impossibility. Globally, fossil fuel reserves, if all were extracted and burned, would release enough CO_2 to exceed this limit several times over.[104]

The question of what amount of fossil fuels can be extracted and burned without negating a realistic chance of meeting a 1.5 or 2°C target is relatively easy to answer, even if the answer is framed in probabilities and ranges. The IPCC Fifth Assessment Report and other expert assessments have established global carbon budgets, or the total amount of remaining carbon that can be burned while maintain some probability of staying below a given temperature target. According to the IPCC, total cumulative anthropogenic emissions of CO_2 must remain below about 1,000 gigatonnes ($GtCO_2$) from 2011 onward for a 66% probability of limiting warming to

[101] Anderson, K. and A. Bows, Beyond 'Dangerous' Climate Change: Emission Scenarios for a New World, 369 Philosophical Transactions, Series A, Mathematical, Physical, and Engineering Sciences 20, 20–44 (2011).
[102] McGlade, Christophe & Ekins, Paul. The geographic distribution of fossil fuels unused when limiting global warming to 2°C, 517 Nature 187 (Jan. 2015) ("McGlade and Ekins").
[103] U.N. Subsidiary Body for Scientific and Technological Advice, Report on the structured expert dialogue on the 2013-2015 review (2015), FCCC/SB/2015/1NF.1 (2014), http://unfccc.int/resource/docs/2015/sb/eng/inf01.pdf.
[104] Cimons at 6, 33 n.2.

2°C above pre-industrial levels.[105] Given more than 100 $GtCO_2$ have been emitted since 2011,[106] the remaining portion of the budget under this scenario is well below 900 $GtCO_2$. To have an 80% probability of staying below the 2°C target, the budget from 2000 is 890 $GtCO_2$, with less than 430 $GtCO_2$ remaining.[107]

To have even a 50% probability of achieving the Paris Agreement goal of limiting warming to 1.5°C above pre-industrial levels equates to a carbon budget of 550-600 $GtCO_2$ from 2011 onward, [108] of which more than 100 $GtCO_2$ has already been emitted. To achieve a 66% probability of limiting warming to 1.5°C requires adherence to a more stringent carbon budget of only 400 $GtCO_2$ from 2011 onward, [109] of which less than 300 $GtCO_2$ remained at the start of 2015. An 80% probability budget for 1.5°C would have far less that 300 $GtCO_2$ remaining. Given that global CO_2 emissions in 2014 alone totaled 36 $GtCO_2$,[110] humanity is rapidly consuming the remaining burnable carbon budget needed to have even a 50/50 chance of meeting the 1.5°C temperature goal.[111]

1. Global and United States Fossil Fuels Exceed any Rational Carbon Budget

The science is clear that the vast majority of the world's fossil fuels must remain in the ground in order to maintain any reasonable hope of limiting global warming to 1.5º or even 2°C above pre-industrial levels. While there is significant variation in estimates, all recent scientific analyses have concluded that global fossil fuel reserves and resources far exceed the carbon budgets needed to stay below a 1.5º or 2°C temperature target.[112]

Two recent studies estimated that oil, gas, and coal resources considered currently economically recoverable contain potential greenhouse gas emissions estimated at 2,900

---

[105] IPCC AR5 Physical Science Basis at 27; IPCC AR5 Synthesis Report at 63-64 & Table 2.2.
[106] From 2012-2014, 107 $GtCO_2$ was emitted (*see* Annual Global Carbon Emissions at http://co2now.org/Current-CO2/CO2-Now/global-carbon-emissions.html).
[107] Carbon Tracker Initiative at 6; Meinshausen *et al.* 2009 at 1159
[108] IPCC AR5 Synthesis Report at 64 & Table 2.2.
[109] *Id*.
[110] *See* Global Carbon Emissions, http://co2now.org/Current-CO2/CO2-Now/global-carbon-emissions html
[111] In addition to limits on the *amount* of fossil fuels that can be utilized, emissions pathways compatible with a 1.5 or 2°C target also have a significant temporal element. Leading studies make clear that to reach a reasonable likelihood of stopping warming at 1.5° or even 2°C, global CO_2 emissions must be phased out by mid-century and likely as early as 2040-2045. *See, e.g*. Rogelj, Joeri et al., Energy system transformations for limiting end-of-century warming to below 1.5°C, 5 Nature Climate Change 519, 522 (2015). United States focused studies indicate that we must phase out fossil fuel CO_2 emissions even earlier—between 2025 and 2040—for a reasonable chance of staying below 2ºC. *See, e.g*. Climate Action Tracker, USA Rating Assessment webpage, http://climateactiontracker.org/countries/usa (accessed Apr 29, 2016). Issuing new legal entitlements to explore for and extract federal fossil fuels for decades to come is wholly incompatible with such a transition.
[112] Analyses by the Carbon Tracker Initiative estimated that 80% of proven fossil fuel reserves must be kept in the ground to have a reasonable probability (75-80%) of staying below even 2°C. This estimate includes only the fossil fuel reserves that are considered currently economically recoverable with a high probability of being extracted. *See* Carbon Tracker Initiative at 2, 6.

$GtCO_2$[113] and 4196 $GtCO_2$[114] respectively. Other sources estimate even greater global fossil fuel reserves at 3,677 to 7,120 $GtCO_2$.[115] When considering all fossil fuel resources (defined as those recoverable over all time with both current and future technology irrespective of current economic conditions), potential combustion emissions have been estimated at nearly 11,000 $GtCO_2$[116] upwards to 31,353 and 50,092 $GtCO_2$.[117]

Even the lowest of these estimates (2,900 $GtCO_2$) is more than three times greater than the most generous carbon budget nominally consistent with a 2°C temperature limit (~900 $GtCO_2$), while the largest (50,092 $GtCO_2$) is over 160 times greater than the remaining budget for a 66% probability of not exceeding a 1.5°C limit (<300 $GtCO_2$).

As stated by one study, "the disparity between what resources and reserves exist and what can be emitted while avoiding a temperature rise greater than the agreed 2C limit is therefore stark."[118] Another recent report on global carbon reserves found that:

> The reserves of coal, oil and natural gas outlined in this report contain enough carbon to rocket the planet far beyond the 2˚C limit. Warming from fossil fuels puts other carbon sinks at risk. As permafrost melts and peat bogs dry, they emit enormous quantities of carbon dioxide, furthering a chain reaction where the release of carbon results in a warmer world, which in turn releases more carbon.[119]

While global carbon budgets provide a straightforward and relatively objective framework for determining the total *amount* of fossil fuels that can be combusted consistent with pathways to meeting our climate targets, the question of what level of risk of not meeting the target is acceptable, along with the questions of *which* fossil fuels can be burned and by *whom*, are inherently political and ethical questions. But, under *any* formulation, the vast majority of United States fossil fuels, must stay in the ground if we are to have any realistic hope of staying below 1.5°C, or even 2°C of warming.

A recent detailed analysis found that the United States alone contains enough recoverable fossil fuels, split about evenly between federal and non-federal resources, which if extracted and burned, would generate enough greenhouse emissions (median estimate 840 $GtCO_2e$) to

---

[113] McGlade and Ekins at 187-192.
[114] Raupach, M. et al., Sharing a quota on cumulative carbon emissions. 4 Nature Climate Change 873 (2014) ("Raupach *et al*") at Figure 2.
[115] IPCC, 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change at Table 7.2 [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.("IPCC AR5 Mitigation of Climate Change")
[116] McGlade and Ekins at 188.
[117] IPCC AR5 Mitigation of Climate Change at Table 7.2.
[118] McGlade and Ekins at 188.
[119] Cimons at 6.

consume more than half the entire global carbon budget for a 2°C target (~900 $GtCO_2$, equivalent to ~1350 $GtCO_2e$), and greatly exceed the remaining budget for a 1.5°C target (~300 $GtCO_2$ equivalent to ~450 $GtCO_2e$).[120] Clearly, even if the rest of the world somehow reduced its carbon emissions to near zero, the United States still could not safely burn all of its own fossil fuels.

This analysis highlights the impossibility of reconciling continued leasing of federal fossil fuels with a pathway to keeping warming from exceeding 1.5°C. Total remaining fossil fuel resources in the United States, including both federal and non-federal resources, are estimated to equate to 697 to 1070 $GtCO_2e$ of emissions.[121] Federal fossil fuels represent about half (46-50%) of that total at between 349 and 492 $GtCO_2e$ of potential emissions,[122] and the vast majority (91%) of federal fossil fuels are still unleased.[123] Overall the potential greenhouse gas emissions of unleased federal fossil fuel resources are enormous, estimated at 319 to 450 $GtCO_2e$. In other words, unleased federal fossil fuels, if extracted and burned, would consume between 70 and 100% of a *global* budget of 300 $GtCO_2$ (equivalent to ~450 $GtCO_2e$), the amount remaining at the start of 2015 under a budget scenario that itself has only a 66% chance of limiting temperature increase to 1.5°C. Continued leasing of these resources, without examining the climate consequences of such action, is incompatible with any reasonable l path to limiting warming to 1.5°C or even 2°C.

Various efforts have been made to ascribe portions of the global carbon budget to specific countries or regions, based on factors ranging from equity to economics.[124] One medium-range estimate of a U.S. carbon quota allocates 158 $GtCO_2$ to the United States, equivalent to 11% of the global carbon budget needed for a 50% chance of limiting warming to 2°C.[125] Potential emissions from unleased federal fossil fuels (319 to 450 $GtCO_2e$) vastly exceed even this highly non-precautionary U.S. carbon budget.

---

[120] *See* Mulvaney *et al.* 2015 at 4. Using a metric of CO_2e (which also includes the radiative forcing potential of non-CO_2 greenhouse gases such as methane), this study calculated that extraction and combustion of total U.S. recoverable fossil fuels would produce 697 to 1070 $GtCO_2e$ of emissions, with a median estimate of 840 $GtCO_2e$. To compare these emissions to the global carbon budgets for 1.5°C and 2°C, we converted these carbon budgets from to $GtCO_2$ to $GtCO_2e$ by applying a conversion factor of 1 $GtCO_2$ = 1.5 $GtCO_2e$based on Table 1 in Meinshausen *et al.* 2009.

[121] Mulvaney *et al.* 2015 at 19 Table 2.

[122] *Id.* at 18.

[123] *Id.*

[124] *See, e.g.* Raupach *et al.*.

[125] Raupach *et al*. at 875. We use a mid-range estimate of the U.S. carbon quota (158 $GtCO_2$) from Raupach *et al.* (2014). This mid-range estimate was calculated using a "blended" scenario of sharing principles for allocating the global carbon budget among countries. The "blended" scenario is midway between an "inertia" approach (sharing based on current emissions) and "equity" approach (sharing based on population). Raupach *et al.* (2014) estimates the U.S. carbon quota using a "blended" sharing approach at 158 $GtCO_2$ which is 11% of the global carbon budget of 1400 $GtCO_2$ for a 50% chance of staying below 2°C. *See* Raupach *et al.* (2014) at Supplementary Figure 7. This Petition employs the United States emissions quotas in Raupach *et al.* for illustration purposes only; this Petition does not endorse the equity assumptions made therein..

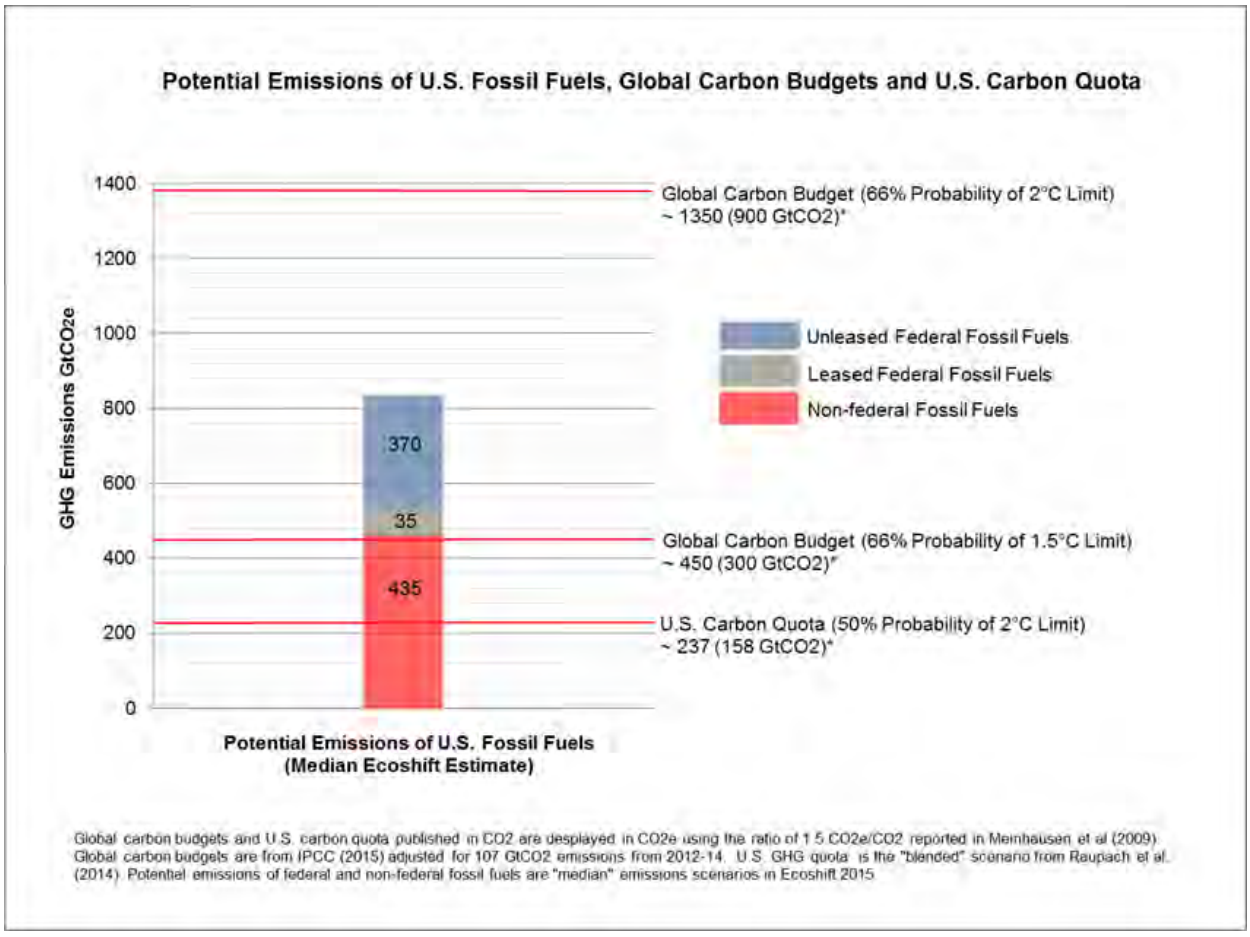


Figure 1: Relationship of United States Fossil Fuel Resources and Global Carbon Budgets for 1.5 and 2°C Emissions Pathways.[126]

As described above and illustrated in Figure 1, United States resources greatly exceed the *entire* global budget for a 66% chance of limiting warming to 1.5°C. Emissions from use of the median estimate of non-federal fossil fuels (435 $GtCO_2e$) themselves would use up almost the entire global budget, while unleased fossil fuels alone (370 $GtCO_2e$) would utilize over 80% of that budget. Even under a carbon budget in which great risk to human health, prosperity, and stability and the planet's natural systems is tolerated (only 50% chance of staying below 2°C) the United States still cannot utilize the entirety of its non-federal fossil fuel resources, much less those under direct federal control. Because decisions as to whether or not these non-federal fossil

[126] Figure 1 illustrates the relationship between potential United States greenhouse gas emissions from federal and non-federal fossil fuels resources (per the median estimate from Mulvaney *et al.* 2015, in $GtCO_2e$) and three representative carbon budgets: (1) 66% probability of limiting warming to 2°C, per IPCC AR5 (2014) (1000 Gt from 2011-2100, less 107 Gt emitted 2012-14); (2) 66% probability of limiting warming to 2°C, per IPCC AR5 (2014) (400 Gt from 2011-2100, less 107 Gt emitted 2012-14); (3) a representative United States allocation, under a "blended" equity scenario, for a 50% probability of limiting warming to 2°C, per Raupach *et al.* (2014). For purposes of this comparison, $GtCO_2$ estimates from IPCC and Raupach *et al.* have been converted to $GtCO_2e$ at a ratio of $GtCO_2$ to 1.5 $GtCO_2e$, per Meinhausen *et al.* 2009, Table 1.

fuels are developed are in part beyond direct federal management under existing law,[127] and therefore they are more likely to be developed, it is difficult to formulate a scenario that leaves room for any significant new development of federal fossil fuels.[128]

A recent analysis of the "production horizons" for currently-leased federal fossil fuels, using the U.S. Energy Information Agency's ("EIA") 2016 "reference case" for fossil fuel production indicates that federal fuels under lease will remain in production long past the point global carbon budgets necessary for a 66 percent probability of remaining under 1.5ºC and 2ºC are exceeded.[129] Assuming global CO_2 emissions continue at 2014 rates, analysis of the EIA data indicates that federal oil under lease will remain in production through 2055, federal coal through 2041, and federal gas through 2044, greatly exceeding thresholds for a reasonable likelihood of keeping warming under 1.5ºC (2021) or 2ºC (2036).[130]

Finally, while the climate consequences of a gigatonne of CO_2 emitted from the combustion of a barrel of oil are the same regardless of whether it was extracted from federal or non-federal lands, the legal, political and economic hurdles of keeping most federal fossil fuels in the ground are far simpler to overcome than for non-federal lands; the Secretary of the Interior can simply refrain from issuing any new fossil fuel leases.

2. The United States' Path to 1.5ºC Necessarily Includes Federal Fossil Fuels

The federal government manages approximately 650 million acres, or 29% of the 27 billion acres of land in the United States, and about 700 million acres of subsurface resources. The federal government also owns the submerged lands on the Outer Continental Shelf. Within these federal lands and waters are enormous fossil fuel deposits, which if extracted and burned, would release hundreds of billions of tons of greenhouse gasses.[131] These lands and oceans, including their coal, oil, gas, oil shale, and tar sands resources, are owned by the American public and are to be managed for public welfare by federal agencies, primarily within the Department of the Interior, according to federal law.

---

[127] While the federal government may lack direct land management authority as to whether non-federal fossil fuels are extracted, the federal government does have significant authority under the Clean Air Act and other statutes to dictate if and how they are combusted. Still, oversight and control of federal fossil fuels is inherently greater than for the non-federal estate.

[128] Because any reasonable carbon budget necessarily limits future development to a small portion of even existing declared, proven fossil fuel reserves, such budgets render completely superfluous the further exploration of recoverable resources to establish additional proved reserves. *See* IPCC AR5 Synthesis Report at 64 & Table 2.2; Cimons at 5-6. Under any pathway to 1.5º or even 2ºC, new reserves that could be established by leasing and exploration of additional resources are simply unburnable.

[129] Dustin Mulvaney *et al.*, Over-Leased: How Production Horizons of Already Leased Federal Fossil Fuels Outlast Global Carbon Budgets, EcoShift Consulting 2016 ("Mulvaney *et al.* 2016").

[130] Mulvaney *et al.* 2016 at 1, 5 & Figure 1.

[131] Mulvaney *et al.* 2015 at 4. For a detailed discussion of the sources, definitions, assumptions, and methodology employed in this analysis, *see* Mulvaney *et al.* 2015 at 12-17.

The fate of these federal fossil fuels, and their potential development and resulting emissions, are subject to significant executive discretion. At the direction of the executive, the Department of the Interior can affirmatively enact programs to develop these fossil fuels, further contributing to the climate crisis as they do now, or they can exercise their existing discretion and halt new federal fossil fuel leasing, reduce greenhouse gas emissions and start the United States down the path to a decarbonized economy. Unfortunately, current federal policy consists largely of auctioning off publicly owned fossil fuels to private companies for extraction and sale in domestic and international markets.[132] Such federal fossil fuel leasing contributes significantly to domestic and global greenhouse gas pollution while industrializing and degrading America's public lands and oceans.

From 2003 to 2014 approximately 25% of all United States and 3-4% of global fossil fuel greenhouse gas emissions are attributable to the Department of the Interior's leasing program.[133] Since 2008 the Obama administration has leased more than 35 million acres of federal public lands and oceans to the fossil fuel industry, with nearly 13 million acres of that total onshore.[134] Under current resource management plans, about 90% of lands administered by the Bureau in the 11 western states are available for new oil and gas leasing,[135] with additional acres available for new federal coal, oil shale, and tar sands leases.[136] More than 67 million acres of public land and oceans — an area 55 times larger than Grand Canyon National Park — are already leased to the fossil fuel industry. These leases contain up to 43 $GtCO_2e$.[137] And these staggering numbers are just the tip of the iceberg; more that 90% of the emissions potential of the federal mineral estate is contained in fossil fuel deposits that have yet to be leased, with onshore oil, gas, tar sands, and oil shale comprising over half that total.[138] These resources contain up to 450 $GtCO_2e$ — nearly half of the total remaining potential greenhouse emissions from all United States fossil fuel

[132] *See* The White House, Obama Administration Record on an All-of-the-Above Energy Strategy, Executive Office of the President, https://www.whitehouse.gov/sites/default/files/docs/clean_energy_record.pdf (last visited Dec. 20, 2015) (last visited Dec. 20, 2015).
[133] *See* Energy Information Administration, Sales of Fossil Fuels Produced from Federal and Indian Lands, FY 2003 through FY 2013 (June 2014) http://www.eia.gov/analysis/requests/federallands/pdf/eia-federallandsales.pdf; Climate Accountability Institute. Memorandum from Richard Heede to Friends of The Earth and Center for Biological Diversity (2015), available at: http://webiva-downton.s3.amazonaws.com/877/3a/7/5721/Exhibit_1-1_ONRR_ProdEmissions_Heede_7May15.pdf; Stratus Consulting, Greenhouse Gas Emissions from Fossil Energy Extracted from Federal Lands and Waters: An Update, 13 (2014) available at http://wilderness.org/sites/default/files/Stratus-Report.pdf.
[134] U.S. Energy Information Administration, Sales of Fossil Fuels Produced from Federal and Indian Lands, FY 2003 through FY 2013 (June 2014); U.S. Bureau of Land Management, Oil and Gas Statistics (2016), *available at* http://www.blm.gov/wo/st/en/prog/energy/oil_and_gas/statistics.html.
[135] *See* The Wilderness Society, Open For Business: How Public Lands Management Favors the Oil and Gas Industry (2014), *available at* http://wilderness.org/sites/default/files/TWS%20--%20BLM%20report_0.pdf.
[136] *See* U.S. Department of the Interior, Approved Land use Plan Amendments/Record of Decision for Allocation of Oil Shale and Tar Sands Resources on Lands Administered by the Bureau of Land Management in Colorado, Utah, and Wyoming (March 2013).
[137] Mulvaney *et al.* 2015 at 3.
[138] Mulvaney *et al.* 2015 at 18.

resources— and more than enough to propel the world far past a 1.5°C target.[139] Clearly, the current federal leasing program, if continued, is simply incompatible with any rational climate policy.

Staying within a carbon budget compatible with a 1.5°C target will necessitate leaving substantial portions of global and United States fossil fuels undeveloped. Unleased federal fossil fuel resources are among the easiest of such resources to leave in the ground, given the clear authority of the Secretary of the Interior to exercise discretion over leasing. Importantly, the issuance of additional federal fossil leases are not necessary in order to manage a prompt, just, and orderly transition to a 100% renewable energy economy in the United States. There is already more than sufficient non-federal coal, oil, and gas to exceed even the largest conceivable domestic carbon budget.[140]

Beginning the phase-out of fossil fuel production by ceasing new onshore leases for public fossil fuels would be a significant step toward the U.S. meeting the greenhouse gas emissions reduction targets announced under the Paris Agreement. The first systematic quantitative assessment of the emissions consequences of a cessation of federal leasing (both onshore and offshore) found that:

> [U]nder such a policy, U.S. coal production would steadily decline, moving closer to a pathway consistent with a global 2°C temperature limit. Oil and gas extraction would drop as well, but more gradually, as federal lands and waters represent a smaller fraction of national production, and these resources take longer to develop. Phasing out federal leases for fossil fuel extraction could reduce global CO2 emissions by 100 million tonnes per year by 2030, and by

[139]Mulvaney *et al.* 2015 at 18. Although coal accounts for the largest share of the United States' public lands CO_2 emissions, the contribution of oil and gas is highly significant. In addition to the emissions from the combustion of the oil and gas itself, emissions from drilling, stimulation, gathering, processing, and transmission operations also contribute greenhouse gas pollution, particularly via release of methane. This extremely potent greenhouse gas traps eighty-six times as much heat as carbon dioxide over a twenty-year period. IPCC AR5 Physical Science Basis Chapter 8 & Table 8.7. Although efforts continue to determine the precise amount of methane release from oil and gas operations, EPA has estimated that "oil and gas systems are the largest human-made source of methane emissions and account for 37 percent of methane emissions in the United States and is expected to be one of the most rapidly growing sources of anthropogenic methane emissions in the coming decades." U.S. Environmental Protection Agency, Natural Gas STAR Program, Basic Information, Major Methane Emission Sources and Opportunities to Reduce Methane Emissions. EPA's estimate is based on an estimated calculation of methane emissions, rather than measured actual emissions, which indicate that methane emissions may be much greater in volume than calculated. Miller, S. M. *et al.* Anthropogenic Emissions of Methane in the United States, Proc. Natl. Acad. Sci. Early Edition, DOI: 10.1073/pnas.1314392110 (2013).

[140] Mulvaney *et al.* 2015 at 6 & Figure 2; *see also* Raupach *et al.*, Supplementary Figure 7; McGlade and Ekins, 189 Table 1. This Petition cites Raupach and McGlade and Ekins's studies on U.S. emissions quotas for illustration purposes only; this Petition does not endorse equity assumptions made therein.

greater amounts thereafter.[141]

The ultimate success or failure of the United States' and global community's climate mitigation efforts depends in large part on whether countries are willing and able to leave the majority of their fossil fuel deposits in the ground. As discussed above, existing statutory authority confers considerable discretion on the Secretary of the Interior over the potential leasing of fossil fuels . Because extraction of non-federal fossil fuels is governed in part by economic and legal factors outside the direct control of the federal executive branch, any immediate federal effort to curb United States fossil fuel production should begin with federally-controlled fossil fuels. And because executive authority to limit federal fossil fuel production is strongest with regard to unleased fossil fuels, the easiest and most straightforward starting point is a cessation of new fossil fuel leasing.

By immediately deferring all new federal fossil fuel leasing, and eventually withdrawing federal lands from availability for leasing,[142] the Secretary can immediately remove somewhere between 319 and 450 $GtCO_2e$ of unleased fossil fuels from becoming part of the pool of potential global greenhouse gas emissions.[143] She can do this now, under existing statutory authority, without Congressional action.[144] Fundamentally, Congress chose, in the Mineral Leasing Act and all its subsequent amendments, to vest authority in the Executive to elect when, where, and how to make oil, gas, and coal available for leasing to private developers.The courts have long and consistently recognized that discretion. Given the scope of the climate crisis, the vast amounts of federal fossil fuels already under lease, and the pressing need to keep carbon in the ground to avert catastrophic climate change, the Secretary can and must exercise her discretion to ensure that no new leases for oil, gas, coal, oil shale, or tar sands be issued for federal public lands until a comprehensive strategy is in place to keep the United States' contributions to global greenhouse gas emissions within a range likely to limit warming to 1.5°C.

VI. Text of Proposed Order

Pursuant to 43 C.F.R. §14.2, and the reasons set forth above, Petitioners hereby request that the Secretary of the Interior issue a Secretarial Order consistent with or identical to the following proposed language:

> Pursuant to my discretionary authority under the Mineral Leasing Act (e.g., 30 U.S.C §§ 201, 226, 241, 352) and other statutes, and based on the reasons discussed herein, I conclude that further evaluation, additional receipt of public input, and comprehensive consideration of the Federal public lands fossil fuel

[141] Peter Erickson and Michael Lazarus, *How Would Phasing Out U.S. Federal Leases for Fossil Fuel Extraction Affect CO_2 Emissions and 2°C Goals?* 1, 31-32, Stockholm Environment Institute Working Paper 2016-02 (May 2016).
[142] *See* 43 U.S.C. § 1714(a).
[143] Mulvaney *et al.* 2015 at 18.
[144] *See* 30 U.S.C. §§ 226(c), 241 & *supra* Part IV.

program is warranted, and accordingly, I hereby direct BLM to take the following measures:

(i) Pause on the Issuance of New Federal Fossil Fuel Leases.

a. Pending Completion of Programmatic Review. No new nominations for fossil fuel leases shall be processed, nor lease sales conducted, prior to completion of the review described in part (ii). For pending nominations, no lease sales will be held, leases issued, or modifications approved, prior to completion of the review described in part (ii).

b. After Completion of Programmatic Review. Pursuant to my discretionary authority under the Mineral Leasing Act, I hereby determine that no federal public lands shall be considered eligible or available for fossil fuel mineral leasing until the satisfactory completion of the comprehensive environmental and climate review described in part (ii) and certification, based on the information provided in that review, that leasing is consistent with the United States' goal of limiting climate change to 1.5° Celsius above pre-industrial levels.

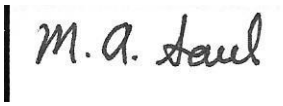
(ii) Comprehensive Programmatic Environmental Impact Statement. BLM shall prepare a Programmatic Environmental Impact Statement addressing the cumulative climate impacts of all Federal oil and gas, oil shale, tar sands, and coal leasing.

VII. Conclusion

As President Obama has recognized, "[u]ltimately, if we're going to prevent large parts of this Earth from becoming not only inhospitable but uninhabitable in our lifetimes, we're going to have to keep some fossil fuels in the ground rather than burn them and release more dangerous pollution into the sky."[145]The federal fossil fuel estate is the obvious and essential place where this global effort to keep fossil fuels in the ground must begin. Consequently, through this petition, Petitioners seek issuance of a Secretarial Order placing a moratorium on the issuance of *all* onshore federal fossil fuel leases (coal, oil and gas, oil shale, and tar sands) until and unless it can be demonstrated that resumption of such leasing is consistent with our national and international climate goals and obligations.

[145] Statement by the President on the Keystone XL Pipeline.

Respectfully submitted this 12th day of July, 2016,



Michael Saul
Senior Attorney
Center for Biological Diversity
1536 Wynkoop Street, Suite 421
Denver CO 80202
msaul@biologicaldiversity.org

Petition for a Moratorium on the Leasing of Federal Public Land Fossil Fuels – List of Petitioners

Jason Kowalski
Policy Director
350.org

Molly Ornati
Coordinator
350 Brooklyn

Melissa Brice
Founder
350 Chicago

Micah Parkin
Executive Director
350 Colorado

Patricia Hine
Co-founder and Director
350 Eugene

Natalie Pien
Chair
350 Loudoun & Unitarian Universalist Church of Loudoun Green Team

Renate Heurich
Co-founder
350 Louisiana - New Orleans

Sarah Lachance
Organizer
350 Maine

Laurie Litman
President
350 Sacramento

Pauline Seales
Organizer
350 Santa Cruz

Brian Haberly
Board Member
350 Silicon Valley

Stephen Malagodi
President
350 South Florida

Robert Shaw
Convenor
350 Waldo County

Rosemary Carey
President
350 NJ

Deirdre Aherne
Steering Committee Member
350NYC

Natalie Shuttleworth
CEO
A Glimpse of the Wild

Lynn Ellen Marsh
President
Advocates for Cherry Valley

Tara Sumner
Vice President
Advocates for Springfield, NY

David Delk
Co-Chair
Alliance for Democracy

Ken Dolsky
Director
Already Devalued and Devastated Homeowners of Parsippany

Leila Salazar-López
Executive Director
Amazon Watch

David Braun
Executive Director
Americans Against Fracking

Sarah Stewart
President
Animals Are Sentient Beings, Inc.

Laurel Brier
Apollo Kauai Energy Alliance

Petition for a Moratorium on the Leasing of Federal Public Land Fossil Fuels – List of Petitioners

Michaelann Bewsee
Executive Director
Arise for Social Justice

Dean Wilson
Executive Director
Atchafalaya Basinkeeper

Heather Cantino
Steering Committee Chair
Athens County Fracking Action Network

Chairman Larke
Director
Atlantic Energy

Clifford Krolick
Operations Leader
Back Country Excursions

Jim Lamm
President Emeritus
Ballona Creek Renaissance

Alex P. Brown
Executive Director
Bark

Marily Woodhouse
Director
Battle Creek Alliance

David Gassman
Facilitator
Bay Area System Change not Climate Change

Rebecca Casstevens
Sole Proprietor
BeanCounters Unlimited

Pat Lupo, OSB
Environmental Education and Advocacy Director
Benedictine Sisters Erie, PA

Karen Feridun
Steering Committee Member
Berks Gas Truth

Jane Winn
Executive Director
Berkshire Environmental Action Team

Jimmy Betts
Organizer
Beyond Extreme Energy

Ed Fallon
Direcor
Bold Iowa

Sahru Keiser
Program Manager
Breast Cancer Action

Jennifer Scarlott
Coordinator
Bronx Climate Justice North

Debbie Reyes
Director
California Prison Moratorium Project

Brian Eden
Vice-Chair
Campaign for Renewable Energy

Tevyn East
Carnival de Resistance

Tom Swan
Executive Director
CCAG

David Kyler
Executive Director
Center for a Sustainable Coast

Michael Saul
Senior Attorney
Center for Biological Diversity

Aura Vasquez
Climate Justice Director
Center for Popular Democracy

Petition for a Moratorium on the Leasing of Federal Public Land Fossil Fuels – List of Petitioners

Madeline Stano
Staff Attorney
Center on Race, Poverty & the Environment

Sid Robert Madison
Central Jersey Coalition Against Endless War

Martha Girolami
Member
Chatham Research Group

Mary Smith
Communications Coordinator
Church Women United in New York State

Ellen Rendulich
Director
Citizens Against Ruining the Environment

Paul Ferrazzi
Executive Director
Citizens Coalition for a Safe Community

Georgina Shanley
Co-founder
Citizens United for Renewable Energy (CURE)

Russell Zerbo
Advocacy Coordinator
Clean Air Council

Anne Butterfield
President
Clean Energy Action

Harriet Shugarman
Executive Director
ClimateMama

Victoria Furio
Convener
Climate Justice

Judith Canepa
Coordinator
Coalition Against the Rockaway Pipeline

Dave Ewoldt
Senior Analyst
Coalitions of Mutual Endeavor

Kathleen Maher
President
Coastal Monmouth Democratic Club

Karen Dike
Spokesperson
Coloradans Against Fracking

Denny Larson
Community Science Institute for Health and Justice

Donald Hebbard
President and Founder
Compressor Free Franklin

Eric Banford
Co-founder
Concerned Citizens of Danby

D. Robinson
CEO
Concerned Friends of Ferry County

Eddie Kurtz
President and Executive Director
Courage Campaign

Elijah Zarlin
Director of Climate Campaigns
CREDO

Carissa Miller
Campaign Associate
Daily Kos

Mavis Belisle
Board Member
Dallas Peace and Justice Center

Petition for a Moratorium on the Leasing of Federal Public Land Fossil Fuels – List of Petitioners

Mike Bucci
Member
Deep Green Resistance New York

Michael Hennen
President
Denton Drilling Awareness Group

Donna Charpied
Desert Protection Society

Anne D. Burt
Coordinator
Down to Earth Climate Justice Storytelling Project

Kathleen Rogers
President
Earth Day Network

Mary Gutierrez
Executive Director
Earth Ethics, Inc.

Jennifer Krill
Executive Director
Earthworks

SpencerVeale
Project Coordinator
East Bay Community Solar Project

Peter Sawtell
Executive Director
Eco-Justice Ministries

Wanda Guthrie
Convener
EcoJustice Working Group Thomas Merton Center

Tom Athanasiou
Executive Director
EcoEquity

Cara Campbell
Chair
Ecology Party of Florida

Brien Brennan
Co-founder
Elder Creek Ecological Preserve

Jill Merritt
Co-founder
Elders Rising

Colleen Boland
Co-founder
Elmirans & Friends Against Fracking

Dan Silver
Executive Director
Endangered Habitats League

Lydia Avila
Executive Director
Energy Action Coalition

Margie Alt
Environment America

Drew Hudson
Executive Director
Environmental Action

Joy Bergey
Director
Environmental Justice Center at Chestnut Hill United Church

Natalynne DeLapp
Executive Director
Environmental Protection Information Center

M. Neville Wall
Owner
Exodus Acres

Judi Poulson
Chair
Fairmont, MN Peace Group

Wenonah Hauter
Executive Director
Food and Water Watch

Petition for a Moratorium on the Leasing of Federal Public Land Fossil Fuels – List of Petitioners

Randy Hayes
Executive Director
Foundation Earth

Marc McCord
Executive Director
FracDallas

Patricia Popple
Organizer
Frac Sand Sentinel/Concerned Chippewa Citizens

Shane Davis
Executive Director
Fractivist.org

Carol Blankenship
Director
Friends of Butternuts

Ed Friedman
Chair
Friends of Merrymeeting Bay

Erich Pica
President
Friends of the Earth

AhminaMaxey
US & Canada Campaigns & Membership Coordinator
GAIA: Global Alliance for Incinerator Alternatives

YvonneTaylor
Vice President
Gas Free Seneca

Eric Balken
Executive Director
Glen Canyon Institute

Jaron Browne
National Organizer
Grassroots Global Justice Alliance

Randy Block
Chair
Gray Panthers, National Office

Jack Kupferman
President
Gray Panthers NYC Network

John Hadder
Director
Great Basin Resource Watch

Gloria Rivera, IHM
Coordinator
Great Lakes Bioneers Detroit

Shelley Silbert
Executive Director
Great Old Broads for Wilderness

Bradley Angel
Executive Director
Greenaction for Health and Environmental Justice

Lauren Wood
Director
Green River Action Project

Verne McArthur
Liaison
Green Team, Unitarian Universalist Society of Greater Springfield

Lore Rosenthal
Program Coordinator
Greenbelt Climate Action Network

Dorothy Pomponio
Groton Resource Awareness Coalition

Matt Pacenza
Executive Director
HEAL Utah

Myke Luurtsema
Co-chair
Heartwood

Petition for a Moratorium on the Leasing of Federal Public Land Fossil Fuels – List of Petitioners

Mary Turgi
Committee Chair
Holy Cross International Justice Office

F. Taylor
Coordinator
Hilton Head for Peace

Marilyn Elie
Member of the Leadership Council
Indian Point Safe Energy Coalition

Tom Goldtooth
Executive Director
Indigenous Environmental Network

Annette Marshall
Executive Director
Inner City Neighborhood Art House

Marty Landa
Organizer
Inspiration of Sedona

David Wimberly
Coordinator
It's Not Garbage Coalition

Kimberly Baker
Public Land Advocate
Klamath Forest Alliance

Joseph Vaile
Executive Director
KS Wild

Joe Uehlein
Executive Director
Labor Network for Sustainability

Al Weinrub
Coordinator
Local Clean Energy Alliance

Paul Gallimore
Director
Long Branch Environmental Education Center

Gregory Mello
Executive Director
Los Alamos Study Group

Jeff Kuyper
Executive Director
Los Padres Forest Watch

Kathy Callaway
Board Chair
Mainstreet Moms

Rachel Clark
Manhattan Project for a Nuclear-Free World

Mary Raven
Social Media Liaison
Merrimack Citizens for Pipeline Information

Kimberlee Wright
Executive Director
Midwest Advocates

Otto Butz
Founder
Milford Doers/Residents of Crumhorn Mountain

Cheryl Nenn
Riverkeeper
Milwaukee Riverkeeper

Beverly Edwards
Chair
Monadnock Energy Resources Initiative

Ty Markham
Co-Chair Director
Mormon Environmental Stewardship Alliance

April Keating
Chair
Mountain Lakes Preservation Alliance

Petition for a Moratorium on the Leasing of Federal Public Land Fossil Fuels – List of Petitioners

Beverly Braverman
Executive Director
Mountain Watershed Association, Inc.

Greg Yost
Organizer
NC PowerForward

Jim Warren
Executive Director
NC WARN

Mariel Nanasi
Executive Director
New Energy Economy

Matt Shapiro
President
New Jersey Tenants Organization

Joan Brown, OSF
Executive Director
New Mexico Interfaith Power and Light

Judith Canepa
Co-founder
New York Climate Action Group

Russ Haven
Legislative Council
New York Public Interest Research Group, Inc. (NYPIRG)

Ginger Storey-Welch
Local Leader
North Country 350 Alliance

Dale Pondysh
Treasurer
North Country Veterans for Peace

Executive Director
Nuclear Information and Resource Service

John LaForge
Co-director
Nukewatch a Project of the Progressive Foundation

Robert Kolodny
Coordinator
NY Buddhist Climate Action Network

Edie Kantrowitz
President
NYC Friends of Clearwater

Michael Stocker
Director
Ocean Conservation Research

Diane McAvoy
Occupy The Pipeline

Heather Taylor-Miesle
Political Director
Ohio Environmental Council

Dianne Bady
Project Coordinator
Ohio Valley Environmental Coalition

David Turnbull
Campaigns Director
Oil Change International

Alexis Baden-Mayer
Political Director
Organic Consumers Association

Angela Spotts
Spokesperson
Oklahoma Citizens for Responsible Oil & Gas Production

Page Atcheson
Co-Director
Oregon Climate

Kelly O'Hanley
Oregon Physicians for Social Responsibility

Doug Heiken
Conservation and Restoration Director
Oregon Wild

Petition for a Moratorium on the Leasing of Federal Public Land Fossil Fuels – List of Petitioners

Kaye Fissinger
President
Our Health, Our Future, Our Longmont

Cynthia Crowner
Organizer
PA Interfaith Moral-torium Coalition

Marcia Berry
PA-IPL

Alex Levinson
Executive Director
Pacific Environment

Mary Booth
Director
Partnership for Policy Integrity

Nancy O'Byrne
Executive Director
Pax Christi Florida

Norma J.F. Harrison
Central Committee Member
Peace and Freedom Party

Jenny Lisak
Co-director
Pennsylvania Alliance for Clean Water and Air

Karen Feridun
Steering Committee Member
Pennsylvanians Against Fracking

Andrea Miller
Executive Director
People Demanding Action

Diana Wright
Facilitator
People of Albany United for Safe Energy-PAUSE

Leslie Cagan
Coordinator
People's Climate Movement-NY

Barbara Gottlieb
Director of Environment and Health
Physicians for Social Responsibility

Barbara Warren
Director
Physicians for Social Responsibility, Arizona Chapter

Shannon Gearhart, MD, MPH
Secretary/Treasurer
Physicians for Social Responsibility, New York

Margaret Flowers
Co-Director
Popular Resistance

Eve Shapiro
Progressive Democrats of America

Ellen Moore
Mining Justice Organizer
Progressive Leadership Alliance of Nevada

John H Bradin
Steering Committee Member
QEW

Bob Musil
President and CEO
Rachel Carson Council

Lindsey Allen
Executive Director
Rainforest Action Network

Tim Keating
Executive Director
Rainforest Relief

William Kibler
Director of Policy
Raritan Headwaters

Petition for a Moratorium on the Leasing of Federal Public Land Fossil Fuels – List of Petitioners

Priscilla Mustin
Renac

Gerri Wiley
Co-founder
Residents Allied for the Future of Tioga

Kathy Redman
Organizer
Resilient Nacogdoches

Courtney Williams
Spokesperson
ResistAIM

Michael Kellett
Executive Director
RESTORE: The North Woods

Cori Redstone
Lead Organizer
Rising Tide Southern California

George Matthis
President
River Guardian Foundation

David Swanson
Campaign Coordinator
RootsAction

Jessica Wohlander
Director of Operations
Rootskeeper

Dan Becker
Director
Safe Climate Campaign

Russell Lowes
Research Director
SafeEnergyAnalyst.org

Nancy Vann
President
Safe Energy Rights Group (SEnRG)

Christian Gerlach
Volunteer Executive Director
Save Nevada's Water: Ban Fracking In Nevada

Lori Andresen
President
Save Our Sky Blue Waters

Kaitlin Butler
Program Director
Science and Environmental Health Network

Lena Moffit
Director Beyond Dirty Fuels
Sierra Club

Jen Miller
Ohio Chapter Director
Sierra Club Ohio Chapter

Anny Martinez
Environmental Education Chair
Sierra Club, New Jersey

Sara Schultz
Vice-chair
Sierra Club, Niagara Group

Sara Schultz
Co-Conservation Chair
Sierra Club, NY Chapter

Cassidy White
Alaska Climate and Renewable Energy Organizer
Sitka Conservation Society

David Kunhardt
CEO
SolEd Benefit Corp

Joe Galliani
Founding Organizer
South Bay Los Angeles 350 Climate Action Group

Petition for a Moratorium on the Leasing of Federal Public Land Fossil Fuels – List of Petitioners

Matthew Schwartz
Executive Director
South Florida Wildlands Association

Russell Donnelly
Chairperson
SouthEast Communities Against Pollution (SECAP)

Tabitha Tripp
Board of Directors
Southern Illinoisans Against Fracturing Our Environment

Alan Journet
Co-facilitator
Southern Oregon Climate Action Now

Matt Krogh
Extreme Oil Campaign Director
Stand

Angela Spotts
Spokesperson and Co-founder
Stop Fracking Payne County (Oklahoma)

Robby Diesu
National Coordinator
Stop the Frack Attack Advisory Council

Collin Rees
Organizer
Students for a Just and Stable Future

Aisha Delilah
Organizer
Sugar Shack Alliance

Michael Chojnicki
President
Sullivan Alliance for Sustainable Development

Shoshana Wechsler
Co-coordinator
Sunflower Alliance

Daphne Wysham
Director
Sustainable Energy & Economy Network

Kiki La Porta
President
Sustainable Marin

Gay Nicholson
President
Sustainable Tompkins

Adam Hasz
Executive Coordinator
SustainUS

Alyssa Burgin
Executive Director
Texas Drought Project

Avram Friedman
Executive Director
The Canary Coalition

Mike Petersen
Executive Director
The Lands Council

Don Ogden
Producer and Co-host
The Enviro Show

Jeremy Lent
President
The Liology Institute

Rabbi Arthur Waskow
Executive Director
The Shalom Center

Michaelann Bewsee
The Springfield Climate Justice Coalition

Dan York
Vice President
The Wildlands Conservancy

Petition for a Moratorium on the Leasing of Federal Public Land Fossil Fuels – List of Petitioners

Rabbi Michael Lerner
Founding Editor
Tikkun Magazine

James Kimball
Director
Time Laboratory

Priscilla Rich
Executive Director
Transition Express Inc.

Miriam Thompson
Labor Chair
Triangle Branch,Women's International League for Peace & Freedom

Todd Steiner
Executive Director
Turtle Island Restoration Network

Taquiena Boston
Director of Multicultural Growth and Witness
Unitarian Universalist Association

Anita Mentzer
Director
Unitarian Universalist Pennsylvania Legislative Advocacy Network (UUPLAN)

Susan Soleil
Executive Director
Utah Interfaith Power & Light

Brian Moench
President
Utah Physicians for a Healthy Environment

Joseph Nickolick
Elder Board Member
Valleywatch

Paddy Mcclelland
Director
Wall of Women Colorado

Daniel Estrin
General Counsel and Legal Director
Waterkeeper Alliance, Inc.

Elan Shapiro
Coordinating Team Member
We Are Seneca Lake

Janice Schroeder
Core Member
West Berkeley Alliance for Clean Air and Safe Jobs

Janine Blaeloch
Director
Western Lands Project

Cynthia Ellis
President
West Virginia Highlands Conservancy

Erik Schlenker-Goodrich
Executive Director
Western Environmental Law Center

Travis Bruner
Executive Director
Western Watersheds Project

Kirk Robinson
Executive Director
Western Wildlife Conservancy

Regina Asmutis-Silvia
Executive Director
Whale and Dolphin Conservation

Zachary Plopper
Conservation Director
WILDCOAST

John Horning
Executive Director
WildEarth Guardians

George Nickas
Executive Director
Wilderness Watch

Petition for a Moratorium on the Leasing of Federal Public Land Fossil Fuels – List of Petitioners

Jeri Bodemar
WILPF Earth Democracy, SC CAN

Christine Llewellyn
Director
Williamsburg Climate Action Network

Christine Ellis
Deputy Director
Winyah Rivers Foundation

Dace Zeps
Administrator
Wisconsin Network for Peace and Justice

Ginger Hintz
Program Manager
Women Donors Network

Osprey Orielle Lake
Executive Director
Women's Earth and Climate Action Network

John Harder
President
Zero Waste Kauai

Attachment B - List of References

Anderson, K. and A. Bows, Beyond 'Dangerous' Climate Change: Emission Scenarios for a New World, 369 Philosophical Transactions, Series A, Mathematical, Physical, and Engineering Sciences 20 (2011).

Beneke, Patricia J., The Federal Onshore Oil and Gas Leasing Reform Act of 1987: A Legislative History and Analysis, 4 J. Min. L. & Pol'y (1988)

Carbon Tracker Initiative, Unburnable Carbon – Are the world's financial markets carrying a carbon bubble? (2011)

Chen, I. et al., Rapid range shifts of species associated with high levels of climate warming, 333 Science 1024 (2011).

Cimons, Marlene and Jeff Nesbit, Keep It In the Ground, Sierra Club et al. (Jan. 25, 2016)

Climate Accountability Institute. Memorandum from Richard Heede to Friends of The Earth and Center for Biological Diversity (2015)

Climate Action Tracker, USA Rating Assessment webpage, http://climateactiontracker.org/countries/usa (accessed Apr 29, 2016)

CO2.earth, Annual Global Carbon Emissions, http://co2now.org/Current-CO2/CO2-Now/global-carbon-emissions.html (accessed Apr 29, 2016)

DARA and the Climate Vulnerability Forum, Climate Vulnerability Monitor, 2nd Edition: A Guide to the Cold Calculus of a Hot Planet (2012).

Esposito, Valerie et al., Climate Change and Ecosystem Services: The Contribution and Impacts on Federal Public Lands in the United States, USDA Forest Service Proceedings RMRS-P-64 (2011)

Foti, R., Met al., Signs of critical transition in the Everglades wetlands in response to climate and anthropogenic changes, 110 Proc. Natl. Acad. Sci. 6296-6300, (2013), doi:10.1073/pnas.1302558110

Frieler, K. M. et al., Limiting Global Warming to 2ºC is Unlikely to Save Most Coral Reefs, Nature Climate Change, Published Online (Sep 16, 2012), doi: 10.1038/NCLIMATE1674

Hansen, J.M. et al., Assessing "dangerous climate change": required reduction of carbon emissions to protect young people, future generations and nature, 8 PLoS ONE 8 e81648 (2013)

Hare, W. W. et al., Climate Hotspots: Key Vulnerable Regions, Climate Change and Limits to Warming, 11 Regional Environmental Change 1 (2011)

IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change at 64 & Table 2.2 [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)] at 63-64 & Table 2.2

IPCC, Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change at Table 7.2 [Edenhofer, O., R. Pichs-Madruga, Y.

Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA (2014)

IPCC, Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change 48 [Core Writing Team, Pachauri, R.K and Reisinger, A.(eds.)] (2007)

IPCC,The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change; Summary for Policymakers (2013)

Jones, C. et al, Committed Terrestrial Ecosystem Changes due to Climate Change, 2 Nature Geoscience 484 (2009)

MacDougall, A. H., et al., Significant contribution to climate warming from the permafrost carbon feedback, 5 Nature Geoscience 719-721 (2012), doi:10.1038/ngeo1573

Maclean, I. M. D. and R. J. Wilson, Recent ecological responses to climate change support predictions of high extinction risk, 108 Proc. Natl. Acad. Sci. 12337 (2011)

McGlade, Christophe & Ekins, Paul. The geographic distribution of fossil fuels unused when limiting global warming to 2°C, 517 Nature 187 (Jan. 2015)

Meinshausen, M. et al., Greenhouse gas emission targets for limiting global warming to 2 degrees Celsius, 458 Nature 1158–1162 (2009)

Melillo, Jerry M., Climate Change Impacts in the United States: The Third National Climate Assessment, Terese (T.C.) Richmond, and Gary W. Yohe, Eds., U.S. Global Change Research Program, doi:10.7930/J0Z31WJ2 (2014)

Miller, S. M. et al. Anthropogenic Emissions of Methane in the United States, Proc. Natl. Acad. Sci. Early Edition, DOI: 10.1073/pnas.1314392110 (2013).

Mulvaney, Dustin et al., The Potential Greenhouse Gas Emissions of U.S. Federal Fossil Fuels, EcoShift Consulting (2015).

Dustin Mulvaney *et al.*, Over-Leased: How Production Horizons of Already Leased Federal Fossil Fuels Outlast Global Carbon Budgets, EcoShift Consulting (2016).

National Oceanic and Atmospheric Administration, Recent Monthly Mean CO2 at Mauna Loa, http://www.esrl.noaa.gov/gmd/ccgg/trends/ (Dec. 2015).

National Research Council, Advancing the Science of Climate Change (2010)

Parmesan, C. and G. Yohe, A globally coherent fingerprint of climate change impacts across natural systems, 421 Nature 37 (2003)

Raupach, M. et al., Sharing a quota on cumulative carbon emissions. 4 Nature Climate Change 873 (2014)

Rogelj, Joeri et al., Energy system transformations for limiting end-of-century warming to below 1.5°C, 5 Nature Climate Change 519 (2015)

Root, T. et al., Fingerprints of global warming on wild animals and plants, 421 Nature 57 (2003)

Schaeffer, M. et al., Adequacy and Feasibility of the 1.5°C Long-Term Global Limit, Climate Analytics (2013)

Smith, J. B. et al., Assessing Dangerous Climate Change Through an Update of the Intergovernmental Panel on Climate Change (IPCC) 'Reasons for Concern', 106 Proc. Natl. Acad. Sci. 4133 (2009)

Stratus Consulting, Greenhouse Gas Emissions from Fossil Energy Extracted from Federal Lands and Waters: An Update, 13 (2014)

The White House, Obama Administration Record on an All-of-the-Above Energy Strategy, Executive Office of the President, https://www.whitehouse.gov/sites/default/files/docs/clean_energy_record.pdf (last visited Dec. 20, 2015).

The White House, Statement by the President on the Keystone XL Pipeline, Office of the Press Secretary (Nov. 6, 2015), https://www.whitehouse.gov/the-press-office/2015/11/06/statement-president-keystone-xl-pipeline

The White House, Statement by the President on the Paris Climate Agreement, Office of the Press Secretary (Dec. 12, 2015), https://www.whitehouse.gov/the-press-office/2015/12/12/statement-president-paris-climate-agreement.

The Wilderness Society, Open For Business: How Public Lands Management Favors the Oil and Gas Industry (2014)

Thomas, Chris D., et al., Extinction risk from climate change, 427 Nature 145 (2004)

U.N. Framework Convention on Climate Change Subsidiary Body for Scientific and Technological Advice, Report on the structured expert dialogue on the 2013-2015 review (2015)

U.N. Framework Convention on Climate Change, Cancun Agreement. Available at http://cancun.unfccc.int/ (last visited Jan 7, 2015)

U.N. Framework Convention on Climate Change, Copenhagen Accordt. Available at http://cancun.unfccc.int/ (last visited Jan 7, 2015)

U.S. Bureau of Land Management, Coal Operations, http://www.blm.gov/wo/st/en/prog/energy/coal_and_non-energy.html (accessed Apr 29, 2016)

U.S. Bureau of Land Management, Oil and Gas Leasing Reform – Land Use Planning and Lease Parcel Reviews, Instruction Memorandum No. 2010-117 (2010)

U.S. Bureau of Land Management, Oil and Gas Statistics (2015), http://www.blm.gov/wo/st/en/prog/energy/oil_and_gas/statistics.html.

U.S. Department of State, Background Briefing on the Paris Climate Agreement, (Dec. 12, 2015), http://www. state.gov/ r/pa/prs/ps/2015/12/250592.htm.

U.S. Department of the Interior, Approved Land use Plan Amendments/Record of Decision for Allocation of Oil Shale and Tar Sands Resources on Lands Administered by the Bureau of Land Management in Colorado, Utah, and Wyoming (March 2013)

U.S. Department of the Interior, Secretarial Order No. 3338: Discretionary Programmatic Environmental Impact Statement to Modernize the Federal Coal Program (Jan. 15, 2016)

U.S. Energy Information Administration, Sales of Fossil Fuels Produced from Federal and Indian Lands, FY 2003 through FY 2013 (June 2014)

U.S. Environmental Protection Agency, Climate Change and Public Lands: National Parks at Risk (1999)

U.S. Environmental Protection Agency, Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66,496 (Dec. 15, 2009)

United Nations Framework Convention on Climate Change, Conference of the Parties Nov. 30-Dec. 11, 2015, Adoption of the Paris Agreement Art. 2, U.N. Doc. FCCC/CP/2015/L.9 (Dec. 12, 2015)

United States Department of the Interior, Secretarial Order 2952 (Feb. 1973);

Veron, J. E. N. et al., The Coral Reef Crisis: The Critical Importance of <350 ppm CO2, 58 Marine Pollution Bulletin 1428 (2009)

Warren, R. J. et al., Increasing Impacts of Climate Change Upon Ecosystems with Increasing Global Mean Temperature Rise, 106 Climatic Change 144 (2011)

Whitney, Gene et al., U.S. Fossil Fuel Resources: Terminology, Reporting and Summary. Cong. Research Serv., R40872 (2010)

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL ON ENVIRONMENTAL QUALITY
WASHINGTON, D.C. 20503

August 1, 2016

MEMORANDUM FOR HEADS OF FEDERAL DEPARTMENTS AND AGENCIES

FROM: CHRISTINA GOLDFUSS
COUNCIL ON ENVIRONMENTAL QUALITY

SUBJECT: Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews

I. INTRODUCTION

The Council on Environmental Quality (CEQ) issues this guidance to assist Federal agencies in their consideration of the effects of greenhouse gas (GHG) emissions[1] and climate change when evaluating proposed Federal actions in accordance with the National Environmental Policy Act (NEPA) and the CEQ Regulations Implementing the Procedural Provisions of NEPA (CEQ Regulations).[2] This guidance will facilitate compliance with existing NEPA requirements, thereby improving the efficiency and consistency of reviews of proposed Federal actions for agencies, decision makers, project proponents, and the public.[3] The guidance provides Federal agencies a common

[1] For purposes of this guidance, CEQ defines GHGs in accordance with Section 19(m) of Exec. Order No. 13693, Planning for Federal Sustainability in the Next Decade, 80 Fed. Reg. 15869, 15882 (Mar. 25, 2015) (carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, nitrogen trifluoride, and sulfur hexafluoride). Also for purposes of this guidance, "emissions" includes release of stored GHGs as a result of land management activities affecting terrestrial GHG pools such as, but not limited to, carbon stocks in forests and soils, as well as actions that affect the future changes in carbon stocks. The common unit of measurement for GHGs is metric tons of CO_2 equivalent (mt CO_2-e).

[2] *See* 42 U.S.C. 4321 et seq.; 40 CFR Parts 1500–1508.

[3] This guidance is not a rule or regulation, and the recommendations it contains may not apply to a particular situation based upon the individual facts and circumstances. This guidance does not change or substitute for any law, regulation, or other legally binding

approach for assessing their proposed actions, while recognizing each agency's unique circumstances and authorities.[4]

Climate change is a fundamental environmental issue, and its effects fall squarely within NEPA's purview.[5] Climate change is a particularly complex challenge given its global nature and the inherent interrelationships among its sources, causation, mechanisms of action, and impacts. Analyzing a proposed action's GHG emissions and the effects of climate change relevant to a proposed action—particularly how climate change may change an action's environmental effects—can provide useful information to decision makers and the public.

CEQ is issuing the guidance to provide for greater clarity and more consistency in how agencies address climate change in the environmental impact assessment process. This guidance uses longstanding NEPA principles because such an analysis should be similar to the analysis of other environmental impacts under NEPA. The guidance is intended to assist agencies in disclosing and considering the reasonably foreseeable effects of proposed actions that are relevant to their decision-making processes. It confirms that agencies should provide the public and decision makers with explanations of the basis for agency determinations.

---

requirement, and is not legally enforceable. The use of non-mandatory language such as "guidance," "recommend," "may," "should," and "can," is intended to describe CEQ policies and recommendations. The use of mandatory terminology such as "must" and "required" is intended to describe controlling requirements under the terms of NEPA and the CEQ regulations, but this document does not affect legally binding requirements.

[4] This guidance also addresses recommendations offered by a number of stakeholders. *See* President's State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience, *Recommendations to the President* (November 2014), p. 20 (recommendation 2.7), *available at* www.whitehouse.gov/sites/default/files/docs/task_force_report_0.pdf; U.S. Government Accountability Office, *Future Federal Adaptation Efforts Could Better Support Local Infrastructure Decision Makers*, (Apr. 2013), *available at* http://www.gao.gov/assets/660/653741.pdf. Public comments on drafts of this guidance document are available at http://www.whitehouse.gov/administration/eop/ceq/initiatives/nepa/comments.

[5] NEPA recognizes "the profound impact of man's activity on the interrelations of all components of the natural environment." (42 U.S.C. 4331(a)). It was enacted to, *inter alia,* "promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man." (42 U.S.C. 4321).

Focused and effective consideration of climate change in NEPA reviews[6] will allow agencies to improve the quality of their decisions. Identifying important interactions between a changing climate and the environmental impacts from a proposed action can help Federal agencies and other decision makers identify practicable opportunities to reduce GHG emissions, improve environmental outcomes, and contribute to safeguarding communities and their infrastructure against the effects of extreme weather events and other climate-related impacts.

Agencies implement NEPA through one of three levels of NEPA analysis: a Categorical Exclusion (CE); an Environmental Assessment (EA); or an Environmental Impact Statement (EIS). This guidance is intended to help Federal agencies ensure their analysis of potential GHG emissions and effects of climate change in an EA or EIS is commensurate with the extent of the effects of the proposed action.[7] Agencies have discretion in how they tailor their individual NEPA reviews to accommodate the approach outlined in this guidance, consistent with the CEQ Regulations and their respective implementing procedures and policies.[8] CEQ does not expect that implementation of this guidance will require agencies to develop new NEPA implementing procedures. However, CEQ recommends that agencies review their NEPA procedures and propose any updates they deem necessary or appropriate to facilitate their consideration of GHG emissions and climate change.[9] CEQ will review agency

[6] The term "NEPA review" is used to include the analysis, process, and documentation required under NEPA. While this document focuses on NEPA reviews, agencies are encouraged to analyze GHG emissions and climate-resilient design issues early in the planning and development of proposed actions and projects under their substantive authorities.
[7] *See* 40 CFR 1502.2(b) (Impacts shall be discussed in proportion to their significance); 40 CFR 1502.15 (Data and analyses in a statement shall be commensurate with the importance of the impact…).
[8] *See* 40 CFR 1502.24 (Methodology and scientific accuracy).
[9] *See* 40 CFR 1507.3. Agency NEPA implementing procedures can be, but are not required to be, in the form of regulation. Section 1507.3 encourages agencies to publish explanatory guidance, and agencies also should consider whether any updates to explanatory guidance are necessary. Agencies should review their policies and implementing procedures and revise them as necessary to ensure full compliance with NEPA.

proposals for revising their NEPA procedures, including any revision of CEs, in light of this guidance.

As discussed in this guidance, when addressing climate change agencies should consider: (1) The potential effects of a proposed action on climate change as indicated by assessing GHG emissions (e.g., to include, where applicable, carbon sequestration);[10] and, (2) The effects of climate change on a proposed action and its environmental impacts.

This guidance explains the application of NEPA principles and practices to the analysis of GHG emissions and climate change, and

- Recommends that agencies quantify a proposed agency action's projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools that are suitable for the proposed agency action;
- Recommends that agencies use projected GHG emissions (to include, where applicable, carbon sequestration implications associated with the proposed agency action) as a proxy for assessing potential climate change effects when preparing a NEPA analysis for a proposed agency action;
- Recommends that where agencies do not quantify a proposed agency action's projected GHG emissions because tools, methodologies, or data inputs are not reasonably available to support calculations for a quantitative analysis, agencies include a qualitative analysis in the NEPA document and explain the basis for determining that quantification is not reasonably available;

[10] Carbon sequestration is the long-term carbon storage in plants, soils, geologic formations, and oceans.

- Discusses methods to appropriately analyze reasonably foreseeable direct, indirect, and cumulative GHG emissions and climate effects;
- Guides the consideration of reasonable alternatives and recommends agencies consider the short- and long-term effects and benefits in the alternatives and mitigation analysis;
- Advises agencies to use available information when assessing the potential future state of the affected environment in a NEPA analysis, instead of undertaking new research that is , and provides examples of existing sources of scientific information;
- Counsels agencies to use the information developed during the NEPA review to consider alternatives that would make the actions and affected communities more resilient to the effects of a changing climate;
- Outlines special considerations for agencies analyzing biogenic carbon dioxide sources and carbon stocks associated with land and resource management actions under NEPA;
- Recommends that agencies select the appropriate level of NEPA review to assess the broad-scale effects of GHG emissions and climate change, either to inform programmatic (e.g., landscape-scale) decisions, or at both the programmatic and tiered project- or site-specific level, and to set forth a reasoned explanation for the agency's approach; and
- Counsels agencies that the "rule of reason" inherent in NEPA and the CEQ Regulations allows agencies to determine, based on their expertise and

experience, how to consider an environmental effect and prepare an analysis based on the available information.

II. BACKGROUND

A. NEPA

NEPA is designed to promote consideration of potential effects on the human environment[11] that would result from proposed Federal agency actions, and to provide the public and decision makers with useful information regarding reasonable alternatives[12] and mitigation measures to improve the environmental outcomes of Federal agency actions. NEPA ensures that the environmental effects of proposed actions are taken into account before decisions are made and informs the public of significant environmental effects of proposed Federal agency actions, promoting transparency and accountability concerning Federal actions that may significantly affect the quality of the human environment. NEPA reviews should identify measures to avoid, minimize, or mitigate adverse effects of Federal agency actions. Better analysis and decisions are the ultimate goal of the NEPA process.[13]

Inherent in NEPA and the CEQ Regulations is a "rule of reason" that allows agencies to determine, based on their expertise and experience, how to consider an environmental effect and prepare an analysis based on the available information. The usefulness of that information to the decision-making process and the public, and the

[11] 40 CFR 1508.14 ("'Human environment' shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment.").
[12] 40 CFR 1508.25(b) ("Alternatives, which include: (1) No action alternative. (2) Other reasonable courses of actions. (3) Mitigation measures (not in the proposed action).").
[13] 40 CFR 1500.1(c) ("Ultimately, of course, it is not better documents but better decisions that count. NEPA's purpose is not to generate paperwork—even excellent paperwork—but to foster excellent action. The NEPA process is intended to help public officials make decisions that are based on understanding of environmental consequences, and take actions that protect, restore, and enhance the environment.").

extent of the anticipated environmental consequences are important factors to consider when applying that "rule of reason."

B. Climate Change

Climate change science continues to expand and refine our understanding of the impacts of anthropogenic GHG emissions. CEQ's first Annual Report in 1970 referenced climate change, indicating that "[m]an may be changing his weather."[14] At that time, the mean level of atmospheric carbon dioxide (CO_2) had been measured as increasing to 325 parts per million (ppm) from an average of 280 ppm pre-Industrial levels.[15] Since 1970, the concentration of atmospheric carbon dioxide has increased to approximately 400 ppm (2015 globally averaged value).[16] Since the publication of CEQ's first Annual Report, it has been determined that human activities have caused the carbon dioxide content of the atmosphere of our planet to increase to its highest level in at least 800,000 years.[17]

It is now well established that rising global atmospheric GHG emission concentrations are significantly affecting the Earth's climate. These conclusions are built upon a scientific record that has been created with substantial contributions from the

[14] *See* CEQ, *Environmental Quality The First Annual Report*, p. 93 (August 1970); *available at* https://ceq.doe.gov/ceq_reports/annual_environmental_quality_reports.html.
[15] *See* USGCRP, *Climate Change Impacts in the United States The Third National Climate Assessment* (Jerry M. Melillo, Terese (T.C.) Richmond, & Gary W. Yohe eds., 2014) [hereinafter "Third National Climate Assessment"], *Appendix 3 Climate Science Supplement*, p. 739; EPA, April 2015: *Inventory of U.S. Greenhouse Emissions and Sinks 1990-2013, available at* https://www3.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2015-Main-Text.pdf. *See also* Hartmann, D.L., A.M.G. Klein Tank, M. Rusticucci, et al., *2013 Observations Atmosphere and Surface. In Climate Change 2013 The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.-K., et al. (eds)]. Cambridge University Press: Cambridge, United Kingdom and New York, NY, USA. *Available at* http://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_Chapter02_Final.pdf.
[16] *See* Ed Dlugokencky & Pieter Tans, National Oceanic and Atmospheric Administration/Earth System Research Laboratory, http://www.esrl.noaa.gov/gmd/ccgg/trends/global.html.
[17] *See* http://earthobservatory.nasa.gov/Features/CarbonCycle; University of California Riverside, National Aeronautics and Space Administration (NASA), and Riverside Unified School District, *Down to Earth Climate Change*, http://globalclimate.ucr.edu/resources.html; USGCRP, *Third National Climate Assessment, Appendix 3 Climate Science Supplement*, p. 736 ("Although climate changes in the past have been caused by natural factors, human activities are now the dominant agents of change. Human activities are affecting climate through increasing atmospheric levels of heat-trapping gases and other substances, including particles.").

United States Global Change Research Program (USGCRP), which informs the United States' response to global climate change through coordinated Federal programs of research, education, communication, and decision support.[18] Studies have projected the effects of increasing GHGs on many resources normally discussed in the NEPA process, including water availability, ocean acidity, sea-level rise, ecosystem functions, energy production, agriculture and food security, air quality and human health.[19]

Based primarily on the scientific assessments of the USGCRP, the National Research Council, and the Intergovernmental Panel on Climate Change, in 2009 the Environmental Protection Agency (EPA) issued a finding that the changes in our climate caused by elevated concentrations of greenhouse gases in the atmosphere are reasonably anticipated to endanger the public health and public welfare of current and future generations.[20] In 2015, EPA acknowledged more recent scientific assessments that "highlight the urgency of addressing the rising concentration of CO_2 in the atmosphere," finding that certain groups are especially vulnerable to climate-related effects.[21] Broadly

---

[18] *See* Global Change Research Act of 1990, Pub. L. 101–606, Sec. 103 (November 16, 1990). For additional information on the United States Global Change Research Program [hereinafter "USGCRP"], visit http://www.globalchange.gov. The USGCRP, formerly the Climate Change Science Program, coordinates and integrates the activities of 13 Federal agencies that conduct research on changes in the global environment and their implications for society. The USGCRP began as a Presidential initiative in 1989 and was codified in the Global Change Research Act of 1990 (Public Law 101–606). USGCRP-participating agencies are the Departments of Agriculture, Commerce, Defense, Energy, Interior, Health and Human Services, State, and Transportation; the U.S. Agency for International Development, the Environmental Protection Agency, NASA, the National Science Foundation, and the Smithsonian Institution.

[19] *See* USGCRP, *Third National Climate Assessment*, *available at* http://nca2014.globalchange.gov/system/files_force/downloads/low/NCA3_Climate_Change_Impacts_in_the_United%20States_LowRes.pdf?download=1; IPCC, *Climate Change 2014 Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (R.K. Pachauri, & L.A. Meyer eds., 2014), *available at* https://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full.pdf; *see also* http://www.globalchange.gov; 40 CFR 1508.8 (effects include ecological, aesthetic, historic, cultural, economic, social, and health effects); USGCRP, *The Impacts of Climate Change on Human Health in the United States A Scientific Assessment, available at* https://health2016.globalchange.gov/.

[20] *See generally Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act*, 74 Fed. Reg. 66496 (Dec. 15, 2009). (For example, at 66497-98: "[t]he evidence concerning how human-induced climate change may alter extreme weather events also clearly supports a finding of endangerment, given the serious adverse impacts that can result from such events and the increase in risk, even if small, of the occurrence and intensity of events such as hurricanes and floods. Additionally, public health is expected to be adversely affected by an increase in the severity of coastal storm events due to rising sea levels").

[21] *See* EPA, *Final Rule for Carbon Pollution Emission Guidelines for Existing Stationary Sources Electric Utility Generating Units*, 80 Fed. Reg. 64661, 64677 (Oct. 23, 2015) ("Certain groups, including children, the elderly, and the poor, are most vulnerable to climate-related effects. Recent studies also find that certain communities, including low-income communities and some communities of color … are disproportionately affected by certain climate change related impacts—including heat waves, degraded air quality, and

stated, the effects of climate change observed to date and projected to occur in the future include more frequent and intense heat waves, longer fire seasons and more severe wildfires, degraded air quality, more heavy downpours and flooding, increased drought, greater sea-level rise, more intense storms, harm to water resources, harm to agriculture, ocean acidification, and harm to wildlife and ecosystems.[22]

III. CONSIDERING THE EFFECTS OF GHG EMISSIONS AND CLIMATE CHANGE

This guidance is applicable to all Federal actions subject to NEPA, including site-specific actions, certain funding of site-specific projects, rulemaking actions, permitting decisions, and land and resource management decisions.[23] This guidance does not – and cannot – expand the range of Federal agency actions that are subject to NEPA. Consistent with NEPA, Federal agencies should consider the extent to which a proposed action and its reasonable alternatives would contribute to climate change, through GHG emissions, and take into account the ways in which a changing climate may impact the proposed action and any alternative actions, change the action's environmental effects over the lifetime of those effects, and alter the overall environmental implications of such actions.

This guidance is intended to assist agencies in disclosing and considering the effects of GHG emissions and climate change along with the other reasonably foreseeable environmental effects of their proposed actions. This guidance does not establish any

extreme weather events—which are associated with increased deaths, illnesses, and economic challenges. Studies also find that climate change poses particular threats to the health, well-being, and ways of life of indigenous peoples in the U.S.").

[22] *See* http://www.globalchange.gov/climate-change/impacts-society and Third National Climate Assessment, Chapters 3-15 (Sectors) and Chapters 16-25 (Regions), *available at* http://nca2014.globalchange.gov/downloads.

[23] *See* 40 CFR 1508.18.

particular quantity of GHG emissions as "significantly" affecting the quality of the human environment or give greater consideration to the effects of GHG emissions and climate change over other effects on the human environment.

A. GHG Emissions as a Proxy for the Climate Change Impacts of a Proposed Action

In light of the global scope of the impacts of GHG emissions, and the incremental contribution of each single action to global concentrations, CEQ recommends agencies use the projected GHG emissions associated with proposed actions as a proxy for assessing proposed actions' potential effects on climate change in NEPA analysis.[24] This approach, together with providing a qualitative summary discussion of the impacts of GHG emissions based on authoritative reports such as the USGCRP's National Climate Assessments and the Impacts of Climate Change on Human Health in the United States, a Scientific Assessment of the USGCRP, allows an agency to present the environmental and public health impacts of a proposed action in clear terms and with sufficient information to make a reasoned choice between no action and other alternatives and appropriate mitigation measures, and to ensure the professional and scientific integrity of the NEPA review.[25]

Climate change results from the incremental addition of GHG emissions from millions of individual sources,[26] which collectively have a large impact on a global scale.

[24] *See* 40 CFR 1502.16, 1508.9.
[25] *See* 40 CFR 1500.1, 1502.24 (requiring agencies to use high quality information and ensure the professional and scientific integrity of the discussions and analyses in environmental impact statements).
[26] Some sources emit GHGs in quantities that are orders of magnitude greater than others. *See* EPA, *Greenhouse Gas Reporting Program 2014 Reported Data*, Figure 2: Direct GHG Emissions Reported by Sector (2014), *available at* https://www.epa.gov/ghgreporting/ghgrp-2014-reported-data (amounts of GHG emissions by sector); *Final Rule for Carbon Pollution Emission Guidelines for Existing Stationary Sources Electric Utility Generating Units*, 80 Fed. Reg. 64661, 64663, 64689 (Oct. 23, 2015) (regulation of GHG emissions from fossil fuel-fired electricity generating power plants); *Oil and Natural Gas Sector Emission Standards for New, Reconstructed, and Modified Sources*, 81 Fed. Reg. 34824, 35830 (June 3, 2016 (regulation of GHG emissions from oil and gas sector).

CEQ recognizes that the totality of climate change impacts is not attributable to any single action, but are exacerbated by a series of actions including actions taken pursuant to decisions of the Federal Government. Therefore, a statement that emissions from a proposed Federal action represent only a small fraction of global emissions is essentially a statement about the nature of the climate change challenge, and is not an appropriate basis for deciding whether or to what extent to consider climate change impacts under NEPA. Moreover, these comparisons are also not an appropriate method for characterizing the potential impacts associated with a proposed action and its alternatives and mitigations because this approach does not reveal anything beyond the nature of the climate change challenge itself: the fact that diverse individual sources of emissions each make a relatively small addition to global atmospheric GHG concentrations that collectively have a large impact. When considering GHG emissions and their significance, agencies should use appropriate tools and methodologies for quantifying GHG emissions and comparing GHG quantities across alternative scenarios. Agencies should not limit themselves to calculating a proposed action's emissions as a percentage of sector, nationwide, or global emissions in deciding whether or to what extent to consider climate change impacts under NEPA.

1. GHG Emissions Quantification and Relevant Tools

This guidance recommends that agencies quantify a proposed agency action's projected direct and indirect GHG emissions. Agencies should be guided by the principle that the extent of the analysis should be commensurate with the quantity of projected GHG emissions and take into account available data and GHG quantification tools that

are suitable for and commensurate with the proposed agency action.[27] The rule of reason and the concept of proportionality caution against providing an in-depth analysis of emissions regardless of the insignificance of the quantity of GHG emissions that would be caused by the proposed agency action.

Quantification tools are widely available, and are already in broad use in the Federal and private sectors, by state and local governments, and globally.[28] Such quantification tools and methodologies have been developed to assist institutions, organizations, agencies, and companies with different levels of technical sophistication, data availability, and GHG source profiles. When data inputs are reasonably available to support calculations, agencies should conduct GHG analysis and disclose quantitative estimates of GHG emissions in their NEPA reviews. These tools can provide estimates of GHG emissions, including emissions from fossil fuel combustion and estimates of GHG emissions and carbon sequestration for many of the sources and sinks potentially affected by proposed resource management actions.[29] When considering which tool(s) to employ, it is important to consider the proposed action's temporal scale, and the availability of input data.[30] Examples of the kinds of methodologies agencies might consider using are presented in CEQ's 2012 Guidance for Accounting and Reporting GHG Emissions for a wide variety of activities associated with Federal agency operations.[31] When an agency determines that quantifying GHG emissions would not be

[27] *See* 40 CFR 1500.1(b) ("Most important, NEPA documents must concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail."); 40 CFR 1502.2(b) (Impacts shall be discussed in proportion to their significance); 40 CFR 1502.15 (Data and analyses in a statement shall be commensurate with the importance of the impact…).
[28] *See* https://ceq.doe.gov/current_developments/GHG-accounting-tools.html.
[29] For example, USDA's COMET-Farm tool can be used to assess the carbon sequestration of existing agricultural activities along with the reduction in carbon sequestration (emissions) of project-level activities, http://cometfarm.nrel.colostate.edu/. Examples of other tools are available at https://ceq.doe.gov/current_developments/GHG-accounting-tools.html.
[30] *See* 40 CFR 1502.22.
[31] *See*
https://www.whitehouse.gov/sites/default/files/microsites/ceq/revised_federal_greenhouse_gas_accounting_and_reporting_guidance_

warranted because tools, methodologies, or data inputs are not reasonably available, the agency should provide a qualitative analysis and its rationale for determining that the quantitative analysis is not warranted. A qualitative analysis can rely on sector-specific descriptions of the GHG emissions of the category of Federal agency action that is the subject of the NEPA analysis.

When updating their NEPA procedures[32] and guidance, agencies should coordinate with CEQ to identify 1) the actions that normally warrant quantification of their GHG emissions, and consideration of the relative GHG emissions associated with alternative actions and 2) agency actions that normally do not warrant such quantification because tools, methodologies, or data inputs are not reasonably available. The determination of the potential significance of a proposed action remains subject to agency practice for the consideration of context and intensity, as set forth in the CEQ Regulations.[33]

2. The Scope of the Proposed Action

In order to assess effects, agencies should take account of the proposed action – including "connected" actions[34] – subject to reasonable limits based on feasibility and practicality. Activities that have a reasonably close causal relationship to the Federal action, such as those that may occur as a predicate for a proposed agency action or as a consequence of a proposed agency action, should be accounted for in the NEPA analysis.

060412.pdf. Federal agencies' Strategic Sustainability Performance Plans reflecting their annual GHG inventories and reports under Executive Order 13514 are available at https://www.performance.gov/node/3406/view?view=public#supporting-info.

[32] *See* 40 CFR 1507.3.

[33] 40 CFR 1508.27 ("'Significantly' as used in NEPA requires considerations of both context and intensity: (a) Context. This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. . . . (b) Intensity. This refers to the severity of impact.").

[34] 40 CFR 1508.25(a) (Actions are connected if they: (i) Automatically trigger other actions which may require environmental impact statements; (ii) Cannot or will not proceed unless other actions are taken previously or simultaneously, or; (iii) Are interdependent parts of a larger action and depend on the larger action for their justification.).

For example, NEPA reviews for proposed resource extraction and development projects typically include the reasonably foreseeable effects of various phases in the process, such as clearing land for the project, building access roads, extraction, transport, refining, processing, using the resource, disassembly, disposal, and reclamation. Depending on the relationship between any of the phases, as well as the authority under which they may be carried out, agencies should use the analytical scope that best informs their decision making.

The agency should focus on significant potential effects and conduct an analysis that is proportionate to the environmental consequences of the proposed action.[35] Agencies can rely on basic NEPA principles to determine and explain the reasonable parameters of their analyses in order to disclose the reasonably foreseeable effects that may result from their proposed actions.[36]

3. Alternatives

Considering alternatives, including alternatives that mitigate GHG emissions, is fundamental to the NEPA process and accords with NEPA Sections 102(2)(C) and 102(2)(E).[37] The CEQ regulations emphasize that the alternatives analysis is the heart of the EIS under NEPA Section 102(2)(C).[38] NEPA Section 102(2)(E) provides an independent requirement for the consideration of alternatives in environmental documents.[39] NEPA calls upon agencies to use the NEPA process to "identify and assess the reasonable alternatives to proposed actions that will avoid or minimize adverse effects of these actions upon the quality of the human environment."[40] The requirement to

[35] *See* 40 CFR 1501.7(a)(3), 1502.2(b), and 1502.15.
[36] *See* 40 CFR 1502.16.
[37] 42 U.S.C. 4332(2)(C), 4332(2)(E); 40 CFR 1502.14, 1508.9(b).
[38] 40 CFR 1502.14.
[39] *See* 40 CFR 1500.2, 1508.9(b).
[40] 40 CFR 1500.2(c).

consider alternatives ensures that agencies account for approaches with no, or less, adverse environmental effects for a particular resource.

Consideration of alternatives also provides each agency decision maker the information needed to examine other possible approaches to a particular proposed action (including the no action alternative) that could alter the environmental impact or the balance of factors considered in making the decision. Agency decisions are aided when there are reasonable alternatives that allow for comparing GHG emissions and carbon sequestration potential, trade-offs with other environmental values, and the risk from – and resilience to – climate change inherent in a proposed action and its design.

Agencies must consider a range of reasonable alternatives consistent with the level of NEPA review (e.g., EA or EIS) and the purpose and need for the proposed action, as well as reasonable mitigation measures if not already included in the proposed action or alternatives.[41] Accordingly, a comparison of these alternatives based on GHG emissions and any potential mitigation measures can be useful to advance a reasoned choice among alternatives and mitigation actions. When conducting the analysis, an agency should compare the anticipated levels of GHG emissions from each alternative – including the no-action alternative – and mitigation actions to provide information to the public and enable the decision maker to make an informed choice.

Agencies should consider reasonable alternatives and mitigation measures to reduce action-related GHG emissions or increase carbon sequestration in the same fashion as they consider alternatives and mitigation measures for any other environmental effects. NEPA, the CEQ Regulations, and this guidance do not require the decision

[41] *See* 42 U.S.C. 4332(2)(C), 4332(2)(E), and 40 CFR 1502.14(f), 1508.9(b). The purpose and need for action usually reflects both the extent of the agency's statutory authority and its policies.

maker to select the alternative with the lowest net level of emissions. Rather, they allow for the careful consideration of emissions and mitigation measures along with all the other factors considered in making a final decision.

4. Direct and Indirect Effects

If the direct and indirect GHG emissions can be quantified based on available information, including reasonable projections and assumptions, agencies should consider and disclose the reasonably foreseeable direct and indirect emissions when analyzing the direct and indirect effects of the proposed action.[42] Agencies should disclose the information and any assumptions used in the analysis and explain any uncertainties.

To compare a project's estimated direct and indirect emissions with GHG emissions from the no-action alternative, agencies should draw on existing, timely, objective, and authoritative analyses, such as those by the Energy Information Administration, the Federal Energy Management Program, or Office of Fossil Energy of the Department of Energy.[43] In the absence of such analyses, agencies should use other available information. When such analyses or information for quantification is unavailable, or the complexity of comparing emissions from various sources would make quantification overly speculative, then the agency should quantify emissions to the extent that this information is available and explain the extent to which quantified emissions information is unavailable while providing a qualitative analysis of those emissions. As

[42] For example, where the proposed action involves fossil fuel extraction, direct emissions typically include GHGs emitted during the process of exploring for or extracting the fossil fuel. The indirect effects of such an action that are reasonably foreseeable at the time would vary with the circumstances of the proposed action. For actions such as a Federal lease sale of coal for energy production, the impacts associated with the end-use of the fossil fuel being extracted would be the reasonably foreseeable combustion of that coal.
[43] For a current example, see Office of Fossil Energy, Nat'l Energy Tech. Lab., U.S. Dep't of Energy, *Life Cycle Greenhouse Gas Perspective on Exporting Liquefied Natural Gas from the United States*, Pub. No. DOE/NETL-2014/1649 (2014), *available at* http://energy.gov/sites/prod/files/2014/05/f16/Life%20Cycle%20GHG%20Perspective%20Report.pdf.

with any NEPA analysis, the level of effort should be proportionate to the scale of the emissions relevant to the NEPA review.

5. Cumulative Effects

"Cumulative impact" is defined in the CEQ Regulations as the "impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions."[44] All GHG emissions contribute to cumulative climate change impacts. However, for most Federal agency actions CEQ does not expect that an EIS would be required based *solely* on the global significance of cumulative impacts of GHG emissions, as it would not be consistent with the rule of reason to require the preparation of an EIS for every Federal action that may cause GHG emissions regardless of the magnitude of those emissions.

Based on the agency identification and analysis of the direct and indirect effects of its proposed action, NEPA requires an agency to consider the cumulative impacts of its proposed action and reasonable alternatives.[45] As noted above, for the purposes of NEPA, the analysis of the effects of GHG emissions is essentially a cumulative effects analysis that is subsumed within the general analysis and discussion of climate change impacts. Therefore, direct and indirect effects analysis for GHG emissions will adequately address the cumulative impacts for climate change from the proposed action and its alternatives and a separate cumulative effects analysis for GHG emissions is not needed.

6. Short- and Long-Term Effects

[44] 40 CFR 1508.7.
[45] *See* 40 CFR 1502.16, 1508.7, 1508.8. *See also* CEQ Memorandum to Heads of Federal Agencies, *Guidance on the Consideration of Past Actions in Cumulative Effects Analysis*, June 24, 2005, *available at* https//ceq.doe.gov/nepa/regs/Guidance_on_CE.pdf.

When considering effects, agencies should take into account both the short- and long-term adverse and beneficial effects using a temporal scope that is grounded in the concept of reasonable foreseeability. Some proposed actions will have to consider effects at different stages to ensure the direct effects and reasonably foreseeable indirect effects are appropriately assessed; for example, the effects of construction are different from the effects of the operations and maintenance of a facility.

Biogenic GHG emissions and carbon stocks from some land or resource management activities, such as a prescribed burn of a forest or grassland conducted to limit loss of ecosystem function through wildfires or insect infestations, may result in short-term GHG emissions and loss of stored carbon, while in the longer term a restored, healthy ecosystem may provide long-term carbon sequestration. Therefore, the short- and long-term effects should be described in comparison to the no action alternative in the NEPA review.

7. Mitigation

Mitigation is an important component of the NEPA process that Federal agencies can use to avoid, minimize, and compensate for the adverse environmental effects associated with their actions. Mitigation, by definition, includes avoiding impacts, minimizing impacts by limiting them, rectifying the impact, reducing or eliminating the impacts over time, or compensating for them.[46] Consequently, agencies should consider reasonable mitigation measures and alternatives as provided for under existing CEQ Regulations and take into account relevant agency statutory authorities and policies. The NEPA process is also intended to provide useful advice and information to State, local

[46] *See* 40 CFR 1508.20, 1508.25 (Alternatives include mitigation measures not included in the proposed action).

and tribal governments and private parties so that the agencies can better coordinate with other agencies and organizations regarding the means to mitigate effects of their actions.[47] The NEPA process considers the effects of mitigation commitments made by project proponents or others and mitigation required under other relevant permitting and environmental review regimes.[48]

As Federal agencies evaluate potential mitigation of GHG emissions and the interaction of a proposed action with climate change, the agencies should also carefully evaluate the quality of that mitigation to ensure it is additional, verifiable, durable, enforceable, and will be implemented.[49] Agencies should consider the potential for mitigation measures to reduce or mitigate GHG emissions and climate change effects when those measures are reasonable and consistent with achieving the purpose and need for the proposed action. Such mitigation measures could include enhanced energy efficiency, lower GHG-emitting technology, carbon capture, carbon sequestration (e.g., forest, agricultural soils, and coastal habitat restoration), sustainable land management practices, and capturing or beneficially using GHG emissions such as methane.

Finally, the CEQ Regulations and guidance recognize the value of monitoring to ensure that mitigation is carried out as provided in a record of decision or finding of no significant impact.[50] The agency's final decision on the proposed action should identify those mitigation measures that the agency commits to take, recommends, or requires

---

[47] NEPA directs Federal agencies to make "advice and information useful in restoring, maintaining, and enhancing the quality of the environment" available to States, Tribes, counties, cities, institutions and individuals. NEPA Sec. 102(2)(G).
[48] *See* CEQ Memorandum to Heads of Federal Agencies, *Appropriate Use of Mitigation and Monitoring and Clarifying the Appropriate Use of Mitigated Findings of No Significant Impact*, 76 FR 3843 (Jan. 21, 2011) *available at* https://ceq.doe.gov/current_developments/docs/Mitigation_and_Monitoring_Guidance_14Jan2011.pdf.
[49] *See* Presidential Memorandum: *Mitigating Impacts on Natural Resources from Development and Encouraging Related Private Investment* (https://www.whitehouse.gov/the-press-office/2015/11/03/mitigating-impacts-natural-resources-development-and-encouraging-related) defining "durability" and addressing additionality.
[50] *See* 40 CFR 1505.2(c), 1505.3. *See also* CEQ Memorandum to Heads of Federal Agencies, *Appropriate Use of Mitigation and Monitoring and Clarifying the Appropriate Use of Mitigated Findings of No Significant Impact*, 76 FR 3843 (Jan. 21, 2011) *available at* https://ceq.doe.gov/current_developments/docs/Mitigation_and_Monitoring_Guidance_14Jan2011.pdf.

others to take. Monitoring is particularly appropriate to confirm the effectiveness of mitigation when that mitigation is adopted to reduce the impacts of a proposed action on affected resources already increasingly vulnerable due to climate change.

B. CONSIDERING THE EFFECTS OF CLIMATE CHANGE ON A PROPOSED ACTION AND ITS ENVIRONMENTAL IMPACTS

According to the USGCRP and others, GHGs already in the atmosphere will continue altering the climate system into the future, even with current or future emissions control efforts.[51] Therefore, a NEPA review should consider an action in the context of the future state of the environment. In addition, climate change adaptation and resilience — defined as adjustments to natural or human systems in response to actual or expected climate changes — are important considerations for agencies contemplating and planning actions with effects that will occur both at the time of implementation and into the future.[52]

1. Affected Environment

An agency should identify the affected environment to provide a basis for comparing the current and the future state of the environment as affected by the proposed action or its reasonable alternatives.[53] The current and projected future state of the environment without the proposed action (i.e., the no action alternative) represents the reasonably foreseeable affected environment, and this should be described based on

[51] *See* Third National Climate Assessment, *Appendix 3 Climate Science Supplement* 753-754, *available at* http://s3.amazonaws.com/nca2014/low/NCA3_Full_Report_Appendix_3_Climate_Science_Supplement_LowRes.pdf?download=1.
[52] *See* Third National Climate Assessment, Chapter 28, "Adaptation" and Chapter 26, "Decision Support: Connecting Science, Risk Perception, and Decisions," *available at* http://www.globalchange.gov/nca3-downloads-materials; see also, Exec. Order No. 13653, 78 Fed. Reg. 66817 (Nov. 6, 2013) and Exec. Order No.13693, *Planning for Federal Sustainability in the Next Decade*, 80 Fed. Reg. 15869 (Mach 25, 2015) (defining "climate-resilient design").
[53] *See* 40 CFR 1502.15 (providing that environmental impact statements shall succinctly describe the environmental impacts on the area(s) to be affected or created by the alternatives under consideration).

authoritative climate change reports,[54] which often project at least two possible future scenarios.[55] The temporal bounds for the state of the environment are determined by the projected initiation of implementation and the expected life of the proposed action and its effects.[56] Agencies should remain aware of the evolving body of scientific information as more refined estimates of the impacts of climate change, both globally and at a localized level, become available.[57]

2. Impacts

The analysis of climate change impacts should focus on those aspects of the human environment that are impacted by both the proposed action and climate change. Climate change can make a resource, ecosystem, human community, or structure more susceptible to many types of impacts and lessen its resilience to other environmental impacts apart from climate change. This increase in vulnerability can exacerbate the effects of the proposed action. For example, a proposed action may require water from a stream that has diminishing quantities of available water because of decreased snow pack in the mountains, or add heat to a water body that is already warming due to increasing atmospheric temperatures. Such considerations are squarely within the scope of NEPA and can inform decisions on whether to proceed with, and how to design, the proposed action to eliminate or mitigate impacts exacerbated by climate change. They can also

[54] *See, e.g.,* Third National Climate Assessment (Regional impacts chapters) *available at* http://www.globalchange.gov/nca3-downloads-materials.
[55] *See, e.g.,* Third National Climate Assessment (Regional impacts chapters, considering a low future global emissions scenario, and a high emissions scenario) *available at* http://www.globalchange.gov/nca3-downloads-materials.
[56] CEQ, *Considering Cumulative Effects Under the National Environmental Policy Act* (1997), https://ceq.doe.gov/publications/cumulative_effects html. Agencies should also consider their work under Exec. Order No. 13653, *Preparing the United States for the Impacts of Climate Change*, 78 Fed. Reg. 66817 (Nov. 6, 2013), that considers how capital investments will be affected by a changing climate over time.
[57] *See, e.g.,* http://nca2014.globalchange.gov/report/regions/coasts.

inform possible adaptation measures to address the impacts of climate change, ultimately enabling the selection of smarter, more resilient actions.

3. Available Assessments and Scenarios

In accordance with NEPA's rule of reason and standards for obtaining information regarding reasonably foreseeable effects on the human environment, agencies need not undertake new research or analysis of potential climate change impacts in the proposed action area, but may instead summarize and incorporate by reference the relevant scientific literature.[58] For example, agencies may summarize and incorporate by reference the relevant chapters of the most recent national climate assessments or reports from the USGCRP.[59] Particularly relevant to some proposed actions are the most current reports on climate change impacts on water resources, ecosystems, agriculture and forestry, health, coastlines, and ocean and arctic regions in the United States.[60] Agencies may recognize that scenarios or climate modeling information (including seasonal, inter-annual, long-term, and regional-scale projections) are widely used, but when relying on a single study or projection, agencies should consider their limitations and discuss them.[61]

4. Opportunities for Resilience and Adaptation

As called for under NEPA, the CEQ Regulations, and CEQ guidance, the NEPA review process should be integrated with agency planning at the earliest possible time that would allow for a meaningful analysis.[62] Information developed during early

[58] *See* 40 CFR 1502.21 (material may be incorporated by reference if it is reasonably available for inspection by potentially interested persons during public review and comment).
[59] *See* http://www.globalchange.gov/browse/reports.
[60] *See* Third National Climate Assessment, *Our Changing Climate*, *available at* http://nca2014.globalchange.gov/report. Agencies should consider the latest final assessments and reports when they are updated.
[61] *See* 40 CFR 1502.22. Agencies can consult www.data.gov/climate/portals for model data archives, visualization tools, and downscaling results.
[62] *See* 42 U.S.C. 4332 ("agencies of the Federal Government shall … utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision-making"); 40 CFR 1501.2 ("Agencies shall integrate the NEPA process with other planning at the earliest possible time…"); *See also* CEQ Memorandum

planning processes that precede a NEPA review may be incorporated into the NEPA review. Decades of NEPA practice have shown that integrating environmental considerations with the planning process provides useful information that program and project planners can consider in the design of the proposed action, alternatives, and potential mitigation measures. For instance, agencies should take into account increased risks associated with development in floodplains, avoiding such development wherever there is a practicable alternative, as required by Executive Order 11988 and Executive Order 13690.[63] In addition, agencies should take into account their ongoing efforts to incorporate environmental justice principles into their programs, policies, and activities, including the environmental justice strategies required by Executive Order 12898, as amended, and consider whether the effects of climate change in association with the effects of the proposed action may result in a disproportionate effect on minority and low income communities.[64] Agencies also may consider co-benefits of the proposed action, alternatives, and potential mitigation measures for human health, economic and social stability, ecosystem services, or other benefit that increases climate change preparedness or resilience. Individual agency adaptation plans and interagency adaptation strategies, such as agency Climate Adaptation Plans, the National Fish, Wildlife and Plants Climate Adaptation Strategy, and the National Action Plan: Priorities for Managing Freshwater

for Heads of Federal Departments and Agencies, *Improving the Process for Preparing Efficient and Timely Environmental Reviews under the National Environmental Policy Act*, 77 Fed. Reg. 14473 (Mar. 12, 2012), *available at* https://ceq.doe.gov/current_developments/docs/Improving_NEPA_Efficiencies_06Mar2012.pdf.

[63] *See* Exec. Order No. 11988, "Floodplain Management," 42 Fed. Reg. 26951 (May 24, 1977), *available at* http://www.archives.gov/federal-register/codification/executive-order/11988.html; Exec. Order No. 13690, *Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input*, 80 Fed. Reg. 6425 (Jan. 30, 2015), *available at* https://www.gpo.gov/fdsys/pkg/FR-2015-02-04/pdf/2015-02379.pdf.

[64] *See* Exec. Order No. 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*, 59 Fed. Reg. 7629 (Feb. 16, 1994), *available at* https://ceq.doe.gov/nepa/regs/eos/ii-5.pdf; CEQ, *Environmental Justice Guidance Under the National Environmental Policy Act* (Dec. 1997), *available at* http://ceq.doe.gov/nepa/regs/ej/justice.pdf.

Resources in a Changing Climate, provide other good examples of the type of relevant and useful information that can be considered.[65]

Climate change effects on the environment and on the proposed project should be considered in the analysis of a project considered vulnerable to the effects of climate change such as increasing sea level, drought, high intensity precipitation events, increased fire risk, or ecological change. In such cases, a NEPA review will provide relevant information that agencies can use to consider in the initial project design, as well as alternatives with preferable overall environmental outcomes and improved resilience to climate impacts. For example, an agency considering a proposed long-term development of transportation infrastructure on a coastal barrier island should take into account climate change effects on the environment and, as applicable, consequences of rebuilding where sea level rise and more intense storms will shorten the projected life of the project and change its effects on the environment.[66] Given the length of time involved in present sea level projections, such considerations typically will not be relevant to short-term actions with short-term effects.

In addition, the particular impacts of climate change on vulnerable communities may be considered in the design of the action or the selection among alternatives to

---

[65] *See* http://sustainability.performance.gov for agency sustainability plans, which contain agency adaptation plans. *See also* http://www.wildlifeadaptationstrategy.gov; http://www.whitehouse.gov/sites/default/files/microsites/ceq/2011_national_action_plan.pdf; and https://www.epa.gov/greeningepa/climate-change-adaptation-plans

[66] *See* U.S. Department of Transportation, Gulf Coast Study, Phase 2, *Assessing Transportation Vulnerability to Climate Change Synthesis of Lessons Learned and Methods Applied*, FHWA-HEP-15-007 (Oct. 2014) (focusing on the Mobile, Alabama region), *available at* http://www.fhwa.dot.gov/environment/climate_change/adaptation/ongoing_and_current_research/gulf_coast_study/phase2_task6/fhwahep15007.pdf; U.S. Climate Change Science Program, Synthesis and Assessment Product 4.7, Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I (Mar. 2008) (focusing on a regional scale in the central Gulf Coast), *available at* https://downloads.globalchange.gov/sap/sap4-7/sap4-7-final-all.pdf. Information about the Gulf Coast Study is *available at* *http //www.fhwa.dot.gov/environment/climate_change/adaptation/ongoing_and_current_research/gulf_coast_study*. *See also* Third National Climate Assessment, Chapter 28, "Adaptation," at 675 (noting that Federal agencies in particular can facilitate climate adaptation by "ensuring the establishment of federal policies that allow for "flexible" adaptation efforts and take steps to avoid unintended consequences"), *available at* http://nca2014.globalchange.gov/report/response-strategies/adaptation#intro-section-2.

assess the impact, and potential for disproportionate impacts, on those communities.[67] For example, chemical facilities located near the coastline could have increased risk of spills or leakages due to sea level rise or increased storm surges, putting local communities and environmental resources at greater risk. Increased resilience could minimize such potential future effects. Finally, considering climate change preparedness and resilience can help ensure that agencies evaluate the potential for generating additional GHGs if a project has to be replaced, repaired, or modified, and minimize the risk of expending additional time and funds in the future.

C. Special Considerations for Biogenic Sources of Carbon

With regard to biogenic GHG emissions from land management actions – such as prescribed burning, timber stand improvements, fuel load reductions, scheduled harvesting, and livestock grazing – it is important to recognize that these land management actions involve GHG emissions and carbon sequestration that operate within the global carbon and nitrogen cycle, which may be affected by those actions. Similarly, some water management practices have GHG emission consequences (e.g., reservoir management practices can reduce methane releases, wetlands management practices can enhance carbon sequestration, and water conservation can improve energy efficiency).

Notably, it is possible that the net effect of ecosystem restoration actions resulting in short-term biogenic emissions may lead to long-term reductions of atmospheric GHG concentrations through increases in carbon stocks or reduced risks of future emissions. In the land and resource management context, how a proposed action affects a net carbon sink or source will depend on multiple factors such as the climatic region, the distribution

[67] For an example, *see* https://www.blm.gov/epl-front-office/projects/nepa/5251/42462/45213/NPR-A_FINAL_ROD_2-21-13.pdf.

of carbon across carbon pools in the project area, and the ongoing activities and trends. In addressing biogenic GHG emissions, resource management agencies should include a comparison of estimated net GHG emissions and carbon stock changes that are projected to occur with and without implementation of proposed land or resource management actions.[68] This analysis should take into account the GHG emissions, carbon sequestration potential, and the changes in carbon stocks that are relevant to decision making in light of the proposed actions and timeframes under consideration.

One example of agencies dealing with biogenic emissions and carbon sequestration arises when agencies consider proposed vegetation management practices that affect the risk of wildfire, insect and disease outbreak, or other disturbance. The public and the decision maker may benefit from consideration of the influence of a vegetation management action that affects the risk of wildfire on net GHG emissions and carbon stock changes. NEPA reviews should consider whether to include a comparison of net GHG emissions and carbon stock changes that are anticipated to occur, with and without implementation of the proposed vegetation management practice, to provide information that is useful to the decision maker and the public to distinguish between alternatives. The analysis would take into account the estimated GHG emissions (biogenic and fossil), carbon sequestration potential, and the net change in carbon stocks relevant in light of the proposed actions and timeframes under consideration. In such cases the agency should describe the basis for estimates used to project the probability or likelihood of occurrence or changes in the effects or severity of wildfire. Where such

[68] One example of a tool for such calculations is the Carbon On Line Estimator (COLE), which uses data based on USDA Forest Service Forest Inventory & Analysis and Resource Planning Assessment data and other ecological data. COLE began as a collaboration between the National Council for Air and Stream Improvement, Inc. (NCASI) and USDA Forest Service, Northern Research Station. It currently is maintained by NCASI. It is available at http://www.fs.usda.gov/ccrc/tools/cole.

tools, methodologies, or data are not yet available, the agency should provide a qualitative analysis and its rationale for determining that the quantitative analysis is not warranted. As with any other analysis, the rule of reason and proportionality should be applied to determine the extent of the analysis.

CEQ acknowledges that Federal land and resource management agencies are developing agency-specific principles and guidance for considering biological carbon in management and planning decisions.[69] Such guidance is expected to address the importance of considering biogenic carbon fluxes and storage within the context of other management objectives and ecosystem service goals, and integrating carbon considerations as part of a balanced and comprehensive program of sustainable management, climate change mitigation, and climate change adaptation.

IV. TRADITIONAL NEPA TOOLS AND PRACTICES

A. Scoping and Framing the NEPA Review

To effectuate integrated decision making, avoid duplication, and focus the NEPA review, the CEQ Regulations provide for scoping.[70] In scoping, the agency determines the issues that the NEPA review will address and identifies the impacts related to the proposed action that the analyses will consider.[71] An agency can use the scoping process to help it determine whether analysis is relevant and, if so, the extent of analysis

[69] *See* Council on Climate Change Preparedness and Resilience, *Priority Agenda Enhancing the Climate Resilience of America's Natural Resources*, at 52 (Oct. 2014), *available at* http://www.whitehouse.gov/sites/default/files/docs/enhancing_climate_resilience_of_americas_natural_resources.pdf.
[70] *See* 40 CFR 1501.7 ("There shall be an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action. This process shall be termed scoping."); *see also* CEQ Memorandum for Heads of Federal Departments and Agencies, *Improving the Process for Preparing Efficient and Timely Environmental Reviews under the National Environmental Policy Act*, March 6, 2012, *available at* https://ceq.doe.gov/current_developments/docs/Improving_NEPA_Efficiencies_06Mar2012.pdf (the CEQ Regulations explicitly require scoping for preparing an EIS, however, agencies can also take advantage of scoping whenever preparing an EA).
[71] *See* 40 CFR 1500.4(b), 1500.4(g), 1501.7.

appropriate for a proposed action.[72] When scoping for the climate change issues associated with the proposed agency action, the nature, location, timeframe, and type of the proposed action and the extent of its effects will help determine the degree to which to consider climate projections, including whether climate change considerations warrant emphasis, detailed analysis, and disclosure.

Consistent with this guidance, agencies may develop their own agency-specific practices and guidance for framing the NEPA review. Grounded on the principles of proportionality and the rule of reason, such aids can help an agency determine the extent to which an analysis of GHG emissions and climate change impacts should be explored in the decision-making process and will assist in the analysis of the no action and proposed alternatives and mitigation.[73] The agency should explain such a framing process and its application to the proposed action to the decision makers and the public during the NEPA review and in the EA or EIS document.

B. Frame of Reference

When discussing GHG emissions, as for all environmental impacts, it can be helpful to provide the decision maker and the public with a recognizable frame of reference for comparing alternatives and mitigation measures. Agencies should discuss relevant approved federal, regional, state, tribal, or local plans, policies, or laws for GHG emission reductions or climate adaptation to make clear whether a proposed project's

[72] *See* 40 CFR 1501.7 (The agency preparing the NEPA analysis must use the scoping process to, among other things, determine the scope and identify the significant issues to be analyzed in depth) and CEQ, *Memorandum for General Counsels, NEPA Liaisons, and Participants in Scoping*, April 30, 1981, *available at* https://ceq.doe.gov/nepa/regs/scope/scoping.htm.

[73] *See, e.g.,* Matthew P. Thompson, Bruce G. Marcot, Frank R. Thompson, III, Steven McNulty, Larry A. Fisher, Michael C. Runge, David Cleaves, and Monica Tomosy, *The Science of Decisionmaking Applications for Sustainable Forest and Grassland Management in the National Forest System* (2013), *available at* http://www.fs.fed.us/rm/pubs_other/rmrs_2013_thompson_m004.pdf; U.S. Forest Service Comparative Risk Assessment Framework And Tools, *available at* www.fs.fed.us/psw/topics/fire_science/craft/craft; and Julien Martin, Michael C. Runge, James D. Nichols, Bruce C. Lubow, and William L. Kendall, *Structured decision making as a conceptual framework to identify thresholds for conservation and management* (2009), Ecological Applications 19:1079–1090, *available at* http://www.esajournals.org/doi/abs/10.1890/08-0255.1.

GHG emissions are consistent with such plans or laws.[74] For example, the Bureau of Land Management has discussed how agency actions in California, especially joint projects with the State, may or may not facilitate California reaching its emission reduction goals under the State's Assembly Bill 32 (Global Warming Solutions Act).[75] This approach helps frame the policy context for the agency decision based on its NEPA review.

C. Incorporation by Reference

Incorporation by reference is of great value in considering GHG emissions or where an agency is considering the implications of climate change for the proposed action and its environmental effects. Agencies should identify situations where prior studies or NEPA analyses are likely to cover emissions or adaptation issues, in whole or in part. When larger scale analyses have considered climate change impacts and GHG emissions, calculating GHG emissions and carbon stocks for a specific action may provide only limited information beyond the information already collected and considered in the larger scale analyses. The NEPA reviews for a specific action can incorporate by reference earlier programmatic studies or information such as management plans, inventories, assessments, and research that consider potential changes in carbon stocks, as well as any relevant programmatic NEPA reviews.[76]

Accordingly, agencies should use the scoping process to consider whether they should incorporate by reference GHG analyses from other programmatic studies, action

[74] *See* 40 CFR 1502.16(c), 1506.2(d) (where an inconsistency exists, agencies should describe the extent to which the agency will reconcile its proposed action with the plan or law). *See also* Exec. Order No. 13693, 80 Fed. Reg. 15869 (Mar. 25, 2015) (establishing GHG emission and related goals for agency facilities and operations. Scope 1, 2, and 3 emissions are typically separate and distinct from analyses and information used in an EA or EIS.).
[75] *See*, *e.g.*, U.S. Bureau of Land Management, Desert Renewable Energy Conservation Plan Proposed Land Use Plan Amendment and Final Environmental Impact Statement, Vol. I, § I.3.3.2, at 12, *available at* http://drecp.org/finaldrecp/.
[76] *See* 40 CFR 1502.5, 1502.21.

specific NEPA reviews, or programmatic NEPA reviews to avoid duplication of effort. Furthermore, agencies should engage other agencies and stakeholders with expertise or an interest in related actions to participate in the scoping process to identify relevant GHG and adaptation analyses from other actions or programmatic NEPA documents.

D. Using Available Information

Agencies should make decisions using current scientific information and methodologies. CEQ does not expect agencies to fund and conduct original climate change research to support their NEPA analyses or for agencies to require project proponents to do so. Agencies should exercise their discretion to select and use the tools, methodologies, and scientific and research information that are of high quality and available to assess the impacts.[77]

Agencies should be aware of the ongoing efforts to address the impacts of climate change on human health and vulnerable communities.[78] Certain groups, including children, the elderly, and the poor, are more vulnerable to climate-related health effects, and may face barriers to engaging on issues that disproportionately affect them. CEQ recommends that agencies periodically engage their environmental justice experts, and the Federal Interagency Working Group on Environmental Justice, [79] to identify approaches to avoid or minimize impacts that may have disproportionately high and

[77] *See* 40 CFR 1502.24 (requiring agencies to ensure the professional and scientific integrity of the discussions and analyses in environmental impact statements).
[78] USGCRP, *The Impacts of Climate Change on Human Health in the United States A Scientific Assessment* (Apr. 2016), *available at* https://health2016.globalchange.gov/downloads.
[79] For more information on the Federal Interagency Working Group on Environmental Justice co-chaired by EPA and CEQ, *see* http://www.epa.gov/environmentaljustice/interagency/index.html.

adverse human health or environmental effects on minority and low-income populations.[80]

E. Programmatic or Broad-Based Studies and NEPA Reviews

Agency decisions can address different geographic scales that can range from the programmatic or landscape level to the site- or project-specific level. Agencies sometimes conduct analyses or studies that are not NEPA reviews at the national level or other broad scale level (e.g., landscape, regional, or watershed) to assess the status of one or more resources or to determine trends in changing environmental conditions.[81] In the context of long-range energy, transportation, and resource management strategies an agency may decide that it would be useful and efficient to provide an aggregate analysis of GHG emissions or climate change effects in a programmatic analysis and then incorporate by reference that analysis into future NEPA reviews.

A tiered, analytical decision-making approach using a programmatic NEPA review is used for many types of Federal actions[82] and can be particularly relevant to addressing proposed land, aquatic, and other resource management plans. Under such an approach, an agency conducts a broad-scale programmatic NEPA analysis for decisions such as establishing or revising USDA Forest Service land management plans, Bureau of Land Management resource management plans, or Natural Resources Conservation Service conservation programs. Subsequent NEPA analyses for proposed site-specific

[80] *President's Memorandum for the Heads of All Departments and Agencies, Executive Order on Federal Actions to Address Environmental Justice in Minority and Low-Income Populations* (Feb. 11, 1994), *available at* https://ceq.doe.gov/nepa/regs/eos/ii-5.pdf; CEQ, *Environmental Justice Guidance Under the National Environmental Policy Act*, *available at* https://ceq.doe.gov/nepa/regs/ej/justice.pdf.

[81] Such a programmatic study is distinct from a programmatic NEPA review which is appropriate when the action under consideration is itself subject to NEPA requirements. *See* CEQ, *Memorandum for Heads of Federal Departments and Agencies, Effective Use of Programmatic NEPA Reviews*, Dec. 18, 2014, § I(A), p. 9, *available at* https://www.whitehouse.gov/sites/default/files/docs/effective_use_of_programmatic_nepa_reviews_final_dec2014_searchable.pdf (discussing non-NEPA types of programmatic analyses such as data collection, assessments, and research, which previous NEPA guidance described as joint inventories or planning studies).

[82] *See* 40 CFR 1502.20, 1508.28. A programmatic NEPA review may be appropriate when a decision is being made that is subject to NEPA, such as establishing formal plans, programs, and policies, and when considering a suite of similar projects.

decisions – such as proposed actions that implement land, aquatic, and other resource management plans – may be tiered from the broader programmatic analysis, drawing upon its basic framework analysis to avoid repeating analytical efforts for each tiered decision. Examples of project- or site-specific actions that may benefit from being able to tier to a programmatic NEPA review include: constructing transmission lines; conducting prescribed burns; approving grazing leases; granting rights-of-way; issuing leases for oil and gas drilling; authorizing construction of wind, solar or geothermal projects; and approving hard rock mineral extraction.

A programmatic NEPA review may also serve as an efficient mechanism in which to assess Federal agency efforts to adopt broad-scale sustainable practices for energy efficiency, GHG emissions avoidance and emissions reduction measures, petroleum product use reduction, and renewable energy use, as well as other sustainability practices.[83] While broad department- or agency-wide goals may be of a far larger scale than a particular program, policy, or proposed action, an analysis that informs how a particular action affects that broader goal can be of value.

F. Monetizing Costs and Benefits

NEPA does not require monetizing costs and benefits. Furthermore, the weighing of the merits and drawbacks of the various alternatives need not be displayed using a monetary cost-benefit analysis and should not be when there are important qualitative considerations.[84] When an agency determines that a monetized assessment of the impacts of greenhouse gas emissions or a monetary cost-benefit analysis is appropriate and

[83] *See* Exec. Order No. 13693, 80 Fed. Reg. 15869 (Mar. 25, 2015).
[84] *See* 40 CFR 1502.23.

relevant to the choice among different alternatives being considered, such analysis may be incorporated by reference[85] or appended to the NEPA document as an aid in evaluating the environmental consequences.[86] For example, a rulemaking could have useful information for the NEPA review in an associated regulatory impact analysis which could be incorporated by reference.[87] When using a monetary cost-benefit analysis, just as with tools to quantify emissions, the agency should disclose the assumptions, alternative inputs, and levels of uncertainty associated with such analysis. Finally, if an agency chooses to monetize some but not all impacts of an action, the agency providing this additional information should explain its rationale for doing so.[88]

V. CONCLUSION AND EFFECTIVE DATE

Agencies should apply this guidance to all new proposed agency actions when a NEPA review is initiated. Agencies should exercise judgment when considering whether to apply this guidance to the extent practicable to an on-going NEPA process. CEQ does not expect agencies to apply this guidance to concluded NEPA reviews and actions for

[85] *See* 40 CFR 1502.21 (material may be cited if it is reasonably available for inspection by potentially interested persons within the time allowed for public review and comment).

[86] When conducting a cost-benefit analysis, determining an appropriate method for preparing a cost-benefit analysis is a decision left to the agency's discretion, taking into account established practices for cost-benefit analysis with strong theoretical underpinnings (for example, see OMB Circular A-4 and references therein). For example, the Federal social cost of carbon (SCC) estimates the marginal damages associated with an increase in carbon dioxide emissions in a given year. Developed through an interagency process committed to ensuring that the SCC estimates reflect the best available science and methodologies and used to assess the social benefits of reducing carbon dioxide emissions across alternatives in rulemakings, it provides a harmonized, interagency metric that can give decision makers and the public useful information for their NEPA review. For current Federal estimates, *see* Interagency Working Group on Social Cost of Carbon, United States Government, *Technical Support Document Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866* (revised July 2015), *available at* https://www.whitehouse.gov/omb/oira/social-cost-of-carbon.

[87] For example, the regulatory impact analysis was used as a source of information and aligned with the NEPA review for Corporate Average Fuel Economy (CAFÉ) standards, *see* National Highway Traffic Safety Administration, Corporate Average Fuel Economy Standards, Passenger Cars and Light Trucks, Model Years 2017-2025, Final Environmental Impact Statement, Docket No. NHTSA-2011-0056 (July 2012), § 5.3.2, *available at* http://www.nhtsa.gov/Laws+&+Regulations/CAFE+-+Fuel+Economy/Environmental+Impact+Statement+for+CAFE+Standards,+2017-2025.

[88] For example, the information may be responsive to public comments or useful to the decision maker in further distinguishing between alternatives and mitigation measures. In all cases, the agency should ensure that its consideration of the information and other factors relevant to its decision is consistent with applicable statutory or other authorities, including requirements for the use of cost-benefit analysis.

which a final EIS or EA has been issued. Agencies should consider applying this guidance to projects in the EIS or EA preparation stage if this would inform the consideration of differences between alternatives or address comments raised through the public comment process with sufficient scientific basis that suggest the environmental analysis would be incomplete without application of the guidance, and the additional time and resources needed would be proportionate to the value of the information included.

# # #

Airborne methane remote measurements reveal heavy-tail flux distribution in Four Corners region

Christian Frankenberg[a,b,1], Andrew K. Thorpe[b], David R. Thompson[b], Glynn Hulley[b], Eric Adam Kort[c], Nick Vance[b], Jakob Borchardt[d], Thomas Krings[d], Konstantin Gerilowski[d], Colm Sweeney[e,f], Stephen Conley[g,h], Brian D. Bue[b], Andrew D. Aubrey[b], Simon Hook[b], and Robert O. Green[b]

[a]Division of Geology and Planetary Sciences, California Institute of Technology, Pasadena, CA 91125; [b]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109; [c]Department of Climate and Space Sciences and Engineering, University of Michigan, Ann Arbor, MI 48109; [d]Institute of Environmental Physics, University of Bremen, 28334 Bremen, Germany; [e]Cooperative Institute for Research in Environmental Sciences, University of Colorado Boulder, Boulder, CO 80309; [f]Global Monitoring Division, Earth System Research Laboratory, National Oceanic and Atmospheric Administration, Boulder, CO 80305; [g]Scientific Aviation, Boulder, CO 80301; and [h]Department of Land, Air, and Water Resources, University of California, Davis, CA 95616

Edited by Gregory P. Asner, Carnegie Institution for Science, Stanford, CA, and approved June 17, 2016 (received for review April 10, 2016)

Methane (CH_4) impacts climate as the second strongest anthropogenic greenhouse gas and air quality by influencing tropospheric ozone levels. Space-based observations have identified the Four Corners region in the Southwest United States as an area of large CH_4 enhancements. We conducted an airborne campaign in Four Corners during April 2015 with the next-generation Airborne Visible/Infrared Imaging Spectrometer (near-infrared) and Hyperspectral Thermal Emission Spectrometer (thermal infrared) imaging spectrometers to better understand the source of methane by measuring methane plumes at 1- to 3-m spatial resolution. Our analysis detected more than 250 individual methane plumes from fossil fuel harvesting, processing, and distributing infrastructures, spanning an emission range from the detection limit ~ 2 kg/h to 5 kg/h through ~ 5,000 kg/h. Observed sources include gas processing facilities, storage tanks, pipeline leaks, and well pads, as well as a coal mine venting shaft. Overall, plume enhancements and inferred fluxes follow a lognormal distribution, with the top 10% emitters contributing 49 to 66% to the inferred total point source flux of 0.23 Tg/y to 0.39 Tg/y. With the observed confirmation of a lognormal emission distribution, this airborne observing strategy and its ability to locate previously unknown point sources in real time provides an efficient and effective method to identify and mitigate major emissions contributors over a wide geographic area. With improved instrumentation, this capability scales to spaceborne applications [Thompson DR, et al. (2016) *Geophys Res Lett* 43(12):6571–6578]. Further illustration of this potential is demonstrated with two detected, confirmed, and repaired pipeline leaks during the campaign.

methane | Four Corners | remote sensing | heavy tail

Global spaceborne measurements of methane with the Scanning Imaging Absorption Spectrometer for Atmospheric Chartography (SCIAMACHY) instrument (1) revealed a methane anomaly in the Four Corners region, with an estimated regional emission of 0.59 Tg/y (2). This study explores the role of point sources that supposedly drive the regional enhancement throughout the San Juan Basin in Four Corners.

The San Juan Basin is primarily a natural gas production area, mostly from coal bed methane and shale formations. More than 20,000 oil and gas wells operate in the basin, and, for 2009, the US Energy Information Administration reported an overall annual gas production of 1.3 trillion cubic feet, equivalent to 19.2 Tg CH_4/y.

To estimate methane emissions from oil and gas facilities, the Environmental Protection Agency uses a process based approach that assumes a normal distribution of emissions for each process used in extraction, processing, and distribution. In reality, the flux distribution can be heavily skewed, resulting in a heavy tailed distribution. This suggests that a relatively small percent of the sources in a given field may dominate the overall budget. The role of heavy tail distributions has been discussed as a possible reason for underestimated methane emissions in bottom up inventories (3 5). Although the heavy tailed distribution makes it more difficult to estimate emissions using a process based (or bottom up) approach, it suggests that mitigation of field wide emissions such as those estimated for Four Corners will be less costly because it only requires identifying and fixing a few emitters.

However, evaluating the distribution and role of point sources in large geographical areas with limited road access is too time consuming without prior knowledge of suspected locations. We conducted an intensive airborne campaign in April 2015 to overcome this shortcoming and directly measure the source distribution, identify strong emitters, and provide real time feedback to ground teams. We flew two NASA/Jet Propulsion Laboratory airborne imaging spectrometers, namely, the next generation Airborne Visible/Infrared Imaging Spectrometer (AVIRIS NG) (6) and the Hyperspectral Thermal Emission Spectrometer (HyTES).

Recent studies have shown that both can retrieve methane quantitatively using methane absorption features in the shortwave infrared around 2.3 μm [AVIRIS NG (7, 8)] and in the thermal infrared around 7.65 μm [HyTES (ref. 9 or refs. 10 and 11)]. Here, we report on the experiment design as well results from both instruments, having successfully identified more than 250 individual point sources, for which quantitative flux estimates are derived.

Significance

Fugitive methane emissions are thought to often exhibit a heavy-tail distribution (more high-emission sources than expected in a normal distribution), and thus efficient mitigation is possible if we locate the strongest emitters. Here we demonstrate airborne remote measurements of methane plumes at 1- to 3-m ground resolution over the Four Corners region. We identified more than 250 point sources, whose emissions followed a lognormal distribution, a heavy-tail characteristic. The top 10% of emitters explain about half of the total observed point source contribution and ~1/4 the total basin emissions. This work demonstrates the capability of real-time airborne imaging spectroscopy to perform detection and categorization of methane point sources in extended geographical areas with immediate input for emissions abatement.

Author contributions: C.F. designed research; C.F., A.K.T., D.R.T., E.A.K., J.B., T.K., K.G., C.S., A.D.A., S.H., and R.O.G. performed research; C.F., A.K.T., D.R.T., G.H., N.V., J.B., T.K., S.C., and B.D.B. analyzed data; and C.F., A.K.T., and E.A.K. wrote the paper.

The authors declare no conflict of interest.

This article is a PNAS Direct Submission.

Freely available online through the PNAS open access option.

[1]To whom correspondence should be addressed. Email: cfranken@caltech.edu.

This article contains supporting information online at www.pnas.org/lookup/suppl/doi:10.1073/pnas.1605617113/-/DCSupplemental.

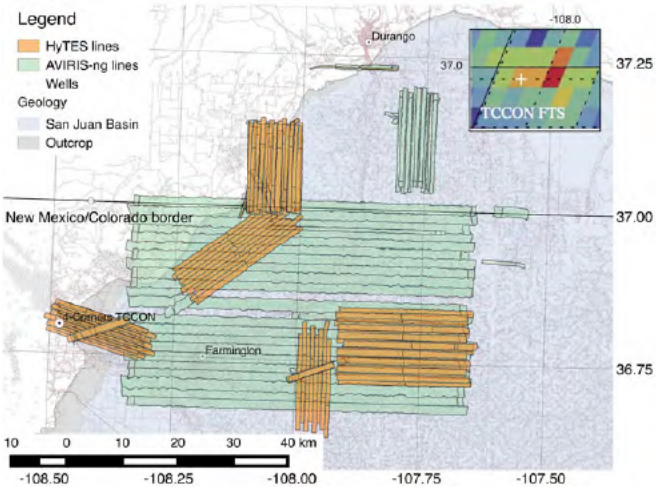


Fig. 1. Airborne Experiment overview of the Four Corners area. The ground projections of individual airborne imagery are shown for both instruments. (*Inset*) The previous SCIAMACHY enhancements (2).

Experiment Design

The overarching strategy was to map most of the identified methane hotspot in Four Corners (2), covering an area of around 80×40 km^2. Fig. 1 provides an overview of the study area, indicating a focus on the northwestern part of the San Juan Basin and its outcrop area toward the west (coal mine) and north. We covered a large box between 36.66 to 37°N and 107.66 to 108.33°W, east of the Total Carbon Column Observing Network (TCCON) Four Corners site (12), which operated until March 2014. Additional flight lines covered the coal mine a few kilometers east of the TCCON site as well as the natural outcrop area and smaller areas in Colorado near our home base at the Durango airport.

In most cases, AVIRIS NG flew at about 3 km above ground level (AGL), allowing a wider swath to map larger areas, whereas HyTES flew at 1 km AGL, leveraging the enhanced methane sensitivities of the thermal band when flying low. For AVIRIS NG, we used a recently developed real time detection algorithm (13), enabling us to both identify and geolocate methane plumes in flight. This software allowed us to (*i*) convey plume locations to the ground based teams for follow up investigations and (*ii*) perform spontaneous repeat overflights or provide guidance for additional flight lines in the following days. For some of the ambiguous findings, ground based verification could thus be performed during the flight campaign, often on the same day.

Results

HyTES. For HyTES, we used a Clutter Matched Filter Approach (CMF) (*Materials and Methods*) to isolate methane plumes. Some examples are shown in Fig. 2, ranging from a small plume to one emanating from a storage tank, extending almost 1 km.

Even though HyTES didn't have a real time retrieval capability during the campaign, some locations could be corroborated by our ground team if the plumes had been detected by AVIRIS NG as well. The large plume in Fig. 2, cut off by the end of the HyTES swath at the northern edge, is one example, for which we could trace down the origin to a leaking storage tank (Movie S1). In the remainder of this manuscript, we focus on the large scale AVIRIS NG survey and quantitative upscaling of total flux rates.

AVIRIS-NG. For AVIRIS NG, we used a linearized matched filter technique for the entire dataset as well as using the Iterative Maximum a Posteriori Differential Optical Absorption Spectroscopy (IMAP DOAS) method for selected scenes (*Materials and Methods*). Both methods derive column methane enhancements, expressed in ppm × meters, representing the plume methane mixing ratio if the plume was 1 m thick. In total, we identified 245 individual point sources and computed an integrated methane enhancement (IME) for each, integrating the total mass of excess methane within the plume structure (*Materials and Methods*).

Here, we use IME as a proxy for the total methane flux from a point source, as emissions and methane enhancements are linearly related at constant wind speed, and full plume inversions for more than 250 point sources are not yet feasible. We tested the approach against both Gaussian Integral inversions (*Materials and Methods*, *Supporting Information*, and Figs. S1 S5) and flux estimates derived using a mass balance approach with in situ measurements obtained during circling known sources at different height levels (similar to ref. 14). For the former, we selected individual plumes of variable size and used Gaussian Integral modeling to invert the flux based on the remotely sensed plume structure and magnitude. For the latter, we performed joint overflights on 22 April, targeting three previously identified methane sources of variable strength. While circular patterns were flown around the respective site for about 20 min to 30 min using an aircraft equipped with in situ methane measurements, AVIRIS NG observed the scene three to four times.

Fig. 2. HyTES methane plume examples for a small, intermediate, and large plume (left to right), related to well pads as well as a storage tank, positively identified by the ground crew (Movie S1). Note the scale difference of the pictures.

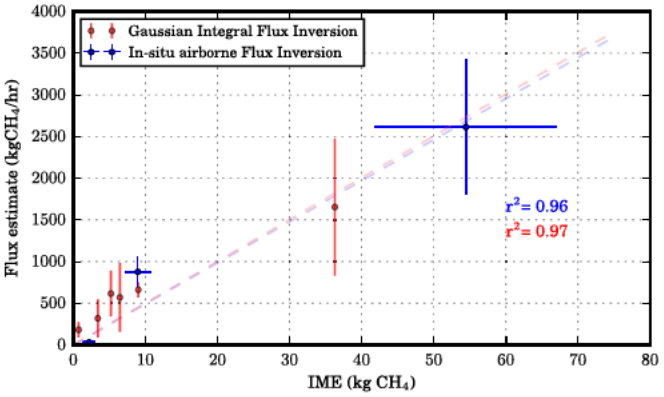


Fig. 3. IME (x axis) against inverted methane fluxes (y axis) using two different datasets and techniques. The scaling factor is derived using three local sources estimated using in situ airborne sampling circling the location at different altitudes (blue) as well as Gaussian integration methods using the observed plumes from AVIRIS NG (red), for which an average wind speed of 2 m/s was assumed. The average of the slopes has been used for upscaling, and the high r^2 is driven by the largest fluxes.

The results are shown in Fig. 3, with very high correlations for both comparisons. In the following, we use the averaged slope between the two methods to estimate methane fluxes from IME. Owing to variable meteorological conditions in the complex terrain, errors on individual estimates can be high. In a statistical sense, many of these errors will cancel out in aggregates, however, as variable conditions will lead to both overestimations and underestimations. In the absence of direct wind measurements for each of the >200 plumes, we have to rely on statistical approaches to characterize the area quantitatively. In addition, many emissions, such as liquid unloading events (15, 16), are transient and more variable in time than our actual measurement error during a specific overpass. Performing a large scale survey with AVIRIS NG provides a representative statistical distribution if individual events are randomly distributed in time. It should be noted that the Gaussian Inversions assumed 2 m/s wind speed, and the three direct aircraft inversions were performed at 2 to 3 m/s wind speed, whereas the average wind speed for all aircraft in situ inversions was 4 m/s. Our upscaling is thus more likely to be conservative rather than an overestimate.

We find that the flux rates follow a lognormal distribution, as shown in Fig. 4 for all 245 plumes detected by AVIRIS NG. Other studies have discussed and observed this type of distribution (3, 4), but here this emissions distribution was observed for a range of point sources over a large geographic scale within 1 wk. Fig. 4 also shows plume examples for a diverse range of estimated fluxes, as indicated by numbered vertical gray lines in the flux distribution plot. Even though our quantitative upscaling may be prone to large individual errors, especially due to wind variation, the lognormal distribution would not be strongly affected by this, thus robustly summarizing the overall source distribution using actual data with full spatial coverage across a wide geographical area.

A few of the plumes warrant a more detailed discussion. Plume #2 represents one example where the AVIRIS NG real time methane retrieval was invaluable. As can be seen, the methane plume appears unrelated to any gas processing facility and might have been considered spurious without corroboration. In this case, however, the ground team could follow up, and they positively identified a pipeline leak (Movie S2) and subsequently reported to the operating company, which shut down the pipeline and commenced repair the day after. The same happened at another location during the campaign, with ground confirmation and subsequent reporting to the pipeline operator. Two additional potential locations (Fig. S6) were identified in March 2016 while preparing this manuscript and have been reported to the respective state authorities. These have been subsequently confirmed as a pipeline leak and natural seep.

Plume #4, with a flux rate around 100 kg/h, was also followed up by the ground team and could be traced to a hatch in an underground storage tank (Movie S3). Plume #6, with an estimated flux rate of ~1,600 kg/h, is a coal mine venting shaft, about 7.5 km to the east of the TCCON station. It represents a strong source, which has been sampled by the in situ aircraft multiple times, with direct flux estimates ranging from 360 kg/h to 2,800 kg/h, in line with our estimate. Example #7 has been observed multiple times as well, and its origin is unclear, as the site was inaccessible to the ground team. The estimated flux is slightly higher than the venting shaft and is caused by multiple strong plumes, presumably emanating from newly built gas production and processing facilities. This site is only 3.5 km to the east of the coal mine venting shaft and is one example where the in situ aircraft suspected an additional strong source but was unable to trace it back to a specific location. Even without quantitative methane retrievals, the mere detection of individual plumes and the capability to geolocate strong sources to within a few meters is invaluable for source attribution and design of ground based studies.

Plume #8 has to be treated differently, even though it represents the highest observed flux rate, estimated at 7,500 kg/h. It was observed at the gas processing facility near the Durango airport in Colorado. As Durango was our base, we overflew this site multiple times, usually without plume detection. On one particular occasion, a very strong plume was found, even though the swath didn't cover the entire facility (swath edge indicated by thin white line in Fig. 4). Knowing that this is a sporadic but very large source renders average flux estimation difficult without specific knowledge of industry practices and what caused that specific incident.

Apart from this large flux from plume #8, the entire dataset constituting the flux distribution in Fig. 4 is based on the regular survey flights only and thus excludes multiple overflights. Even though individual flux rates can vary dramatically in time (as evidenced by plume #8), a large scale survey should provide a statistically representative sample, particularly when such a large number of sources are sampled in the survey. Repeated mapping of the entire area would be invaluable to assess source types and discriminate permanent and transient fluxes. In the following analysis, we divided the estimated flux from plume #8 by a factor of 4 to account for the number of multiple overpasses. Summing up all fluxes yields a regional total of ~0.3 Tg/y, explaining about half of the previously reported total of 0.59 Tg/y (2). Owing to the complexities of the retrievals and the upscaling and intermittency of sources, a full theoretical error propagation of all terms into a final regional flux estimate is not necessarily meaningful. Hence, we performed a nonparametric bootstrap analysis of the 245 plumes, resulting in a 95% confidence interval of 0.23 Tg/y to 0.39 Tg/y.

Flux Distribution. The lognormal behavior directly implies a heavy tail distribution in absolute fluxes. The aerial surveys directly observed the lognormal distribution in a bottom up survey. The cumulative distribution function shows that the biggest 10% of all plumes contributes about 60% to the inferred point source flux (Fig. 5). Using a parametric bootstrap method, the range of explained fluxes at the 10 percentile level ranges from 35 to 60% of the overall point source flux.

The nature of the lognormal distribution explains the large randomness of this explained fraction, as the sample size of large emitters is very low and thus largely variable using random draws. Another important aspect is the behavior of the low flux tail of the lognormal distribution. It might be argued that emissions below our detection threshold of 2 kg/h to 5 kg/h [depending on wind speed (8)] might contribute substantially to the total flux. However, the theoretical lognormal curve, which would not be cut

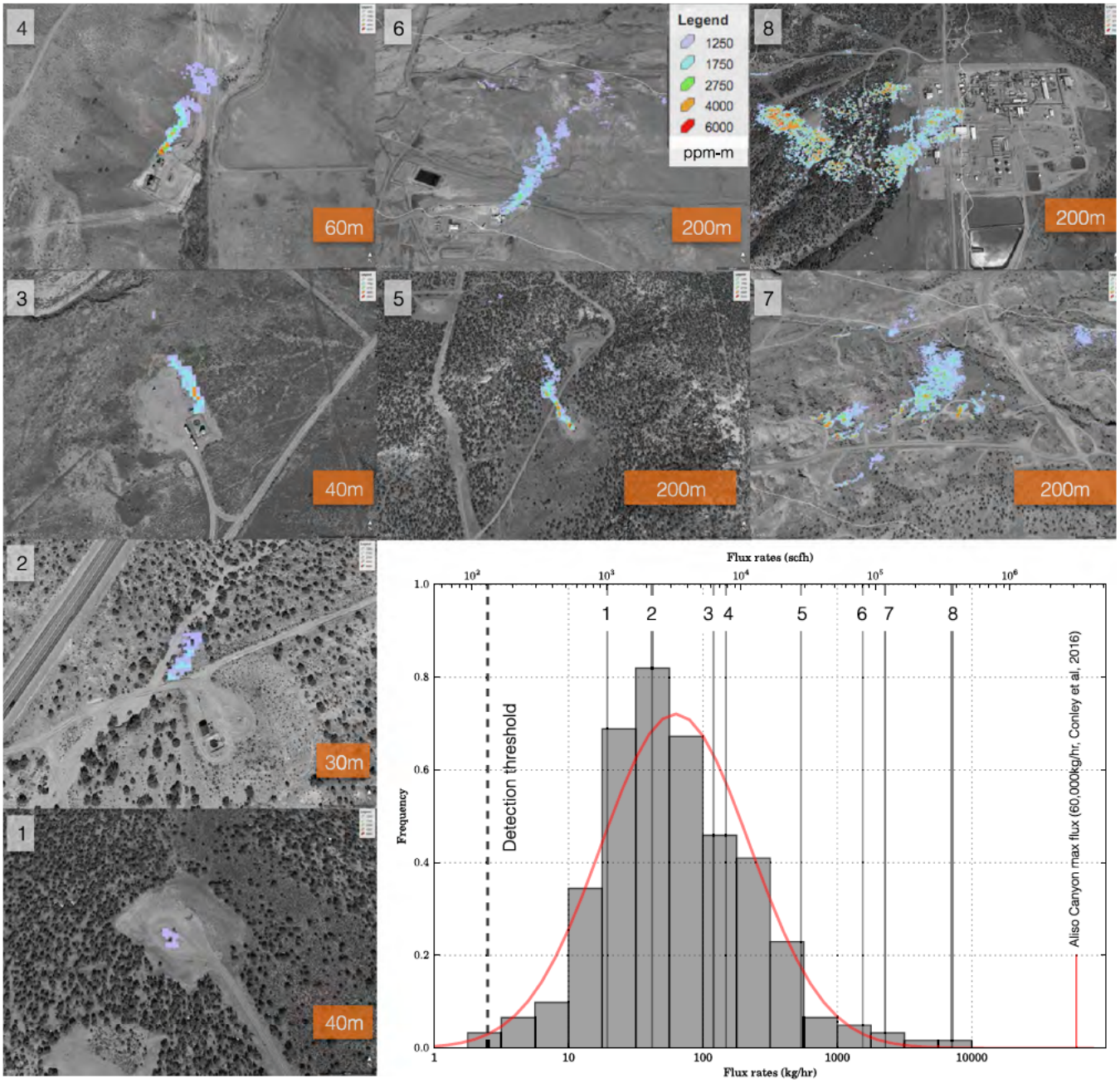


Fig. 4. Flux distribution of all 245 plumes observed by AVIRIS NG with individual examples spanning the entire range of fluxes from low to high. Examples include well pads (*1* and *5*), a confirmed pipeline leak (*2*), storage tanks (*3* and *4*), gas processing facilities (*8*), a coal mine venting shaft (*6*), and a cluster of strong sources near a well completion site (*7*). The detection threshold is based on controlled release experiments performed at the Rocky Mountain Operating Test Facility in Wyoming (*8*). The fitted lognormal distribution has a mean of $10^{1.75}$ and a 1σ of 0.55. For comparison, the unique Aliso Canyon blowout is depicted as a red line, corresponding to a maximum flux rate of 60,000 kg/h.

off below the threshold, shows negligible contributions from low fluxes as well. A bimodal distribution with a peak at flux rates well below our detection would need to exist if small fluxes were to contribute substantially to the regional flux total. Airborne remote sensing appears to be an effective way of identifying the biggest point sources in large geographical areas and thus efficiently mitigating avoidable emissions such as pipeline leaks or faulty storage tanks.

Discussion and Conclusion

We performed a large scale aerial survey in New Mexico and Colorado to map methane plumes within a previously discovered large scale methane hotspot. For this study, satellite based observations at the 60 × 30 km scale guided this detailed follow up study with imaging spectrometers and 1 to 3 m spatial resolution. A real time methane retrieval further allowed us to provide exact locations of individual points of interest to a ground team, which could follow up with thermal infrared videos, narrowing down the exact cause for various plumes, with most prominent examples covering leaking storage tanks and pipeline leaks. Using a simple linear scaling of integrated excess methane, we derived estimates of methane flux rates, ranging from a few kilograms per hour to several thousand kilograms per hour. Fig. 6

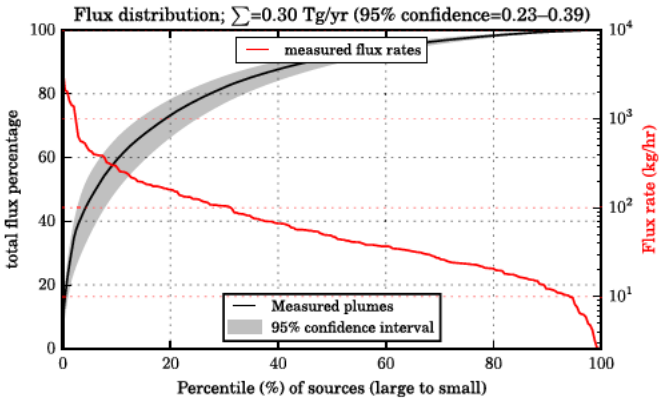


Fig. 5. Black line denotes cumulative distribution function of summed fluxes against flux percentiles (in descending order). Red line denotes corresponding flux rates at the respective percentile. The gray area shows the 95% confidence interval of the distribution, using a nonparametric bootstrap method.

provides an overview of all detected point sources (see *Supporting Information* for details).

Our upscaled flux estimate of all point sources ranges from 0.23 Tg/y to 0.39 Tg/y, explaining 39 to 66% of the total regional emissions determined for 2003 through 2009 (2). This finding confirms earlier assumptions that most of the enhanced methane is related to natural gas extraction as well as coal mining but also that there is not a single source explaining most enhancements. The observed lognormal source distribution further implies that small sources below 1 kg/h contribute very little to the total flux rate. However, it should be noted that our snapshots in time might only catch periodic emissions that exceed our detection threshold at the time of overpass, resulting in an overestimate for these locations, while others are missed. Imaging thousands of wells across the area should nevertheless provide a statistical sampling and thus a nonbiased regional average. In the future, repeat overflights can further discriminate transient from persistent sources and thereby greatly help to evaluate source mitigation potentials across large geographic areas.

Our analysis shows that strong emitters dominate the regional budget, with presumably lower marginal cost for emissions reductions. We have also demonstrated the ability to quantify and identify both small and large point source emissions widely spread over inaccessible geographic areas. Airborne remote measurements, combined with in situ sensing, could thus provide a path forward toward effective methane emission (monitoring) mitigation strategies. A dedicated sensor with increased sensitivity through higher spectral resolution would also reduce spurious signals (17) and enable efficient automation of the retrieval and plume detection chain, similar to current satellite retrieval algorithms.

Materials and Methods

AVIRIS NG Methane Retrievals. AVIRIS NG measures reflected solar radiation between 0.35 μm and 2.5 μm with 5 nm spectral resolution and sampling. Here, we used two related CH_4 retrieval algorithms based on absorption spectroscopy (7, 13), namely, (*i*) IMAP DOAS and (*ii*) a linearized matched filter technique.

The IMAP method was originally developed for use with the SCIAMACHY satellite instrument (18) and has been modified for use with imaging spectrometers AVIRIS and AVIRIS NG (7). Using a nonlinear iterative minimization of the differences between modeled and measured radiance, we quantitatively retrieve the excess methane abundances below the aircraft.

The real time CH_4 retrieval exploits a linearized matched filter strategy described previously in ref. 13. We model the background radiance spectra as a multivariate Gaussian having mean μ and covariance Σ, and estimate its parameters using the image data in the appropriate pushbroom cross track location. The matched filter tests the null background case H_0 against the alternative H_1 in which the background undergoes a linear perturbation by a target signal $\mathbf{t}$,

$$H_0 : \mathbf{x} \sim \mathcal{N}(\mu, \Sigma) \quad H_1 : \mathbf{x} \sim \mathcal{N}(\mu + \alpha\mathbf{t}, \Sigma). \qquad [1]$$

Here α represents a scaling of the perturbing signal. The optimal discriminant is the classical matched filter $\hat{\alpha}(\mathbf{x})$. It estimates α using a noise whitened dot product. This takes the form

$$\hat{\alpha}(\mathbf{x}) = \frac{(\mathbf{x} \quad \mu)^T \Sigma^{-1} \mathbf{t}}{\mathbf{t}^T \Sigma^{-1} \mathbf{t}}. \qquad [2]$$

For our real time retrieval, we calculate the target signature as the change in radiance units of the background caused by adding a unit mixing ratio length of CH_4 absorption. The additional absorption acts as a thin Beer Lambert attenuation of the background μ. Specifically, our target signature is the partial derivative of measured radiance with respect to a change in absorption path length ℓ by an optically thin absorbing layer of CH_4. At $\ell = 0$, we have

$$\mathbf{t} = \frac{\partial \mathbf{x}}{\partial \ell} = \quad \mu e^{-\ell \kappa} = \quad \mu\kappa, \qquad [3]$$

where κ represents the unit absorption coefficient and μ is the mean radiance as before. The detected quantity $\hat{\alpha}(\mathbf{x})$ is a mixing ratio length in units of ppb × km representing the thickness and concentration within a volume of equivalent absorption.

For both retrieval techniques, we compute methane enhancements in parts per million per meter, which is equivalent to an excess methane concentration in parts per million if the layer is 1 m thick (i.e., directly equivalent to parts per billion per kilometer). At a scale height of about 8 km, the total column averaged excess mixing ratio XCH_4 would be about 0.000125 times the excess in parts per million per meter. For example, 1,000 ppm/m is equivalent to an XCH_4 enhancement of 125 ppb.

HyTES Methane Retrievals. HyTES has sufficient spectral information in the 7.4 to 12 μm region (256 bands) to resolve the spectral absorption signatures of a variety of different atmospheric chemical species including CH_4, NO_2, NH_3, SO_2, N_2O, and H_2S. An in scene atmospheric technique is first used to remove the background attenuation from the intervening atmosphere and then find evidence of the gas target signature that is assumed to be linearly superimposed on the background radiance data. A CMF (19 21) is then used to generate a weighting function based on a given specific target gas signature extracted from the HITRAN high resolution transmission molecular absorption database. The weighting function is superimposed on the observed hyperspectral data to generate a CMF image in which the intensity of the image correlates with the presence of the desired gas signature.

In addition to the CMF detection algorithm, a HyTES CH_4 concentration retrieval algorithm was developed and adapted from the algorithm used for

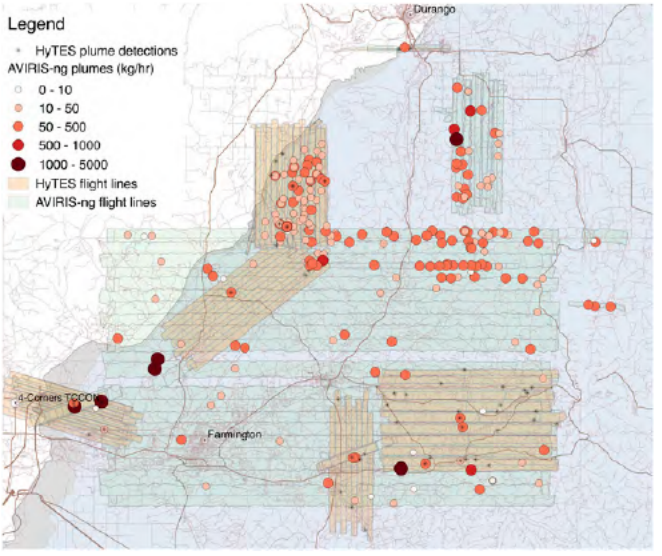


Fig. 6. Map of covered areas and detected point sources by HyTES (stars) and AVIRIS NG (red dots with estimated flux rates color coded).

retrieving trace gases from the Tropospheric Emission Spectrometer (TES) onboard the Aura satellite. Using HyTES radiance spectra in the 7.5 to 9.2 μm range, the HyTES TES quantitative algorithm has been used to quantify methane concentrations with a total error of ∼20% using uncertainties determined primarily from instrument noise and spectral interferences from air temperature, surface emissivity, and atmospheric water vapor (22).

Methane Flux Inversion. Emission rates from the remote sensing column information were obtained using a mass balance approach similar to (23, 24)

$$F = \int\int_S V\,\vec{u}\cdot\vec{n}\,dS \approx \vec{u}\cdot\vec{n}\sum_i V_i\,\Delta S_i,$$

where V denotes the vertical column of CH_4, $\vec{u}$ is the wind. and $\vec{n}$ is the normal vector on the boundary S. The integral is evaluated in its discretized form on a straight cross section with segments of length $\Delta S = 1$ m and interpolated vertical column information V_i.

For each target, multiple cross sections orthogonal to the wind direction were defined at different distances to the analyzed sources. Thereby the background was determined via a linear background fit over regions in the cross section outside the plume. Typically, each flank comprises about 10 to 20% of total data points in a track. About 15 to 100 individual cross sections were then averaged for a mean emission rate. Examples are shown in *Supporting Information*.

IME. We use IME, a measure of the total excess mass of observed methane, as a surrogate for fluxes of all identified plumes. We use a segmentation technique to isolate the methane plumes with an XCH_4 minimum threshold of 200 ppm/m enhancements and subsequent summation of all pixels multiplied with the surface area S of an individual measurement i,

$$IME = k\sum_{i\ 0}^{n} XCH_4(i)\cdot S(i),$$

with a constant factor k to convert a methane volume into grams of CH_4. Observed excess IME ranged from 100 g to about 100 kg.

Thermal Infrared Videos: Movies S1 S3. A Xenics Onca VLWIR MCT 384 thermal imaging camera was used to identify plumes as part of ground surveys. This instrument has a 384 × 288 pixel resolution and HgCdTe detector sensitive between 7.7 μm and 11.5 μm. For this study, a Spectrogon optical filter centered at 7.746 μm was used as a digital filter applied to a contiguous spectrometer output to match either an absorption or emission response of methane, creating contrast between methane plumes and the background.

ACKNOWLEDGMENTS. We thank the AVIRIS NG flight and instrument teams, including Michael Eastwood, Sarah Lundeen, Scott Nolte, Mark Helmlinger, and Betina Pavri. Didier Keymeulen and Joseph Boardman assisted with the real time system. We also thank the HyTES flight and instrument teams, including Bjorn Eng, Jonathan Mihaly, Seth Chazanoff, and Bill Johnson. We thank the organizers and all the participants in the TOPDOWN campaign for the fruitful collaboration. We thank NASA Headquarters, in particular Jack Kaye, for funding this flight campaign, which augmented the overall Twin Otter Projects Defining Oil/Gas Well Emissions (TOPDOWN) campaign. J.B., T.K., and K.G. were funded by the state of Bremen and University of Bremen. E.A.K. and C.S. were supported, in part, by the National Oceanic and Atmospheric Administration AC4 program under Grant NA14OAR0110139.

1. Frankenberg C, et al. (2011) Global column-averaged methane mixing ratios from 2003 to 2009 as derived from SCIAMACHY: Trends and variability. *J Geophys Res* 116(D4): D04302.
2. Kort EA, et al. (2014) Four corners: The largest US methane anomaly viewed from space. *Geophys Res Lett* 41(19):6898–6903.
3. Brandt AR, et al. (2014) Methane leaks from North American natural gas systems. *Science* 343(6172):733–735.
4. Zavala-Araiza D, et al. (2015) Reconciling divergent estimates of oil and gas methane emissions. *Proc Natl Acad Sci USA* 112(51):15597–15602.
5. Lyon DR, et al. (2016) Aerial surveys of elevated hydrocarbon emissions from oil and gas production sites. *Environ Sci Technol* 50(9):4877–4886.
6. Green RO, et al. (1998) Imaging spectroscopy and the Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). *Remote Sens Environ* 65(3):227–248.
7. Thorpe AK, Frankenberg C, Roberts D (2014) Retrieval techniques for airborne imaging of methane concentrations using high spatial and moderate spectral resolution: Application to AVIRIS. *Atmos Meas Tech* 7(2):491–506.
8. Thorpe AK, et al. (2016) Mapping methane concentrations from a controlled release experiment using the next generation Airborne Visible/Infrared Imaging Spectrometer (AVIRIS-NG). *Remote Sens Environ* 179:104–115.
9. Hulley GC, et al. (2016) High spatial resolution imaging of methane and other trace gases with the airborne Hyperspectral Thermal Emission Spectrometer (HyTES). *Atmos Meas Tech* 9(5):2393–2408.
10. Tratt DM, et al. (2014) Airborne visualization and quantification of discrete methane sources in the environment. *Remote Sens Environ* 154:74–88.
11. Galfalk M, Olofsson G, Crill P, Bastviken D (2015) Making methane visible. *Nat Clim Change* 6(4):426–430.
12. Lindenmaier R, et al. (2014) Multiscale observations of CO_2, $^{13}CO_2$, and pollutants at Four Corners for emission verification and attribution. *Proc Natl Acad Sci USA* 111(23): 8386–8391.
13. Thompson D, et al. (2015) Real-time remote detection and measurement for airborne imaging spectroscopy: A case study with methane. *Atmos Meas Tech* 8(10):4383–4397.
14. Conley S, et al. (2016) Methane emissions from the 2015 Aliso Canyon blowout in Los Angeles, CA. *Science* 351(6279):1317–1320.
15. Allen DT, et al. (2013) Measurements of methane emissions at natural gas production sites in the United States. *Proc Natl Acad Sci USA* 110(44):17768–17773.
16. Allen DT, et al. (2015) Methane emissions from process equipment at natural gas production sites in the United States: Liquid unloadings. *Environ Sci Technol* 49(1): 641–648.
17. Thorpe AK, et al. (2016) The Airborne Methane Plume Spectrometer (AMPS): Quantitative imaging of methane plumes in real time. *Conf Proc IEEE,* in press.
18. Frankenberg C, Platt U, Wagner T (2005) Iterative maximum a posteriori (IMAP)-DOAS for retrieval of strongly absorbing trace gases: Model studies for CH_4 and CO_2 retrieval from near infrared spectra of SCIAMACHY onboard ENVISAT. *Atmos Chem Phys* 5(1):9–22.
19. Funk CC, Theiler J, Roberts DA, Borel CC (2001) Clustering to improve matched filter detection of weak gas plumes in hyperspectral thermal imagery. *IEEE Trans Geosci Remote Sens* 39(7):1410–1420.
20. Theiler J, Foy BR (2006) Effect of signal contamination in matched-filter detection of the signal on a cluttered background. *IEEE Geosci Remote Sens Lett* 3(1):98–102.
21. Hulley GC, et al. (2016) High spatial resolution imaging of methane and other trace gases with the airborne Hyperspectral Thermal Emission Spectrometer (HyTES). *Atmos Meas Tech* 9(5):2393–2408.
22. Kuai L, et al. (2016) Characterization of anthropogenic methane plumes with the Hyperspectral Thermal Emission Spectrometer (HyTES): A retrieval method and error analysis. *Atmos Meas Tech Discuss* 2016:1–24.
23. Krings T, et al. (2011) Mamap—A new spectrometer system for column-averaged methane and carbon dioxide observations from aircraft: Retrieval algorithm and first inversions for point source emission rates. *Atmos Meas Tech* 4(9):1735–1758.
24. Krings T, et al. (2013) Quantification of methane emission rates from coal mine ventilation shafts using airborne remote sensing data. *Atmos Meas Tech* 6(1): 151–166.

Enforcement Report

NM OCD

NEW MEXICO OIL & GAS CONSERVATION DIVISION

Inadequate enforcement guarantees irresponsible oil and gas development

MAY 2012

Failure to adequately enforce existing drilling rules is harming New Mexico's public health, safety, and environment

EARTHWORKS™
OIL & GAS ACCOUNTABILITY PROJECT

New Mexico's Inadequate Enforcement of Oil & Gas Rules

OCD NEEDS NEW ENFORCEMENT RULES IN ORDER TO PROTECT THE PUBLIC INTEREST

The New Mexico Oil Conservation Division (OCD) is charged by the New Mexico Oil and Gas Act to "enforce effectively the provisions of this act or any other law of this state relating to the conservation of oil or gas."[1]

New Mexico has been a major oil-and-gas-producing state since the 1920s.[2] The number of wells producing oil and gas in New Mexico has remained fairly constant over the past few years at approximately 53,000 wells.[3] However, according to the U.S. Energy Information Administration the potential for increased shale oil and shale gas development in New Mexico is on the horizon.[4]

Unfortunately, by any reasonable measure, the OCD fails to fulfill its duty to the law, and to the public interest. In particular:

- **inspection capacity is severely limited;**
- **violations are arbitrarily assessed;**
- **violations are inadequately reported and tracked, and what information exists is opaque to the public;**
- **civil fines cannot be administratively assessed by the OCD;**
- **fines are rarely issued to companies violating the rules;**
- **penalties are inadequate to punish or prevent irresponsible behavior by oil and gas operators – or even to cover the state's costs of fining a violator.**

Consequently, the public cannot have confidence that oil and gas development is occurring or will occur responsibly in the state of New Mexico.

Inspection Capacity – SEVERELY UNDERSTAFFED

In 2010, there were just 12 New Mexico Oil Conservation Division (OCD) inspectors to oversee the 53,000 producing wells: that is more than 4,000 wells per inspector, the most unfavorable ratio amongst all states surveyed by Earthworks.[5] To visit every producing well at least once per year, OCD inspectors would each have to inspect more than 15 wells per day.[6]

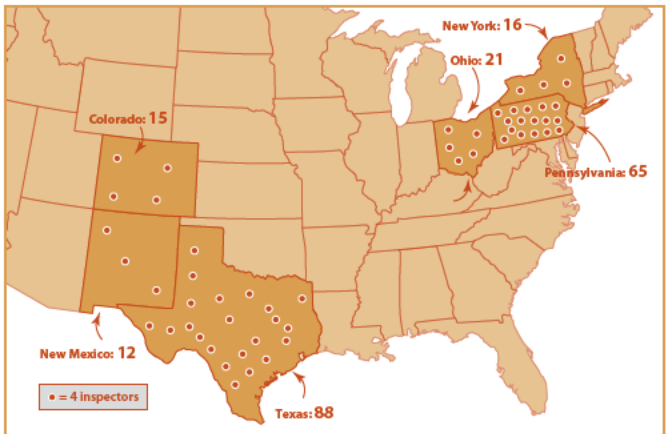
Needless to say, OCD does not inspect all producing wells in New Mexico each year. In 2010, OCD conducted 20,780 inspections of producing and inactive wells, which means that at least 60% of producing wells did not get inspected.[7] In 2011, OCD increased its number of inspections but still failed to inspect approximately 54% of producing wells.[8]

In the Aztec office in 2008, OCD inspected each of the district's 24,000 wells only once every five years. In 2012 there are even fewer inspectors.[9, 11]

Inspection capacity has been a problem in New Mexico for years. In 2008, OCD inspectors in the Aztec office tried to inspect each of the district's 24,000 active wells only once every five years.[9] In that year, New Mexico employed 18 inspectors.[10] In 2012 there are six fewer inspectors in the state,[11] so it is almost certain that wells inspected by the Aztec office of OCD are still only inspected once every five years, at most.

OCD has recognized its lack of inspection capacity. In the *2011 Energy, Minerals and Natural Resources Annual Report*, one of the OCD's goals was increasing "staffing in the district offices to enhance application processing and well inspections."[14]

OCD must increase the number of inspectors on staff until all wells can be adequately inspected. New staff hires must go to inspections of existing wells, not permitting of new wells.



State oil and gas inspection capacity (2010) Compared to other oil and gas states, New Mexico's inspection capacity is very low. In 2010 Pennsylvania had 65 inspectors to monitor 90,000 active wells and New York state had 16 inspectors for 10,000 active wells. Meanwhile, New Mexico OCD had 12 inspectors to monitor more than 50,000 wells in a state that is larger than New York and Pennsylvania combined.[13]

Violations – ARBITRARILY ASSESSED; PUBLICLY OPAQUE

When a serious violation of OCD rules is discovered, an OCD inspector may issue a formal Letter of Violation (LOV). For less serious violations, noncompliance letters (LET) or Field Visit Inspection Letters (FVIs) may be sent.[15]

But New Mexico lacks consistent state guidelines for determining what constitutes a significant violation of OCD rules.

This means each individual inspector has total discretion to determine what constitutes a serious violation requiring an LOV, for example. According to OCD, "Each inspector has his own criteria," for determining when Letters of Violation are issued to operators.[16] In some cases, noncompliance is not formally recorded at all – instead inspectors may simply call

or email a violator and ask them to come into compliance. As a result, operators may receive different treatment simply because their site was inspected by inspector X instead of inspector Y.

Based on Earthworks' analysis of OCD data acquired through a public information request, it is clear that LOVs are inconsistently applied. For example, in 2011 the very same rule violations resulted in an LOV, LET or FVI. About half of the operators that did not have signs on their wells received an LOV, while half received an FVI or LET. Similarly, the more serious violation of a "failed pressure test" resulted in 6 LOVs, 11 FVIs and 6 LETs. (See Earthworks' New Mexico Enforcement web page for more details.)

Furthermore, there are regional differences in the use of LOVs as an enforcement tool. For example, very few Letters of Violation are issued out of the Aztec field office – a district that has more than 22,000 active oil and gas wells.[17] According to OCD, the Aztec District has a "different type of working relationship with operators," than other OCD districts. There are fewer operators, and so Aztec inspectors convey non-compliance through emails, phone calls or letters that are not official Letters of Violation.[18]

When enforcement actions for both minor and more serious violations can vary widely from one inspector to the next, and from one district to the next, it erodes public confidence in OCD. Where inspectors have their own personal criteria for enforcement, it makes a mockery of the notion that we are a country of laws. And it creates the opposite of the regulatory "certainty" oil and gas operators repeatedly and publicly claim they desire.[19]

OCD should create binding policies statewide outlining what level of enforcement action should be taken for different violations (e.g., based on which rule was violated, the severity of the violation, etc.), and require all inspectors to consistently adhere to the policy.

OCD inspectors should record all rule violations found during inspections, and all violations should result in a Letter of Violation informing the operator of the violation and a date by which then must come into compliance.

When violations are assessed, the public cannot easily find information about them.

OCD does maintain an internal database that tracks violations, enforcement actions and compliance data, but this database is not accessible to the public. Nor are statistics on violations of OCD oil and gas rules published on the OCD web site.

The only violations-related data readily available to the public is via the OCD Electronic Permitting System (EPS). The EPS allows users to search for individual wells, and provides information on compliance actions and other data for each well.[20] But EPS compliance information is misleading. The only time OCD considers a Letter of Violation to have been issued is if the Notification box and the Enforcement box in the Compliance Section of a well file both indicate "Letter of Violation". If the Notification box includes "Field Visit or Inspection" or is empty, and the Enforcement section shows Letter of Violation, it really means that a letter was sent that was not an actual LOV.

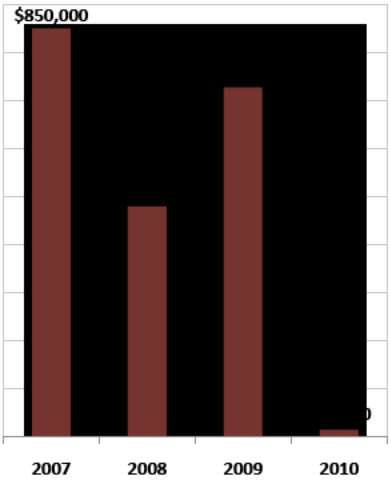
In New Mexico the maximum fine has not changed since the 1935 Oil and Gas Act. It is still is $1,000 per day.

This ambiguous system mirrors the letters that violators receive: all are titled LETTER OF VIOLATION whether it was an actual LOV or a less significant letter of noncompliance.[21]

In addition, not all letters cite the rule(s) that have been violated,[22] so it is not always possible to determine how serious the violation was or even which rules were violated.

OCD needs to increase the public transparency of the violations data. OCD should develop an on-line, publicly accessible system that allows both OCD staff and the public to track an operator's record of compliance and ensure that violations have been corrected. The database should include information on violations by well sites, operator name, the rules violated, the OCD response (e.g., date and type of enforcement actions), the date compliance was achieved, and a link to other OCD well data.

All violations, regardless of whether or not an LOV was issued, should be recorded and tracked by OCD. These statistics should be compiled and reported on a monthly and annual basis on the "Statistics" page of the OCD web site.



Oil and gas penalites collected by OCD From 2007 through 2009
New Mexico collected hundreds of thousands of dollars in penalties per year from the oil and gas industry. In 2009, however, an oil and gas company won a court case that effectively stopped OCD from assessing civil penalties for rule violations.

The New Mexico Supreme Court ruled that OCD could not administratively assess penalties, but rather, the state Attorney General's office must bring suit on behalf of the OCD in district court for each and every violation to establish liability and assess the appropriate penalty. [29]

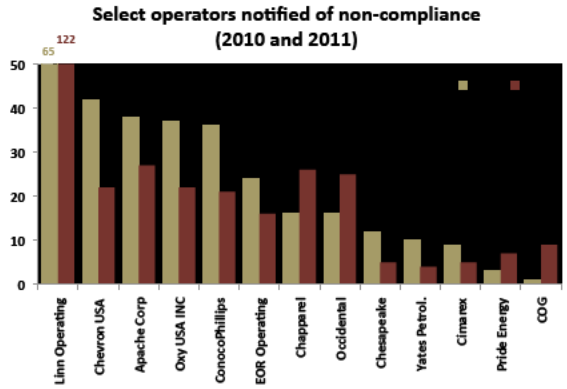
Sanctions – PENALTIES IMPOSSIBLE TO ADMINISTER, TOO LOW TO DETER VIOLATORS

The OCD lacks a regulatory tool that many other oil-and-gas-producing states and even other New Mexico state agencies possess – the ability to administratively assess civil penalties on operators who violate the rules. See box at left.

When properly implemented, not only do such penalties help to deter operators from breaking the rules, they can also be a source of revenue to help fund oil and gas

agency programs (such as enforcement or plugging inactive wells).[23]

In Pennsylvania, the Department of Environment can penalize operators of unconventional gas wells up to $75,000 plus $5,000 for each continuing day of violation and operators of conventional wells $25,000 plus $1,000 per day for violating oil and gas rules.[24] In Texas, the Railroad Commission can fine oil and gas operators up to $10,000/day if they break rules pertaining to safety or pollution prevention.[25] In recent years, Pennsylvania, Texas and Colorado have each annually collected millions of dollars worth of revenue from penalties for oil and gas rule violations.[26]



2010 - 2011 Incidents of non-compliance by New Mexico oil and gas operators.
Linn Operating, Chapparel, Occidental, Pride Energy and COG all had more incidents of non-compliance in 2011 than 2010, and other companies continued to have high numbers of violations in 2011 (e.g., Apache, Oxy USA, ConocoPhillips).

Since 2009, when OCD lost its ability to administratively levy penalties, OCD had not pursued any penalty cases in court "due to lack of funding and resources."[30] This is not surprising. The fines that OCD can pursue are so low that it would rarely make financial sense for OCD to pursue penalties through the court system. In New Mexico the maximum fine — which has not changed since the inception of the 1935 *Oil and Gas Act*— is $1,000 per day.[31] The cost for OCD staff to work with the Attorney General to prepare a case, travel to the district court in the county in which the defendant resides,[32] and pay for meals and lodging no doubt often exceeds what OCD would collect in fines.

Not only is the maximum penalty for an oil and gas violation extremely low in New Mexico, but the threshold for assessing this penalty is extremely high: penalties only apply if an operator knowingly and willfully commits the violation.[33] Plainly speaking, *for New Mexico oil and gas operators incompetence or ignorance of OCD rules serve as legitimate excuses to break the law*. Contrast this with New Mexico's Air Quality Bureau, which has a policy that "the violator's lack of knowledge regarding the requirement does not excuse the violation because *ignorance of the law is not a defense to liability.*"[34]

As seen in the table below, other New Mexico resource or environmental statutes provide for higher penalties than the *Oil and Gas Act*, they provide "strict liability" for civil penalties (i.e., a violator is subject to a penalty for any violation regardless of knowledge or intent), and the penalties can be assessed administratively (i.e., by the agencies, rather than the courts).

The inability of OCD to take strong enforcement actions may explain why many of the same operators receive high numbers of non-compliance letters (LOVs, FVIs and LETs) from one year to the next, and why numerous violations remain unresolved for years. The chart above illustrates how some companies clearly have a problem with compliance.[47]

Earthworks' analysis of data from Compliance Summaries supplied by OCD shows that as of February 2012 compliance had been achieved in only 311 (39%) of the 797 incidents that resulted in letters of non-compliance in 2010, and compliance had been achieved in 170 of the 453 cases in 2011 (38% compliance).

With respect to the more serious violations (those that inspectors believed warranted LOVs), Earthworks' analysis of OCD data showed slightly higher rates of compliance. In 2010, 414 LOVs were sent to operators, and as of early 2012 compliance had been achieved for 220 (53%) of the cases.[48] In 2011, 203 LOVs were sent, and compliance had been achieved for 101 (50%) of the cases.

Still, when only half of the serious problems are resolved within a year or two, it is clear that there is a significant problem with compliance.

New Mexico's oil and gas statute needs to be revised to return to OCD the ability to assess administrative penalties, to remove ignorance/incompetence as a means of escaping liability for violations, and to increase penalty amounts to a level sufficient to deter potential violators. As with violations, clear and consistent guidelines for levying penalties must be included as well. Otherwise, oil and gas operators have little incentive to comply with oil and gas law.

Inconsistent penalty assessment in New Mexico statutes.

	Maximum Penalty	Strict Liability	Able to administratively assess penalties
Oil and Gas Act	1,000[35]	**NO.** OCD must prove violator acted willfully and knowingly.[36]	NO[37]
Air Quality Control Act	$15,000[38]	**YES.** Knowing and willful violations can increase a penalty, but lack of knowledge cannot reduce or negate a penalty.[39]	YES[40]
Water Quality Act	$10,000 to $15,000[41]	**YES.** Whenever a constituent agency determines there has been a violation the agency may issue a compliance order to assess a civil penalty.[42]	YES[43]
New Mexico Mining Act	$10,000[44]	**YES.** Knowing and willful violations increase the amount of penalty, but are not required to assess penalty.[45]	YES[46]

OCD needs to develop an inspection protocol to ensure that sites with violations receive follow-up inspection within a specified timeframe. If this is not done, there is no incentive for operators to come into compliance in a timely manner.

The Path Forward

Our review of New Mexico's enforcement of oil and gas regulations shows OCD does not have the regulatory tools to adequately enforce its rules. To remedy this, we believe there should be a new rulemaking focusing exclusively on enforcement. **Those new rules should address:**

INSPECTIONS

- Develop comprehensive and binding inspection protocols.
- Establish minimum inspector-to-well and annual-inspections-to-well ratios. New wells must not be permitted unless the state meets the minimum inspection levels.
- Competitively pay inspectors so as to retain high quality personnel and ensure competent inspections.

VIOLATIONS

- Reestablish the rule of law by developing clear and consistent guidelines for assessing Letters of Violation and other types of non-compliance notifications.

PENALTIES

- Transparently establish binding criteria for levying penalties.
- Revise New Mexico's Oil and Gas Act to enable administrative assessment of penalties and increase penalty amounts so that penalties effectively deter rule violations.

TRANSPARENCY/THE PUBLIC ROLE

- Collect and track comprehensive data regarding oil and gas enforcement including citizen complaints, violation data, dates of resolution, enforcement actions taken, and penalties levied/collected.
- Periodically analyze and publicly report trends in enforcement.
- Make comprehensive enforcement data publicly available online – on a well-by–well basis and by bulk download.

For a more detailed analysis of oil and gas enforcement in New Mexico visit Earthworks' New Mexico Enforcement web page: http://enforcement-nm.earthworksaction.org

ENDNOTES

1 2011 New Mexico Statutes Chapter 70 Oil and Gas Article 2 Oil Conservation Commission; Division; Regulation of Wells, 70-2-6 A. http //law.justia.com/codes/new-mexico/2011/chapter70/article2/section70-2-6/

2 New Mexico Bureau of Geology and Mineral Resources. "Oil and Gas Program." http //geoinfo.nmt.edu/resources/petroleum/home.html

3 We looked for data on "active" wells, but the OCD does not have active well statistics on its web site. The New Mexico Energy, Minerals and Natural Resources Annual Reports for 2010 and 2011 have information on the number of "wells," while previous reports, e.g., 2008 and 2009 have data on "active producing wells." (http://www.emnrd.state.nm.us/main/Publications.htm) Because of this lack of consistency, we decided to report the number of producing wells, based on data from the Petroleum Recovery Research Center. GO-TECH web site. "General Production Data Search." (http://octane.nmt.edu/gotech/Petroleum_Data/General.aspx) Data accessed March 22, 2012. Searched years: 2008, 2009, 2010, 2011. Selected: Production. Ignored wells with no data. Summary provides a count of producing wells. 2008: 53,179, 2009: 52,545, 2010: 53,063, 2011: 53,209.

4 U.S. Energy Information Administration. July 2011. *Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays*. ftp //ftp.eia.doe.gov/natgas/usshaleplays.pdf This report mentions shale oil resources of 2 billion barrels in the Avalon shale formation in the Permian Basin of New Mexico and Texas, and a resource of 12 billion cubic feet of natural gas in the Lewis shale of New Mexico and Colorado.

5 More information on this comparison is available on Earthworks' New Mexico Enforcement – Inspections web page http //www.earthworksaction.org/issues/detail/new_mexico_oil_gas_enforcement_inspections

6 Assumes each inspector works 5 days per week and receives two weeks vacation and 5 holidays.

7 There were 53,063 wells that produced oil or gas in 2010. OCD inspectors conducted 20,780 inspections in 2010. It is likely that some wells were inspected more than once (e.g., if a violation was found a well might receive a follow-up inspection, or if a new well might be inspected multiple times during and after drilling) and that some "inactive" wells, i.e., unplugged wells that did not produce oil and/or gas, were inspected. Unfortunately, OCD does not publish annual statistics on inactive wells. Assuming that each inspection was done for a different well, OCD inspectors did not visit at least 32,283 wells, or 61% of wells that produced oil or gas in 2010. Data available on Earthworks' NM Inspections web page http //www.earthworksaction.org/issues/detail/new_mexico_oil_gas_enforcement_inspections

8 According to information provided to Earthworks by OCD, the agency conducted 25,543 inspections in 2011. The Petroleum Recovery Research Center. GO-TECH web site shows 53,309 producing wells that year, which means that 53,309 – 24,543 28,766 producing wells (54%) were not inspected. (Source Information request to Jim Winchester, New Mexico Energy, Minerals & Natural Resources Department (EMNRD) Communications officer. March 5, 2012.)

9 Haywood, P. March 1, 2008. "Inspectors struggle to monitor vast area," *Santa Fe New Mexican*. http //www.santafenewmexican.com/Local%20News/Inspectors-struggle-to-monitor-vast-area

10 *ibid.*

11 Personal communication between Lisa Sumi, Earthworks and New Mexico Oil Conservation Division (OCD) Enforcement and Compliance Manager, Daniel Sanchez, OCD attorney, Sonny Swazo, and New Mexico EMNRD Communications officer, Jim Winchester. March 5, 2012.

14 New Mexico EMNRD Annual Report for 2011. Page 39. http //www.emnrd.state.nm.us/main/documents/EMNRD-2011-Annual-Report.pdf

15 Noncompliance letters such as LETs and FVIs are not Letters of Violations and are not counted in LOV statistics.

16 Personal communication between Lisa Sumi and Gwen Lachelt, Earthworks and New Mexico OCD Enforcement and Compliance Manager, Daniel Sanchez, OCD attorney, Sonny Swazo, and New Mexico EMNRD Communications officer, Jim Winchester. April 11, 2012.

17 OCD Electronic Permitting System. Well Search. https //wwwapps.emnrd.state.nm.us/ocd/ocdpermitting/Data/Wells.aspx

18 Personal communication between Lisa Sumi and Gwen Lachelt, Earthworks and New Mexico OCD Enforcement and Compliance Manager, Daniel Sanchez, OCD attorney, Sonny Swazo, and New Mexico EMNRD Communications officer, Jim Winchester. April 11, 2012.

19 When the fracturing fluid disclosure rule was passed, the oil and gas association said it was pleased because it offered certainty for operators. (Source: Montoya, S. Nov. 17, 2011. "NM regulators approve fracking disclosure rule," *Santa Fe New Mexican*. http://www.santafenewmexican.com/localnews/N-M--regulators-approve-fracking-disclosure-rule)

20 OCD Electronic Permitting Well Search. https //wwwapps.emnrd.state.nm.us/ocd/ocdpermitting/Data/Wells.aspx

21 Personal communication between Lisa Sumi and Gwen Lachelt, Earthworks and New Mexico OCD Enforcement and Compliance Manager, Daniel Sanchez, OCD attorney, Sonny Swazo, and New Mexico EMNRD Communications officer, Jim Winchester. April 11, 2012.

22 This LOV and Shut-In Directive for Apache's East Blinebry Drinkard Unit #003 well did not mention which rule(s) had been violated (http //ocdimage.emnrd.state.nm.us/Imaging/FileStore/hobbs/wf/81924/3002506535_21_wf.tif), while this LOV and Shut-In Directive for Apache's North Monument G/SA Unit #003 well did list a rule violation. (http //ocdimage.emnrd.state.nm.us/Imaging/FileStore/hobbs/wf/91895/3002504155_38_wf.tif).

23 According to the STRONGER board, "Pennsylvania's oil and gas program is now completely funded by well permit fees. The increase in permit fees allowed DEP to increase the size of its permitting, compliance and enforcement staff." (Source STRONGER (State Review of Oil and Natural Gas Environmental Regulations, Inc.). Sept. 2010. Pennsylvania Hydraulic Fracturing State Review. p. 6. http //www.shalegas.energy.gov/resources/071311_stronger_pa_hf_review.pdf)

24 Feb. 14, 2012. "Pennsylvania passes comprehensive amendments to Oil and Gas Laws." Morgan Lewis. http://www.morganlewis.com/index.cfm/publicationID/cfd3c31d-64a3-4e9e-9e49-ee9506deac03/fuseaction/publication.detail To view the bill, go to: General Assembly of Pennsylvania. House Bill No. 1950. Session of 2011. §3256. Civil penalties. http://www.legis.state.pa.us/CFDOCS/Legis/PN/Public/btCheck.cfm?txtType=HTM&sessYr=2011&sessInd=0&billBody=H&billTyp=B&billNbr=1950&pn=3048

25 Texas Natural Resources Code. Title 3. Oil and Gas; Subtitle B. Conservation and Regulation of Oil and Gas; Chapter 85. Conservation of Oil and Gas; Subchapter A. General Provisions; Section 85.381. Penalty for violation of laws, rules and orders. http //www.statutes.legis.state.tx.us/Docs/NR/htm/NR.85.htm

26 TEXAS DATA Sunset Advisory Commission. January 2011. *Sunset Advisory Commission Decision. Railroad Commission of Texas.* p. 8. http //www.sunset.state.tx.us/82ndreports/trc/trc_fr.pdf COLORADO DATA Colorado Oil and Gas Conservation Commission. *2011 Annual Report to Water Quality Control Commission*. p. 11. http //cogcc.state.co.us/Library/WQCC_WQCD_AnnualReports/WQCC10_11RPT.pdf

30 New Mexico Legislative Finance Committee. Feb. 17, 2011. Fiscal Impact Report for HB 176, Oil & Gas Act Enforcement. p. 6. http //www.nmlegis.gov/sessions/11%20regular/firs/HB0176.pdf

31 *ibid*

32 New Mexico Statutes Annotated (NMSA). 1978. Section 70-2-31. Violations of the Oil and Gas Act; penalties. http //search.nmcompcomm.us/nmsu/lpext.dll/nmsa1978/4cb/22920/2292f/229ba?f templates&fn document-frame.htm&2.0#JD_70-2-31

33 *ibid*

34 New Mexico Air Quality Bureau. Oct. 20, 2005. *Civil Penalty Policy.* p. 14. http //www.nmenv.state.nm.us/aqb/enforce_compliance/Civil%20Penalty%20Policy%2010-20-05%20Version.pdf

47 Due to time constraints, the chart contains a selection of operators receiving enforcement letters (LOVs, FVI or LET in the compliance summaries) in 2010 and 2011.

48 The number of wells in compliance was determined by counting the number of LOVs that had a date in the column "Dt Comp. Achv'd."

EARTHWORKS™
OIL & GAS ACCOUNTABILITY PROJECT

OGAP

OGAP PO Box 22003; Albuquerque, New Mexico 87154 • 505-469-0380
EARTHWORKS • 1612 K St., NW, Suite 808 Washington, D.C., USA 20006
www.earthworksaction.org • www.ogap.org

July 26, 2016

Secretary Sally Jewell
U.S. Department of the Interior
1849 C Street, NW
Washington, DC 20240
Secretary_Jewell@ios.doi.gov

Neil Kornze, Director
Bureau of Land Management
1849 C Street NW, Rm. 5665
Washington, DC 20240
director@blm.gov

Amy Lueders, New Mexico State Director
Bureau of Land Management
301 Dinosaur Trail
Santa Fe, NM 87508
alueders@blm.gov

Victoria Barr, Farmington District Manager
Bureau of Land Management
6251 College Blvd. Suite A
Farmington, NM 87402
vbarr@blm.gov

RE: Mancos Shale Oil Drilling, Public Participation, and WPX Energy Explosion

Dear Secretary Jewell, Mr. Kornze, Ms. Lueders, and Ms. Barr:

A fire at a new WPX Energy well site (consisting of six wells) erupted on the night of July 11, 2016, burning 36 storage tanks and causing the evacuation of 55 residents. This development is just southwest of U.S. Highway 550 near Nageezi, New Mexico, and is just 14 miles from Chaco Culture National Historical Park.

The Bureau of Land Management ("BLM") Farmington Field Office approved development of federal mineral on this site through an environmental assessment ("EA") and finding of no significant impact ("FONSI"), identified as National Environmental Policy Act ("NEPA") No. DOI-BLM-NM-FO10-2016-0036. The EA failed to take a hard look at the health and safety risks of well construction and production, providing only a cursory section on health and safety despite the fact that the project area is adjacent to numerous homes, families, and the major highway in the region. BLM's failure to properly assess these risks is only exacerbated by the agency's troubling decisions, as detailed below: (1) to provide the public with the decision documents three months after BLM approved and WPX Energy spudded the wells; and (2) to approve new Mancos shale oil wells even though it has yet to complete the Mancos Shale Resource Management Plan Amendment ("RMP Amendment"). We therefore reiterate our request that BLM impose a moratorium on all further federal reviews and approvals of drilling and construction of infrastructure to extract federal—i.e., publicly owned—minerals in the Mancos Shale oil formation. At

the very least, BLM should provide the public with advance notice and an opportunity to review and comment on decisions regarding Mancos shale oil projects before those decisions are made.

These issues and risks are not new. Ongoing litigation in the U.S. District Court for the District of New Mexico, *Diné CARE et al., v. Jewell et al.,* No. 1:15-cv-00209-JB-LF, with an interlocutory appeal pending before the U.S. Court of Appeals for the Tenth Circuit, No. 15-2130, concerns the precise type of development which occurred at the WPX Energy site. Because the Farmington Field Office has continued to approve new well-development decisions on an ongoing basis, plaintiffs in *Diné CARE* have filed several supplemental petitions for review with the Court. Including the most recent petition, filed on July 22, 2016, BLM has approved at least 360 horizontally drilled and multi-stage fractured wells to date, despite great and substantiated public concern that development of the Mancos Shale formation was never properly analyzed. BLM's Farmington Field Office has consistently fast-tracked approval of these horizontal wells, undermining the RMP Amendment's efforts to account for public input and, to the degree development proceeds, to ensure orderly and efficient development that protects the public interest, including life, property, and the land, air, and water. 43 C.F.R. §§ 3160.0–4; 3161.2.

We emphasize that one of the claims alleged in *Diné CARE* involves BLM's failure to involve the public in its decisionmaking, as required by NEPA. *See* 40 C.F.R. §§ 1501.4, 1506.6. The timeline for BLM's approval of the WPX Energy project exemplifies Plaintiffs' concerns that the failure to involve the public undermines the agency's credibility and increases the risk of drilling problems. BLM signed the EA and FONSI for the project on February 12, 2016. WPX Energy spudded approved wells between February 17 and 19, 2016. Not until three months later, on May 20, 2016, did BLM post the EA and FONSI to its website and, on May 23, 2016 did BLM send an email to Plaintiffs and counsel informing them of the decision.

In other words, the public was made aware of this drilling project only after BLM approved and WPX Energy drilled these wells. The public, therefore, was unaware of this project and never given the opportunity to meaningfully participate in the agency's decisionmaking. This failure is particularly troublesome in the context of the current litigation—which seeks to enjoin such development until BLM completes a landscape level impacts analysis—suggesting what many in the public deem a concerted effort to facilitate as much development as possible before the Court has an opportunity to rule.

These WPX Energy wells were producing for just one week before the entire site went up in flames. Little is still known about the underlying causes and consequences of the explosion, but what we do know is that 55 residents were evacuated because of extreme danger, many livestock and domestic animals were killed, and nearby residents have reported respiratory and other health problems as a result. Emergency response for this explosion was hours away, citizens were not properly informed, and the BLM had no known evacuation/hazardous materials plan in place.

It is incumbent upon BLM to act as steward of our public lands rather than catalysts for private industry's exploitation absent meaningful public participation and consideration of all potential significant impacts, including health and safety. We again urge you to give your full attention to the WPX Energy explosion, to impose a moratorium on all additional Mancos Shale drilling until BLM completes the required RMP Amendment, and to provide the public the meaningful response it deserves. Given the immediacy of this incident, we would appreciate a prompt response.

Signed,

/s/ Carol Davis
Carol Davis
Diné Citizens Against Ruining Our Environment
HCR 63 Box 272
Winslow, AZ 86047
caroljdavis.2004@gmail.com

/s/ Dan Olson
Dan Olson
San Juan Citizens Alliance
1309 3rd Ave., Suite 5
Durango, CO 81302
danolson@sanjuancitizens.org

/s/ Tim Ream
Tim Ream
WildEarth Guardians
PO Box 641672
San Francisco, CA 94164
tream@wildearthguardians.org

/s/ Amy Mall
Amy Mall
Natural Resources Defense Council
1152 15th Street, N.W., Suite 300
Washington, D.C. 20005
amall@nrdc.org

CC:
Kyle Tisdel, Attorney, Western Environmental Law Center, tisdel@westernlaw.org
Samantha Ruscavage-Barz, Attorney, WildEarth Guardians, sruscavagebarz@wildearthguardians.org
Clare Boronow, Attorney, U.S. Department of Justice, Clare.Boronow@usdoj.gov

Senator Tom Udall
531 Hart Senate Office Building
Washington, DC 20510

Senator Martin Heinrich
303 Hart Senate Office Building
Washington, DC 20510

Representative Ben Ray Luján
2446 Rayburn HOB
Washington, DC 20515

From:	Gregory Cowan
To:	Moses-Nedd, Cynthia
Cc:	Randy Phillips; Joel Bousman (Joel.Bousman@sublettewyo.com); Forrest Chadwick
Subject:	RE: September dial-in with the commissioners
Date:	Wednesday, September 21, 2016 3:21:21 PM
Attachments:	Ag and Public Lands.pdf

Excellent. Thank you! See attached for the Committee's agenda. And FYI, it'd be at 11:00 A.M. EST instead of my prior announcement that it'd be at noon. Hopefully that still works!

As far as topics go . . .

Cynthia: (1) Planning 2.0 update; (2) external outreach in re the recently released GSG IMs; and (3) please be prepared to address any Wyoming RAC appointment gaps (this may not be an issue, I need to check in with folks locally)

Randy: (1) if you can, please outline general administrative constraints and opportunities when addressing roadless areas; and (2) note USFS commitment (logistical, human, financial) for local forest collaboratives that may affect, in whole or in part, NFs in Wyoming (e.g., the collaboratives outlined in the governor's Task Force on Forest Health)

After writing down those topics, twenty minutes presents a tall order. If we go over a bit, assuming your time allows, that's OK.

Thanks for doing this. I know the Commissioners appreciate hearing from you. Let me know if you have any questions or thoughts in the lead up to next Wednesday. Here is the dial-in info:

1.605.475.3235

Pass: 829747#

Gregory

From: Moses-Nedd, Cynthia [mailto:cnedd@blm.gov]
Sent: Wednesday, September 21, 2016 12:35 PM
To: Gregory Cowan
Cc: Randy Phillips
Subject: Re: September dial-in with the commissioners

Hi Gregory,

Hope all is well! Randy and I are happy to participate on next Wednesday at noon ET. If you have a few topics of

interest to the committee, let us know.

Thanks!

Cynthia

****

Cynthia Moses-Nedd

Liaison to State & Local Government

DOI-Bureau of Land Management

Washington, DC

(202) 912-7446 Ofc

(202) 821-9410 Cell

On Wed, Aug 10, 2016 at 4:22 PM, Gregory Cowan <gcowan@wyo-wcca.org> wrote:

Excellent! Thank you.

Be in touch.

Gregory

From: Moses-Nedd, Cynthia [mailto:cnedd@blm.gov]
Sent: Wednesday, August 10, 2016 11:34 AM
To: Gregory Cowan
Cc: Randy Phillips
Subject: Re: September dial-in with the commissioners

Hi Gregory,

Right now, September 28th is open other than a couple of tentative invitations. I have put it on my calendar.

Life is good and summer has been HOT, but kind.

Cynthia

****

Cynthia Moses-Nedd

Liaison to State & Local Government

DOI-Bureau of Land Management

Washington, DC

(202) 912-7446 Ofc

(202) 821-9410 Cell

On Wed, Aug 10, 2016 at 11:54 AM, Gregory Cowan <gcowan@wyo-wcca.org> wrote:

Good morning!

Hope the summer's been kind to you both. Glad to report that it has been for me and mine. Anyway, curious your availability to call into a WCCA Public Lands committee (Joel chairs it) meeting on Wednesday, September 28 @ noon (EST)? Figure 10 minutes each for a total of 20? If you recall we did something similar a couple of years ago and the takeaway was that it was good to connect and otherwise briefly touch base. We can nail down specific topics if you care to in the lead up to the meeting.

Thanks! Be in touch.

Gregory

Gregory M. Cowan

Natural Resource Staff Attorney

Wyoming County Commissioners Association <http://www.wyo-wcca.org/>

O: 307.632.5409

C: 307.275.4746

<http://www.wyo-wcca.org/index.php/initiatives/wpli>

NOTICE: this communication (including attachments) may be protected as an attorney-client communication. Any unauthorized interception of this message or the use or disclosure of the information it contains may violate the law and subject the violator to civil or criminal penalties. If you believe you have received this message in error, please notify the sender and delete the email immediately.

Wyoming County Commissioners Association

Agriculture, Water, State & Public Lands Committee

Chairman Joel Bousman, Sublette County
(307) 749-6154 eastforklive@wildblue.net
Co-Chairman Forrest Chadwick, Natrona County
(307) 259-0286 fchadwick@natronacounty-wy.gov

2016 Fall Meeting at the WACO Conference
Wednesday, September 28, 2016, 1 p.m.
Laramie, Wyoming
UW Conference Center, Salon C

Committee Meeting Agenda Topics:

- **Welcome and Introductions** [5 minutes]
- **Approval of Minutes**
- **Update from D.C.** [20 minutes]
  - Cynthia Moses-Nedd (BLM) and Randy Phillips (USFS) via conference call
- **Update from Governor Mead's Office**[20 minutes]
  - Jessica Crowder, Public Lands Advisor to Governor Mead
    - » Task Force on Forest Health Update
    - » Status of State/Federal Cooperative Management Pilot Project
- **Update from WCCA Staff** [30 minutes]
  - Gregory Cowan, WCCA Natural Resource Staff Attorney
    - » Thunder Basin National Grassland Update
    - » MOA with USFS Update
    - » Quarterly Meeting Feedback
    - » Ideas for the 2017 NEPA and Coordination Training
- **Commissioner Roundtable** [45 minutes]

Minutes of Previous Meeting:

Joint Meeting - WCCA Agriculture, Water, State and Public Lands Committee and WCCA Energy and Environment Committee
September 23, 2015
Laramie, Wyoming

The meeting was called to order by Chairman Bousman and Chairman Grosskopf.

All non-commissioners introduced themselves to the committees. The meeting included ten members of the Energy & Environment Committee, eleven members of the Public Lands Committee, and twelve other guests.

A motion was made to approve the minutes of the Energy and Environment Committee from the last meeting. The motion was seconded. All voted aye. A motion was made to approve the minutes of the Public Lands Committee from the last meeting with one noted change to attendees. The motion was seconded. All voted aye.

Staff Update
Gregory Cowan, WCCA's Natural Resource Staff Attorney, presented a summary of pending litigation with which WCCA is involved. This includes:

- BLM's Hydraulic Fracturing Rule
- Waters of the U.S.
- Regional Haze
- Coal Leasing / Permitting based upon Wild Earth Guardians Suit

continued on page 2...

Mr. Cowan also discussed "A Sublette County Profile: Socioeconomics". The document was put together by Sublette County and was recently utilized by the state for the Governor's Consistency Review on Sage Grouse rules.

The Governor's office has committed funds to the purpose of developing similar plans for other counties.

The state will participate in the cost at a 2/3 State / 1/3 County ratio. The state will contribute $5,500 towards the socioeconomics work for each county. These are being done in cooperation with the University of Wyoming. Mr. Thompson asked about moving this process forward. Mr. Cowan indicated that the University is ready to move forward with profiles whenever WCCA and funding is ready. The holdup at this point seems to be getting all of the documents for funding in place.

The Association is also participating in rulemaking and/or review of the following:
- Methane Reduction from Oil & Gas Rule from BLM – Expected middle to end of October
- Clean Power Plan
- National Ambient Air Quality Standards (NAAQS) for Ozone

Mr. Cowan also drew attention to the Wyoming Public Lands Handbook which was recently completed by WCCA. This is based upon a similar document from Idaho.

Federal Coal Leasing 101
Mr. Jonathan Downing, Executive Director, Wyoming Mining Association, provided general background on coal and mining. This past year the coal industry in Wyoming contributed $1.1 billion in state, federal, and local taxes. Additionally, coal lease bonus bid monies are going to be ending in 2017. This has been adding approximately $250 million per year ($500 million per biennium) to school capital construction in Wyoming. Over the past 5 years, BLM managed coal generated approximately $8 billion in royalties and approximately $4 billion in taxes. When looked at in the aggregate, taxes on coal are approximately 40% of the value.

Approximately 40% of the coal produced in the U.S. is federal coal. 85% of the federal coal produced is from the Powder River Basin. In 2012, Wyoming mines paid $799 million in royalties to BLM. Permitting and leasing is now seven to twelve years in length.
By statute coal lessees must pay no less than 12.5% in royalties. The concern lies in the Department of Interiors ability to increase royalty rates above 12.5%.

OSM Stream Buffer Rule
Mr. Adam Eckman, National Mining Association, joined by phone to discuss Office of Surface Mining changes to the Stream Buffer Rule. Previously, this was mostly an Appalachian problem. Unfortunately, the rule is being expanded broadly. The rule would significantly increase requirements for bonding and/or liability. Under the Stream Buffer Rule, OSM proposes to prohibit the abilities for companies to self-bond any portion of a mining operation that would affect any stream. Additionally, the rule expands protections to further streams by referencing the proposed Waters of the U.S. rule and emphemeral streams.

Proposed rules would also require additional analysis for mitigating and protecting not only listed species, but proposed species, plus a new requirement that the Fish & Wildlife Service sign-off on any permits. Up to this point, companies had to comply with the Endangered Species Act, but Fish & Wildlife Service was not involved in the permit approval process for Surface Mining Control and Reclamation Act mine permits.

The comment period for the proposed rule ends October 26, 2015. The final rule is expected approximately one year from now.

Iterative NEPA
Mr. David Loomis, Environmental Planner, U.S. Forest Service, and Ms. Jessica Clement, Research Scientist and Program Director, Ruckelshaus Institute, University of Wyoming Haub School of Natural Resources, provided background and commentary on Iterative NEPA.

continued on page 3...

The heart of the Iterative NEPA process is that the agency may make changes to its proposals before putting forward a draft and that these incremental changes may become additional alternatives. This process saves the agency time and money and honors public input by allowing for incremental changes during the NEPA process. It also helps to avoid polar opposite views in proposed alternatives. Major changes to proposals are not allowed and require a supplemental EIS.

Iterative NEPA is different than collaboration. The two are very different processes and should be used in different situations.

Mr. Doug Thompson shared his experience that Iterative NEPA sometimes allows the public to bypass Cooperating Agencies. Mr. Loomis explained that Iterative NEPA is actually a benefit because feedback from the Cooperating Agencies can be included earlier.

It was shared that Iterative NEPA applies through issuance of the Environmental Impact Statement.

RAC Update
Mr. Doug Thompson provided an update on the RAC. Mr. Thompson is limited to two terms (three yearseach) by BLM rules. Mr. Thompson believes it is important to serve on the RAC to effectively influence BLM and make sure your voice is heard. The Association recognized Mr. Thompson's contributions to the RAC and his recognition nationally as a resource. Mr. Thompson noted that to serve on the RAC you must be an elected official. He asked members of the committee to look for upcoming advertisement of the availability of his position on the RAC.

Good of the Order
Mr. Thompson also provided an update on the Sage Grouse. The Sage Grouse was not listed, but will instead be managed through a cooperative regulatory process between federal agencies and the states. Mr. Thompson also indicated there are large inconsistencies between federal management plans and the state management plan. The Governor addressed inconsistencies during his consistency review, and though answers were received from BLM, the response of BLM was not clear. Two Records of Decision regarding the Sage Grouse were subsequently signed by the Secretary of the Interior. Mr. Thompson stressed the importance of making sure that Wyoming's plan and the RMPs are implemented as written.

Mr. Loren Grosskopf provided comments and background on various NACo projects and the WIR (Western Interstate Region) Convention which will be in Jackson this next year. Mr. Grosskopf proposed chartering a flight for NACo representatives attending WIR in Jackson next year to visit Gillette and see visit the coal mines and a power plant. Mr. Bousman shared the importance of educating NACo representatives who lobby on our behalf on Wyoming issues. Mr. Avery shared information on the Northern Campbell County Resource Tools.

Mr. Gregory Cowan reminded commissioners that committee materials are available for their use on the WCCA DropBox.

There being nothing further to come before the committees, the meeting was adjourned at 3:05 p.m.

From: jbaranga@blm.gov
Subject: News Release: BLM Announces Annual Adjustment to Its Mineral Fee Cost-Recovery Schedule
Date: Thursday, September 22, 2016 6:10:05 PM

News Release

Bureau of Land Management Contact: Kimberly Brubeck (202) 208-5832

For Immediate Release Date: Thursday, Sept. 22, 2016

BLM Announces Annual Adjustment to Its Mineral Fee Cost-Recovery Schedule

Effective October 1, 2016, the Bureau of Land Management (BLM) will implement an updated fee schedule to recover costs incurred in the processing of certain actions related to oil, gas, coal, and solid minerals activities on public lands. The updates to the existing fee schedule are based on inflation and follow the BLM cost recovery adjustment procedures established in 2005. The updated fee schedule appears in today's Federal Register and will be posted to the BLM website: http://www.blm.gov.

The updated fees cover costs for processing actions such as lease applications, name changes, corporate mergers, lease consolidations, and reinstatements. The BLM updates the fee schedule each year based on changes in the Implicit Price Deflator for Gross Domestic Product (IPD-GDP), as determined by the U.S. Department of Commerce.

Since the IPD-GDP reflected only a small increase this year, 30 of the 48 fees subject to annual adjustment remain unchanged. Of the remaining 18 fees, 15 will increase by only $5, one will increase by $0.01 per acre, and two will increase by $20 and $35, respectively. Specifically, the fee for adjudicating 10 or fewer mineral patent claims will increase $20, from $1,535 to $1,555. The fee for adjudicating more than 10 claims will increase $35, from $3,075 to $3,110.

The BLM is authorized to charge cost recovery fees under the Federal Land Policy and Management Act of 1976 (FLPMA) and the 2005 Cost Recovery Rule. The Office of Management and Budget (OMB) has also directed Federal agencies to recover costs for their services. The BLM first implemented a cost recovery fee schedule for certain oil and gas activities in November 2005. The 2005 Cost Recovery Rule expressly contemplated that the BLM would annually adjust the fee schedule to account for inflation.

—BLM—

The BLM manages more than 245 million acres of public land, the most of any Federal agency. This land, known as the National System of Public Lands, is primarily located in 12 Western states, including Alaska. The BLM also administers 700 million acres of sub-surface mineral estate throughout the nation. The BLM's mission is to sustain the health, diversity, and productivity of America's public lands for the use and enjoyment of present and future generations. In Fiscal Year 2015, the BLM generated $4.1 billion in receipts from activities occurring on public

lands.

From:	Nada Culver
To:	brett@csp-inc.org; kbail@blm.gov; fcheever@law.du.edu; Mark S Squillace
Subject:	National Conservation Lands panel FW: University of Colorado Law School: FLPMA Turn 40 Event Info
Date:	Thursday, September 29, 2016 12:48:18 PM
Attachments:	FLPMA Turns 40 Event Program.pdf FLPMA. Speaker Logistics and Travel Information.pdf

---

Hi fellow panelists, Professor Cheever and Professor Squillace – Having just seen our collective topic and 70 minutes, I was hoping we could check in (at least by email) about how our panel would run. Selfishly, I'm technically on sabbatical and only in town for a few more days and then back the week of the panel so was hoping to get a sense of your thoughts.

Brett Dickson and I touched base briefly over email and were thinking that it could work for each panelist to talk for about 15 minutes about our engagement with the Conservation Lands and also how we see the conservation agenda of the BLM continuing to move forward with the Conservation Lands, which would then allow us some time for the comments of Professor Cheever and for discussion questions. We were also thinking that we'd be able to use powerpoint slides to show some great places and key points. Does that sound workable and like what you had in mind?

We can also check in a few days before the conference to make sure, for instance, that Kristin and I aren't overlapping too much if we are both delving into some history of the National Conservation Lands.

Thoughts welcome and looking forward to our panel next month.

Nada Culver

Senior Counsel and Director, BLM Action Center

The Wilderness Society

1660 Wynkoop, #850

Denver, CO 80202

Main: 303-650-5818

Direct: 303-225-4635

Nada_Culver@tws.org <mailto:Nada_Culver@tws.org>

From: Getches-Wilkinson Center [mailto:gwc@colorado.edu]
Sent: Thursday, September 22, 2016 1:27 PM
To: Nada Culver <nada_culver@tws.org>
Subject: University of Colorado Law School: FLPMA Turn 40 Event Info

Good Afternoon Ms. Culver,

On behalf of the Getches-Wilkinson Center and Professor Mark Squillace we would like to thank you for joining us for the upcoming FLPMA Turns 40 event.

We write to you today to provide some important information for your reference. Attached here you will find:

* The current event program/agenda
* Information on travel arrangements and early logistical information

Please review the attached information and direct any questions, or travel inquiries to:

Shaun LaBarre

Program Manager

Getches-Wilkinson Center for Natural Resources, Energy, and the Environment
University of Colorado Law School
Wolf Law Building, 401 UCB | Boulder, CO 80309
Direct: (303) 492-1286

Shaun.LaBarre@colorado.edu <mailto:Shaun.LaBarre@colorado.edu>

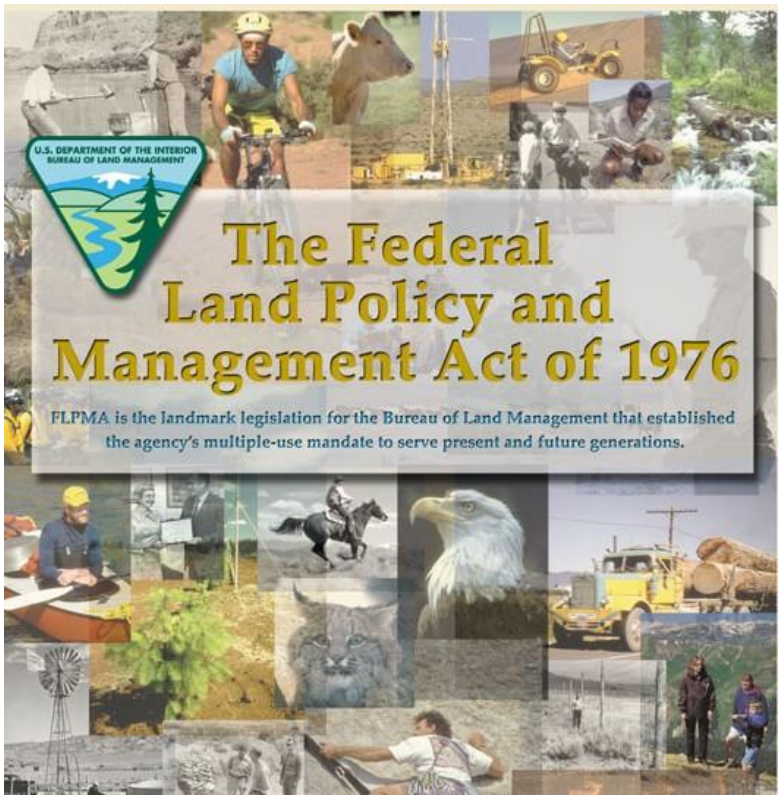
We are excited you can join us for this important celebration and look forward to seeing you in October.

Regards,

Getches-Wilkinson Center for Natural Resources, Energy, and the Environment
University of Colorado Law School

GWC

Getches-Wilkinson Center
for Natural Resources, Energy,
and the Environment

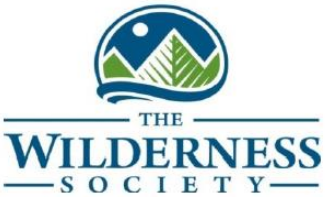


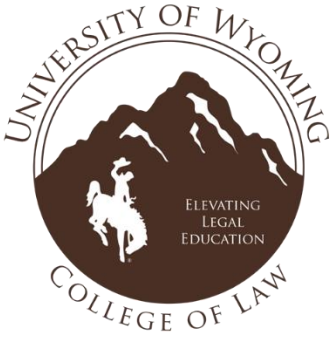
FLPMA Turns 40

University of Colorado School of Law
Wolf Law Building, Wittemyer Courtroom
Friday, October 21, 2016

GETCHES WILKINSON CENTER
FOR NATURAL RESOURCES, ENERGY, AND THE ENVIRONMENT

Event Sponsors





Agenda: Friday, September 21st

7:30-8:00 Welcome and Refreshments

8:00-8:15 Welcoming Remarks

8:15-9:10 a.m.

FLPMA in its Historical Context

This session traces the history of FLPMA including, among other things, its legislative, administrative, and historical antecedents, including for example, and the Public Land Law Review Commission's 1970 report, *One Third of Our Nation's Lands*. It then considers FLPMA's unique public lands policies and requirements and how they are reflected in the BLM's management of public lands today.

See: https://www.nps.gov/parkhistory/online_books/blm/history/contents.htm

Speaker:
John Leshy, University of California, Hastings College of Law

Moderator and commentator:
Karin Sheldon, Four Echoes Strategies

9:10-10:30 a.m.

Managing our Public Lands under the Multiple Use Mandate
(The BLM Directors Panel)

The current and two former BLM Directors discuss the challenges of managing public lands under FLPMA's multiple use mandate. Among the issues that will be covered are land use planning, resource constraints, the challenges of balancing commodity uses alongside recreational uses and environmental values. Each panelist will offer their vision for how the BLM should evolve over the next several decades.

Panelists:
Neil Kornze, Director, Bureau of Land Management (BLM)
Mike Dombeck, University of Wisconsin, Stevens Point

Moderator and commentator:
Ruth Welch, Colorado State Director, BLM

10:30-10:50 Morning Networking Break
(Refreshments provided in Boettcher Hall)

10:50 to Noon

Managing our Public Lands for Conservation Values

Even before the creation of the National Landscape Conservation System, the BLM had a conservation mantle. FLPMA itself provides for protection of wilderness and wilderness study areas as well as for areas of critical environmental concern (ACECs), and BLM national monuments. These and other protected BLM lands, including historic and cultural properties, now fall under the umbrella of the NLCS and the panel will consider the role of the NLCS in broadening the BLM's mission, and in affording the agency a conservation agenda.

Panelists:
Nada Culver, The Wilderness Society
Brett Dickson, Conservation Science Partners
Kristin Bail, Bureau of Land Management

Moderator and commentator:
Fred Cheever, University of Denver, Sturm College of Law

Noon-1:15 Hosted Lunch
Environmental Law Society BBQ

Lunch Speaker:
Brian O'Donnell, Conservation Lands Foundation
The Past, Present, and Future of BLM National Monuments

1:15 to 2:30 p.m.

Managing our Public Lands for Extractive Uses

Our public lands have long been used for extractive uses. These include for example, mineral leasing, hard rock mining, livestock grazing, and more recently large-scale renewable energy siting. The panel will consider how well the current system is working and how it might be improved.

Panelists:
Kathryn Kovacs, Bureau of Land Management
Rebecca Watson, Wellborn, Sullivan, Meck, and Tooley, P.C.
Roger Flynn, Western Mining Action Project

Moderator and commentator:
Marcilynn Burke, University of Houston Law Center

2:30-2:50 Afternoon Networking Break (with Birthday Cake)

2:50 to 4:10 p.m.

Modern Challenges and Modern Solutions

The BLM faces many recurring challenges. On the land use planning side, the BLM is struggling to incorporate landscape-level planning and adaptive management into its program in the face of serious resource constraints. Challenges to the BLM's management authority abound as shown by the Cliven Bundy incident, the Malheur Wildlife Refuge standoff, the state supremacy movement, and the long-standing fight over R.S. 2477 roads. On the other hand, cooperative efforts to protect the greater sage grouse suggest that interested parties can still work together to resolve difficult problems. This panel consider these multiple challenges and the hopeful signs that people can come together to address the myriad problems that face our public lands.

Panelists:
Ken Rait, The Pew Charitable Trusts
Bret Birdsong, UNLV School of Law
Dave Theobold, Conservation Science Partners

Moderator and commentator:
Mark Squillace, University of Colorado School of Law

4:10 to 5:10 p.m.

The Future of our Public Lands

This wrap-up panel will consider how FLPMA might look in the short term – during the next presidential administration, and what we might expect going forward over the next 40 years.

Panelists:
John Leshy, University of California, Hastings College of Law
Mike Dombeck, University of Wisconsin, Stevens Point
Linda Lance, Bureau of Land Management

University of Colorado Law School

Established in 1892, the University of Colorado Law School is one of the top public law schools in the United States. Colorado Law School's diverse student body is selected from among the statistically best applicants from every corner of the nation representing over 100 undergraduate institutions, and its highly published faculty is dedicated to interacting with students both inside and outside the classroom. The school's state-of-the-art green building is located at the base of the Rocky Mountains in beautiful Boulder, Colorado. With about 500 students and a low student to faculty ratio, Colorado Law School is a thriving academic community where the study of law is embraced to create leaders who recognize the civic responsibilities essential to the legal profession.

Getches-Wilkinson Center for Natural Resources, Energy, and the Environment

The Getches-Wilkinson Center for Natural Resources, Energy and the Environment continues the long-standing work of Colorado Law's Natural Resources Law Center. The newly renamed Center endeavors to serve the people of the American West, the nation, and the world through creative, interdisciplinary research, bold, inclusive teaching and innovative problem solving in order to further true sustainability for our use of the lands, waters, and environment. Major programs and initiatives focus on natural resources, water and public lands issues in Colorado and the West; energy and environmental security in the developing world; electricity regulation and energy policy; climate change law and policy; and native communities and environmental justice. The name comes from the contributions of two iconic figures in the law school's environmental law history, David Getches and Charles Wilkinson.

GWC
Getches-Wilkinson Center
for Natural Resources, Energy,
and the Environment

University of Colorado Law School
401 UCB
2450 Kittredge Loop Road
Boulder, Co 80309
www.colorado.edu/law/research/gwc
gwc@colorado.edu

We are pleased to have you join us for ***FLPMA Turns 40***, celebrating the 40th anniversary of the Federal Land Policy and Management Act, coming Friday, October 21st. Below are some important dates and deadlines to calendar and all the relevant logistical information for travel and location information. I will be in touch with reminders, and please feel free to contact me if I can help with anything.

MARK YOUR CALENDAR:

- **Event Date:** Friday, October 21st (8:00 a.m.-5:10 p.m., current agenda attached to email)
- **Speaker Dinner:** Thursday, October 20th (Rio Grande, reservation for 6:30)

TRAVEL AND ACCOMMODATIONS:

If you are making travel plans and would like the Getches-Wilkinson Center to cover the expense:

Please contact Shaun LaBarre at shaun.labarre@colorado.edu to arrange flight and hotel accommodations.

Air Travel

Shaun will work with the CU Travel Agent based on your preferred travel times to identify some itinerary options for your selection. This is the best way for the University to cover the cost of your air travel. You are able to self-book your air travel and be reimbursed, but this will require a more lengthy paperwork process for reimbursement.

When you call or email Shaun, please have the following information available:

- Your Name as it appears on the traveler's driver's license
- Date of birth
- Gender
- Personal contact information including email & phone number
- Preferred travel dates and times

We will work with the CU travel agent to setup flight options for you to select.

Hotel

Based on your flight itinerary, Shaun will book your hotel accommodations and provide a confirmation. Based on availability we plan on hosting the group at the Best Western Boulder Inn. The Best Western Boulder Inn is a recently remodeled facility located a couple blocks from the Wolf Law Building.

EVENT LOCATION:
University of Colorado Law School
Wolf Law Building
Wittemyer Courtroom
2450 Kittredge Loop
Boulder CO 80309
Maps & Directions: http://www.colorado.edu/law/about/visitus

OTHER NOTES and LOGISTICS

- There will be a dinner for the event speakers the evening of Thursday, October 20th at the Rio Boulder, sponsored by The Wilderness Society. Please rsvp if you plan to join us for dinner
- I will register each panelist for the event.
- As the event draws near I will be in touch with additional logistical information including; ground transportation options and a finalized event agenda.
- Parking will be provided on campus for all speakers and attendees the day of the event.

REIMBURSEMENTS
If you have items to be reimbursed by the University including meals, ground transport, parking, or other incidentals you must have a receipt (itemized receipt for meals). All receipts can be submitted to Shaun; original receipts or copy/scan to email works. With the receipts we will setup a non-employee reimbursement form for your review to be submitted to CU procurement.

Meals
Please note, to be reimbursed for meal expenses we will need an itemized receipt for all meals which are requested to be reimbursed, and the University does not reimburse for alcohol purchases. Meal reimbursements can be submitted and processed with other travel reimbursements you may be requesting. The University will not compensate for general per diem payment inquiries, only as reimbursement for actual purchases with an itemized receipt.

For meal purchases please do not exceed the U.S. GSA Per Diem Rates for Colorado found here: **http://www.gsa.gov/portal/content/101518**

Meals Provided

The information below outlines meals provided during the conference:

- Thursday, Oct 20th:
  - Speaker Dinner at the Rio Grande
- Friday, October 21st:
  - Snacks and refreshments will be served upon arrival to the event, and during each break
  - Lunch will be provided with the event
    (BBQ hosted by the Environmental Law Society)

DINNER LOCATION:
Rio Grande Mexican Restaurant
1101 Walnut Street
Boulder, Co 80302
Time: Reservation for 6:30

REQUESTS:
Please, no later than Friday, October 7th, contact me with the following:

- **Short Bio & Photo**
- **RSVP for the dinner**
- **Also, please review the agenda attached to the original email**

MY CONTACT INFORMATION:
Shaun LaBarre
Program Manager
Getches-Wilkinson Center
Email: shaun.labarre@colorado.edu
Office Phone: 303-492-1286

I am always happy to help with any conference-related questions or requests. Thank you for being part of this important event, and we look forward to celebrating with you.

From:	Lundell, Michael
To:	Steve Bloch
Subject:	Re: Moab Class I Fourth Meeting Notes
Date:	Friday, September 30, 2016 1:34:49 PM
Attachments:	MoabClassI_Part_1_DRAFT_Revised_31Aug2016compressed2.pdf

Hello Steve,

Here is the second draft.

M. Jared Lundell
Archaeologist (Acting)
Bureau of Land Management
Washington Office-240
20 M. Street SE
Washington DC, 20003
202-912-7241
mlundell@blm.gov

On Fri, Sep 30, 2016 at 1:22 PM, Steve Bloch <steve@suwa.org> wrote:

> Perfect – thanks. And confirming that the June 2016 version of the Class I is the latest version that consulting parties have in hand for this review (that there wasn't a revised version that BLM shared with us).
>
> **From:** Lundell, Michael [mailto:mlundell@blm.gov]
> **Sent:** Friday, September 30, 2016 11:18 AM
> **To:** Steve Bloch <steve@suwa.org>
> **Subject:** Re: Moab Class I Fourth Meeting Notes
>
> Hello Steve,
>
> The maps are figures 8-8 (sensitivity) and 8-9 (composite) on pages 8-47 and 8-51 respectively.
>
> M. Jared Lundell
>
> Archaeologist (Acting)
> Bureau of Land Management
> Washington Office-240
>
> 20 M. Street SE
>
> Washington DC, 20003

202-912-7241

mlundell@blm.gov

On Fri, Sep 30, 2016 at 12:59 PM, Steve Bloch <steve@suwa.org> wrote:

> Hi Jared -
>
> Thanks for sending around the notes – they're helpful. Would you please remind me what the "sensitivity map" is that you refer to in I.a.iii of your notes (e.g. which map(s))? Thanks.
>
> Steve
>
> **From:** Lundell, Michael [mailto:mlundell@blm.gov]
> **Sent:** Wednesday, September 28, 2016 2:19 PM
> **To:** Amanda Nichols <amanda@cedarmesafriends.org>; Benjamin Pykles <benjamin.pykles@ldschurch.org>; Christopher Merrit <cmerritt@utah.gov>; Dave Vaughn <davecvsr@frontiernet.net>; Diana Acerson <dace1950@gmail.com>; Ewing Josh <josh@cedarmesafriends.org>; Heidi Essex <usasnewsletter@gmail.com>; James Hurst <jhurst@uwyo.edu>; Jerry Spangler <jerry_cpaa@comcast.net>; Jessica Montcalm <jmontcalm@utah.gov>; Jill Jensen <jill_jensen@nps.gov>; Jody Patterson <JPatterson@montarch.com>; John Hiscock <ostamgr@gmail.com>; Kelly Pehrson <kpehrson@sanjuancounty.org>; Kenny Wintch <KennyWintch@utah.gov>; Laura Martin <laura_martin@nps.gov>; Lindsey Kester <lkester@swca.com>; Lynn Jackson <ljackson@grandcountyutah.net>; Marietta Eaton <meaton@blm.gov>; Mark Henderson <markscotthenderson@gmail.com>; Maurine Smith <maurinesmith@isdup.org>; Mike Cannon <mcannon@swca.com>; Mike Diem <mdiem@fs.fed.us>; Mike Nelson <mikenelson@utah.gov>; Nick Sandberg <nsandberg@sanjuancounty.org>; Owen Severance <oseverance@yahoo.com>; Pam Baker <2pnqbaker@gmail.com>; Phil Lyman <plyman@sanjuancounty.org>; Richard Jenkinson <RCjenkinson@yahoo.com>; Rosemary Sucec <rosemary_sucec@nps.gov>; Steve Turner <steve.turner@state.co.us>; Steven Manning <sjmanning@yahoo.com>; Terry Fisk <terry_fisk@nps.gov>; Tim Smith <timsmith@utah.gov>; John Foster <director@moabmuseum.org>; Steve Bloch <steve@suwa.org>; Crystal White <crystalwhite@utah.gov>; Allison Parks <aparks@nndoj.org>; Troy Scotter <troyscotter@gmail.com>; Brian Harmon <brian_harmon@nps.gov>; Elizabeth Hora <ehora@utah.gov>; Don Irwin <dcirwin@fs.fed.us>; Thompson, Charmaine -FS <cthompson01@fs.fed.us>; Julie Howard <julie_howard@nps.gov>; Jonathan Till <jtill@utah.gov>; Carol Duecker <dueckercm@gmail.com>; Werner Duecker <wdeck.wd@gmail.com>; Laura Peterson <laura@suwa.org>; Keith Fessenden <khfessenden@gmail.com>; Julia Guarino <jguarino@nndoj.org>

Cc: Donald Montoya <dmontoya@blm.gov>; Christina Price <cjprice@blm.gov>; Brian Mueller <bmueller@blm.gov>; Leigh Grench <lgrench@blm.gov>; Ashley Long <along@blm.gov>; Nathan Thomas <nthomas@blm.gov>
Subject: Moab Class I Fourth Meeting Notes

Hello Everyone,

Here are the notes for the fourth and final meeting for the Moab Class I and predictive model. Please remember that final comments are due by Ocober 3, 2016 as discussed during the last meeting. We look forward to hearing from everyone and thanks again for all your time and effort on the Class I and predictive model. It really has and will continue to improve the final product.

Thanks again,

M. Jared Lundell

Archaeologist (Acting)
Bureau of Land Management
Washington Office-240

20 M. Street SE

Washington DC, 20003
202-912-7241

mlundell@blm.gov

SWCA®
ENVIRONMENTAL CONSULTANTS
Sound Science. Creative Solutions.®

A Class I Cultural Resource Inventory of Lands Administered by the Bureau of Land Management, Moab Field Office

Part 1: Regional Overview

DRAFT

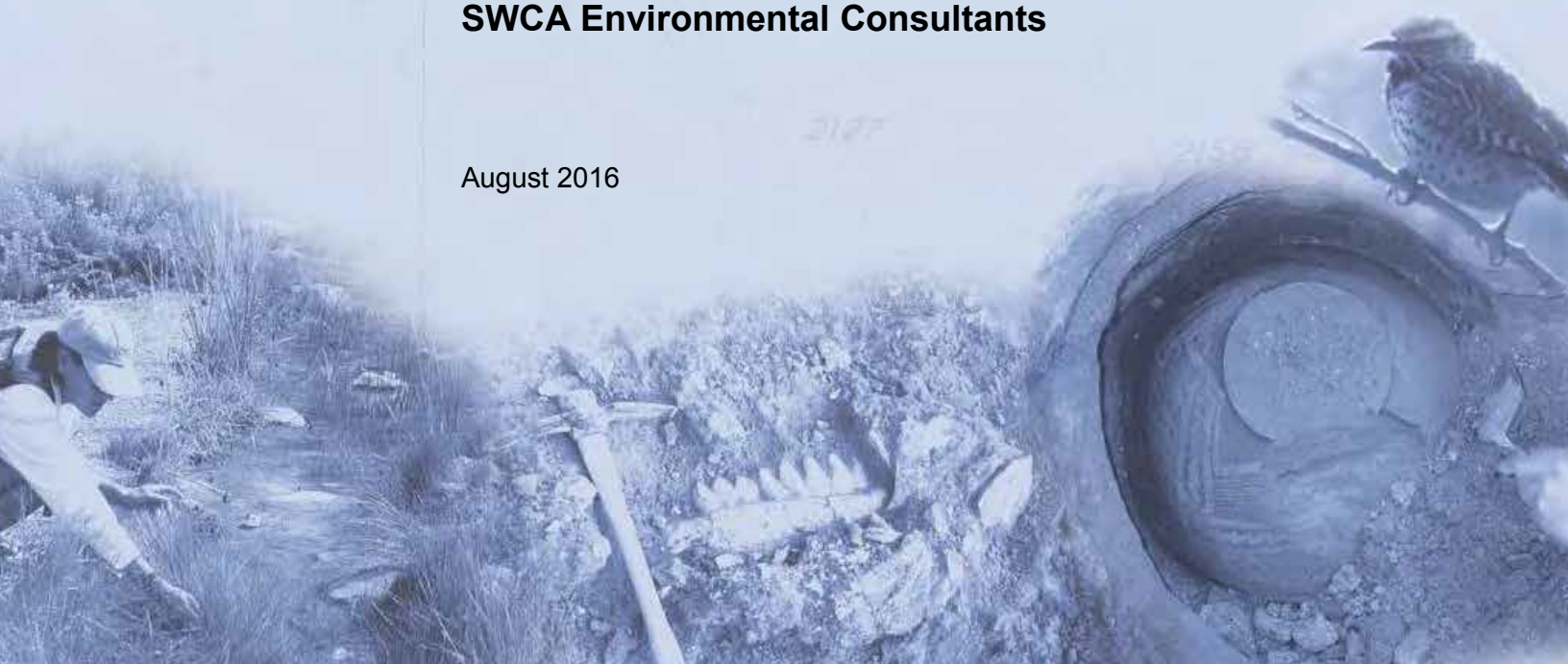
Prepared for

**Bureau of Land Management,
Moab Field Office**

Prepared by

SWCA Environmental Consultants

August 2016



A CLASS I CULTURAL RESOURCE INVENTORY OF LANDS ADMINISTERED BY THE BUREAU OF LAND MANAGEMENT, MOAB FIELD OFFICE

PART 1: REGIONAL OVERVIEW

DRAFT

Prepared for

Bureau of Land Management, Moab Field Office
82 East Dogwood
Moab, Utah 84532
(435) 259-2100

Prepared by

Mike Cannon, Ph.D., Ralph Burrillo, Stephanie Lechert, Kiera Westwater, Paul Burnett, R. Kelly Beck, Ph.D., Rob D'Andrea, Lisa Krussow, Sarah Creer, and Lindsey Kester

SWCA Environmental Consultants
257 East 200 South, Suite 200
Salt Lake City, Utah 84111
(801) 322-4307
www.swca.com

BLM Permit No. 14UT55126

SWCA Project No. 34435
SWCA Cultural Resources Report No. 2016-350

August 31, 2016

ABSTRACT

The Bureau of Land Management (BLM) Moab Field Office (MFO) planning area contains a diverse archaeological record, reflecting the fact that the region has been home to a wide array of human cultural groups for at least the last 13,000 years. This important archaeological record is explored in detail throughout this Class I inventory report. This Class I report gathers together available cultural resources information for the MFO planning area and summarizes the current state of knowledge regarding those resources. Importantly, this document provides a synthesis of cultural resources data for the planning area through the development of an archaeological site predictive model, or planning model, and a synthesis of current and future research directions. Finally, these data are used to confront a few of the most pressing management challenges likely to be faced by MFO management in coming years.

The study area reported in this document comprises all land within the MFO planning area, or field office boundary. The MFO manages one of the archaeologically richest regions of Utah, and available site records indicate the presence of no fewer than 8,017 archaeological sites in the planning area. The region is noteworthy for its cultural diversity over space and time. After more than 10,000 years of occupation by hunter-gatherers of the Paleoindian and Archaic periods, some people in the region added domesticated crops to their diets, beginning a nearly two-millennia period known as the Formative. The region was home to two Formative cultural traditions, the Fremont and the Ancestral Puebloan, and the archaeological remains of these two traditions appear to exhibit a high degree of spatial overlap within the planning area, much more so than most archaeologists have likely previously thought. The Formative period was followed by the Protohistoric period, which saw a shift back to hunting and gathering as the primary means of subsistence. When Euro-Americans began to venture into the region in the late 1700s, the area that is now the MFO planning area was home primarily to Ute bands, though other Native American groups, including Southern Paiute, Navajo, Hopi, and Zuni peoples, also have a cultural affiliation with the area. The earliest Euro-American exploration of the area was conducted by Spanish priests, and this was followed in the early 1800s with inroads made by Euro-American trappers and traders. Settlement of the region by Euro-Americans, primarily Mormon pioneers, began in the mid-1800s. Since that time, human population density in the region that is now the MFO planning area has always been very low except in discrete areas, particularly around the town of Moab. The area's economy during the historic and contemporary periods has been based primarily on uses of the abundant natural resources that occur here such as agriculture, minerals extraction and, especially in recent decades, recreational uses.

Archaeological and anthropological research conducted in the MFO planning area has provided a wealth of information on the lifeways and cultural traditions of southeastern Utah, both past and present. Looking forward, some key research issues can be crystallized to guide future scholars working in the area. These include questions regarding mobile Paleoindian foragers, broad-diet Archaic foragers, Formative period farmers and farmer/foragers, and finally Protohistoric peoples who returned to broader diets and more mobile lifeways. Questions about these periods have previously been couched largely in terms of documenting and understanding spatial and temporal variation, and new questions that build upon the knowledge accumulated through answering earlier ones can now be posed. Issues related to the adoption of domesticates and social interactions within and among different cultural groups rise to the forefront of current themes in prehistoric archaeological research.

A variety of Native American groups have inhabited or migrated through the area managed by the MFO. At the time of Euro-American contact, the Native Americans inhabiting the planning area were Numic-speaking people identified as Ute and Southern Paiute. The Navajo also inhabited some parts of southeastern Utah during historic times. These and numerous other modern Native American tribes claim cultural affiliation to the planning area and vicinity. Assembling additional data relevant to modern Native American groups claiming cultural affiliation to the planning area is an important research objective.

The Historic period archaeology of the MFO planning area provides evidence of use relevant to several important research themes. Specific research questions regarding farming and ranching, mining and mineral extraction, transportation, railroads, the Civilian Conservation Corps and Works Progress Administration, and recreation and tourism can been outlined, and close attention should be paid to questions that result in documentation and exploration of the causes for apparent temporal and spatial variation. In addition, Historic period research in the MFO planning area would benefit from identifying mining and ranching site locations, particularly in the eastern portion of the planning area, as well as recreation and tourism site locations throughout the planning area.

The MFO actively manages 1.8 million acres of the larger 2.9-million-acre MFO planning area for multiple-use, as directed by the Federal Land Policy and Management Act of 1976 and BLM planning documents. As potential uses intersect on the ground, MFO managers are faced with the challenges of considering the effects of those uses on cultural resources, as required by statute and by agency policy. The MFO faces two significant challenges, in particular, as it works to 1) manage minerals development on MFO-administered land and 2) manage recreation on BLM land, including backcountry access on the area's many four-wheel-drive roads and trails and other travel routes. In the MFO planning area, the main forms of minerals development that currently occur and that can be anticipated in the future are exploration and production activities for oil and gas and for potash. The planning model developed in this report may be useful for identifying areas within minerals lease parcels that have a high potential for the presence of significant cultural resources and that accordingly may merit special stipulations in leasing actions. Recreation and travel routes are a concern because the area's many travel routes provide easy public access to areas containing important cultural resources, and the effects of this access are greatly increased by the region's heavy recreational use. To help manage potential impacts to significant cultural resource sites related to their proximity to travel routes, the MFO could examine the planning model on a road-by-road or undertaking-by-undertaking basis in order to identify routes or sites that might merit special attention. The planning model could also be used in the planning of Special Recreation Management Areas (SRMAs), which the BLM has designated to better manage visitation. Using the model as a guide, the BLM could design facilities and designate trails to avoid, as much as practical, areas of expected high archaeological sensitivity. For SRMAs as a whole, the planning model could be used to identify high-priority areas for more-intensive cultural resources investigations with either probabilistic sampling surveys or intensive-level surveys for cultural resources.

CONTENTS

Abstract ..... **i**

CHAPTER 1. Management Summary **1-1**
1.1 Regional Overview Summary 1-1
1.2 Data Compilation Summary 1-4
1.3 Human Land Use in the Moab Field Office Planning Area 1-7
1.4 The Moab Field Office Cultural Resource Database 1-8
1.5 Relative Importance of Cultural Resources in the Moab Field Office Planning Area 1-8
1.6 References Cited 1-10

CHAPTER 2. Study Orientation **2-1**
2.1 The Moab Field Office Planning Area 2-1
2.2 Objectives of the Class I Inventory 2-4
2.2.1 Inventory Report Organization 2-4
2.3 Theoretical Orientation 2-4
2.4 Introduction to the Study Team 2-5
2.5 Data Collection and Management Methods 2-6
2.5.1 Project Database 2-6
2.5.2 CURES Data 2-6
2.5.3 Additional Data Collection 2-9
2.6 Report Preparation 2-12
2.7 References Cited 2-13

CHAPTER 3. Environment of the Moab Field Office Planning Area **3-1**
3.1 Modern Climate 3-1
3.2 Paleoclimate 3-3
3.2.1 Terminal Pleistocene 3-3
3.2.2 Holocene 3-5
3.3 Topography 3-8
3.4 Surface Geology 3-14
3.5 Hydrology 3-17
3.6 Soils 3-20
3.7 Flora and Fauna 3-21
3.7.1 Flora 3-21
3.7.2 Fauna 3-34
3.8 The Effects of Time and Human Activity 3-43
3.9 References Cited 3-45

CHAPTER 4. Prior Cultural Resource Investigations **4-1**
4.1 Summary of Past and Current Work 4-1
4.1.1 Explorers, Antiquarians, and Early Archaeologists 4-1
4.1.2 Institutional Archaeologists 4-4
4.1.3 Salvage Archaeology and the Birth of Cultural Resources Management 4-6
4.1.4 Ethnographers 4-10
4.2 Survey Coverage 4-12
4.3 Present Research Emphases 4-14
4.4 References Cited 4-16

CHAPTER 5. Cultural Resource Overview 5-1
5.1 Prehistoric Cultural Sequence and Lifeways 5-1
5.1.1 Paleoindian Hunters and Foragers of Southeast Utah 5-1
5.1.2 The Archaic Period 5-3
5.1.3 The Formative Period 5-6
5.2 The Southeast Utah Ethnographic Record 5-17
5.2.1 The Numic People 5-18
5.2.2 Southern Athapaskans 5-24
5.2.3 The Western Pueblos 5-27
5.2.4 Tribes Today 5-30
5.3 Historic Period Lifeways 5-32
5.3.1 Early Exploration and Settlement (1775–1880) 5-32
5.3.2 Industry and Growth (1880–1929) 5-37
5.3.3 The Great Depression (1929–1940) 5-43
5.3.4 World War II (1940–1945) 5-45
5.3.5 The Post-War Period (1945–Present) 5-46
5.4 Contemporary Culture 5-49
5.4.1 Socioeconomic Profile 5-49
5.4.2 Livestock Grazing and Agriculture 5-50
5.4.3 Minerals and Energy 5-50
5.4.4 Recreation and Tourism 5-50
5.5 Summary 5-51
5.6 References Cited 5-52
CHAPTER 6. Cultural Resource Synthesis and Future Research Directions 6-1
6.1 First Order Research Questions 6-1
6.1.1 Data Needs 6-2
6.2 The Paleoindian Period 6-2
6.2.1 Data Needs 6-5
6.3 The Archaic Period 6-5
6.3.1 Data Needs 6-9
6.4 The Formative Period 6-10
6.4.1 Ancestral Puebloan 6-11
6.4.2 Fremont 6-13
6.4.3 Data Needs 6-16
6.5 The Protohistoric Period 6-17
6.5.1 Data Needs 6-19
6.6 Ethnography 6-20
6.6.1 Data Needs 6-23
6.7 The Historic Period 6-23
6.7.1 Farming and Ranching 6-27
6.7.2 Mining and Mineral Extraction 6-30
6.7.3 Transportation and Railroads 6-33
6.7.4 Civilian Conservation Corps and Works Progress Administration 6-36
6.7.5 Recreation and Tourism 6-39
6.8 Summary 6-42
6.9 References Cited 6-43

CHAPTER 7. Cultural Resource Site Management Classification 7-1
7.1 Methods 7-1
7.2 Results 7-9
7.3 References Cited 7-11
CHAPTER 8. Moab Field Office Planning Area Predictive Model and Future Inventory Strategy 8-1
8.1. Simple Models of a Complex World 8-2
8.1.1. Scientific Modeling 8-2
8.1.2. Predictive Modeling in Archaeology 8-2
8.1.3. Limitations and Promise of Archaeological Site Location Models 8-3
8.2. Developing the Models 8-3
8.2.1. Ecoregion Approach 8-4
8.2.2. Archaeological Predictive Modeling Background 8-6
8.2.3. Archaeological Data 8-7
8.2.4. Environmental Variables 8-12
8.3. Evaluating the Planning Area Models 8-18
8.3.1. Stepwise Logistic Regression 8-18
8.3.2. Model Tests 8-20
8.3.3. Statistical Analysis 8-22
8.4. GIS-Based Predictive Models for the Planning Area 8-28
8.4.1. GIS-Based Archaeological Sensitivity Zones 8-43
8.5. A Composite GIS-Based and Intuitive Archaeological Sensitivity Model 8-49
8.6. Land Use and Cultural Resource Site Probabilities 8-53
8.7. Recommendations for Future Inventory Strategies 8-69
8.8. Summary 8-70
8.9. References Cited 8-73
CHAPTER 9. Suggested Cultural Resource Use Allocations and Management Options 9-1
9.1 Cultural Resource Use Allocations 9-1
9.1.1 Cultural Resource Site Classification 9-1
9.1.2 Scientific Use 9-3
9.1.3 Conservation for Future Use 9-3
9.1.4 Traditional Use 9-3
9.1.5 Public Use 9-4
9.1.6 Experimental Use 9-4
9.1.7 Discharged from Management 9-4
9.2 Suggested Management Options 9-5
9.3 References Cited 9-8

FIGURES

Figure 2-1. Moab Field Office planning area. 2-3
Figure 2-2. Steps used in processing CURES data. 2-8
Figure 3-1. Physiographic sections in the MFO planning area. 3-10
Figure 3-2. Book Cliffs, east of Green River, Utah. Photograph taken by Rob D'Andrea. 3-11
Figure 3-3. Salt Anticline and Moab Valley, east of Green River, Utah. Photograph taken by Rob D'Andrea. 3-12
Figure 3-4. Mid-elevation meadow in the southeastern foothills of the La Sal Mountains, with Mount Tukuhnikivatz at center and Mount Peale at right. Photograph taken by Ralph Burrillo. 3-14
Figure 3-5. Snow-covered sandstone formations viewed through a natural window at Arches National Park. Photograph taken by Ralph Burillo. 3-15
Figure 3-6. Sandstone pinnacles in the Canyonlands National Park area. Photograph taken by Ralph Burillo. 3-16
Figure 3-7. Hydrology of the MFO planning area. 3-19
Figure 3-8. Vegetation communities in the MFO planning area. 3-27
Figure 3-9. Mixed Salt Desert vegetation, overlooking Moab Valley from Arches National Park. Photograph taken by Rob D'Andrea. 3-29
Figure 3-10. Mixed Sagebrush Shrubland community within MFO planning area, foreground. Photograph taken by Rob D'Andrea. 3-30
Figure 3-11. Pinyon Juniper community blending upward into Aspen-Conifer vegetation community in the sandstone cliffs on the north slopes of the La Sal Mountains, view facing Fisher Valley. Photograph taken by Ralph Burrillo. 3-31
Figure 3-12. Rocky Mountain Woodland community within the Sand Flats Recreation Area. Photograph taken by Reid Persing. 3-32
Figure 3-13. A typical riparian zone along the Colorado River near Moab. Photograph taken by Rob D'Andrea. 3-33
Figure 4-1. Previous survey coverage in the MFO planning area. 4-13
Figure 5-1. Fremont and Ancestral Puebloan occupation areas as typically represented in the literature. 5-7
Figure 5-2. Distribution of Fremont and Ancestral Puebloan sites as reflected in the MFO Class I inventory dataset. 5-8
Figure 6-1. Locations of Paleoindian period archaeological sites in the MFO planning area. 6-4
Figure 6-2. Locations of Archaic period archaeological sites in the MFO planning area. 6-8
Figure 6-3. Locations of Fremont complex sites in the MFO planning area. 6-14
Figure 6-4. Locations of Ancestral Puebloan archaeological sites in the MFO planning area. 6-15
Figure 6-5. Locations of Protohistoric archaeological sites in the MFO planning area. 6-18
Figure 6-6. Locations of important ethnographic sites in the MFO planning area. 6-22
Figure 6-7. Locations of Historic period archaeological sites in the MFO planning area. 6-26
Figure 6-8. Location of farming and ranching sites in the MFO planning area. 6-29
Figure 6-9. Location of mining and mineral extraction sites in the MFO planning area. 6-32
Figure 6-10. Location of transportation and railroad sites in the MFO planning area. 6-35
Figure 6-11. Location of CCC/WPA (conservation in general) sites in the MFO planning area. 6-38
Figure 6-62. Locations of recreation and tourism sites in the MFO planning area. 6-41
Figure 7-1. Site classification IMENSITY routine decision tree. 7-2
Figure 7-2. Site classification PSites routine decision tree. 7-3
Figure 7-3. Site classification HSites routine decision tree. 7-4

Figure 8-1. Ecoregions used in the planning area predictive models. 8-5
Figure 8-2. Probability map for Historic Architectural sites. 8-31
Figure 8-3. Probability map for Historic Artifact Scatter sites. 8-33
Figure 8-4. Probability map for Prehistoric Open Sites without Features. 8-35
Figure 8-5. Probability map for Prehistoric Open Sites with Features 8-37
Figure 8-6. Probability map for Prehistoric Rock Art sites. 8-39
Figure 8-7. Probability map for Prehistoric Sheltered sites. 8-41
Figure 8-8. Archaeological sensitivity for the MFO planning area derived from NRHP eligibility percentages per modeled site type. 8-47
Figure 8-9. Final planning model created by intuitively adding the Old Spanish Trail and historic linear sites to the high sensitivity zone. 8-51
Figure 8-10. Overlay of municipal boundaries (with 1-mile buffer) on archaeological sensitivity zones. 8-55
Figure 8-11. Overlay of travel routes (with 200-m buffer) on archaeological sensitivity zones. 8-57
Figure 8-12. Overlay of special designation areas on archaeological sensitivity zones. 8-59
Figure 8-13. Overlay of potash lease areas and oil and gas lease areas on archaeological sensitivity zones. 8-61
Figure 8-14. Overlay of the Cisco Desert MLP area on archaeological sensitivity zones. 8-63
Figure 8-15. Acres of land in or within 1 mile of municipal boundaries per sensitivity level. 8-65
Figure 8-16. Acres of land within 200 m of a travel route per sensitivity level. 8-66
Figure 8-17. Acres of land within special designation areas per sensitivity level. 8-66
Figure 8-18. Acres of land within oil and gas lease areas per sensitivity level. 8-67
Figure 8-19. Acres of land within potash lease areas per sensitivity level 8-67
Figure 8-20. Acres of land within the Cisco Desert MLP area per sensitivity level. 8-68

TABLES

Table 1-1. Prehistoric Cultural Chronology for the Moab Field Office Planning Area, with Numbers of Documented Sites by Time Period 1-4
Table 1-2. Historic Themes Represented in the Moab Field Office Planning Area, with Numbers of Documented Sites by Theme 1-5
Table 1-3. Numbers of Prehistoric Sites by Type in the Moab Field Office Site Classification Dataset 1-6
Table 1-4. Numbers of Historic Sites by Type in the Moab Field Office Site Classification Dataset 1-6
Table 2-1. SWCA Study Team for the MFO Class I Inventory 2-5
Table 2-2. Total Number of MFO CURES Sites by Landowner 2-9
Table 3-1. Physiographic Sections in the MFO Planning Area 3-9
Table 3-2. Common Flora in the MFO Planning Area 3-21
Table 3-3. Mammal Species in the MFO Planning Area 3-34
Table 3-4. Bird Species in the MFO Planning Area 3-38
Table 3-5. Reptile, Amphibian, and Fish Species in the MFO Planning Area 3-41
Table 4-1. Previous Project Types and Coverage 4-12
Table 5-1. Prehistoric Cultural Chronology for the Planning Area 5-1
Table 5-2. Ancestral Puebloan Chronology* 5-9
Table 6-1. Historic Themes for Historic and Multicomponent Sites in the MFO Planning Area 6-24

Table 7-1. Intermountain Antiquities Computer System (IMACS) Encoding Data Fields Used in Site Typing 7-5
Table 7-2. IMACS Encoding Data Site Typing Classification Criteria 7-6
Table 7-3. IMACS Encoding Data Site Types for Prehistoric Sites and Components 7-7
Table 7-4. IMACS Encoding Data Site Types for Historic Sites and Components 7-8
Table 7-5. Counts of Prehistoric Sites and Components in the Planning Area by Type and National Register of Historic Places Eligibility Status 7-9
Table 7-6. Counts of Historic Sites and Components in the Planning Area by Type and National Register of Historic Places Eligibility Status 7-10
Table 8-1. Counts of Sites and Components by Predictive Modeling Site Type and Ecoregion 8-9
Table 8-2. Counts of Archaeological Site and Non-Site Grid Cells Used in Model Development 8-11
Table 8-3. Data Used for the Archaeological Predictive Models 8-13
Table 8-4. Format of Contingency Table Used to Determine the Percentage of Correct Model Predictions 8-21
Table 8-5. Benches and Canyons Model Comparisons of Correct Cell Predictions and Gain Data 8-24
Table 8-6. Deserts Model Comparisons of Correct Cell Predictions and Gain Data 8-25
Table 8-7. Escarpments Model Comparisons of Correct Cell Predictions and Gain Data 8-26
Table 8-8. Forests Model Comparisons of Correct Cell Predictions and Gain Data 8-27
Table 8-9. Counts and Percentages of Sites and Components by Predictive Modeling Site Type and National Register of Historic Places Eligibility Status in the Four Modeled Ecoregions 8-44
Table 8-10. Historic Linear Sites Intuitively Added to the Final Planning Model 8-49
Table 8-11. Final Planning Model Results: Acreage per Archaeological Sensitivity Level in the Planning Area 8-50
Table 9-1. IMENSITY Site Types for Prehistoric and Historic Sites/Components 9-2

APPENDICES

Appendix A. Project Database Overview
Appendix B. Environmental Variable Abbreviations and Probability Model Equations

CHAPTER 1. MANAGEMENT SUMMARY

Mike Cannon and R. Kelly Beck

This report constitutes a Class I existing information inventory following standards described in *BLM Manual Section 8110 – Identifying and Evaluating Cultural Resources* (Bureau of Land Management 2004). The purpose of a Class I inventory is to use information that has been previously collected and that is reasonably available to help Bureau of Land Management (BLM) managers and cultural resource professionals better understand the cultural resources on the lands for which they are responsible, so that they can make more informed management decisions consistent with overall planning efforts for the Moab Field Office (MFO) resource management plan (RMP). Specifically, it is expected that the comprehensive cultural resources information summarized here will facilitate implementation of plans detailed in the MFO RMP. The study area for the inventory reported here comprises all land within the BLM MFO planning area. This area consists of approximately 2.9 million acres, of which the BLM administers approximately 1.8 million acres; it covers all of Grand County and the northern third of San Juan County.

The content of this report and its organization (i.e., the chapters and chapter sections included and the order in which they occur) are specified by *BLM Manual Section 8110* (Bureau of Land Management 2004) and the scope of work under which SWCA Environmental Consultants (SWCA) was contracted to prepare this document. SWCA prepared the report in close consultation with BLM staff—particularly MFO archaeologists Jared Lundell and Don Montoya—and also incorporated helpful input and data that the BLM received from a range of parties with whom BLM consulted regarding this document. A variety of readers other than BLM staff—such as academic researchers, land managers and cultural resource specialists with other agencies, and interested members of the public—may find this report useful. However, not all sections of this report, each of which is included because it fulfills a specific requirement of *BLM Manual Section 8110* and/or the scope of work, will be relevant to all readers. Likewise, there are many topics related to cultural resources in southeastern Utah that would likely be of interest to many readers but that are not covered in this document because they fall outside of the scope of what the BLM requires for a Class I inventory. In the same vein, the data and literature used to prepare this report are relevant primarily to resources found on land administered by the BLM, though information collected by or under the oversight of other agencies is also employed to a lesser extent. SWCA acknowledges that this Class I inventory report was prepared as a BLM management tool, but SWCA also expects that it will also be useful to the larger public the BLM serves. Key findings of the Class I inventory are summarized in this management summary.

1.1 Regional Overview Summary

The MFO planning area covers a diverse archaeological landscape, reflecting the fact that the region has been home to a wide array of human cultural groups for at least the last 13,000 years. After more than 10,000 years of occupation by hunter-gatherers of the Paleoindian and Archaic periods, some people in the region added domesticated crops to their diets, beginning a nearly two-millennia period known as the Formative. The region now encompassed by the MFO planning area was home to two Formative cultural traditions, the Fremont and the Ancestral Puebloan, and the archaeological remains of these two traditions appear to exhibit a high degree of spatial overlap within the planning area, much more so than most archaeologists have likely previously thought. The Formative period was followed by the Protohistoric period, which saw a shift back to hunting and gathering as the primary means of subsistence. When Euro-Americans began to venture into the region in the late 1700s, the area that is now the MFO planning area was home primarily to Ute bands, though other Native American groups, including Southern Paiute,

Navajo, Hopi, and Zuni peoples, also have a cultural affiliation with the area. The earliest Euro-American exploration of the area was conducted by Spanish priests, and this was followed in the early 1800s with inroads made by Euro-American trappers and traders. Settlement of the region by Euro-Americans, primarily Mormon pioneers (adherents of the Church of Jesus Christ of Latter-Day Saints), began in the mid-1800s. Since that time, human population density in the region that is now the MFO planning area has always been low except in discrete areas, particularly around the town of Moab. The area's economy during the historic and contemporary periods has been based primarily on uses of the abundant natural resources that occur here such as agriculture, minerals extraction and, especially in recent decades, recreational uses.

The environmental landscape of the MFO planning area is also diverse. The Colorado Plateau physiographic region, where the entire planning area is located, presently consists largely of arid desert and steppe environments that experience little rainfall, large daily temperature fluctuations, and high seasonal variation in temperature and precipitation. Modern vegetation communities consist of mixed salt desert, mixed sagebrush shrubland, pinyon-juniper woodland, Rocky Mountain woodland, and riparian types. The area is also home to a great diversity of animals; economically important ones include mule deer, pronghorn, bighorn sheep, elk, jackrabbits, cottontails, a variety of waterfowl and game birds, and fishes of the area's lakes, rivers, and streams. Over the period of documented human presence in the region, the climate has ranged from the cool, moist conditions of the terminal Pleistocene and early Holocene to the warmer-than-modern conditions of the middle Holocene, and the distributions and abundances of plants and animals have varied as a result. Human activities from the pre-contact era through today have also had significant effects on the region's environment.

Euro-Americans have been interested in studying the human past in the region, and its contemporary cultural groups, virtually from their first explorations of the area. Archaeology began to crystalize as a formal discipline in the early twentieth century, initially taking a primarily academic focus but later, in the second half of that century, shifting to a more resource preservation–oriented or management-oriented focus. With changes in the focus of archaeological thought and changes in governmental goals have come attendant changes in research emphases, methods, and analysis results and conclusions. Recent emphases of research in the region have ranged from cultural resource management–focused topics such as the effects of wildfire, grazing, and recreational activities on archaeological sites, to anthropological interests in past settlement, subsistence, and social systems. To date, approximately 295,000 acres within the MFO planning area have been subject to at least one cultural resources investigation, as indicated by the data compiled for this Class I inventory; approximately 249,000 of these acres have been covered by a survey that employed relatively modern "intensive-level" methods.

The objectives of a Class I inventory necessitate that cultural resource sites be classified into categories that are useful for analytical and management purposes. This was done for the MFO Class I inventory using an original classification methodology that SWCA has developed specifically for Utah BLM Class I inventories; this methodology allows for systematic and replicable classification of sites to types using data collected from Intermountain Antiquities Computer System (IMACS) site forms. Counts of sites by type are presented below in section 1.2 (Data Compilation Summary). The results of the site classification procedure are used in the development of a series of predictive models for the MFO planning area that are intended to 1) illustrate the relationships between sites of different types and key environmental variables and 2) show the locations within the planning area where significant cultural resource sites are most likely to be found, in order to provide for better management of those sites. As part of the predictive modeling effort, an overall archaeological sensitivity model was developed to assist with land use planning and resource management; this is done by scaling the predictive model for each site type by the tendency of that site type to be eligible for the National Register of Historic Places (NRHP). As a last step in model development, a final planning model was created by adding to the overall sensitivity model locational data for cultural resource sites that are not amenable to geographic information system (GIS)-based

predictive modeling; specifically, the probable alignment of the Old Spanish Trail and the known alignments of several historic linear sites were added. The final planning model is used to identify areas in the MFO planning area where current and potential future land uses may either present a threat to or confer some degree of protection to significant cultural resources. The substantive results of these predictive modeling efforts are summarized below in section 1.3 (Human Land Use in the Moab Field Office Planning Area).

SWCA recommends the following ways the BLM might use the planning model to guide future cultural resource inventory strategies in the MFO planning area. For planning-level actions, the BLM could identify places that are modeled to have a high probability for significant archaeological sites and direct targeted, on-the-ground inventories at those places to better understand the cultural resources within them. This would likely identify most of the significant cultural resources within the larger area at the planning stage, without incurring the expense of an intensive inventory of that entire area. The BLM could also tailor on-the-ground survey methods to specific sensitivity levels, for example, by requiring the use of more-intensive methods in areas modeled to have high sensitivity and using less-intensive methods in areas of low sensitivity. This kind of customization would optimize survey efficiency while maintaining a good faith effort to identify significant cultural resources. Beyond on-the-ground inventories, the BLM or project proponents could use the planning model in the alternatives selection or siting phases of an undertaking. Areas modeled to have a high probability for significant cultural resources could be avoided during project design to minimize impacts on cultural resources and the expense of mitigating those impacts. Efforts should also be made, to the extent possible, to direct future inventories toward areas where previous survey coverage is light. This should make it possible to improve the planning model presented here, which is not intended to be static, and to improve the knowledge base from which the BLM makes cultural resource management decisions.

This Class I inventory report discusses the BLM's cultural resource use allocation protocol, suggests which site types may best match each use category in that protocol, discusses a few key conflicts between anticipated land use and cultural resources, and outlines options for managing those conflicts. Although many uses of MFO-managed land could pose conflicts with cultural resources, the MFO faces two significant challenges, in particular, as it works to 1) manage minerals development and 2) manage recreation, including backcountry access on the area's many four-wheel-drive roads and trails and other travel routes. In the MFO planning area, the main forms of minerals development that currently occur and that can be anticipated in the future are exploration and production activities for oil and gas and for potash. The planning model developed in this report may be useful for identifying areas within minerals lease parcels that have a high potential for the presence of significant cultural resources and that accordingly may merit special stipulations in leasing actions through future land use planning.

Recreation and travel routes are a concern because the area's many travel routes provide easy access to areas containing important cultural resources, and the effects of this access are exacerbated by the region's heavy recreational use. To manage potential impacts to significant cultural resource sites that are in proximity to travel routes, the MFO could examine the planning model on a road-by-road or undertaking-by-undertaking basis to identify routes or sites that might merit special attention. The planning model could also be used in the planning of Special Recreation Management Areas (SRMAs), which the BLM has designated to better manage visitation. Using the model as a guide, the BLM could design facilities and designate trails to avoid (as much as practical) areas of expected high archaeological sensitivity. For SRMAs as a whole, the planning model could be used to identify high-priority areas for more-intensive cultural resources investigations with either probabilistic sampling surveys or intensive-level surveys for cultural resources.

1.2 Data Compilation Summary

The data used to prepare this Class I inventory report came from a variety of sources. Data collection and data management methods are discussed in detail in Chapter 2 (Study Orientation). Background information on the cultural history and environment of the study area and on previous archaeological investigations was obtained from sources including SWCA's in-house library, the University of Utah Marriott Library, the Salt Lake City Public Library System, the Edge of the Cedars State Park Museum, the files at the MFO in Moab, and several online government sources. Additional sources of data were used in the predictive modeling efforts conducted for this project and are discussed in Chapter 8 (Moab Field Office Planning Area Predictive Model and Future Inventory Strategy). SWCA obtained data on previously recorded cultural resource sites and previous cultural resource projects within the MFO planning area from the Utah Division of State History Antiquities Section and from the MFO. The cultural resource site and project data that SWCA collected for this Class I inventory were maintained in a GIS database and a relational tabular database created specifically for this project, and these will be provided to the MFO as part of final project deliverables.

As discussed above, the MFO planning area has a rich archaeological record that has been the subject of important research documenting the lifeways of people in this region across the span of human occupation. Available site records for the planning area indicate the presence of no fewer than 8,017 archaeological sites. This archaeological record is summarized here in terms of several different metrics, and it is explored in much greater detail throughout the remainder of this Class I inventory report. The metrics presented here are derived from the data compilation that was conducted for the MFO Class I inventory; tables and maps of all collected data are provided in Part 2 of this report.

Numbers of prehistoric archaeological sites with occupations attributed to a given time period are listed in Table 1-1, and numbers of historic sites that have been associated with a given historic theme are listed in Table 1-2. Occupations dating to the Archaic period are the best represented in the prehistoric site sample, followed in abundance by Formative period and then Late Prehistoric period occupations; Paleoarchaic period sites are the least well documented. The historic site sample is dominated by sites associated with agriculture, mining, and transportation, and sites related to recreation and water control infrastructure are also fairly common.

Table 1-1. Prehistoric Cultural Chronology for the Moab Field Office Planning Area, with Numbers of Documented Sites by Time Period

Period	Dates or Radiocarbon Years Before Present	Number of Sites
Protohistoric	A.D. 1450–1850	256
Formative	150 B.C.–A.D. 1450	554
Archaic	Approximately 8,000–2,000 RCYBP	640
Paleoindian	> 11,000 to approximately 8,000 RCYBP	33

Note: RCYBP = radiocarbon years before present. The total number of sites listed here is far lower than the 8,017 sites included in the database compiled for this Class I inventory because a temporal affiliation is not listed in encoding data for many of the sites.

Table 1-2. Historic Themes Represented in the Moab Field Office Planning Area, with Numbers of Documented Sites by Theme

Theme	Number of Sites
Architecture	3
Breweries and saloons	1
Civilian Conservation Corps/Works Progress Administration (conservation in general)	19
Community development	16
Commerce/industry	5
Cultural landscape	6
Communication	16
Conservation/natural resources	1
Engineering	2
Ethnicity	1
Federal administrative site	1
Farming/ranching (agriculture)	512
Gaming	3
Logging/timber	6
Mining/mineral extraction	186
Military – general	2
Native American	5
Political development/government	1
Prostitution	1
Recreation/tourism	43
Religion	3
Railroad	32
Transportation (including roads/trails)	167
Social organizations and movements/relief programs	1
Trapping/fur trade	6
Waterworks (dams, ditches)/reclamation	39
Unknown	264

A subset of the archaeological sites in the MFO planning area is classified to site type, as was noted above. Counts of sites in this subset by type are provided in Table 1-3 for prehistoric sites and in Table 1-4 for historic sites. Open lithic scatters (consisting of only chipped-stone artifacts) and open artifact scatters (including other artifact types such as ceramics and ground stone) comprise the largest part of the prehistoric archaeological record in the MFO planning area. Most of the historic sites are also simple artifact scatters.

Table 1-3. Numbers of Prehistoric Sites by Type in the Moab Field Office Site Classification Dataset

Site Type	Number of Sites
Sheltered Architectural Residential	11
Sheltered Architectural Non-residential	38
Sheltered Non-Architectural	317
Open Architectural	89
Open Artifact Scatter with Thermal Feature(s)	390
Open Lithic Scatter with Thermal Feature(s)	126
Open Artifact Scatter	1,268
Open Lithic Scatter	3,721
Quarry	33
Rock Art	172
Lithic Source	11
Isolated Other Feature(s)	6
Isolated Thermal Feature(s)	8
Isolated Artifact	3
Other/Unknown	1
Total	**6,194**

Table 1-4. Numbers of Historic Sites by Type in the Moab Field Office Site Classification Dataset

Site Type	Number of Sites
Architectural-Residential	54
Architectural-Farming/Ranching	83
Architectural-Mining	63
Architectural-General Industrial	2
Architectural-Community	1
Architectural-Other	156
Artifact Scatter with Thermal Feature(s)	37
Artifact Scatter	436
Cemetery/Burial	2
Trail/Road with Artifacts	32
Trail/Road without Artifacts	44
Railroad	9
Mining	8
Transmission	6

Table 1-4. Numbers of Historic Sites by Type in the Moab Field Office Site Classification Dataset

Site Type	Number of Sites
Water Control	6
Rock or Tree Art	43
Isolated Thermal Feature(s)	3
Isolated Other Features	68
Isolated Artifact	3
Other/Unknown	9
Total	**1,065**

1.3 Human Land Use in the Moab Field Office Planning Area

The final planning model developed for the MFO Class I inventory provides insight into the spatial distribution of human land use in the area throughout time. In this model, stream networks, hills, and ridges are consistently modeled to be high-sensitivity areas (i.e., they have a high probability for the presence of NRHP-eligible sites), whereas the vast expanses of low-relief flats and uplands that occur throughout the MFO planning area tend to have low to moderate archaeological sensitivity. In the Escarpments ecoregion in the northern portion of the planning area, there is a pattern of highly sensitive areas along stream networks and near streams at the base of hills and ridges, predominantly on the south-facing slopes, and there is a strong pattern of high to medium sensitivity along the base of the Book Cliffs. The vast flats in the Deserts ecoregion tend to express low sensitivity, but pockets of sensitive areas occur near drainages. Relatively large areas of medium to high sensitivity are modeled in the area around Danish, Cisco, and Sagers Washes. Another large high probability area occurs in the Yellow Cat Flat vicinity, around Mine Draw. Other notable high probability areas flank the Green River along the west edge of the MFO planning area, and various sensitive areas are present immediately east of the Green River. In the large Benches and Canyons ecoregion of the central and southern portion of the planning area, high sensitivity areas are located in similar settings as in areas to the north. They tend to be positioned on overlooks above dissected terrain and at the bases of ridges, broad uplands, and canyons. The Forests ecoregion, which is limited to the La Sal Mountains within the MFO planning area, is largely a low sensitivity area, with the exception of streamside settings in the lower elevations, most notably the south-facing slopes.

A comparison of the final planning model with data on contemporary land uses indicates that most areas within the MFO planning area that have environmental characteristics associated with the presence of NRHP-eligible sites (approximately 96 percent) do not co-occur with current population centers. This would suggest that future impacts of the types associated with population centers do not pose a major risk to the remaining significant cultural resources within the MFO planning area overall, even though important "hot spots" around individual towns may well be present. Impacts associated with travel routes appear to pose a somewhat greater potential threat to significant cultural resources because more than 22 percent of the areas in the MFO planning area with a high probability for the presence of such resources occur close to travel routes. However, the precise effects of proximity to travel routes or increased visitation to significant archaeological sites as a result of increased vehicular access are not directly clear. It appears that only a relatively small percentage of the areas in the MFO planning area with the highest potential for the presence of NRHP-eligible sites (approximately 13 percent) are located within special designation areas, such as Wilderness Study Areas or Areas of Critical Environmental Concern, which are subject to some degree of protection

from development. More than half (59 percent) of the high-sensitivity areas in the planning area fall within oil and gas lease areas; 5 percent fall within potash lease areas; and 8 percent fall within the Cisco Desert Master Leasing Plan area, though it is noted that cultural resources within much of these areas may be subject to leasing stipulations that provide some degree of protection to them.

1.4 The Moab Field Office Cultural Resource Database

A primary goal of the Class I inventory presented in this document is to collect and summarize available cultural resources information for the MFO planning area with an eye to how this information might best be used to plan for and effectively manage cultural resources use in the context of the BLM's multiple-use mandate. One significant outcome of the Class I inventory is the identification of areas where data gaps may limit or in some way inhibit informed decision-making. Fortunately, the MFO planning area has been subject to considerable archaeological investigation, and such gaps, although certainly present, are not numerous and are not intractable. Indeed, data gaps concerning research themes, which are more fully discussed in Chapter 6 (Cultural Resource Synthesis and Future Research Directions), are gaps of quantity and not data gaps in the sense of missing information. Simply put, ongoing archaeological investigation using modern field and laboratory methods will likely provide the data necessary to address those themes. Of key concern, however, are apparent disparities in cultural resource survey coverage among different portions of the MFO planning area. Coverage by previous surveys is highest in the central-western, southern, and northeastern parts of the planning area. Many areas with high sensitivity for archaeological sites (per the MFO final planning model) have low survey coverage, such as the base of the Book Cliffs northeast of the town of Green River and the Colorado and Dolores River corridors in the central and eastern parts of the planning area. Recognizing such deficiencies in survey coverage, the BLM could select moderate- to high-sensitivity areas in places that they expect will be subject to increased use and could prioritize probabilistic sample surveys to provide empirically derived observations of cultural resource presence or absence to remedy this data gap.

1.5 Relative Importance of Cultural Resources in the Moab Field Office Planning Area

Notable cultural resources of the MFO planning area date back to the Pleistocene and include the Paleoindian Montgomery Folsom Site (42GR1956), the Archaic Squaw Park Cave (42GR981), widespread Archaic occupations, significant Formative period resources of both Fremont and Ancestral Puebloan affiliation, Protohistoric habitations, especially within Spanish Valley, portions of the Old Spanish National Historic Trail, and a large number of historic agricultural, mining, and transportation sites. Formative resources are particularly well documented. Habitation sites include the Basketmaker II Orchard Pithouse (42GR2206) and Sandy Ridge Site (42SA18500), and the Pueblo II Mill Creek Canyon Site (42GR2897). Rock art localities are numerous and are found in Kane Creek (e.g., 42GR3242, known as the Birthing Panel), Courthouse Wash (e.g., 42GR4228), Thompson Wash (42GR275-277), Lower Kane Creek, Levi Well, Bartlett, Trout Water, Sego, the Wall Street/Colorado River District, and along Potash Road (e.g., 42GR3649). The area also hosts several Areas of Critical Environmental Concern, including Behind the Rocks, Highway 279/Long Canyon/Shafer Basin, and Ten Mile Wash, in addition to numerous canyon localities of cultural importance, including Muleshoe, Seven Mile, Mill, Upper Hell Roaring, and Shay Canyons.

The great variety of archaeological resources and the important history of archaeological research in this area are among the topics covered in this Class I cultural resource overview. Importantly, the archaeological and anthropological research that has been conducted here has provided a wealth of information on the lifeways and cultural traditions of southeastern Utah, past and present. Looking

forward, some key research issues can be crystallized to guide future scholars working in the area. These include questions regarding mobile Paleoindian foragers, broad-diet Archaic foragers, Formative period farmers and farmer/foragers, and Protohistoric peoples who returned to broader diets and more mobile lifeways. Questions about these periods have previously been couched largely in terms of documenting and understanding spatial and temporal variation, and new questions that build upon the knowledge accumulated through answering earlier ones can now be posed. Issues related to the adoption of domesticates and social interactions within and among different cultural groups rise to the forefront of current themes in prehistoric archaeological research.

A variety of Native American groups have inhabited or migrated through the area managed by the MFO. At the time of Euro-American contact, the Native Americans inhabiting the planning area were Numic-speaking people identified as Ute and Southern Paiute. The Navajo also inhabited some parts of southeastern Utah during historic times. These and numerous other modern Native American tribes claim cultural affiliation to the planning area and vicinity. Assembling additional data relevant to modern Native American groups claiming cultural affiliation to the planning area is an important research objective.

The Historic period archaeology of the MFO planning area provides evidence of land use relevant to several important research themes. Specific research questions regarding farming and ranching, mining and mineral extraction, transportation, railroads, the CCC and WPA, and recreation and tourism can been outlined, and close attention should be paid to questions that result in documentation and exploration of the causes for apparent temporal and spatial variation. Historic period research in the MFO planning area would benefit from identifying mining and ranching site locations, particularly in the eastern portion of the planning area, as well as recreation and tourism site locations throughout the planning area.

1.6 References Cited

Bureau of Land Management

2004 Bureau of Land Management Manual, Section 8110 – Identifying and Evaluating Cultural Resources (Public). Available at: http://www.blm.gov/style/medialib/blm/wo/Information_Resources_Management/policy/blm_manual.Par.23101.File.dat/8110.pdf. Accessed January 5, 2015.

CHAPTER 2. STUDY ORIENTATION

Mike Cannon, Rob D'Andrea, Kiera Westwater, Lisa Krussow, Sarah Creer, and R. Kelly Beck

This chapter provides context for the MFO Class I inventory by describing the study area used for the inventory, the objectives and theoretical orientation of the study, and the methods and procedures used in data collection, data management, and reporting. The personnel involved in the study are also identified, with the role of each study team member noted.

2.1 The Moab Field Office Planning Area

The study area for the inventory reported here comprises all land within the MFO planning area, or the field office boundary (Figure 2-1). This area is approximately 2.9 million acres in size and covers all of Grand County and the northern third of San Juan County. It is bounded geographically by the Book Cliffs to the north, the Colorado state line to the east, Harts Point and Lisbon Valley to the south, and the Green River to the west. The MFO planning area exhibits a range of topographic and environmental variability, including benches and canyons, deserts, and forests, and it is drained by the Green River and the Colorado River, which have been attractive for human settlement throughout prehistory and history. The climate is arid, with large daily and seasonal temperature fluctuations. Winters are cold with little precipitation, and summers are hot with moderate precipitation (Higgins et al. 1997; Mock 1996; Shinker 2010).

Notable cultural resources of the MFO planning area date back to the Pleistocene and include the Paleoindian Montgomery Folsom Site (42GR1956), the Archaic Squaw Park Cave (42GR981), widespread Archaic occupations, significant Formative period resources of both Fremont and Ancestral Puebloan affiliation, Protohistoric habitations (especially within Spanish Valley), portions of the Old Spanish National Historic Trail, and a large number of historic agricultural, mining, and transportation sites. Formative sites are particularly well documented. Habitation sites include the Basketmaker II Orchard Pithouse (42GR2206) and Sandy Ridge Site (42SA18500), and the Pueblo II Mill Creek Canyon Site (42GR2897). Rock art localities are numerous and are found in Kane Creek (e.g., 42GR3242, known as the Birthing Panel), Courthouse Wash (e.g., 42GR4228), Thompson Wash (42GR275-277), Lower Kane Creek, Levi Well, Bartlett, Trout Water, Sego, the Wall Street/Colorado River District, and along Potash Road (e.g., 42GR3649). The area also hosts several Areas of Critical Environmental Concern, including Behind the Rocks, Highway 279/Long Canyon/Shafer Basin, and Ten Mile Wash, in addition to numerous canyon localities of cultural importance, including Muleshoe, Seven Mile, Mill, Upper Hell Roaring, and Shay Canyons. The great variety of archaeological resources and the important history of archaeological research in this area are among the topics covered in this Class I cultural resource overview.

Within the planning area, the BLM manages 1.8 million acres of land. The remainder of the planning area consists of land managed by a variety of other federal agencies (the National Park Service, the U.S. Forest Service, and the U.S. Army Corps of Engineers) and state agencies as well as privately owned and tribal land (see Figure 2-1). The area has a variety of land uses, such as developed and dispersed recreation, oil and gas development, and potash facilities; it is also home to areas requiring special management consideration, including Special Recreation Management Areas and Wild and Scenic Rivers. As an important part of its land management responsibilities, the MFO is charged with stewardship of what are likely thousands of archaeological sites, architectural properties, and other types of cultural resources on the lands it administers. A critical purpose of this Class I inventory is to help the MFO better understand the nature and distribution of these cultural resources to allow for more-informed management.

Because the MFO intends to use this Class I inventory report as an essential tool in managing the cultural resources on the lands it administers, archaeological sites and other cultural resources on BLM-managed lands are considered in the greatest detail. However, this report also presents as much data as feasible pertaining to cultural resources located on lands not managed by the BLM. This is done because understanding distributions of cultural resources in relation to environmental variables is an important goal of the project (as is discussed further in section 2.3 [Theoretical Orientation] of this chapter) and because these environmental variables, obviously, cross-cut land administrative boundaries. Including data from non-BLM land allows for a fuller understanding of the factors that have influenced past land use and the resulting modern distributions of cultural resources.

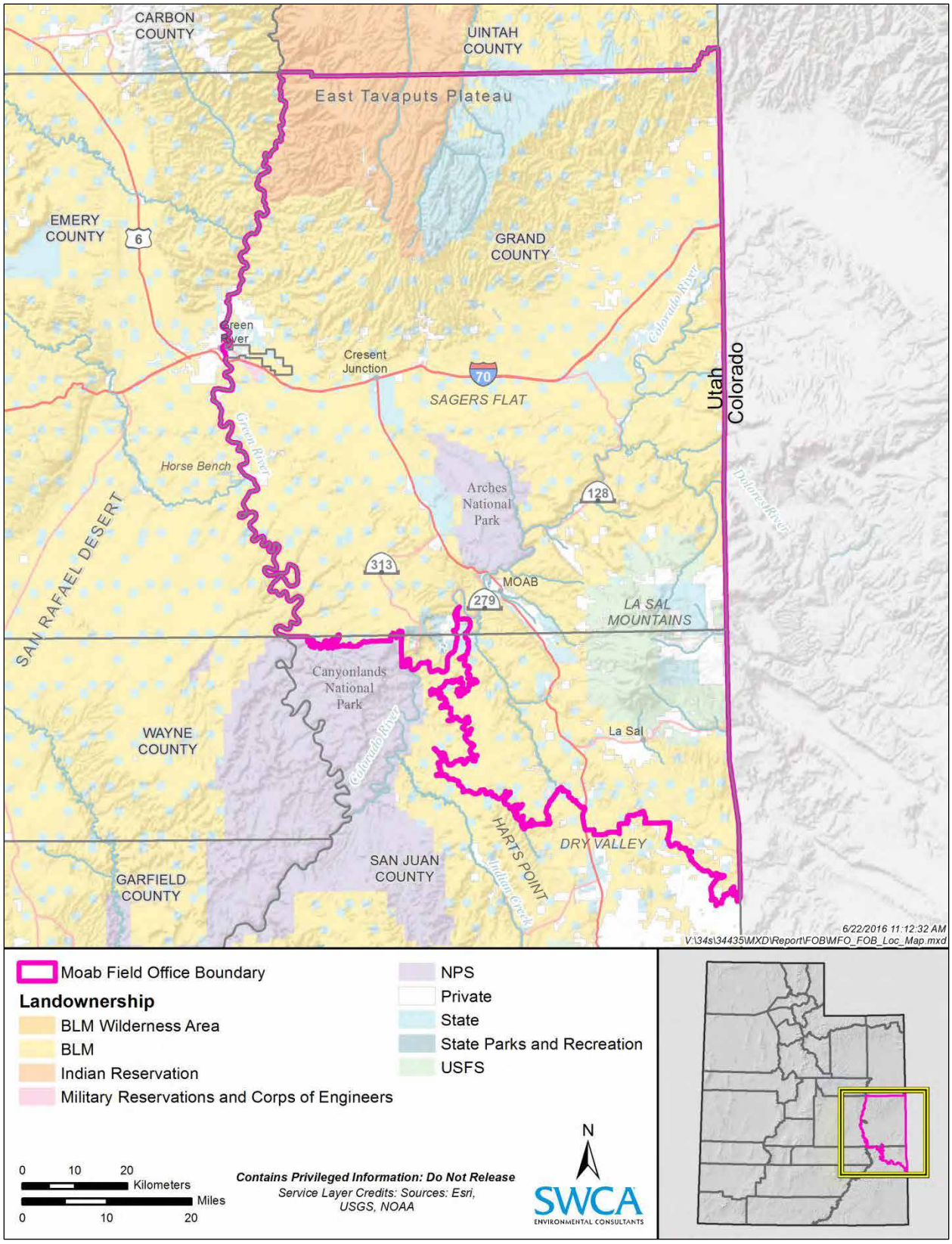


Figure 2-1. Moab Field Office planning area.

2.2 Objectives of the Class I Inventory

This report constitutes a Class I existing information inventory following standards described in *BLM Manual Section 8110 – Identifying and Evaluating Cultural Resources* (Bureau of Land Management 2004). The purpose of a Class I inventory is to use information that has previously been collected and that is reasonably available to help BLM managers and cultural resource professionals better understand the cultural resources on the lands for which they are responsible. This is done through an overview of known cultural resource data and a synthesis of these data. This inventory is much more than a simple compilation of known cultural resource data; it is intended, rather, to be a significant tool to help manage and evaluate cultural resources in the MFO planning area. As stated in BLM Manual Section 8110, the objective of a Class I inventory is to give cultural resource managers information for understanding a study area in terms of 1) the kinds of cultural resources known to exist in the area and their significance, 2) the relationship between cultural resources and the natural environment in which they occur, 3) the relationship between cultural resources and land and resource uses in the past and in the future, and 4) areas where an additional cultural resource survey is needed to fill data gaps (Bureau of Land Management 2004:.2.21A1a).

2.2.1 Inventory Report Organization

This report achieves the objectives described above by following the Class I inventory report structure outlined in BLM Manual Section 8110 (Bureau of Land Management 2004:.2.21A2) and refined through consultation with archaeologists from the MFO and the BLM Utah State Office. As context for understanding the relationship between cultural resources and the natural environment, the environmental characteristics of the MFO planning area are described in Chapter 3 (Environmental Factors). Background for understanding the kinds of cultural resources present in the MFO planning area and their significance is presented in Chapter 4 (Prior Cultural Resource Investigations), which contains an overview of prehistoric, ethnographic, and historic investigations into the area, as well as a summary of known gaps in survey coverage. Land and resource use, both past and present, is summarized in Chapter 5 (Cultural Resource Overview). A synthesis of cultural resource data for the MFO planning area, organized by time period, is discussed in Chapter 6 (Cultural Resource Synthesis and Future Research Directions); this synthesis incorporates the background data from the previous chapters to present a comprehensive overview of human use and occupation of the study area. A classification of cultural resource sites into types useful for management and research purposes is presented in Chapter 7 (Cultural Resource Site Management Classification). Relationships between the occurrence of different types of cultural resources and key environmental factors are further explored in a predictive model, presented in Chapter 8 (Moab Field Office Predictive Model and Future Inventory Strategy), and implications of the model for land use planning are discussed there as well. Finally, management options and directions for future research are discussed in Chapter 9 (Suggested Cultural Resource Use Allocations and Management Options). A companion volume of this report, Part 2, presents the compilation of known cultural resource data for the MFO planning area that is also required by BLM Manual Section 8110 (Bureau of Land Management 2004:.2.21A3).

2.3 Theoretical Orientation

In accordance with the Class I inventory objectives of BLM Manual Section 8110 outlined above in section 2.2 (Objectives of the Class I inventory), the orientation of this study is socio-ecological, in that relationships between cultural resource distributions and ecological and social variables are considered. A primary goal of the study is to understand the distribution of cultural resources of different types in relation to key environmental variables in order to allow for more-informed land use planning with respect to cultural resources. This requires understanding not just the present but the past environment of

the study area, and it likewise requires understanding how people have interacted with the environment over the course of human occupation of the area. Further, it is also important to understand the recent and current social and economic contexts of the study area because 1) this has influenced past impacts to cultural resources and likely will continue to do so in the future, and 2) understanding and anticipating such impacts are necessary to allow for responsive management of cultural resources. This approach is implemented by considering variability in past and present environmental and human land use factors in relation to distributions of cultural resources. This approach does not draw on any explicit body of anthropological theory, nor is it necessary for a Class I inventory that such a body of theory be employed because little anthropological interpretation of results is required in such a study. However, it is appropriate (and required by BLM Manual Section 8110) that the general conceptual orientation of the study be identified here. Although this orientation is appropriately geared toward management goals, because there is much interest within the disciplines of anthropologically oriented archaeology and historical and environmental studies in understanding past and present human land use in relation to aspects of the natural environment, the results of the research conducted for this inventory should also have broader academic and public relevance.

2.4 Introduction to the Study Team

The SWCA staff members who contributed to the MFO Class I inventory are listed in Table 2-1. In conducting the inventory and preparing this report, these SWCA staff members consulted closely with MFO archaeologists Jared Lundell and Don Montoya.

Table 2-1. SWCA Study Team for the MFO Class I Inventory

Name	Project Role
Lindsey Kester, B.A.	Project manager
Kelly Beck, Ph.D.	Co-principal investigator
M ke Cannon, Ph.D., RPA	Co-principal investigator
Sarah Baer, M.A., RPA	Cultural resource specialist, research
Ralph Burrillo, M.S.	Cultural resource specialist, research and writing
Paul Burnett, M.A., RPA	Cultural resource specialist, predictive modeling
Sarah Creer, B.A.	Cultural resource specialist, research and writing
Rob D'Andrea, M.S.	Cultural resource specialist, research and writing
Lisa Krussow, M.S.	Cultural resource specialist, research and writing
Stephanie Lechert, M.S., RPA	Cultural resource specialist, research and writing
Cherie Walth, M.A.	Cultural resource specialist, research
Alex Wesson, B.A.	Cultural resource specialist, research
Kiera Westwater, B.S.	Cultural resource specialist, GIS; database administrator
Allen Stutz, B.S.	GIS specialist, predictive modeling
Kari Chalker, M.A.	Lead editor
Vanessa Hastings, B.S.	Technical editor
Rhiannon Held, M.A.	Technical editor
Heidi Orcutt-Gachiri, Ph.D.	Technical editor

2.5 Data Collection and Management Methods

This section describes the methods used in collecting and managing the data used for the Class I inventory. Analytical methods used in the various studies presented in this report are discussed in the respective sections on those studies.

Background information on the cultural history and environment of the study area and on previous archaeological investigations was obtained from a variety of sources including SWCA's in-house library, the University of Utah Marriott Library, the Salt Lake City Public Library System, the Edge of the Cedars State Park Museum, the files at the MFO in Moab, and several online government sources (see citations throughout the report). Additional sources of data used in the predictive modeling efforts conducted for this project are discussed in Chapter 8 (Moab Field Office Predictive Model and Future Inventory Strategy). SWCA obtained data on previously recorded cultural resource sites and previous cultural resource projects within the MFO planning area from the Utah Division of State History (UDSH) Antiquities Section and from the MFO. Methods used in collecting and managing these site and project data are discussed in detail in the remainder of this chapter.

2.5.1 Project Database

The cultural resource site and project data that SWCA collected for the MFO Class I inventory were maintained in a GIS database and a relational tabular database created specifically for this project. These will be provided to the MFO as part of final project deliverables. The GIS database is an Esri ArcGIS 10.3 file geodatabase, and the tabular database is a Microsoft Access 2010 database. SWCA used the GIS database to store and manage all spatial data for both sites and projects, and used the tabular database to hold and manipulate a broader range of site and project attribute data. SWCA linked the GIS geodatabase to the tabular database using the Smithsonian Trinomial and the State of Utah Antiquities project number as primary keys for sites and projects, respectively, for the purposes of conducting certain analyses for this report. The fields included in the various tables of these databases, and the sources of the data incorporated into these fields, are shown in Appendix A. The GIS database and the tabular database are collectively referred to hereafter as the "project database."

2.5.2 CURES Data

Collection of site and project data began when SWCA received a selection of data for the MFO planning area from the CURES GIS database. The UDSH Antiquities Section maintains this database, which is displayed through the UDSH Preservation Pro online system. The UDSH transferred a copy of the CURES data for the study area to SWCA for use in the MFO planning model with permission from the BLM and other agencies with land management responsibilities in the MFO planning area. The CURES data provided to SWCA consist of all geospatial records on file at the UDSH Antiquities Section for previous cultural resource projects and previously recorded cultural resource sites in the study area. The UDSH delivered the CURES data used in the planning model to SWCA on September 24, 2015. The data package consisted of a "raw" dataset that contained attributes related to spatial accuracy, data entry, and data administration, as well as a "view" dataset that contained these plus additional attributes for each site recording and project. The "view" dataset was the one that was used, and the data fields from this dataset that were used in SWCA's project database for projects (at least for some sites and projects; see discussion of data sources below) were state project number, survey method, report title, and reporting organization; for site recordings, they were Smithsonian Trinomial, National Register of Historic Places (NRHP) eligibility (as indicated on Intermountain Antiquities Computer System [IMACS] site forms), reporting organization, and state project number. The CURES site and project geospatial data each included point, line, and polygon feature classes. SWCA's initial data management action was to process the CURES site and project data using GIS, as illustrated in Figure 2-2. SWCA followed separate processing procedures for the site and project datasets.

For cultural resource sites, the first step in processing was removing any sites from the database that were obviously plotted incorrectly. For example, the CURES data provided to SWCA contained sites that had county designations from counties outside of the MFO planning area; in these cases, SWCA reviewed site records and removed sites from the dataset if misplotting was indicated. Second, because the Smithsonian Trinomial was used as a database primary key and because site data needed to be sorted, SWCA added leading zeroes to all Smithsonian Trinomials such that each contained exactly six digits after the county designation. Third, SWCA added a 1-meter (m) buffer to all site point and line shapes to establish landownership for each site. As a fourth step, SWCA determined landownership for each site using data from the Utah Automated Geographic Reference Center (Utah Automated Geographic Reference Center 2015), and added it to the geodatabase. If any portion of a site fell on BLM-administered land, its landownership was classified for purposes of this planning model as BLM; for all other sites, if landownership was split, it was attributed to the entity that owns or administers most of the site area. Once this was complete, the site polygons, buffered points, and buffered lines were merged into one polygon feature class.

The next step in processing the site dataset was to remove duplicate records for individual site numbers. As is common, many cultural resource sites in the MFO planning area have been recorded in the field multiple times, and each separate site recording is represented in the CURES data by a separate record. There were also a few duplicate site records that occurred in the CURES data for other reasons. It was necessary to create a duplicate-free list of sites in the study area to ensure 1) accurate site counts for tabular data and 2) an accurate representation of site location for the spatial data used in the predictive modeling; neither would be possible if duplicate records were present. The most recent record for a site number was generally the one that was used. (For the final database, SWCA confirmed that the most-recent available record for any site was included after completing the additional data collection described below in section 2.5.3 [Additional Data Collection]). GIS tools were employed to account for sites with duplicate GIS locations. In some cases, there were two sites with the same site number that overlapped spatially; in these cases, SWCA dissolved the site locations into a single site boundary. The dissolve function merged both shapes them into one, eliminating overlapping areas and representing the site at its maximum extent (with no duplication of area covered). In cases where a site number had been assigned to shapes located in different places (of which there are a few in the CURES data), SWCA examined original site records on a case-by-case basis to determine the correct site location and boundary, which means that multipart polygons were eliminated in the GIS database. In cases where shapes for sites overlapped with shapes with different site numbers (which also occur in the CURES data), SWCA also examined original site records on a case-by-case basis to determine the appropriate site boundary and site number to use—generally the most recent site boundary and the earliest assigned site number. Where required, SWCA reviewed original site records to resolve such issues for sites. This was done after the "additional data collection" step described below. The result of these data review and cleaning steps was a final, duplicate-free site dataset. This duplicate-free dataset is included in SWCA's final deliverable GIS database for the project. In addition, SWCA exported the duplicate-free site list from GIS and imported it into the project's Microsoft Access database, where it serves as a primary key table and allows linkage of additional data in the Microsoft Access database back to the geodatabase.

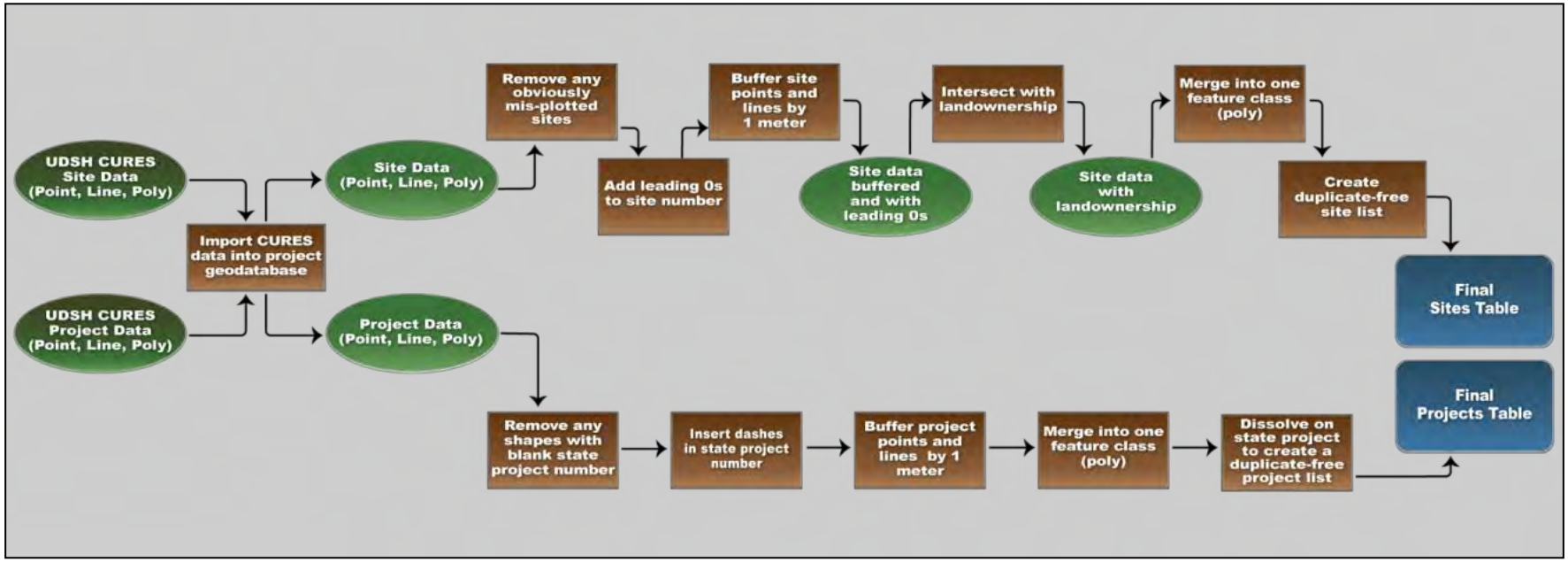


Figure 2-2. Steps used in processing CURES data.

The total number of sites in the database compiled for this project after all of the duplicates were removed and other spatial issues were resolved is 8,017 (Table 2-2).

Table 2-2. Total Number of MFO CURES Sites by Landowner

Landowner	Site Count
BLM	5,842
Department of Defense	6
National Park Service	227
Private	430
School and Institutional Trust Lands Administration	837
Utah Division of Forestry, Fire & State Lands	7
Utah Department of Transportation	10
Utah Division of Wildlife Resources	8
U.S. Forest Service	635
Utah State Parks	15

For cultural resource projects, SWCA added a 15-m buffer to all project point and line shapes to facilitate combining them into a single polygon feature class. Because many projects were represented by multiple shapes, SWCA dissolved the project shapes based on project number in order to produce a single duplicate-free table of all projects. The data collected for this report indicate that 2,465 projects have occurred in the MFO planning area.

2.5.3 Additional Data Collection

SWCA collected additional data after processing the CURES data. The CURES data that SWCA received included almost all previously recorded cultural resource sites and previous cultural resource projects on BLM-administered land within the MFO planning area for which information was available (as of the time of CURES data delivery). Two recent cultural resource projects conducted on BLM-administered land within the MFO planning area—the La Sal and Gunnison Valley Seismic Inventories—were not included in the CURES data. In addition, the Old Spanish Trail designated alignment and a number of rock art sites documented by the Utah Rock Art Research Association were not included in the CURES data. The BLM provided data for these additional projects and sites directly to SWCA, and no records searches were conducted to identify additional sites or projects. However, the planning model objectives outlined earlier in this chapter required the compilation and analysis of a range of site and project attributes that are not recorded in the CURES data, either because the attributes themselves are not included as data fields in the CURES data, or because entries for data fields that are present in the CURES data were blank for certain sites or projects. For this reason, SWCA collected additional data for sites and projects already in the CURES data that were received.

For cultural resource sites, the attribute data that were considered critical (beyond the geospatial data held in the GIS database) were the year recorded, reporting organization, NRHP eligibility, and a range of information provided on IMACS site forms that was used in site classification, which is discussed in further detail in Chapter 7 (Cultural Resource Site Management Classification). In the project's Microsoft Access database, the first three fields are provided in the table "FINAL: MFO Sites" (see Appendix A, Table A-1), and the fields derived from IMACS site forms are provided in the table "ANALYSIS: MFO Site Classification Results" (see Appendix A, Table A-3).

SWCA also obtained another key source of data for the sites from the UDSH and BLM, an IMACS encoding dataset. This dataset is a Microsoft Excel spreadsheet with data taken from IMACS encoding forms. SWCA imported the encoding dataset into the project's Microsoft Access database as a separate data source table, then evaluated the table for obvious errors and formatted it so that it could be linked to other data tables through the Smithsonian Trinomial.

For the year recorded, reporting organization, and NRHP eligibility site data fields, SWCA prioritized the encoding data for use in the project database. If the required data were not present in this source, SWCA used the information provided in the CURES data (with year of recording inferred from the state project number listed for a site in the CURES data).

The remaining required data for sites, as noted, consist of a set of information provided on IMACS site forms that was used in site classification. SWCA collected data to ensure that this information was present in the project database for all sites with BLM landownership ("BLM sites"). SWCA examined copies of the original full site forms to obtain the required data for BLM sites in the CURES data that were not included in the encoding dataset, or that were included but appeared to have incomplete or incorrect data on the encoding sheet (e.g., codes were entered that were not valid per the IMACS User's Guide). SWCA attempted to retrieve the site forms from Preservation Pro first, then from the hard copy files of the UDSH Antiquities Section, and finally from files maintained by the MFO. Where it was not possible to find information such as year recorded, reporting organization, or NRHP eligibility in UDSH encoding data or CURES data as described in the previous paragraph, SWCA tried Preservation Pro or hard copy site forms at the UDSH or MFO, in that order. After searching all these sources for site forms, there were only a handful of BLM sites for which copies of site forms could not be found and for which data remain incomplete; these sites are noted in the project database as "data unavailable."

For sites with non-BLM landownership ("non-BLM sites"), SWCA used in the planning model only those sites that had the complete set of required data in the CURES and IMACS encoding datasets provided by UDSH, and conducted no additional data collection. However, due to programming requirements of the Microsoft Excel macro that was used for site classification (see Chapter 7 [Cultural Resource Site Management Classification]), dummy data that did not affect site classification or planning model results were entered in certain fields to make the dataset "complete." The dummy data consisted of an "unknown" code entered into certain fields for sites where these fields were blank. These fields were secondary landform (IMACS Part A, Line 32), prehistoric cultural affiliation and dating method (Part B, Line 2), historic theme (Part C, Line 2), and historic cultural affiliation and dating method (Part C, Line 3).

In total, 6,900 sites located within the MFO planning area were included in the site classification dataset (BLM: 5,781; Other: 1,120). Of the 1,116 sites that were not included, 61 were BLM sites that did not have sufficient encoding data and for which site form data were unavailable, and 1,055 were non-BLM sites that did not have complete encoding data.

For cultural resource projects, survey year, reporting organization, and survey method were considered to be required attribute data. Of these attributes, survey method was the only attribute for which there were any blank entries in the CURES data. For projects for which this field was blank in the CURES data, SWCA determined survey method by retrieving project reports from either UDSH files or MFO files.

SWCA conducted a search of records on Preservation Pro and at UDSH to collect remaining missing data from October 26 to December 7, 2015. Archaeologists Katie Molenhoff, Laurie Fisher, and Rob D'Andrea conducted the file search at UDSH. Principal Investigator (PI) Mike Cannon, Project Manager Lindsey Kester, and Cultural Resource Specialist Christine Michalczuk directly supervised data collection for these file searches. For many sites, the data necessary to fill in gaps or correct errors could be obtained easily from a site form or project report, and, in such cases, SWCA entered the data directly into a data entry form on a laptop computer while at UDSH and made no copies or scans of the site forms or reports

involved. In cases in which it was clear that more time would be required scrutinizing a site form or report to glean required data (which occurred mainly in cases involving pre-IMACS site forms), SWCA scanned the full site form or appropriate report section, and completed data entry at our Salt Lake City office.

Following the UDSH records search, SWCA visited the MFO office to obtain remaining needed site forms or project reports not available at UDSH. The MFO search was conducted on November 19, 2015, by Mike Cannon, and was directly supervised by Project Manager Lindsey Kester, and Cultural Resource Specialist Christine Michalczuk. SWCA scanned the site forms and reports at the field office, reviewed the scanned forms, then entered the data back at our Salt Lake City office.

2.5.3.1 INTERMOUNTAIN ANTIQUITIES COMPUTER SYSTEM DATA COLLECTION METHODS

As noted above, a range of information provided on IMACS site forms was critical for meeting the objectives of the MFO planning model. SWCA obtained this information from the IMACS encoding dataset and from in-person file searches conducted at the UDSH and MFO offices. Further detail on steps taken in the collection and management of IMACS site form data are provided here.

Following the precedent set by the encoding data file, which provided the bulk of the IMACS data used for the MFO planning model, IMACS data codes are used throughout the project database. These are typically one- or two-letter or -digit codes that signify longer text entries; a key to the codes is provided in the IMACS User's Guide (IMACS 1992). SWCA used only codes listed in the IMACS User's Guide.

SWCA screened the encoding data file provided by UDSH and deleted entries that did not correspond to "official" codes from the IMACS User's Guide, most of which were obviously typos or other types of data entry errors. SWCA replaced such deleted entries, as needed, with data collected from copies of original site forms held in UDSH or MFO hard copy files. SWCA also screened for other relatively obvious inconsistencies that suggested data entry errors (e.g., a prehistoric cultural affiliation was listed for a site but no prehistoric artifacts or features were listed, or vice-versa) and again corrected those, as needed, using data collected from original site forms held in UDSH or MFO hard copy files. Other than correcting errors revealed by screening for codes not listed in the IMACS User's Guide and by screening for obvious inconsistencies, SWCA did not revise data that were already in the encoding dataset, and it is assumed that the remaining original data in this dataset were entered correctly and accurately.

From SWCA's screening of the encoding data for codes not listed in the IMACS User's Guide and for obvious inconsistencies, SWCA generated a master table of problematic site records for use in additional data collection. SWCA attempted to obtain copies of the original site forms for the recordings represented in this table; as noted above, there were only a very few records in this table for which original site forms could not be found in UDSH or MFO files. In a very few cases, searches of these files revealed more recent site records for sites in the table; in these cases, SWCA updated the site record in the project database to reflect the more recent site recording. SWCA added other information from the more recent site record to the data already in the project database without deleting data already in the database, except in cases where the original data were clearly incorrect. After completing data entry, SWCA checked the codes again for completeness and accuracy using a series of database queries.

In collecting data from original site forms, SWCA first attempted to enter data directly from entries in IMACS site form data fields, but in some cases it was necessary to read through the longer text sections of the site form (site description, artifact and feature descriptions, etc.) to determine which data should be entered. It was necessary to do this in all cases where earlier site forms were used that did not have the same specific data fields as the IMACS site form, but it was also occasionally necessary to do this where IMACS site forms were used. In doing this, SWCA made every attempt to minimize the amount of data interpretation that occurred; for example, if the cultural affiliation field was blank for a prehistoric site or

component but prehistoric materials were clearly present, data were entered simply as Unknown Aboriginal (ZZ), and no attempt was made to determine a more precise cultural affiliation through interpretation of the artifacts or features listed. In fact, Unknown codes (Z or ZZ) or, in some cases, the Other code (OT) were used as a default entry for any data field where it was clear that there should be an entry, but the specific data to be entered could not be directly determined. Additionally, if data were already present in the encoding dataset, SWCA did not attempt to second-guess those data based on SWCA's own interpretation of the artifacts or features recorded at a site; for example, if a site's cultural affiliation was designated as Fremont (FR) in the encoding data but SWCA's opinion was that the artifact assemblage more likely indicated a Late Prehistoric (LP) occupation, SWCA did not alter the data originally present in the encoding data. Altering the data could cause inconsistencies from what was identified in the field, and field visits to confirm the information provided on site forms were beyond the scope of the project.

If an NRHP eligibility recommendation was not clearly stated on a site form that was reviewed during additional data collection, then Undetermined (Z) was entered into the project database. Undetermined was also entered when there appeared to be a lack of concurrence on an eligibility determination (i.e., there was a stamp or comment by the agency and/or the Utah State Historic Preservation Office indicating that they did not agree or concur with the eligibility recommendation made on the site form) and the final determination was unknown.

On IMACS site form Part B, if no artifacts were listed for a site (e.g., the site form mentions only rock art or features), SWCA entered no artifact data into the project database for that site. If no artifacts were recorded in the artifact summary field (Line 7) but lithic artifacts were recorded in other parts of the site form (e.g., debitage quantity, Line 9), SWCA entered Lithic Scatter (LS) in the artifact summary field. If no count was given in the debitage quantity field but debitage was mentioned elsewhere in the site form, SWCA entered Unknown (Z) for debitage quantity. The presence or absence of lithic tools and ceramics was an essential piece of information for site type determinations; therefore, if the site form indicated that lithic tools or ceramics were present but specific tool or ceramic types were not specified, SWCA entered Unknown (ZZ) to indicate that such artifacts were present.

Sections of Part C most often contained codes that are not listed in the IMACS User's Guide and codes that did not match site or feature descriptions. On site forms, the feature type Dump (DU) was seldom selected, but many site descriptions referred to the site as a dumping area; in such cases, SWCA added the feature code DU (to the Part C, Line 14 data).

2.6 Report Preparation

This report was authored by individuals listed in Table 2-1. Each chapter was written under the direct supervision of a project principal investigator. Senior SWCA cultural resource specialists with appropriate qualifications then conducted a thorough quality control review of the chapter to ensure scientific rigor and compliance with BLM Class I inventory requirements. After any required revisions were made in response to this review, each chapter underwent a complete copy edit by SWCA's technical editors, followed by a final principal investigator review. A project principal investigator also reviewed all other project deliverables, such as GIS data, for quality control.

This draft version of this report was submitted to the BLM and is subject to peer review by a team of BLM archaeologists. Comments and suggestions made by this review team will be incorporated into the report, as appropriate, and presented in a draft final report. This draft final report will undergo an additional round of review by the MFO archaeologist and peer review team, after which SWCA will make further revisions, as necessary, and submit a final report along with all other project deliverables.

2.7 References Cited

Bureau of Land Management

2004 Bureau of Land Management Manual, Section 8110 – Identifying and Evaluating Cultural Resources (Public). Available at: http://www.blm.gov/style/medialib/blm/wo/Information_Resources_Management/policy/blm_manual.Par.23101.File.dat/8110.pdf. Accessed January 5, 2015.

Higgins, R. W., Y. Yao and X. L. Wang

1997 Influence of the North American Monsoon System on the United States Summer Precipitation Regime. *Journal of Climate* 10:2600–2622.

IMACS

1992 *Intermountain Antiquities Computer System User's Guide*. Available at: http://anthro.utah.edu/labs/imacs.php. Accessed January 5, 2015.

Mock, Cary J.

1996 Climate Controls and Spatial Variations of Precipitation in the Western United States. *Journal of Climate* 9:1111-1125.

Shinker, Jacqueline J.

2010 Visualizing Spatial Heterogeneity of Western U.S. Climate Variability. *Earth Interactions* 14(10):1-14.

Utah Automated Geographic Reference Center

2015 Land Ownership GIS Dataset. Available at: http://gis.utah.gov/data/sgid-cadastre/land-ownership/. Accessed November 19, 2015.

This page intentionally blank

CHAPTER 3. ENVIRONMENT OF THE MOAB FIELD OFFICE PLANNING AREA

Rob D'Andrea, Ralph Burrillo, Stephanie Lechert, Lisa Krussow, and Sarah Creer

The MFO planning area is located in southeastern Utah (see Figure 2-1) and encompasses all of Grand County and the northeastern portion of San Juan County approximately from the northeastern extent of Canyonlands National Park east to the Colorado state line. Specifically, the northern boundary extends from the Colorado state line on the east across the East Tavaputs Plateau to end at the Green River in the west. The western boundary follows the Green River south past the San Juan County line and along the northeastern boundary of Canyonlands National Park to the Colorado River. From there, it follows the Colorado River to the end of a maintained road up Long Canyon, and heads south, roughly following the contours of Hatch Point, after which it bears southwest across Hatch Creek and Highway 191 to the Colorado state line. The eastern boundary follows the Utah-Colorado state boundary line north, crossing Ray Mesa, the Dolores River, and the Colorado River, before meeting back up with the northern border of Grand County.

The area has a variety of federally managed lands, which are administered by the National Park Service, the BLM, and the U.S. Forest Service, including Arches National Park; portions of the Old Spanish National Historic Trail; the Colorado and Green Rivers (both of which are Wild and Scenic Rivers); the Desolation Canyon, Floy Canyon, Coal Canyon, Spruce Canyon, Flume Canyon, Westwater Canyon, Lost Spring, Behind the Rocks, Negro Bill Canyon, and Mill Creek Canyon Wilderness Study Areas and the Black Ridge Canyons Wilderness Area; and the Manti-La Sal National Forest. Also within the area are the state-administered Dead Horse Point State Park and portions of the tribally administered Uintah and Ouray Reservation. The planning area exhibits a range of topographic and environmental variability, including benches and canyons, deserts, and forests, which all ultimately drain into the Colorado River.

This chapter characterizes the area's environmental complexity and includes overviews of modern climate, paleoclimate, topography, hydrology, geology, soils, flora, and fauna. These characteristics are described to provide background for understanding how the environment has affected—and continues to affect—human use and occupation of the MFO planning area.

3.1 Modern Climate

The MFO planning area encompasses geographic variation in climate and considerable climatic seasonal variability (referred to hereafter as seasonality). The Colorado Plateau physiographic region, where the entire MFO planning area is located (see section 3.3 [Topography] below), is categorized as desert and steppe, which are arid environments. These areas experience little rainfall, large daily temperature fluctuations, and seasonality. Additionally, there is significant spatial heterogeneity of climate on the Colorado Plateau (Mock 1996; Shinker 2010), with precipitation generally increasing from low to high elevation and summer precipitation generally decreasing from the south to the north (Higgins et al. 1997).

The MFO planning area is within the summer monsoon boundary, which is affected by Atlantic Ocean patterns that create a short summer rainy season, a common trait throughout the entire Southwest (Betancourt 1984). Additionally, the Southwest can be affected by the Southern Utah Low cycle, which is the product of low pressure creating precipitation in May and October. Generally, precipitation in higher-elevation areas of the Colorado Plateau occurs mostly during the winter and is derived from Pacific Ocean–sourced, extratropical frontal storms (Mock 1996), whereas lower-elevation areas receive most of their precipitation in the summer; this precipitation is derived from North American Monsoon moisture originating in the Gulf of California and possibly the Gulf of Mexico (Barron and Anderson 2011).

Because the MFO planning area covers several physiographic sections of the Colorado Plateau, much of this chapter discusses climate, including temperature and precipitation, by subregion and refers to data collected at modern and historic climate stations throughout the area. These data date from 1911 to 2015 (Western Regional Climate Center 2016).

Climate data from Nutters Ranch, Utah, northwest of the MFO planning area, represent climate in the East Tavaputs Plateau, which comprises a majority of the northern portion of the study area. Winter temperatures (as determined from the January average) range from 6.4 to 35.3 degrees Fahrenheit (°F) (-14.22 to 1.83 degrees Celsius [°C]), with an average precipitation of 0.56 inch (1.42 centimeters [cm]). In addition, the average snowfall is 6.1 inches (15.49 cm). Summer temperatures (July data) range from 53.6°F to 87.7°F (12°C to 30.94°C), with 1.19 inches (3.02 cm) of rainfall.

Climate data from just north of Interstate 70 at Thompson, Utah, represent Sagers Flat, which occupies much of the north-central portion of the MFO planning area. At this location, south of the East Tavaputs Plateau, winters are marginally warmer and moister, ranging in temperature from 13.9 to 36.9°F (-10.1 to 2.7°C), and having an average precipitation of 0.73 inch (1.85 cm). In addition, the average snowfall is 5.1 inches (12.95 cm). Summer temperatures are warmer and drier, ranging from 63.4°F to 93.7°F (17.4°C to 34.3°C), with only 0.72 inch (1.83 cm) of rainfall.

Climate data representative of the central portion of the MFO planning area come from Arches National Park. Here, winters are substantially warmer and drier than those of the northern regions, ranging on average from 20.1°F to 42.6°F (-6.6°C to 5.89°C) and having an average precipitation of 0.55 inch (1.39 cm) of rain and 1.9 inches (4.83 cm) of snowfall. Summers are also warmer and drier and are characterized by temperatures ranging on average from 67.6°F to 99.1°F (19.78°C to 37.28°C) and an average precipitation of 0.87 inch (2.21 cm) of rain.

Canyonlands National Park is southwest of the MFO planning area and provides representative climate data for the southwestern portion of the MFO planning area. At the Neck weather station, winter is characterized by temperatures ranging on average from 20.6°F to 36.9°F (-6.33°C to 2.72°C), with an average precipitation of 0.49 inch (1.24 cm) of rain and 5.7 inches (14.48 cm) of snowfall. Summer is characterized by temperatures ranging on average from 65.9°F to 90.7°F (18.83°C to 32.61°C), with an average precipitation of 0.96 inch (2.44 cm) of rain. At the Needles station, winter is characterized by temperatures ranging on average from 16.5°F to 41.2°F (-8.61°C to 5.11°C), with an average precipitation of 0.53 inch (1.35 cm) of rain and 3.5 inches (8.89 cm) of snowfall. Summer is characterized by temperatures ranging on average from 62.6°F to 95.3°F (17°C to 35.17°C) and an average precipitation of 0.83 inch (2.11 cm) of rain.

La Sal, which is just south of the La Sal Mountains within the MFO planning area, provides climate data for the southeastern portion of the area and represents a higher-elevation area in the region. Winters are relatively cold and moist compared to the lower-elevation regions of the planning area, and are characterized by temperatures ranging on average from 13.4°F to 36.8°F (-10.33°C to 2.67°C) and an average precipitation of 0.82 inch (2.08 cm) of rain and 9.5 inches (24.13 cm) of snowfall. Summers are also relatively cold and moist, and are characterized by temperatures ranging on average from 54.4°F to 86.4°F (12.44°C to 30.22°C), with an average precipitation of 1.30 inch (3.30 cm) of rain.

These data illustrate the MFO planning area's typical climatic zones and seasonality. Moderate, cool winters with little precipitation and warmer summers with relatively moderate precipitation (mostly occurring in 1 or 2 months) illustrate the environment's overall aridity, with precipitation generally increasing from low- to high-elevation sites and summer precipitation generally decreasing from the south to the north as elsewhere on the Colorado Plateau (Higgins et al. 1997). The lowest precipitation averages are in Canyonlands (Needles) (at 8.35 inches [21.21 cm] rainfall and 14.50 inches [36.83 cm] snowfall per year) and Thompson (at 9.17 inches [23.29 cm] rainfall and 13.80 inches [35.05 cm] snowfall per year). The highest-precipitation averages occur in the La Sal Mountains; La Sal has an average annual rainfall of 13.19 inches (33.50 cm) per year and an average annual snowfall of 47.8 inches (121.41 cm) per year.

3.2 Paleoclimate

Understanding the prehistoric environment of a region can help researchers address questions about human occupation of that region (e.g., Grayson 2011). Humans are adaptive and responsive to their surrounding landscapes, and examining the history of those landscapes can illuminate past human behavior. This section summarizes the climate of what is now the MFO planning area during prehistoric human occupation, which occurred from the terminal Pleistocene through the late Holocene. The past climate of the Colorado Plateau and the adjacent Great Basin, where the MFO planning area is located, is also discussed. This is done because the Colorado Plateau paleoenvironmental record is relatively fragmentary, and the Great Basin record can help provide a broader context.

3.2.1 Terminal Pleistocene

There is evidence that prehistoric human occupation of the MFO planning area started in the terminal Pleistocene (14,500–10,000 radiocarbon years before present [RCYBP]), as is the case throughout North America (W. E. Davis 1985). This period is characterized by extreme seasonality and the presence of pluvial lakes throughout much of the American West, including several on the Colorado Plateau and an extensive system in the nearby Bonneville Basin of the Great Basin (Orme 2008; Reynolds et al. 2001). It has been suggested that the terminal Pleistocene was cool and moist, with a high level of primary productivity, but that the pronounced seasonality kept large mammal population densities low (Broughton et al. 2008). These claims have been corroborated by several environmental proxies. In particular, macrobotanical data have been used to reconstruct past ecological systems based on the presence or absence and relative abundances of environmentally sensitive plant species. Additionally, animal population densities can be estimated through archaeofaunal data such as the density of fecal pellets, overall body size, and relative abundance indices. In turn, because some animal species thrive in particular climates, animal population density studies can provide data for climatic reconstruction.

Although the boundaries of the former Lake Bonneville terminate at the west slopes of the Wasatch Mountains and are therefore outside MFO planning area boundaries, the lake was a major feature of the Pleistocene environment of the larger region and so it is discussed here. Data collected from pluvial Lake Bonneville show lake levels fluctuating considerably during the Pleistocene (e.g., Benson et al. 1992; Madsen 2000). Vegetation in much of the eastern Great Basin during the terminal Pleistocene consisted mostly of subalpine conifers and sagebrush steppes in the valley bottoms, but this changed during the onset of the Holocene (Grayson 2011; Louderback and Rhode 2009). This may be due to the fact that the Great Basin was dominated by pluvial lakes that, upon evaporation, revealed areas not previously available for most plant life (Betancourt 1984). Furthermore, the composition of vegetation communities differed from those that occur today, with low-elevation plants growing among subalpine and montane conifers. Betancourt (1984) believes that it was only after the Pleistocene that plants with greater adaptability to drier climates outcompeted other species, forcing them upslope.

On the Colorado Plateau, glaciers were present on most of the highest mountains during the Pleistocene. This includes the Aquarius, Fish Lake, and Thousand Lake Plateaus; the La Sal Mountains; the San Francisco Peaks; and the White Mountains (Flint and Denny 1958; Merrill and Pewe 1977; Pewe and Updike 1976; Richmond 1962). Deglaciation occurred in the nearby Wasatch Mountains by 12,300 RCYBP and on the Markagunt Plateau by 13,000 RCYBP (Anderson et al. 1999; Madsen and Currey 1979). Elevational gradients of individual plant species were lowered as much as 800 meters (m) along the Grand Canyon, along the Mogollon Rim, and at lower-elevation sites on the Colorado Plateau (Anderson 1993; Betancourt et al. 1990; Cole 1990). These differences in elevation suggest that temperatures were 3 to 5°C cooler than today, and precipitation levels were 35 to 120 percent higher (Betancourt 1984).

Pleistocene fossil vegetation assemblages derived from packrat middens and cave sediment deposits demonstrate the presence of subalpine and montane communities at lower elevations during this time period. Generally, subalpine and montane communities containing limber pine (*Pinus flexilus*), Douglas fir (*Pseudotsuga menziesii*), blue spruce (*Picea pungens*), white fir (*Abies concolor*), Rocky Mountain juniper (*Juniperus scopulorum*), and common juniper (*J. communis*) dominated the elevations where woodland communities occur today, growing directly above Utah juniper (*J. osteosperma*) woodland and desertscrub communities (Betancourt et al. 1990; Thompson et al. 1993). Limber pine dominated plant communities at elevations where modern pinyon-juniper communities currently exist, and pinyon pine (*P. edulis*) and Rocky Mountain juniper grew together at elevations that now support modern desertscrub communities south of the Grand Canyon (Betancourt et al. 1990). Ponderosa pine (*P. ponderosa*) and pinyon pine were displaced to the south at the time of the last glacial maximum, with pinyon pine expanding northward onto the Colorado Plateau during the Bolling and Allerod intervals (Cinnamon 1988; Cole et al. 2013). In addition, riparian and montane plants inhabited the lowest elevations, where modern refugia populations are still observed in well-watered alcoves (Betancourt et al. 1990).

Several packrat midden records that have allowed for paleoenvironmental reconstructions spanning back to the Pleistocene on the Colorado Plateau have been recovered within close proximity of the MFO planning area. These include the Allen Canyon, Cottonwood Cave, the Loop, Fishmouth Cave, Falling Arch, Long Canyon, and Cowboy Cave records, with Cowboy Cave demonstrating the Pleistocene presence of spruce and Douglas fir (Betancourt et al. 1990). Several others demonstrate lower-elevation shifts of plant species during the Pleistocene. Bechan Cave documents the presence of spruce; Escalante Basin sediments contain spruce, Douglas fir, mountain mahogany (*Cercocarpus ledifolius*), Woods' rose (*Rosa woodsii*), and water birch (*Betula occidentalis*). Atlatl Cave in Chaco Canyon demonstrates the presence of an open steppe or woodland dominated by Douglas fir, Rocky Mountain juniper, and limber pine, and containing big sagebrush (*Artemisia tridentata*), fourwing saltbush (*Atriplex canescens*), narrowleaf yucca (*Yucca angustissima*), prickly pear (*Opuntia polycantha*), whipple cholla (*Cylindropuntia whipplei*), hedgehog cactus (*Echinocereus* spp.), Fendler's barberry (*Berberis fendleri*), and Mesa Verde fishhook cactus (*Sclerocactus mesae-verdae*) (Betancourt and Van Devender 1981; O. K. Davis et al. 1984; Spaulding and Petersen 1980; Withers and Mead 1993). Other midden records demonstrating these lower-elevation shifts have been recovered from Canyon del Muerto, Salt Creek, White Rim (within Canyonlands National Park), Tappan Wash, and the eastern Grand Canyon (Betancourt and Davis 1984; Coats et al. 2008; Cole 1990; Van Devender and Spaulding 1979; Van Devender et al. 1987).

As is illustrated later in this report, the distribution of archaeological sites that date to the Paleoindian period in the region suggests that human population density was low. Occupations tended to be concentrated along valley bottoms and the shorelines of the pluvial lakes, which contained a variety of fish and waterfowl. Larger mammals also used these valleys for water and food sources. Pleistocene mammals on the Colorado Plateau and the adjacent Great Basin were numerous and included large-bodied taxa such as saber-toothed cat (*Smilodon fatalis*), horse (*Equus* spp.), camel (*Camelops hesternus*), large-headed llama (*Hemiauchenia macrocephala*), musk-ox (*Bootherium bombifrons*), giant short-faced bear (*Arctodus simus*), short-faced skunk (*Brachyprotoma brevimala*), ground sloth (*Glossotherium*), and mammoth (*Mammuthus columbi*) (Heaton 1985; Mead and Agenbroad 1992; W. E. Miller 1976, 1982, 1987; M. E. Nelson and Madsen 1978, 1980, 1983; Romer 1928). These and other species went extinct as part of the mass extinction that occurred before the Holocene, the cause of which remains the subject of considerable debate (Grayson 1993, 2011; Mead and Agenbroad 1992). Smaller Pleistocene mammals that disappeared from the Great Basin at the end of the Pleistocene include the heather vole (*Phenacomys intermedius*), the northern bog lemming (*Micromys borealis*), the pine marten (*Martes americana*), and the least weasel (*Mustela nivalis*) (Grayson 1982:86–92; 1993:170–184; 2011:186–206). Extinct Pleistocene birds that may have been present in the eastern Great Basin and/or Colorado Plateau areas include flamingos (*Phoenicopterus copei; P. minutus*), stork *(Ciconia maltha*), shelduck (*Anabernicula*

gracilenta), condors and vultures (*Breagyps clarki*), teratorns (*Teratornis incredibilis; T. merriami*), hawks and eagles (*Spizaëtus pliogyrps; S. willetti*), and Old World vultures (*Neogyps errans)* (Grayson 1993:166–170; 2011:181–186).

3.2.2 Holocene

The Holocene saw significant climatic changes from the Pleistocene. Even though researchers have been able to refine the chronology somewhat in various areas, the framework for understanding Holocene climate change in western North America that was originally proposed by Antevs (1955) 60 years ago is still generally used. For the purposes of this discussion, Grayson's (1993) adaptation of Antevs's framework is employed, with the Holocene divided into three periods: early (10,000–7,500 RCYBP), middle (7,500–4,500 RCYBP), and late (4,500 RCYBP–present). These divisions are somewhat arbitrary, and dates of major paleoenvironmental changes differ somewhat in different parts of the Colorado Plateau and Great Basin; nevertheless, some general trends are evident.

3.2.2.1 EARLY HOLOCENE

Inferred summer maximum and winter minimum insolation suggests that summers were warmer and winters were colder than today in western North America during the early Holocene, and climate model simulations indicate that summer temperatures were anywhere from 1 to 2°C or 3 to 5°C warmer than today (Berger and Loutre 1991; Jiménez-Moreno et al. 2008; Morris et al. 2012; Renssen et al. 2012; Toney and Anderson 2006). In addition, early Holocene proxy records from the Colorado Plateau indicate that summers were wetter than today and that vegetation communities were vastly different (Anderson et al. 1999; Hasbargen 1994; Morris et al. 2013; Reheis et al. 2005; Thompson et al. 1993; Weng and Jackson 1999). This may have been due to an enhancement in the onshore flow of moisture from the eastern tropical Pacific that resulted in a greater intensity and northward expansion of the North American Monsoon (Adams and Comrie 1997; Notaro and Zarrin 2011).

The Pleistocene pluvial lakes of the Colorado Plateau and Great Basin diminished considerably in size during the early Holocene, but shallow lakes and marshes were still present in many valleys. Great Basin pollen data from the early Holocene show a dominance of sagebrush communities in areas that are currently dominated by plants in the family Amaranthaceae, suggesting that conditions were more moist than today (Grayson 1993, 2011). However, they also document an expansion of xerophytic shrubs such as shadscale (*Atriplex confertifolia*) into areas that had been populated by pine and sagebrush during the late Pleistocene, suggesting that conditions had become more arid relative to the Pleistocene (Louderback and Rhode 2009). Pollen samples show high densities of spruce and firs, along with a strong presence of sagebrush and grasses, signifying well-established mixed forest and shrub communities (Morris et al. 2012). Additionally, pollen analysis suggests that the high productivity of grass and sagebrush during the warmer, wetter summers increased wildfire frequencies (Morris et al. 2012).

On the Colorado Plateau, plant communities underwent major reorganization during the early Holocene. Montane conifers persisted at relatively low elevations, and modern woodland plants such as Ponderosa pine, pinyon pine, Utah juniper, Gambel oak (*Quercus gambellii*), littleleaf mountain mahogany (*C. intricatus*), single leaf ash (*Fraxinus anomala*), and hackberry (*Celtis reticulate*) became established at higher elevations (Betancourt et al. 1990; Cole 1990; Thompson et al. 1993). In addition, the Colorado Plateau saw the appearance of several plants such as catclaw acacia (*Acacia greggii)* and peach thorn wolfberry *(Lycium cooperi)* in higher elevations and away from known water sources, suggesting that the early Holocene was much moister than it is today (Cole 1990:353). However, some areas in the Colorado Plateau had already begun to experience increased aridity by 9,000 RCYBP, which is evident in the switch to a seed-dominated diet at the North Creek Shelter Site (Louderback 2014). Warming during the early Holocene was sufficient to allow the replacement of subalpine conifers by Ponderosa

pine and the establishment of Ponderosa pine forests on the Colorado Plateau where they currently dominate, in addition to a reduction in the northern extent of pinyon pine (Anderson 1989, 1993; Cole et al. 2013).

Sediment and packrat midden records on the Colorado Plateau demonstrate the vegetation reorganizations that occurred at lower elevations at this time. Sites in the Escalante Basin show evidence for a decreased abundance of mesophytic species, a lack of elevationally depressed conifers, and the presence of mostly Gambel oak and prickly pear (Withers and Mead 1993). Likewise, at Allen Canyon Cave, limber pine, Ponderosa pine, littleleaf mountain mahogany, and gambel oak arrived while the abundance of Engelmann spruce and subalpine fir (*Abies lasiocarpa*) declined sharply. At Fishmouth Cave, spruce had disappeared while Gambel oak, limber pine, Rocky Mountain juniper, and mountain mahogany were replaced by Utah juniper and littleleaf mountain mahogany (Betancourt 1984). At Falling Arch, montane plants disappeared and Utah juniper dominated (Van Devender et al. 1987). In addition, at Long Canyon Cave, mesophytes became replaced by Utah juniper and Gambel oak (Van Devender et al. 1987).

Faunal data from early Holocene cave sites demonstrate a turnover in large mammals during this time on the Colorado Plateau. Megafaunal grazers such as the mammoth had gone extinct, with their niche being filled to a large degree by the American bison (*Bison bison*) (L. W. Nelson 1990). The shortfaced bear (*Arctodus* spp.), one of the most powerful Pleistocene carnivores, was replaced by the smaller and slower grizzly bear (*Ursos arctos*). Additionally, other large predators such as the dire wolf (*Canis dirus*) and the American lion (*Panthera atrox*) had gone extinct and were survived by the gray wolf (*Canis lupus*), the mountain lion (*Felis concolor*), and the bobcat (*Lynx rufus*). Nearby in the eastern Great Basin, faunal data from early Holocene sites such as Homestead Cave indicate the presence of mammals currently only found at higher elevations, such as pikas (*Ochotona* sp.) and yellow-bellied marmots (*Marmota flaviventris*), or in cooler, wetter areas, such as northern pocket gophers (*Thomomys talpoides*), bushy-tailed woodrats (*Neotoma cinerea*), and voles (*Microtus* sp.) (Grayson 1993, 2011; Madsen et al. 2005). In addition, artiodactyl population densities were still apparently lower overall than in the late Holocene (Broughton et al. 2008).

3.2.2.2 MIDDLE HOLOCENE

The middle Holocene (7,500–4,500 RCYBP) was warm and dry in comparison to the rest of the Holocene, a fact that is demonstrated by sedimentary and botanical records on the Colorado Plateau (Anderson et al. 1999; D'Andrea 2015; Hasbargen 1994; Weng and Jackson 1999). Records from the MFO planning area at Canyonlands National Park demonstrate increased aridity with the accumulation of sheetwash deposits, the reactivation of localized sand dunes, and the domination of drought-tolerant vegetation during this period (Reheis et al. 2005). Most researchers agree that this was due, in part, to the amplification of seasonal cycles of insolation (Thompson et al. 1993). By about 6000 RCYBP, the climate had shifted to dominantly wet-dry cycles on millennial timescales, and the onshore flow of moisture to the Colorado Plateau had reached modern amounts.

Colorado Plateau paleobotanical records support the idea that the middle Holocene was more arid than the early Holocene. Pollen records demonstrate an increase in the abundance of xeric plants, such as pinyon pine, prickly pear cactus (*Opuntia* spp.), and narrowleaf yucca, and hybrids between Gambel oak and Sonoran scrub oak (*Q. turbinella*) relative to mesic plants (Betancourt 1984). Generally, warmer temperatures facilitated the spread of pinyon pine throughout the Colorado Plateau and eastern Great Basin and prompted further expansion of plants belonging to the Amaranthaceae family, such as shadscale, into areas previously dominated by sagebrush communities (Grayson 1993, 2011; Louderback and Rhode 2009). Increased aridity during the growing season affected mixed forests, which retreated upslope to wetter environments (Morris et al. 2012).

Packrat midden records recovered from the Colorado Plateau document the upslope retreat of montane mesophytes from lower elevations nearly to modern elevations on the Colorado Plateau during this period (Betancourt et al. 1990; Thompson et al. 1993). At Allen Canyon Cave, Utah juniper, Rocky Mountain juniper, and skunkbush sumac (*Rhus trilobata*) replaced spruce, fir, limber pine, buffaloberry (*Sheperdia canadensis*) and elderberry (*Sambucus* spp.) (Betancourt 1984). At Falling Arch, littleleaf mountain mahogany, single-leaf ash, and hackberry had arrived (Van Devender et al. 1987). At Cottonwood Cave, conifers had disappeared, and Gambel oak, prickly pear cactus, hackberry, fourwing saltbush, Mormon tea (*Ephedra* spp.), Indian ricegrass (*Achnetherum hymenoides),* box elder (*Acer negundo*), and Fremont's mahonia (*Mahonia fremontii*) were present (Van Devender et al. 1987). The Long Canyon Cave middens record demonstrates reduced Utah juniper and the presence of Gambel oak, hackberry, and fourwing saltbush (Van Devender et al. 1987). In addition, the record from Atlatl Cave in New Mexico's Chaco Canyon suggests that cliffsides that had supported limber pine, Douglas fir, Rocky Mountain juniper, and blue spruce became covered by Ponderosa pine, pinyon pine, and one-seed juniper (*J. monosperma*) (Betancourt and Van Devender 1981; Betancourt et al. 1990).

Sedimentological and dendrochronology studies conducted in Great Basin shallow lakes and marshes provide further evidence of xeric conditions in western North American during the middle Holocene (Benson et al. 2002). Evidence suggests that the Great Salt Lake may have desiccated almost completely during this period (Madsen 2000). Moreover, the rarity of middle Holocene archaeological sites in the Colorado Plateau and Great Basin suggests that human populations also may have declined in these regions, possibly as a result of decreased surface water sources (Grayson 1993, 2011).

On the Colorado Plateau, it appears that the regional fauna has lost few small mammals since the last glacial maximum; however, the sagebrush vole (*Lemmiscus curtatus*) and the pygmy rabbit (*Brachylagus idahoensis*) were both extirpated from the Colorado Plateau sometime during the Holocene, even though both species currently exist in the Great Basin (Mead et al. 2003; Murray et al. 2005; Stegner 2015). This species range shift may have been related to middle Holocene climatic change, as other shifts certainly were. Climatic changes also evidently resulted in a dramatic reduction of mammalian taxonomic richness in the Great Basin, with some populations of animals that preferred the cooler and moister climate of the early Holocene diminishing during the middle Holocene (Grayson 2000). These mammals include the yellow-bellied marmot, pygmy rabbit, bushy-tailed woodrat, Ord's kangaroo rat (*Dipodomys ordii*), and Great Basin pocket mouse (*Perognathus parvus*) (Grayson 2000; Madsen 2000). In addition, the pikas that had been present at lower elevations in the early Holocene moved to the cooler climates of higher elevations (Grayson 1993, 2011).

3.2.2.3 LATE HOLOCENE

Generally, the late Holocene (ca. 4500 RCYBP to the present) is characterized by moister, cooler conditions than the middle Holocene but is not as moist and cool as the early Holocene (Grayson 1993, 2011). Seasonality changed, with summer conditions becoming cooler and drier and winter conditions becoming warmer and wetter (Anderson et al. 2008; Barron and Anderson 2011; Petersen 1982; Toney and Anderson 2006).

Specifically, the late Holocene is characterized by periods of decreased temperature and increased effective moisture punctuated by intervals of warmer and drier conditions associated with a strengthening and increase in the frequency of El Niño Southern Oscillation (ENSO) (Thompson et al. 1993; Waters and Haynes 2001). Modern ENSO strength and periodicities (2.0 to 8.5 years) were achieved by ca. 5000 RCYBP, with the Southwest experiencing relatively wetter conditions during the fall and winter months under El Niño conditions (positive ENSO) and relatively drier conditions during winter months under La Niña conditions (negative ENSO) (Barron and Anderson 2011; Menking and Anderson 2003; Rodbell et al. 1999).

During the late Holocene, the lower elevations of the Colorado Plateau have maintained a more arid climate, but overall temperatures have decreased relative to the middle Holocene (Morris et al. 2012). Vegetation communities responded, as can be observed in pollen records from nearby west-central Colorado and the Wasatch Range where the elevational ranges of subalpine forests once again lowered (Fall 1997; Madsen and Currey 1979). In addition, vegetation change can be observed in packrat middens recovered on the Colorado Plateau (Betancourt et al. 1990). The Allen Canyon Cave Canyon record indicates a major vegetation shift by 3400 RCYBP, and the higher-elevation Fishmouth Cave middens record arrival of pinyon pine, single leaf ash, and roundleaf buffaloberry (*S. rotundifolia*) by 3700 RCYBP (Betancourt 1984). In addition, middens from nearby Long Canyon Cave and more distant Tappan Wash indicate that Utah juniper had dominated by 2500 RCYBP and 1500 RCYBP, respectively (Van Devender et al. 1987).

Paleobotanical records for the late Holocene are consistent with other findings that moisture increased during this period on the Colorado Plateau, especially because of an increase in snowpack at the upper elevations (Morris et al. 2012). Interestingly, this moister and cooler environment with increased vegetation diversity limited the occurrence of wildfires, which increased in frequency on the Colorado Plateau after the arrival of Euro-American settlers (Morris et al. 2012). There is ample evidence for the presence of large human populations throughout the Colorado Plateau and Great Basin during the late Holocene, in contrast to the early and middle Holocene (Grayson 2011). On the Colorado Plateau, the Four Corners region of Utah, Colorado, Arizona, and New Mexico, particularly the San Juan Basin, was heavily populated before Euro-American settlement, with subsistence based largely on domesticated foods (Benson et al. 2008). Within the Great Basin, several areas were heavily populated, including the Sevier and Sanpete Valleys and foothill areas, with subsistence based on a combination of wild and domesticated foods (Janetski et al. 2000).

Colorado Plateau faunal studies suggest that small mammal species have not changed in distribution appreciably during the late Holocene; however, landscape level declines in diversity have occurred over time and may be climate related (Stegner 2015). Further, larger mammals have been extirpated from certain regions of the Colorado Plateau during historic times, including the Canada lynx (*Lynx canadensis*), wolverine (*Gulo gulo*), jaguar (*Panthera onca*), gray wolf, grizzly bear (*Ursus arctos*), and black-footed ferret (*Mustela nigripes*), several of which were native to the region that is now the MFO planning area. In the Great Basin, some mammals that had diminished in abundance during the middle Holocene rebounded in the late Holocene due to climate change. At Homestead Cave, species such as Ord's kangaroo rat and the Great Basin pocket mouse increased in abundance in the late Holocene and still inhabit the area today (Madsen 2000). Some species that no longer have natural populations in the Great Basin, such as bison, were present at times during the late Holocene. Bison also were likely present in parts of the Great Basin during the early and middle Holocene, but the available data are insufficient for indicating the extent or density of their distribution (Grayson 2006).

3.3 Topography

According to the physiographic classification presented by Stokes (1986), the MFO planning area falls entirely within the Colorado Plateau province and includes a variety of topographical features in 10 physiographic sections (Figure 3-1). Table 3-1 shows each of the physiographic sections that exist in the MFO planning area. Brief descriptions of the physiographic sections in the planning area follow.

Table 3-1. Physiographic Sections in the MFO Planning Area

Section	Acres
Book Cliffs/Roan Plateau	942,296
Great Sage Plain	9,718
Green River Desert	158,064
Hatch Syncline	183,163
Inner Canyonlands	46,513
La Sal Mountains	152,155
Lisbon Prong Salt Anticline	111,721
Mancos Shale Lowland	561,189
Salt Anticline	556,532
Uncompahgre Extension	133,174

Source: Stokes (1986)

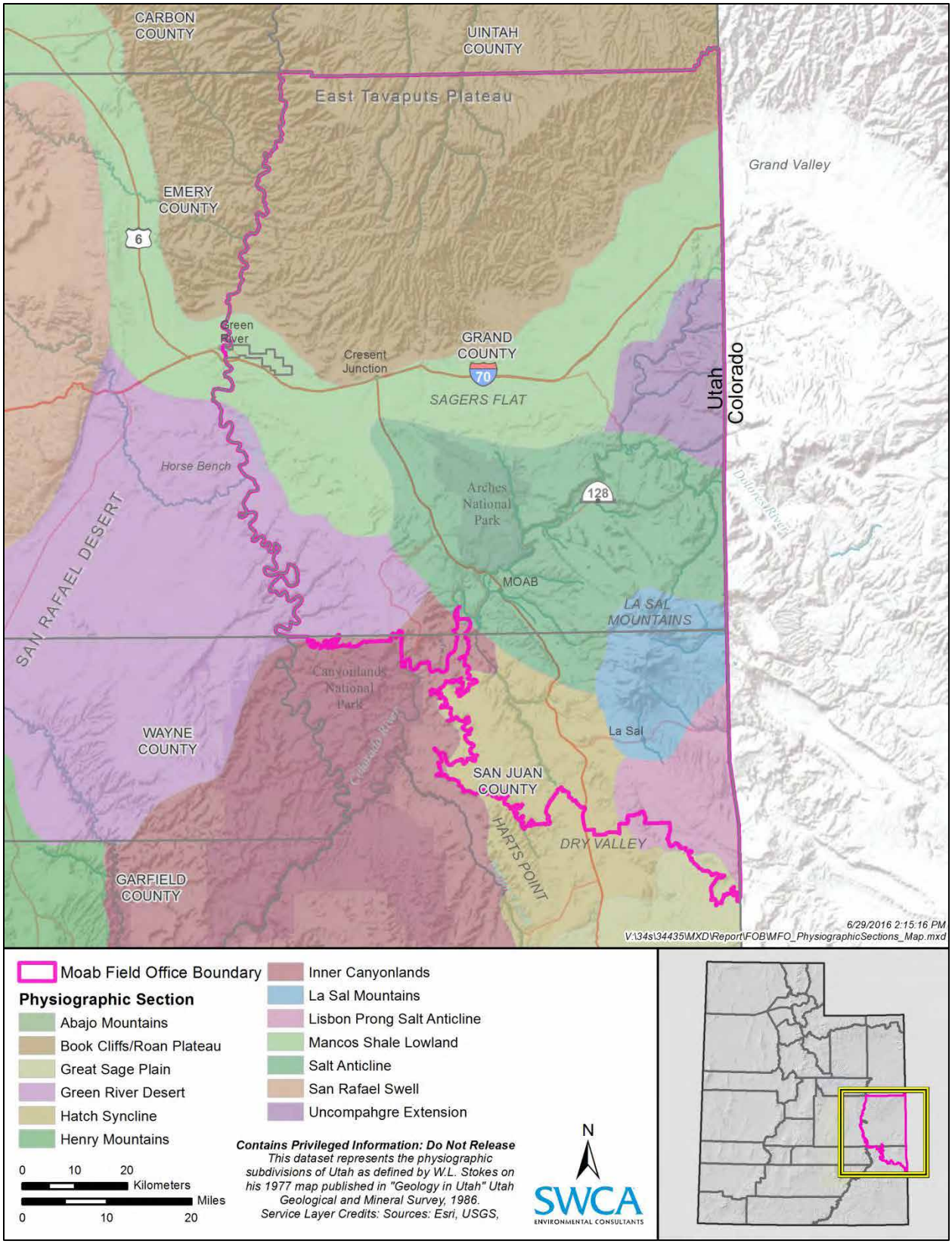


Figure 3-1. Physiographic sections in the MFO planning area.

The northern portion of the MFO planning area within the northern reaches of Grand County falls within the Book Cliffs/Roan Plateau physiographic section (Figure 3-2). This section is composed of Cretaceous and Tertiary strata that that rise gradually to the south to reach elevations ranging from 8,000 to 10,000 feet (2,438 m to 3,048 m) before descending to the south in a series of erosional cliff steps and eventually valleys at elevations ranging from 4,000 to 5,500 feet (1,219 m to 1,676 m). The system of linear cliffs in this section is massive, and those present in the MFO planning area include the Book and Roan Cliffs, which are composed of marine Cretaceous sandstone and Paleocene and Eocene river and floodplain deposits, respectively (Stokes 1986:232–248).

Figure 3-2. Book Cliffs, east of Green River, Utah. Photograph taken by Rob D'Andrea.

South of the Book Cliffs/Roan Plateau section is the Mancos Shale Lowland section, which extends eastward through the MFO planning area and Grand County in a broad, sinuous fashion to meet the Colorado state line. This section, which contains the three major valleys of Castle, Clark, and Grant, lies north of the Green River Desert section in the western part of the of the MFO planning area, the Salt Anticline section in the center, and the Uncompahgre Extension section in the east. The Mancos Shale Lowland section parallels the Book Cliffs eastward, following the southern contours of the Uinta Basin, and is crossed by a few permanent water sources, most notably the Green River, and a number of perennial washes. The topography is characterized by sloping pediments; badlands; and narrow, flat-bottomed alluvial valleys. The agricultural settlements of Grand County are mostly located within this section (Stokes 1986:232–248).

Bordering the Mancos Shale Lowland section to the south are San Rafael Desert, the Salt Anticline, and the Uncompahgre Extension sections, which overlap with the central portions of the MFO planning area. The Green River Desert section is low and flat, containing sands that shift to rearrange drainage systems. Only a few mesas and buttes and one deep gorge, Horseshoe Canyon, disrupt the flat topography. This section is also home to Goblin and Cathedral Valleys (Stokes 1986:232–248).

The part of the Salt Anticline section contained within the MFO planning area is characterized by northwest-trending, elongated oval valleys with high walls and complex marginal structures that formed as a result of the collapse or depression of anticlines. These collapsed features resulted from the dissolution of subterranean salt masses, the remains of which underlie the valleys at shallow depths. Primary valleys in this section include Moab, Lisbon, Salt, and Castle Valleys (Figure 3-3). However, Lisbon Valley is separated from the rest to the south by the La Sal Mountain section and comprises the Lisbon Prong of the Salt Anticline section. These valleys contain various thicknesses of windblown silt because of their depth relative to surrounding topography. Arches National Park is found within the Salt Anticline section (Stokes 1986:232–248).

Figure 3-3. Salt Anticline and Moab Valley, east of Green River, Utah. Photograph taken by Rob D'Andrea.

The part of the Uncompahgre Extension section contained within the MFO planning area is the sloping east end of the ancient Uncompahgre Uplift. This area is characterized by arc-like formations that conform to a buried core of crystalline rock, representing a highly eroded Precambrian mountain range. The Colorado River has eroded through several hundred feet of strata of the Uncompahgre Uplift in the Westwater Canyon area, forming cliffs, buttes, and mesas of non-marine Mesozoic strata (Stokes 1986:232–248).

The Inner Canyonlands section borders the San Rafael Desert and Salt Anticline sections to overlap with the southwest corner of the MFO planning area. This section is characterized by massive bare-rock surfaces formed in steps with sparse soil and vegetation. The confluence of the Colorado and Green Rivers lies near the center of this section, to the southwest of the MFO planning area within Canyonlands National Park (Stokes 1986:232–248).

The Hatch Syncline, the La Sal Mountains, the Lisbon Prong Salt Anticline, and the Great Sage Plain sections overlap with the southeastern portion of the MFO planning area. The Hatch Syncline is an eroded lowland that drains into the Colorado River to the northwest. Most of this section has been eroded down to the Navajo Sandstone, and isolated formations of Entrada Sandstone capped with strata of the Summerville and Morrison Formations form most of the notable topography. Wind has effectively eroded much surface material in this section, and soils are thin (Stokes 1986:232–248)

The La Sal Mountain section includes both the La Sal Mountains and their pediments/foothills (Figure 3-4). The mountains themselves are composed of three separate groups of peaks, each of which represents an intrusive igneous core that has been driven upward through overlying sediments. The highest of the three peaks is Mount Peale, which rises to 12,721 feet. Erosion of the mountains has led to an extensive alluvial fan to the south (Stokes 1986:232–248).

The Lisbon Prong Salt Anticline section is part of the Salt Anticline section, which is described above. The Great Sage Plain section is a stripped plain that forms one of the most extensive flat areas on the Colorado Plateau. In this section, the Dakota and Burro Canyon Formations form a resistant sandstone layer that is blanketed by a thin aeolian-derived soil supportive of dryland agriculture. These layers are eroded by Montezuma Creek from the south and East Canyon from the north (Stokes 1986:232–248).

Figure 3-4. Mid-elevation meadow in the southeastern foothills of the La Sal Mountains, with Mount Tukuhnikivatz at center and Mount Peale at right. Photograph taken by Ralph Burrillo.

In summary, although located entirely on the Colorado Plateau, the MFO planning area contains a diverse range of topography, including vegetation-filled valleys, desert badlands, bare-rock canyons, mountains, and plateaus, with elevations ranging from approximately 4,000 to 12,000 feet. This varied topography, in conjunction with the environmental factors discussed below, has undoubtedly influenced patterns of human settlement and use in the MFO planning area for centuries.

3.4 Surface Geology

Bedrock geology and the formation of landforms vary greatly across the MFO planning area. This section reviews the surface geology of the physiographic provinces discussed in the previous section. Knowledge of an area's surface geology can help illuminate processes that affected the formation of archaeological sites in the past and that continue to affect them today. This section also discusses sources of tool stone that the area's geology made available to its prehistoric occupants.

The Colorado Plateau encompasses an area of approximately 140,000 square miles and occupies the four corners region of Utah, Colorado, Arizona, and New Mexico (King 1977). The landform is a regional uplift of relatively undeformed crustal strata surrounded by the highly deformed Rocky Mountain and Basin and Range provinces. The boundaries of the plateau are defined in the north and northeast by the Uinta and Rocky Mountains, respectively, in the east by the Rio Grande Rift Valley, in the south by the Mogollon Rim, and in the west by a transition zone with the extensively faulted Basin and Range

province. Additionally, major volcanic accumulations mark the margins of the landform. It is the highest plateau in North America, ranging in elevation from 3,000 to 14,000 feet (900 m to 4200 m), and is characterized by large areas of relatively highly elevated mountains and plateaus. It is drained principally by the Colorado River and its tributaries (Wahlquist 1981:17).

The Colorado Plateau is composed primarily of horizontally layered marine and lacustrine Mesozoic to early Tertiary sandstones and shales that are exposed through flexures, monoclines, and vertical faulting. However, the strata of the landform date to the Paloeozoic and include massive subsurface salt deposits. Quaternary deposits are also present in the form of sediments in alluvial fans and floodplains. The exceptions to the predominance of sedimentary rocks on the Colorado Plateau occur as major igneous features, present in the form of massive intrusive laccoliths, intermediate in composition and dating from the Oligocene to the Miocene, and extrusive volcanics composed of andesite and basalt that take the form of lava flows and cinder cones. Examples of such isolated igneous rock formations include the Henry, La Sal, Abajo, Ute, La Plata, and Carrizo Ranges.

Most of the MFO planning area is dry and desolate, but it is noted and prized for its spectacular beauty. The arid environment, weathering, and erosion of the predominately sedimentary strata has resulted in the formation of unusual landforms. These include the mesas, buttes, arches, fins and hoodoos that attract visitors from across the country, and the world alike, to visit areas such as Arches National Park and adjacent Canyonlands National Park (Figures 3-5 and 3-6).

Figure 3-5. Snow-covered sandstone formations viewed through a natural window at Arches National Park. Photograph taken by Ralph Burillo.

Figure 3-6. Sandstone pinnacles in the Canyonlands National Park area. Photograph taken by Ralph Burillo.

The Book and Roan Cliffs, located within the Book Cliffs/Roan Plateau physiographic section, are prominent surface geological features in the northern portion of the MFO planning area. The Book Cliffs, late Cretaceous in age, contain the Farrer Formation, a member of the Mesaverde Group, and the overlying Tuscher Formation. The Farrer Formation is a series of Cretaceaous shale and sandstone beds that are weathering into brown-stained blocky ledges or cliffs separated by medium-gray clay shales with an olive-greenish tinge. The Tuscher Formation is a series of light-colored sandstones separated by minor shale beds. The Roan Cliffs, Paleocene to Eocene in age, contain the Wasatch Formation and the overlying Green River Formation. The Wasatch Formation is bright in color, containing reddish, gray, yellow-brown, and greenish tints, and consists of variegated clays along with sandstone and gray fossiliferous limestone layers. The Green River Formation is an assemblage of sandstone, shale, and fresh-water marlstone with an abundance of calcareous material; it is whitish gray in color (Fisher et al. 1960; Hintze 1988).

The Mancos Shale Lowland section is composed of the Upper Cretaceous Mancos Shale, a badland-forming mudstone, and Quaternary aeolian and alluvial deposits. The portion of the Uncompahgre Extension section contained within the MFO planning area consists of surface exposures of Triassic and Jurassic sandstones, mudstones, and carbonates and Precambrian metamorphics (Hintze 1988).

The Salt Anticline and Lisbon Prong Salt Anticline sections contain strata dating from the Pennsylvanian through the Tertiary, along with Quaternary alluvial deposits. Of particular note are the prominent Jurassic Units in Arches National Park, which are composed of the Entrada and Navajo Sandstones. Exposures at Dead Horse Point State Park are composed of the Permian Cutler Group, the Triassic Moenkopi and Chinle Formations, and the Jurassic Wingate Sandstone (Hintze 1988).

The San Rafael Desert Formation lies in the MFO planning area within the Green River Desert physiographic section. The San Rafael Group, to which the San Rafael Desert Formation belongs, is a middle Jurassic layer between the older Glen Canyon Group and the younger Morrison Formation. These groups contain a high percentage of sandstone components, and the surface geology results from the breakdown of the sandstone from the Entrada Formation (also part of the San Rafael Group) into sands affected by alluvial and aeolian processes (Hintze 1988).

The Inner Canyonlands, which lie in the easternmost portion of the MFO planning area, consist of exposed, unconsolidated sand dunes layered on the Morrison Formation (Hintze 1988). The Morrison Formation is composed of different sandstones and shales with inclusions of salt and potash and dates to the upper Jurassic from 155 to 148 million years ago (Turner and Peterson 2004:310, 318). Not only are fossils commonly found in this formation, but uranium ore is present, as well.

The Hatch Syncline section consists of Jurassic surface exposures of the Navajo Sandstone and isolated formations of Entrada Sandstone capped with strata of the Summerville and Morrison Formations. The portion of the Great Sage Plain section contained in the MFO planning area, composed of surface exposures of the Dakota and Burro Canyon Formations, is a resistant sandstone layer that is blanketed by a thin aeolian-derived soil supportive of dryland agriculture. (Stokes 1986:232–248).

The exception to the predominance of the arid, sedimentary strata–dominated environs of the MFO planning areas occurs in the La Sal Mountains. Composed of isolated igneous rock formations, these mountains create a stark contrast to the austere surrounding environment and form a major landmark for miles in each direction. The La Sal Mountains are a diorite porphyry laccolith that intruded into overlying sedimentary strata 30 million years ago during the Oligocene and experienced glaciation during the Pleistocene (Stokes 1986).

Generally, most of the rocks in the MFO planning area, such as sandstone, shale, mudstone, and gypsum, are not sought-after tool stones. No obsidian tool stone sources are located within the MFO planning area; the closest are located approximately 100 miles away in Piute County at Marysvale and Phonolite Hill (Northwest Research Obsidian Studies Laboratory 2016). In addition, no fine-grained volcanic sources are located within the MFO planning area; the closest are located within Toole County at Cedar Mountains and Flat Hills, approximately 250 miles away. Chert is common and is generally the dominant lithic material at prehistoric lithic scatters on the Colorado Plateau.

3.5 Hydrology

Because settlements and use areas tend to be associated with water sources, knowledge of a region's hydrology can assist with understanding human use of the landscape, particularly in arid regions such as the Colorado Plateau. A review of the MFO planning area's hydrology is presented here.

The dominant hydrologic feature of the Colorado Plateau is the Colorado River (see Figure 3-7 for the location of permanent water sources). This northeast-southwest-trending river originates in the Rocky Mountains and ultimately drains into the Gulf of California. The river has many permanent and semi-permanent tributaries, including, from northeast to southwest, the Gunnison River, Green River, Dolores River, Dirty Devil River, Escalante River, San Juan River, Paria River, Little Colorado River, Kanab Creek, Virgin River, Bill Williams River, and Gila River. Many of these tributaries are fed by spring snowmelt, which can create flash flooding.

The Colorado, Green, and San Juan Rivers are the primary drainages within the MFO planning area. These rivers were heavily used in prehistory, as evidenced in the abundant rock art, permanent and semi-permanent residential structures, granaries, and lithic sites that exist along these drainages. The Colorado River forms the eastern boundaries of Wayne, Garfield, and Kane Counties, and the Green River forms the eastern boundaries of Carbon, Emery, and Wayne Counties. The confluence of the Colorado and Dolores Rivers lies within the MFO planning area, and the confluence of the Colorado and Green Rivers lies to the southwest of the MFO planning area within adjacent Canyonlands National Park.

The Colorado River passes through the southeastern portion of the MFO planning area. Within this area, the river contains several hydrologic units, including the Colorado Headwaters Plateau, Westwater Canyon, and Upper Colorado Kane Springs (Utah Department of Environmental Quality 2016). Most notably, Westwater Creek, San Arroyo Wash, Nash Wash, and Sagers Wash drain into the Colorado River from the north, and Castle Creek, Mill Creek, and Kane Springs Creek enter the Colorado River from the south.

The Green River forms the western boundary of the MFO planning area north of Canyonlands National Park. It acts as the primary drainage for the East Tavaputs Plateau in the northwest corner of the MFO planning area, in addition to collecting waters from the San Rafael and Price Rivers west of the MFO planning area. Within the MFO planning area, the river contains several hydrologic units, including the Lower Green Desolation Canyon, Willow, and Lower Green (Utah Department of Environmental Quality 2016). In addition, the White River, a tributary of the Green River, contains the Lower White hydrologic unit in the far northeastern corner of the MFO planning area.

The Dolores River enters the MFO planning area from the east in Colorado into Utah to empty into the Colorado River. Within the MFO planning area, the Dolores River has two hydrologic units, the Upper Dolores and the Lower Dolores, which both act primarily to drain the La Sal Mountains (Utah Department of Environmental Quality 2016). Of note within these units are Beaver Creek and La Sal Creek.

Wetlands were likely always a focus for prehistoric people and animals on the Colorado Plateau. The waterways mentioned above would have been surrounded in many places by productive wetland environments, supporting humans and animals alike. As human populations increased in the area, some rivers and creeks were diverted for irrigation of domesticated plants. However, these water sources are not sufficient in their natural state to support modern-day populations and agricultural needs, and for this reason, dams and other water-control features have been constructed in and around the MFO planning area. The largest of the dams built along the Colorado River are the Hoover and Glen Canyon Dams, both located downstream from the MFO planning area. The Hoover Dam, located on the border between Nevada and Arizona, created and maintains Lake Mead, whereas the Glen Canyon Dam, located in Northern Arizona, created and maintains Lake Powell. Many smaller tributaries also have dams and reservoirs originally created for agricultural needs.

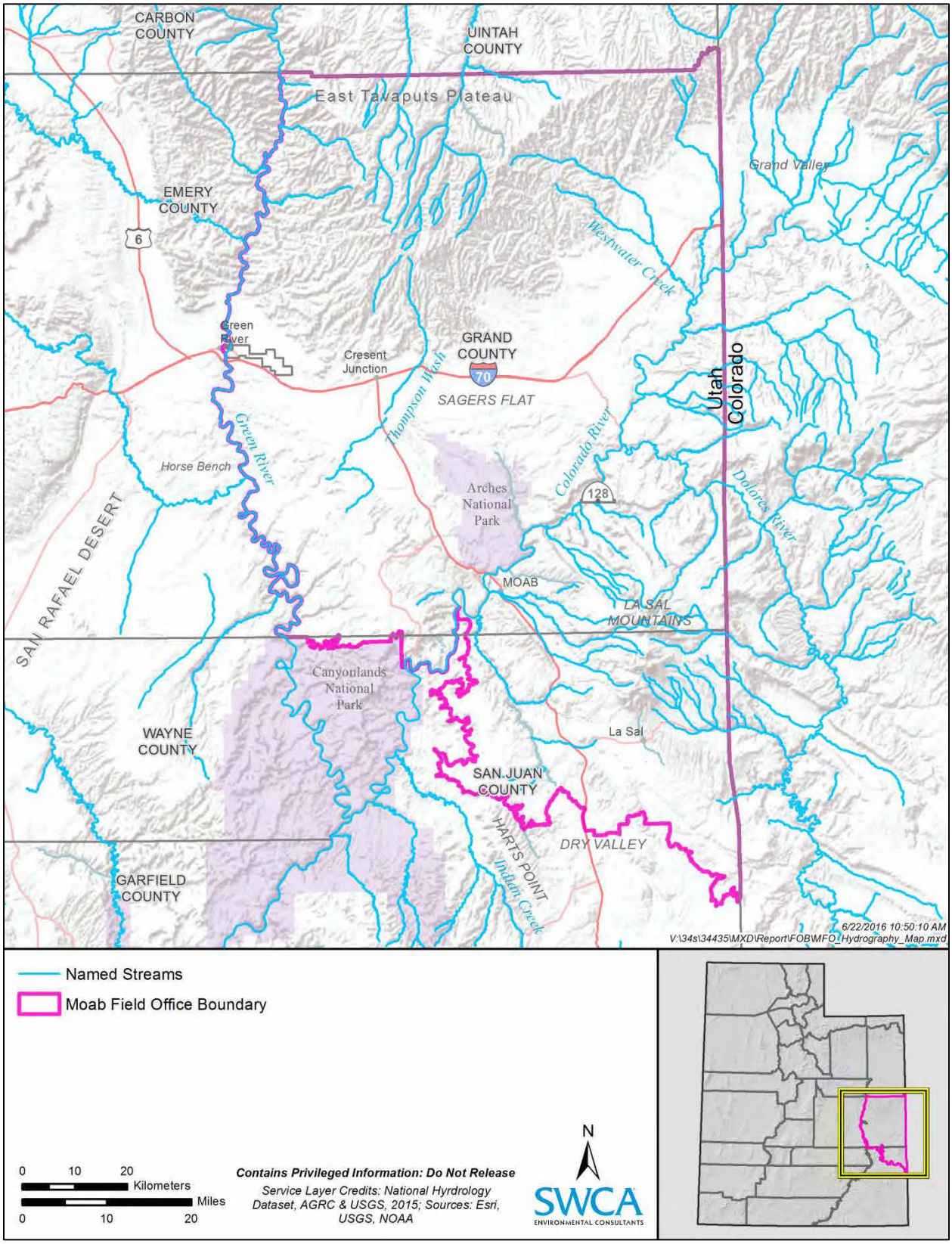


Figure 3-7. Hydrology of the MFO planning area.

3.6 Soils

Sediments in the MFO planning area vary greatly, with soil orders including mollisols, entisols, and aridisols and landforms including badlands, rock outcrops, and rubble lands (Boettinger 2009). However, three dominant depositional processes operate on sediments on the Colorado Plateau: colluvial, alluvial, and aeolian. Aeolian and alluvial processes are highly active and are the dominant depositional processes for most of the valley areas in the MFO planning area. The majority of the parent rocks, most affected by aeolian and alluvial processes, are either sedimentary (such as sandstone, siltstone, and shale) or igneous (such as basalt and rhyolite); however, metamorphics are present as well (e.g., gneiss and granodiorite). Knowing the potential depositional agents and soil types in an area can help determine whether archaeological sites in that area have the potential to provide important information (e.g., that derived from buried archaeological deposits), and whether erosional or depositional processes have affected a site's integrity. Soils types in the MFO planning area are discussed here; see Figure 3-1 for the locations of physiographic sections.

The Book Cliffs/Roan Plateau physiographic section the MFO planning area contains exposures of the Green River, Wasatch, Farrer, and Tuscher Formations (Fisher et al. 1960; Hintze 1988). This area is characterized by three major landforms and their corresponding sediments: drainage ways containing alluvium and colluvium generally consisting of clay, silt, sand, gravel, and cobbles; terrace and bench deposits composed of predominantly medium- to coarse-grained sediments; and landslide and talus deposits that are the products of mass wasting (Leishman et al. 2003). Soil series include moderately to very deep, well-drained soils formed in slope alluvium, colluvium, residuum, and aeolian deposits derived from sedimentary rocks in addition to shallower clay rich and loamy soils (University of California Davis Soil Resource Lab and U. S. Department of Agriculture 2011).

The Mancos Shale Lowland section contains exposures of the Mancos Shale along with Quaternary aeolian and alluvial deposits. This area contains a variety of well-drained soils series ranging in depth from very shallow to very deep; ranging in composition from clay rich to very coarse; and located on alluvial fan pediments, shale plains, and floodplains along drainage ways and on deep escarpments of badland (Hansen 1989).

The Uncompahgre Extension and Salt Anticline sections contain exposures of the Glen Canyon and Cutler Groups, the Morrison Formation, Precambrian metamorphics, and Quaternary alluvial deposits. The terrain through this region is complex, containing nearly level plains, mesas, structural benches, very steep canyons, and mountains. This leads to a diversity of soil series ranging from very shallow to very deep and formed by residuum, alluvium, colluvium, and aeolian materials derived from sedimentary strata sources (Hansen 1989).

The Green River Desert contains exposures of the Morrison and Entrada Formations and the Navajo and Dakota Sandstones. Soils in this area are commonly affected by aeolian and alluvial processes and are fairly unconsolidated. Generally, unconsolidated sediment is shallow. Several of the areas within the Morrison Formation, like many in the Inner Canyonlands, contain a high proportion of clay, which supports only sparse vegetation. Other portions of the Inner Canyonlands are noted for their unconsolidated surface sediments of aeolian silts and sands derived from parent sandstone, which can form into sand dunes (Downs 1990). Soils on the alluvial fans and benches in the Inner Canyonlands and surrounding areas are generally sandy loams with moderate depth (Downs 1990).

The Hatch Syncline section consists of exposures of Navajo Sandstone and isolated formations of Entrada Sandstone capped with strata of the Summerville and Morrison Formations, and the Great Sage Plain section is composed of surface exposures of the Dakota and Burro Canyon Formations that are blanketed by a thin aeolian-derived soil supportive of dryland agriculture (Stokes 1986:232–248). Soil types are

diverse in the area, ranging from dry, hot soils on canyon floors and structural benches to sandy loam, loamy sand, or sand formed in recent aeolian deposits to clay loam or clay formed from shale. Depths vary depending on substrate, including shallow sediments forming from sedimentary residuum on low benches and cuestas, and very deep soils forming in alluvium and aeolian deposits derived from sedimentary strata on valley floors and low benches.

The La Sal Mountains section is composed of igneous intrusives, sedimentary strata, and an extensive south-trending alluvial fan (Stokes 1986). The soils in this area are cold and moist in comparison to those in the surrounding MFO planning area. They have developed on aretes, cirques, U-shaped valleys, glacial outwash fans, solifluction mantles, landslides, moraines, alluvial fans, and talus slopes. They possess a high content of rock fragments, are generally well drained, and are very deep, having formed in colluvium, glacial till, and alluvium derived from diorite, shale, and sandstone.

3.7 Flora and Fauna

Understanding spatial distributions of modern flora and fauna can help us understand past and present human land use. The biota of the MFO planning area is reviewed here. Common names for species are used throughout the remaining text of this chapter, and scientific names are presented in the following tables

3.7.1 Flora

The MFO planning area encompasses several different vegetation communities, which are discussed here following the vegetation classification of the Southwest Regional Gap Analysis Project (SWReGAP). For the purposes of this discussion, the SWReGAP vegetation community classification has been simplified to describe larger areas that the SWReGAP data separate into transitional areas, and to incorporate communities of similar descriptions and traits under five general groups (U.S. Geological Survey 2004). A list of native flora in the MFO planning area is provided in Table 3-2 (common names for plants are used in the report body text, and Scientific names are presented in the table). SWReGAP vegetation communities in the MFO planning area are mapped in Figure 3-8.

Table 3-2. Common Flora in the MFO Planning Area

Scientific Name	Common Name
Mixed Salt Desert Community	
Achnatherum hymenoides	Indian ricegrass
Artemisia filifolia	Sand sagebrush
Artemisia frigida	Prairie sagewort
Artemisia tridentata ssp. tridentata	Basin big sagebrush
Artemisia tridentata ssp. wyomingensis	Wyoming big sagebrush
Atriplex canescens	Fourwing saltbrush
Atriplex confertifolia	Shadscale
Atriplex polycarpa	Allscale saltbrush
Bouteloua gracilis	Blue grama
Chrysothamnus viscidiflorus	Yellow rabbitbrush

Table 3-2. Common Flora in the MFO Planning Area

Scientific Name	Common Name
Coleogyne ramosissima	Blackbrush
Elymus lanceolatus ssp. *lanceolatus*	Thickspike wheatgrass
Ephedra nevadensis	Nevada ephedra
Ephedra spp.	Ephedra
Ericameria nauseosa	Rubber rabbitbrush
Festuca campestris	Mountain rough fescue
Grayia spinosa	Spiny hopsage
Koeleria macrantha	Prairie junegrass
Krascheninnikovia lanata	Winterfat
Leymus flavescens	Yellow wildrye
Lycium spp.	Wolfberry
Opuntia spp.	Prickly pear cactus
Pascopyrum smithii	Western wheatgrass
Picrothamnus desetorum	Bud sagebrush
Pleuraphis jamesii	James' galleta
Pleuraphis rigida	Big galleta
Poa secunda	Sandberg bluegrass
Prunus virginiana	Chokecherry
Pseudoroegneria spicata	Bluebunch wheatgrass
Psoralidium lanceolatum	Lemon scurfpea
Purshia tridentata	Antelope bitterbrush
Sporobolus airoides	A kali sacaton
Tetradymia spp.	Horsebrush
Tetradymia tetrameres	Fourpart horsebrush
Mixed Sagebrush Shrubland Community	
Achnatherum hymenoides	Indian ricegrass
Aristida spp.	Threeawn grass
Artemisia tridentata ssp. tridentata	Basin big sagebrush
Artemisia tridentata ssp. wyomingensis	Wyoming big sagebrush
Atriplex canescens	Fourwing saltbrush
Atriplex spp.	Saltbrush
Bouteloua gracilis	Blue grama
Chrysothamnus viscidiflorus	Yellow rabbitbrush
Coleogyne spp.	Blackbrush
Distichlis spicata	Saltgrass
Elymus lanceolatus	Thickspike wheatgrass
Ephedra spp.	Ephedra

Table 3-2. Common Flora in the MFO Planning Area

Scientific Name	Common Name
Ericameria nauseosa	Rubber rabbitbrush
Gutierrezia sarothrae	Broom snakeweed
Gutierrezia spp.	Snakeweed
Hesperostipa comata	Needle-and-thread grass
Juniperus spp.	Juniper
Krascheninnikovia lanata	Winterfat
Leymus cinereus	Basin wildrye
Muhlenbergia spp.	Muhly grass
Opuntia spp.	Prickly pear cactus
Pascopyrum smithii	Western wheatgrass
Pleuraphis jamesii	James' galleta
Poa secunda	Sandberg bluegrass
Pseudoroegneria spicata	Bluebunch wheatgrass
Purshia tridentata	Antelope bitterbrush
Sarcobatus vermiculatus	Greasewood
Spirobolous airoides	A kali sacaton
Symphoricarpus oreophilus	Mountain snowberry
Pinyon-Juniper Woodland Community	
Arctostaphylos patula	Greenleaf manzanita
Artemisia nova	Black sagebrush
Artemisia tridentata	Big sagebrush
Bouteloua gracilis	Blue grama
Cercocarpus intricatus	Litteleaf mountain mahogany
Cercocarpus montanus	Alderleaf mountain mahogany
Chrysothamnus viscidiflorus	Yellow rabbitbrush
Coleogyne ramosissima	Blackbrush
Juniperus osteosperma	Utah juniper
Juniperus scopulorum	Rocky Mountain juniper
Opuntia spp.	Prickly pear cactus
Pinus edulis	Pinyon pine
Pleuraphis jamesii	James' galleta
Poa fendleriana	Muttongrass
Purshia stansburiana	Stansbury cliffrose
Purshia tridentata	Antelope bitterbrush
Quercus gambelii	Gambel oak

Table 3-2. Common Flora in the MFO Planning Area

Scientific Name	Common Name
Rocky Mountain Woodland Community	
Abies lasiocarpa	Subalpine fir
Achnatherum spp.	Needlegrass
Actaea rubra	Red baneberry
Amelanchier spp.	Serviceberry
Arctostaphylos patula	Greenleaf manzanita
Artemesia tridentata	Big sagebrush
Artemisia nova	Black sagebrush
Bouteloua spp.	Grama grass
Calmagrostis canadensis	Bluejoint grass
Cercocarpus montanus	Alderleaf mountain mahogany
Cornus canadensis	Bunchberry
Erigeron eximius	Spruce-fir fleabane
Festuca spp.	Fescue
Hesperostipa spp.	Needle and thread grass
Juniperus spp.	Juniper
Ledum glandulosum	Trapper's tea
Lupinus arcticus ssp. *Subalpinus*	Subalpine lupine
Luzula glabrata var. hitchcockii	Hitchcock’s smooth woodrush
Maianthemum stelatum	Starry false lily of the valley
Menziesia ferruginea	Rusty menziesia
Muhlenbergia spp.	Muhle grass
Phyllodoce empetriformis	Pink mountain-heather
Picea engelmannii	Engelmann spruce
Pinus edulis	Pinyon pine
Pinus ponderosa	Ponderosa pine
Prunus virginiana	Chokecherry
Pseudoroegneria spicata	Bluebunch wheatgrass
Pseudotsuga menziesii	Douglas fir
Purshia stansburiana	Stansbury cliffrose
Purshia tridentata	Antelope bitterbrush
Quercus gambelii	Gambel oak
Rhododendron albiflorum	White rhododendron
Rosa spp.	Rose
Rubus parviflorus	Thimbleberry
Rubus pedatus	Strawberryleaf raspberry

Table 3-2. Common Flora in the MFO Planning Area

Scientific Name	Common Name
Salix spp.	Willow
Saxifraga bronchialis	Spotted saxifrage
Symphoricarpos oreophilus	Mountain snowberry
Vaccinium membranaceum	Thinleaf huckleberry
Riparian Zone Community	
Acer glabrum	Rocky mountain maple
Acer negundo	Boxelder maple
Alnus incana	Gray alder
Betula occidentalis	Water birch
Cornus sericea	Redosier dogwood
Crataegus rivularis	River hawthorn
Eleagnus angustifolia	Russian olive
Forestiera pubescens	Stretchberry
Juniperus scopulorum	Rocky Mountain juniper
Picea pungens	Blue spruce
Populus angustifolia	Narrowleaf cottonwood
Populus balsamifera	Balsam poplar
Populus deltoides	Eastern cottonwood
Populus fremontii	Fremont cottonwood
Prunus virginiana	Chokecherry
Pseudotsuga menziesii	Douglas fir
Rhus trilobata	Skunkbush sumac
Salix drummondiana	Drummond's willow
Salix amygdaloides	Peachleaf willow
Salix exigua	Narrowleaf willlow
Salix irrorata	Dewystem willow
Salix lucida	Shining willow
Salix monticola	Park willow
Shepherdia argentea	Silver buffaloberry
Symphoricarpos spp.	Snowberry
Tamarix spp.	Tamarisk

***Note*: Table compiled from SWReGAP land cover type classifications (USGS 2004)**

This page intentionally blank

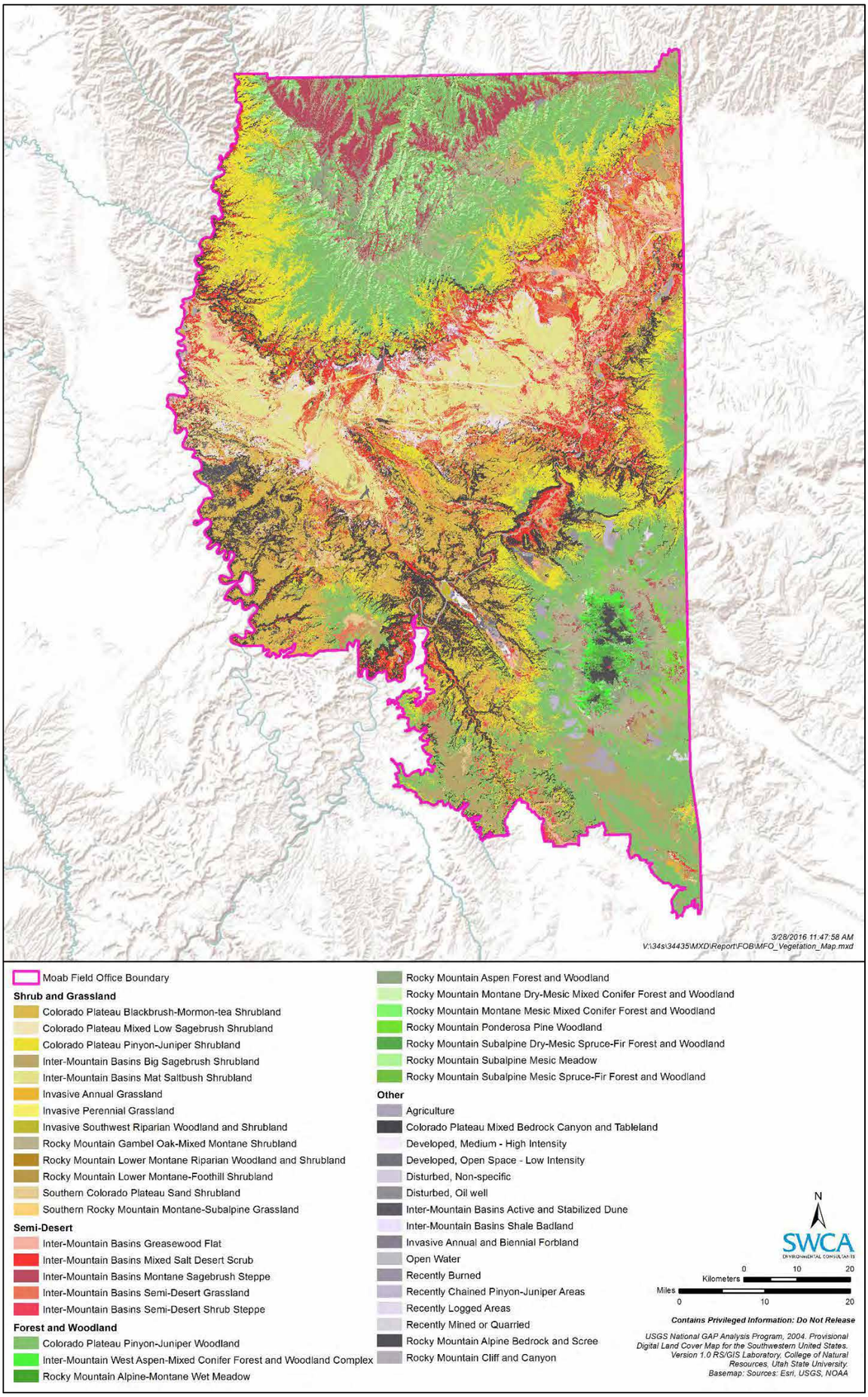


Figure 3-8. Vegetation communities in the MFO planning area.

This page intentionally blank

3.7.1.1 MIXED SALT DESERT

The Mixed Salt Desert community consists of the following SWReGAP communities under the Semi-Desert category: Inter-Mountain Basins Active and Stabilized Dune, Inter-Mountain Basins Big Sagebrush Steppe, Inter-Mountain Basins Greasewood Flat, and Inter-Mountain Basins Mixed Salt Desert Scrub. It is commonly known as the saltbush zone, salt desert scrub, or greasewood flats and is dominated by communities of shadscale or saltbush. It is the most common zone at lower elevations in the eastern Great Basin but is also present in the Colorado Plateau (see Figure 3-8). Shadscale is adapted to low-moisture conditions and can tolerate somewhat saline valley soils. The shadscale community is found along lower valley bottoms, low mesas, and fan slopes and consists of low, widely spaced, drought-resistant and salt-tolerant shrubs, including greasewood (Wahlquist 1981:31). The Mixed Salt Desert community is well developed in Great Basin valleys, where precipitation is low and salt concentrations in the soil are high. Communities of grasses and other vegetation such as winterfat are commonly encountered in the Mixed Salt Desert community (Betancourt et al. 1990). The Mixed Salt Desert community is a prevalent vegetation community at lower elevations in the planning area (Figure 3-9).

Figure 3-9. Mixed Salt Desert vegetation, overlooking Moab Valley from Arches National Park. Photograph taken by Rob D'Andrea.

3.7.1.2 MIXED SAGEBRUSH SHRUBLAND

In the MFO planning area, the Mixed Sagebrush Shrubland community includes Inter-Mountain Basins Semi-Desert Shrub Steppe, Inter-Mountain Basins Semi-Desert Grassland, Inter-Mountain Basins Big Sagebrush Shrubland, and most of the Shrub and Grassland designations in the SWReGAP classification shown in Figure 3-8 (U.S. Geological Survey 2004:109). Big sagebrush is the dominant vegetation at higher elevations, where annual precipitation is usually greater than 7 inches (17.78 cm). This vegetation community covers the broad valleys and lower foothills of the eastern Great Basin and Colorado Plateau. Big sagebrush communities thrive in well-drained valleys and at the bases of mountain ranges, especially on alluvial fans (Figure 3-10). Other shrubs commonly found in big sagebrush communities are little sagebrush, rabbitbrush, Mormon tea, bitterbrush, gooseberry, and snowberry. Grasses that are often codominant with sagebrush include wheatgrass, Great Basin wildrye, and needle-and-thread grass. In places, these bunchgrasses are abundant enough that the dominant vegetation is a sagebrush-grass community. A large portion of the MFO planning area is covered by this vegetation community.

Figure 3-10. Mixed Sagebrush Shrubland community within MFO planning area, foreground. Photograph taken by Rob D'Andrea.

3.7.1.3 PINYON-JUNIPER WOODLAND

The Pinyon-Juniper Woodland community includes the Colorado Plateau Pinyon-Juniper Shrubland and the Colorado Plateau Pinyon-Juniper Woodland vegetation types in the SWReGAP classification (see Figure 3-8) (U.S. Geological Survey 2004:109). The Pinyon-Juniper Woodland community is sometimes treated as a montane zone, but in many areas of Utah, valleys are high enough in elevation that pinyon-juniper can extend from mountain range to mountain range uninterrupted. Pinyon-Juniper Woodland exists along the lower slopes of mountains in the Great Basin and Colorado Plateau. In many parts of the Colorado Plateau, such woodland also exists at higher elevations, mixed with other pines and firs. The Pinyon-Juniper Woodland community is usually found between 5,000 and 8,000 feet (1,524 to 2,438 m) above sea level in areas where annual precipitation is approximately 12 inches (30.48 cm). This community is composed of double-leaf pinyon and Utah juniper (Figure 3-11). Some common understory shrubs and grasses associated with Pinyon-Juniper Woodland are big sagebrush, rabbitbrush, bitterbrush, Mormon tea, Gambel oak, wheatgrass, and needle-and-thread grass. This vegetation community is prominent throughout the MFO planning area.

Figure 3-11. Pinyon Juniper community blending upward into Aspen-Conifer vegetation community in the sandstone cliffs on the north slopes of the La Sal Mountains, view facing Fisher Valley. Photograph taken by Ralph Burrillo.

3.7.1.4 ROCKY MOUNTAIN WOODLAND

The Rocky Mountain Woodland community encompasses all communities in the SWReGAP Forest and Woodland category other than the Pinyon-Juniper Woodlands and Inter-Mountain West Aspen-Mixed Conifer Forest and Woodland Complex (see Figure 3-8). The Rocky Mountain Woodland community is located at higher elevations, from approximately 8,000 to 10,000 feet (2,438 to 3,048 m), and can be composed of several different vegetation communities, all considered montane, such as the mixed-conifer, subalpine, and alpine communities (above 10,000 feet [3,048 m]) (Betancourt et al. 1990). In general, the mixed-confer forest allows a great diversity of plant species and wildlife to flourish. The soil is generally moister and richer than that at lower elevations. The lower mountain brush or mixed-conifer vegetation community consists of Gambel oak, maple, and various grasses and forbs. Ponderosa pine dominates sections of the mixed-conifer forest on the sunny, south-facing slopes of mountains. Aspen communities consist of small patches of quaking aspens with grasses and shrubs. A spruce-fir zone usually exists in the uppermost part of the subalpine area and contains Engelmann spruce and subalpine fir with sparse undergrowth (Figure 3-12). The uppermost zone, at 10,000 feet (3,048 m) and above, is the alpine zone with dwarfed vegetation consisting of willows, pines, grasses, mosses, and lichen. Because of the large amount of high country present in the MFO planning area, the Rocky Mountain Woodland community is one of the dominant vegetation communities there (U.S. Geological Survey 2004:109).

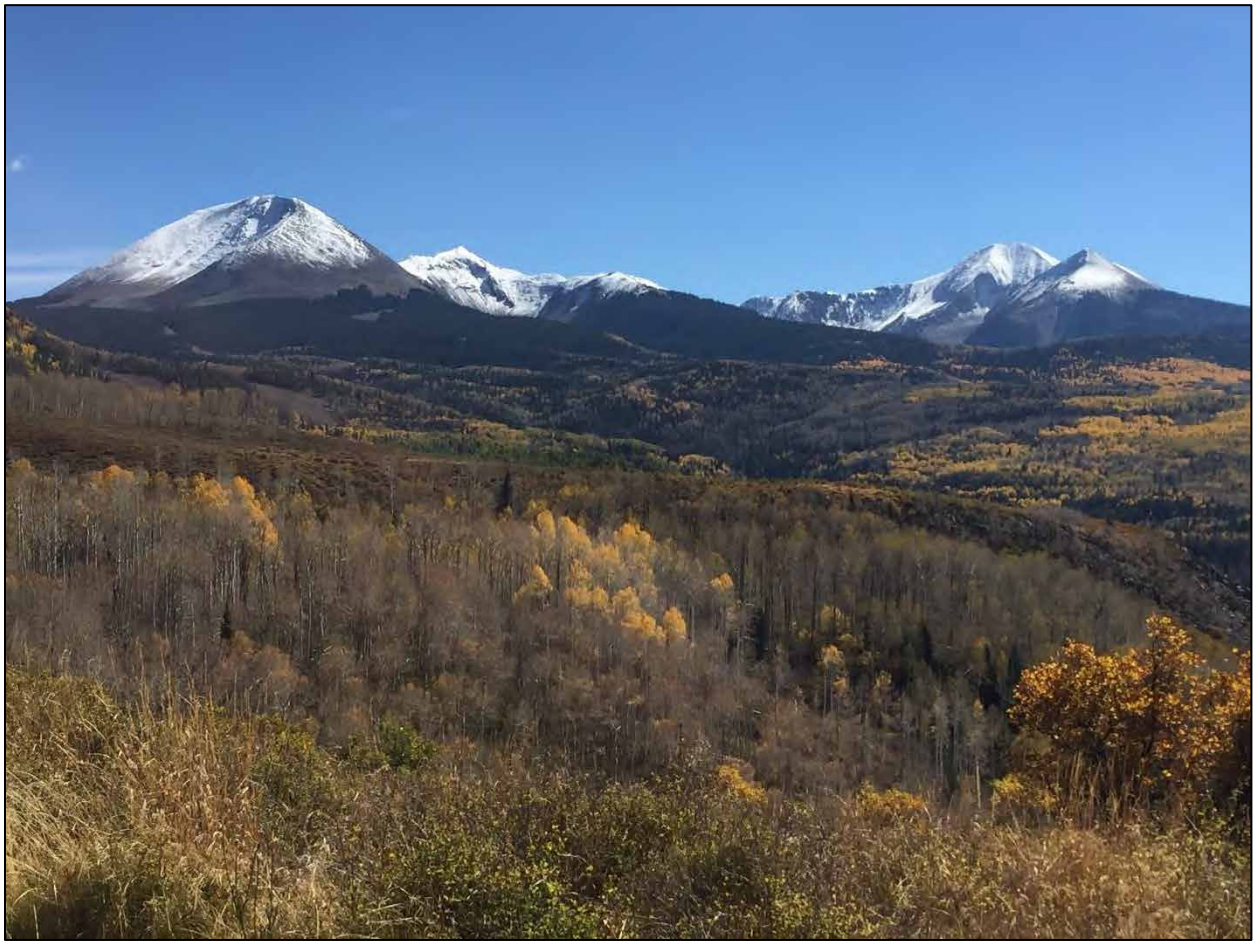


Figure 3-12. Rocky Mountain Woodland community within the Sand Flats Recreation Area. Photograph taken by Reid Persing.

3.7.1.5 RIPARIAN ZONE

The Riparian Zone includes the SWReGAP Rocky Mountain Lower Montane Riparian Woodland and Shrubland community (see Figure 3-8) (U.S. Geological Survey 2004:109). Many riparian zones exist throughout the MFO planning area, primarily along major drainages, river corridors, and wetland areas around lakes (Figure 3-13). The largest and most diverse riparian zones exist close to the Colorado, Green, and Dolores Rivers. A riparian community is defined as being related to or located in close proximity to a long-term water source. Common riparian vegetation consists of cottonwood trees, willows, cattails, maples, elders, various grasses, and invasive plants such as Russian olive (*Elaeagnus angustifolia)* and tamarisk (*Tamarix* spp.). Riparian communities cover by far the smallest amount of land in the MFO planning area, but they play a central role in habitation and subsistence for humans and animals alike.

Figure 3-13. A typical riparian zone along the Colorado River near Moab. Photograph taken by Rob D'Andrea.

3.7.1.6 PREHISTORIC PLANT USE IN THE MFO

Paleoethnobotany—the study of the use of plants by ancestral peoples through investigation of archaeological remains—has revealed extensive use of plant resources in the planning area by prehistoric and historic people. Louderback (2014) notes that the variety of vegetation communities in the area led to a great degree of dietary diversity among peoples of the Colorado Plateau. The record of plant use by indigenous North Americans is massive: Moerman's (1998) compendium alone presents more than 2,500 plant species used as medicines; 1,649 for food; 442 for fiber; 217 as dyes; and 1,074 in other ways, including 704 used "ceremonially."

Among Late Paleoindian and Archaic people, reliance on plant food sources appears to have increased through time (see Chapter 5 [Cultural Resource Overview]). In *Ethnographic Overview and Assessment for Arches National Park*, Stoffle et al. (2016) refer to Rhode and Louderbeck's analysis on material remains in the Bonneville Estates Rockshelter near the Utah-Nevada border and found evidence of the following: ricegrass, sagegrass, sunflower, saltbush, mustard, cactus, sedge, goosefoot, beeweed, pea, greasebush, wild rye, lily, blazingstar, wild rose, pickleweed, bulrush, dropseed, snowberry, and several grasses.

Investigations from Cowboy Cave, Sudden Shelter, Dust Devil Cave, and Old Man Cave in southeast Utah are indicative of broad-spectrum foraging that included goosefoot, pigweed, dropseed, wild rye, prickly pear, sunflower, mustard, and pinyon (Huckell and Toll 2004). Coprolite data from sites just south of the planning area indicate that, in addition to consuming maize, Ancestral Pueblo groups also consumed ricegrass, purslane, beeweed, saltbush, and bursage (Matson and Chisholm 1991). Food plants utilized by the Fremont include, but are not limited to, nuts from both pinyon species; acorns from scrub oak; seeds of cattail, ricegrass, and sunflowers; roots and corms of camas, biscuit roots, wild onion, yampah, sego lily, and bitterroot; the berries chokecherry, Oregon grape, currants, juniper berries, serviceberry, and elderberry; and the stalks of chenopod, amaranth, and thistles (d'Azevedo 1986).

So-called "famine foods" were also utilized during times of drought in the Colorado Plateau and eastern Great Basin; they include juniper bark, prickly pear stems, and charred agave and yucca hearts (Minnis 2000:220-221). Both Fremont and Ancestral Pueblo peoples in the planning area used yucca for weaving baskets and sandals (Geib 2000). Plants utilized as dyes and paints for ceramics, rock art, and clothing are numerous, with the most commonly utilized ones being mountain alder, mountain mahogany, beeweed, rabbitbrush, pinyon, saltbush, birch, Indian paintbrush, tansy mustard, woolly paperflower, and fragrant sumac (Hart and Cox 2000).

3.7.2 Fauna

The variety of landforms and vegetation communities in the MFO planning area allows for a great diversity of animal species. A list of mammal species (in alphabetical order) common to the area is provided in Table 3-3. Many of these animals, including mule deer, pronghorn, bighorn sheep, bison, elk, jackrabbits, and cottontails, were important food resources for prehistoric peoples, but, as noted earlier, species ranges have changed through time and certain species have been extirpated since Euro-American settlement of the area. Mule deer exist throughout the MFO planning area, especially in foothills. Pronghorn reside in the open lower basins and valleys northwest of the La Sal Mountains and throughout the San Rafael Desert. Desert bighorn sheep are present along the Colorado River and its tributaries. Elk, black bears, and snowshoe hares exist in the higher elevations of Manti-La Sal National Forest. These animal populations, and others no longer present in the planning area, have always provided a diverse range of foraging opportunities for people.

Table 3-3. Mammal Species in the MFO Planning Area

Common Name	Scientific Name
ORDER ARTIODACTYLA	
Family Antilocapridae	
Pronghorn antelope	*Antilocapra americana*
Family Bovidae	
Bighorn sheep	*Ovis canadensis*

Table 3-3. Mammal Species in the MFO Planning Area

Common Name	Scientific Name
Family Cervidae	
Elk	*Cervus elaphus*
Mule deer	*Odocoileus hemionus*
ORDER CARNIVORA	
Family Canidae	
Coyote	*Canis latrans*
Red fox	*Vulpes vulpes*
Family Felidae	
Bobcat	*Lynx rufus*
Lynx	*Felis lynx*
Mountain lion/puma/cougar	*Puma concolor*
Family Mephitidae	
Striped skunk	*Mephitis mephitis*
Western spotted skunk	*Spilogale gracilis*
Family Mustelidae	
Subfamily Lutrinae	
North American river otter	*Lontra canadensis*
Subfamily Mustelinae	
American badger	*Taxidea taxus*
Ermine or short-tail weasel	*Mustela erminea*
Long-tailed weasel	*Mustela frenata*
Family Procyonidae	
Raccoon	*Procyon lotor*
Ringtail or cacomistle	*Bassariscus astutus*
Family Ursidae	
Black bear	*Ursus americanus*
ORDER CHIROPTERA	
Family Molossidae	
Big free-tailed bat	*Tadarida macrotis*
Brazilian free-tailed bat	*Tadarida brasiliensis*
Family Vespertilionidae	
Big brown bat	*Eptesicus fuscus*
California myotis	*Myotis californicus*
Fringed myotis	*Myotis thysanodes*

Table 3-3. Mammal Species in the MFO Planning Area

Common Name	Scientific Name
Hoary bat	*Lasiurus cinereus*
Little brown myotis	*Myotis lucifugus*
Long-eared myotis	*Myotis evotis*
Long-legged myotis	*Myotis volans*
Pallid bat	*Antrozous pallidus*
Red bat	*Lasiurus borealis*
Silver-haired bat	*Lasionycteris noctivagans*
Spotted bat	*Euderma maculatum*
Western pipistrelle	*Pipistrellus hesperus*
Townsend's big-eared bat	*Plecotus townsendii*
Western small-footed myotis	*Myotis ciliolabrum*
Yuma myotis	*Myotis yumanensis*
ORDER INSECTIVORA	
Family Soricidae	
American water shrew	*Sorex palustris*
Dusky or montane shrew	*Sorex monticolus*
Masked shrew	*Sorex cinereus*
Merriam's shrew	*Sorex merriami*
ORDER LAGOMORPHA	
Family Ochotonidae	
American pika	*Ochotona princeps*
Family Leporidae	
Black-tailed jackrabbit	*Lepus californicus*
Desert or Audubon's cottontail	*Sylvilagus audubonii*
Nuttall's or mountain cottontail	*Sylvilagus nuttallii*
White-tailed jackrabbit	*Lepus townsendii*
ORDER RODENTIA	
Family Castoridae	
American beaver	*Castor canadensis*
Family Erethizontidae	
American porcupine	*Erethizon dorsatum*
Family Geomyidae	
Botta's pocket gopher	*Thomomys bottae*
Northern pocket gopher	*Thomomys talpoides*

Table 3-3. Mammal Species in the MFO Planning Area

Common Name	Scientific Name
Family Heteromyidae	
Great Basin pocket mouse	*Perognathus parvus*
Ord's kangaroo rat	*Dipodomys ordii*
Plains pocket mouse	*Perognathus flavescens*
Family Muridae	
Bushy-tailed woodrat (packrat)	*Neotoma cinerea*
Brush mouse	*Peromyscus boylii*
Canyon deer mouse	*Peromyscus crinitus*
Desert woodrat (packrat)	*Neotoma lepida*
Long-tailed vole	*Microtus longicaudus*
Montane vole	*Microtus montanus*
Muskrat	*Ondatra zibethicus*
North American deer mouse	*Peromyscus maniculatus*
Northern grasshopper mouse	*Onychomys leucogaster*
Pinyon deer mouse	*Peromyscus truei*
Sagebrush vole	*Lemmiscus curtatus*
Western harvest mouse	*Reithrodontomys megalotis*
Family Sciuridae	
Cliff chipmunk	*Tamias dorsalis*
Golden-mantled ground squirrel	*Spermophilus lateralis*
Hopi chipmunk	*Tamias rufus*
Least chipmunk	*Tamias minimus*
Red squirrel or chickaree	*Tamiasciurus hudsonicus*
Rock squirrel	*Spermophilus variegatus*
Uinta chipmunk	*Tamias umbrinus*
White-tailed antelope ground squirrel	*Ammospermophilus leucurus*
White-tailed prairie dog	*Cynomys leucurus*
Yellow-bellied marmot	*Marmota flaviventris*

Note: Compiled from range maps in Hall (1946) and Zeveloff (1988). Scientific names follow Wilson and Reeder (2005) and Zeveloff (1988). Common names follow Wilson and Cole (2000) and Zeveloff (1988). GIS range data from Utah Division of Wildlife Resources (2015).

Additionally, there has always been an abundance of waterfowl and game birds in the MFO planning area, and these have long been included in human diets there. The topography, together with the abundance of small mammals, makes the area ideal for birds of prey such as the golden eagle, American kestrel, and northern goshawk. Scavenger birds and owls are also abundant in the MFO planning area, and these include the common raven, turkey vulture, the endangered Mexican spotted owl, and burrowing owls. Native game birds and waterfowl include, but are not limited to, mallards, Gambel's quail, and sage-grouse. Medium-sized birds, particularly waterfowl, were essential food resources for prehistoric people. The planning area is also home to an abundance of other native birds, including the American

coot, pinyon jay, black-throated gray warbler, western tanager, western meadowlark, green-tailed towhee, mountain bluebird, cliff swallow, canyon wren, dark-eyed junco, broad-tailed hummingbird, and spotted towhee (National Geographic Society 1983; Ryser Jr. 1985). See Table 3-4 for a comprehensive list of bird species in the MFO planning area.

Table 3-4. Bird Species in the MFO Planning Area

Common Name	Scientific Name
ORDER ACCIPITRIFORMES	
Family Accipitridae	
Golden eagle	*Aquila chrysaetos*
Harrier hawk	*Circus cyaneus*
Red-tailed hawk	*Buteo jamaicensis*
Northern goshawk	*Accipiter gentilis*
Family Cathartidae	
Turkey vulture	*Cathartes aura*
Family Falconiformes	
American kestrel	*Falco sparverius*
Prairie falcon	*Falco mexicanus*
Family Pandionidae	
Osprey	*Pandion haliaetus*
ORDER ANSERIFORMES	
Family Anatidae	
Canada goose	*Branta canadensis*
Mallard	*Ana platyrhynchos*
ORDER APODIFORMES	
Family Trochilidae	
Broad-tailed hummingbird	*Selasphorus platycercus*
ORDER CHARADRIIFORMES	
Family Charadriidae	
Killdeer	*Charadrius vociferous*
ORDER COLUMBIFORMES	
Family Columbidae	
Band-tailed pigeon	*Patagioenas fasciata*
Mourning dove	*Zenaida macroura*

Table 3-4. Bird Species in the MFO Planning Area

Common Name	Scientific Name
ORDER GALLIFORMES	
Family Odontophoridae	
California quail*	*Callipepla californica*
Gambel's quail	*Callipepla gambelii*
Family Phasianidae	
Dusky (blue) grouse	*Dendragapus obscurus*
Chukar*	*Alectoris chukar*
Greater sage-grouse	*Centrocercus urophasianus*
Ruffed grouse	*Bonasa umbellus*
Ring-necked pheasant*	*Phasianus colchicus*
ORDER GAVIIFORMES	
Family Gaviidae	
Common loon	*Gavia immer*
ORDER GRUIFORMES	
Family Rallidae	
American coot	*Fulica americana*
ORDER STRIGIFORMES	
Family Tytonidae or Strigidae	
Burrowing owl	*Athene cunicularia*
Great horned owl	*Bubo virginianus*
Mexican spotted owl	*Strix occidentalis lucida*
Western screech-owl	*Megascops kennicottii*
ORDER PASSERIFORMES	
Family Alaudidae	
Horned lark	*Eremophila alpestris*
Family Cardinalidae	
Western tanager	*Piranga ludoviciana*
Family Corvidae	
Common raven	*Corvus corax*
Pinyon jay	*Gymnorhinus cyanocephalus*
Clark's nutcracker	*Nucifraga columbiana*
Black-billed magpie	*Pica pica*

Table 3-4. Bird Species in the MFO Planning Area

Common Name	Scientific Name
Family Emberizidae	
Chipping sparrow	*Spizella passerina*
Dark-eyed junco	*Junco hyemalis*
Green-tailed towhee	*Pipilo chlorurus*
Spotted towhee	*Pipilo maculatus*
Family Icteridae	
Western meadowlark	*Sturnella neglecta*
Family Hirundinidae	
Cliff swallow	*Petrochelidon pyrrhonota*
Family Paridae	
Black-capped chickadee	*Poecile atricapillus*
Family Parulidae	
Black-throated gray warbler	*Setophaga nigrescens*
Family Polioptilidae	
Blue-gray gnatcatcher	*Polioptila caerulea*
Family Troglodytidae	
Canyon wren	*Catherpes mexicanus*
Family Turdidae	
Mountain bluebird	*Sialia currucoides*
American robin	*Turdus migratorius*
Family Tyrannidae	
Western kingbird	*Tyrannus verticalis*
ORDER PELECANIFORMES	
Family Ardeidae	
Snowy egret	*Egretta thula*
ORDER PICIFORMES	
Family Picidae	
Downy woodpecker	*Picoides pubescens*

Table 3-4. Bird Species in the MFO Planning Area

Common Name	Scientific Name
ORDER PODICIPEDIFORMES	
Family Podicipedidae	
Western grebe	*Aechmophorus occidentalis*
Pied-billed grebe	*Podilymbus podiceps*

Sources: Utah Division of Wildlife Resources (2015); National Geographic Society (1983), and Ryser (1985).
*Denotes species not native to the MFO planning area.

Although there is little evidence for subsistence use of amphibians and reptiles in the Colorado Plateau archaeological record, use of these animals is common in many parts of the world. Further, reptiles and amphibians are essential components of arid ecosystems, and the MFO planning area contains various species of salamanders, toads, frogs, lizards, and snakes. These include the tiger salamander, western pond turtle, Great Basin spadefoot toad, Woodhouse's toad, collared lizard, short-horned lizard, sagebrush lizard, tree lizard, side-blotched lizard, striped whipsnake, kingsnake, gopher snake, and western rattlesnake (Collins and Taggart 2009). See Table 3-5 for a full list of reptiles and amphibians in the planning area.

Additionally, several fish species are found on the Colorado Plateau, including the Utah chub, woundfin, Utah sucker, cutthroat trout, rainbow trout, and mountain whitefish (Sigler and Sigler 1987). See Table 3-5 for a comprehensive list of native fish in the MFO planning area. Many archaeological sites contain strong evidence of the exploitation of native fish in the area. Fishing remains an important activity on the Colorado Plateau, and the stocking of Utah lakes and rivers with fish starting in the late 1880s has led to the introduction of many new species (Sigler and Sigler 1987).

Table 3-5. Reptile, Amphibian, and Fish Species in the MFO Planning Area

Common Name	Scientific Name
CLASS ACTINOPTERYGII: ORDER CYPRINIFORMES	
Family Catostomidae	
Razorback sucker	*Xyrauchen texanus*
Utah sucker	*Catostomus ardens*
Family Cyprinidae	
Bonytail chub	*Gila elegans*
Utah chub	*Gila atraria*
ORDER SALMONIFORMES	
Cutthroat trout	*Oncorhynchus clarkii*
Mountain whitefish	*Prosopium williamsoni*
Rainbow trout	*Oncorhynchus mykiss*

Table 3-5. Reptile, Amphibian, and Fish Species in the MFO Planning Area

Common Name	Scientific Name
CLASS AMPHIBIA: ORDER ANURA	
Family Bufonidae	
Great Plains toad	*Anaxyrus cognatus*
Red-spotted toad	*Anaxyrus punctatus*
Woodhouse's toad	*Anaxyrus woodhousii*
Family Caudata	
Tiger salamander	*Ambystoma tigrinum*
Family Hylidae	
Canyon treefrog	*Hyla arenicolor*
Family Ranidae	
Northern leopard frog	*Lithobates pipiens*
Family Scaphiopodidae	
Great Basin spadefoot toad	*Spea intermontana*
CLASS REPTILIA: ORDER TESTUDINES	
Western pond turtle	*Emys marmorata*
ORDER SQUAMATA	
Suborder Lacertilia or Sauria	
Collared lizard	*Crotaphytus* spp.
Eastern fence lizard	*Sceloporus occidentalis*
Sagebrush lizard	*Sceloporus graciosus*
Short-horned lizard	*Phrynosoma hernandesi*
Side-blotched lizard	*Uta stansburiana*
Tree lizard	*Urosaurus ornatus*
Suborder Serpentes	
Family Crotalidae	
Western rattlesnake	*Crotalus oreganus*
Family Colubridae	
Gopher snake	*Pituophis catenifer*
Kingsnake	*Lampropeltis getula*
Night snake	*Hypsiglena chlorophaea*
Striped whipsnake	*Masticophis taeniatus*
Western terrestrial garter snake	*Thamnophis elegans*

Note: Compiled from several sources (Collins and Taggart 2009; Sigler and Sigler 1987; Utah Division of Wildlife Resources 2015).

3.8 The Effects of Time and Human Activity

Paleoenvironmental records from the Great Basin and Colorado Plateau document environmental change since the late Pleistocene in Utah, as discussed above in section 3.2 (Paleoclimate). In addition to climate-driven changes, anthropogenic effects to the environment have also occurred, affecting vegetation communities and fire regimes on the Colorado Plateau. Anthropogenic impacts to Utah's ecosystems are most noticeable during the period of intensive prehistoric agricultural use that occurred between approximately 800 and 1300 AD, and the period of historic Mormon settlement and land use that was based largely on ranching, agriculture, and mining, beginning with the settlement of Salt Lake City in 1847 (Schwinning et al. 2008).

Prehistoric Puebloan populations affected the landscape on the Colorado Plateau by harvesting tree species for fuel, clearing fields for agricultural use, and cultivating disturbance-related species such as Amarathaceae (Betancourt and Van Devender 1981; Betancourt and Davis 1984; D'Andrea 2015; McFadden 2012; Westfall 1987; Wyckoff 1977). These effects were most notable at large settlement areas such as Chaco Canyon, Canyon de Chelly, and Mesa Verde, but they also have been documented in less densely populated areas in south-central Utah, the Arizona strip, and elsewhere (D'Andrea 2015; Westfall 1987).

The effects of Euro-American land use have been more obvious on the landscape. The introduction of livestock has converted perennial grass–dominated sections of the landscape to shrublands dominated by sagebrush; spread exotic plant species that often become noxious or invasive; and severely impacted biological soil crusts, increasing erosion and decreasing soil fertility. All of this has been exacerbated by human recreation, which has had a profound effect on the landscape. Similarly, in the Great Basin, historic livestock grazing, fire suppression, and wet conditions since Euro-American settlement have led to woodland expansion, as herbaceous vegetation cover has been reduced, leading to reduced fire frequency and increased shrub cover that acts as a nurse canopy for the establishment of tree seedlings (Chambers 2001; R. F. Miller and Tausch 2001).

There is also strong evidence of an increased frequency of wildfires after Euro-American settlement. Before that time, according to late Holocene environmental data, a reduction in wildfire frequencies relative to the middle Holocene had occurred (Morris et al. 2012). The low charcoal counts in late Holocene samples presumably are related to increased snowpack, greater overall moisture, and relatively milder summers, all of which reduced the availability of fuels during the early part of the late Holocene. Indeed, many areas in Utah and Colorado are noted for the absence of widespread wildfires until the 1850s (Morris et al. 2012; Schwinning et al. 2008).

Concern over the greater frequency, severity, and size of wildfires continues to increase (Marlon 2013). Some research has indicated that climate is typically the primary controlling factor for fires and that the droughts in the West from the 1600s to 1800s could account to some degree for increased fire frequencies during that time; however, the peak fire frequency years in the 1800s can be attributed to an increase in human population (Marlon 2013). Human intervention in the natural cycle of fires has included wildfire suppression, which has resulted in increased severity of wildfires when they do ignite. The impact of human activity on future fire cycles cannot be predicted (Marlon 2013).

The predominant uses for agricultural land in the MFO planning area are those related to cattle and sheep ranching, with some farming of various fruits, alfalfa, oats, wheat, and other small grains (Utah State University Cooperative Extension 2005a, 2005b). The dominant use of public lands in the MFO planning area has been related to range animals (Downs 1990). The estimated acreage for farm use (not range animals) is relatively low. The main industries in the region, historically and today, are ranching and mining. The MFO planning area also has been heavily affected by uranium, vanadium, and coal mining. Potash and coal have all been mined in the area, with potash mining continuing today.

Another use of public lands in the MFO planning area is recreation. This includes four-wheel drive and all-terrain vehicle (ATV) trail riding, mountain biking, hiking, fishing, hunting, boating, camping, horseback riding, and many other outdoor activities in or on parks, forests, lakes, and rivers (Moab Area Travel Council 2016; Moab Tourism Center 2016). ATV and four-wheel drive trails include the White Wash Sand Dunes, Chicken Comers, Gemini Bridges, Poison Spider Mesa, and Moab Rim Trails (Moab Area Travel Council 2016). In addition, the region contains forest lands managed by the Manti-La Sal National Forest, national parks such as Arches and Canyonlands, and Dead Horse Point State Park.

3.9 References Cited

Adams, David K. and Andrew C. Comrie

1997 The North American Monsoon. *Bulletin of the American Meteorological Society* 78(10):2197-2213.

Anderson, R. Scott

1989 Development of the Southwestern Ponderosa Pine Forests—What Do We Really Know? In *Multiresource Management of Ponderosa Pine Forests*, edited by A. Tecle, W. W. Covington and R. H. Hamre, pp. 15-22. General Technical Report RM-GTR-185. USDS Forest Service, Missoula, Montana.

1993 A 35,000 Year Vegetation and Climate History from Potato Lake, Mogollon Rim, Arizona. *Quaterary Research* 40:351-359.

Anderson, R. Scott, Jim Hasbargen, Peter A. Koehler, Eric J. Feiler and S. Anderson

1999 Late Wisconsin and Holocene Subalpine Forests of the Markagunt Plateau of Utah, Southwestern Colorado Plateau, U.S.A. *Arctic, Antarctic, and Alpine Research* 31(4):366-378.

Anderson, R. Scott, C. D. Allen, J. L. Toney, R. B. Jass and A. N. Bair

2008 Holocene Vegetation and Fire Regimes in Subalpine and Mixed Conifer Forests, Southern Rocky Mountains, USA. *International Journal of Wildland Fire* 17(1):96–114.

Antevs, Ernst

1955 Geologic-Climatic Dating in the West. *American Antiquity* 20:317–335.

Barron, John A. and Lesleigh Anderson

2011 Enhanced Late Holocene ENSO/PDO Expression Along the Margins of the Eastern North Pacific. *Quaternary International* 235(1-2):3–12.

Benson, Larry V., Donald Currey, Yong Lao and Steve Hostetler

1992 Lake-size Variations in the Lahontan and Bonneville Basins Between 13,000 and 9000 ^{14}C yr BP. *Paleogeography, Paleoclimatology, Palaeoecology* 95:19–32.

Benson, Larry V., H. E. Taylor, K. A. Peterson, B. D. Shattuck, C. A. Ramotnik and J. R. Stein

2008 Development and Evaluation of Geochemical Methods for the Sourcing of Archaeological Maize. *Journal of Archaeological Science* 35(4):912–921.

Benson, Larry V., Michaele Kashgarian, Robert Rye, Steve Lund, Fred Paillet, Joseph Smoot, Cynthia Kester, Scott Mensing, Dave Meko and Susan Lindström

2002 Holocene Multidecadal and Multicentenial Droughts Affecting Northern California and Nevada. *Quaternary Science Reviews* 21:659–682.

Berger, A. and M. F. Loutre

1991 Insolation Values for the Climate of the Last 10 Million Years. *Quaternary Science Reviews* 10(4):297–317.

Betancourt, Julio L.

1984 Late Quaternary Plant Zonation and Climate in Southeastern Utah. *The Great Basin Naturalist* 44(1):1–35.

Betancourt, Julio L. and Thomas R. Van Devender

1981 Holocene Vegetation in Chaco Canyon, New Mexico. *Science* 214(4521):656–658.

Betancourt, Julio L. and O. K. Davis

1984 Packrat Middens From Canyon de Chelly, Northeastern Arizona: Paleoecological and Archaeological Implications. *Quaternary Research* 21(1):56–64.

Betancourt, Julio L., Thomas R. Van Devender and Paul S. Martin

1990 *Packrat Middens: The Last 40,000 Years of Biotic Change*. University of Arizona Press, Tucson.

Boettinger, Janis L.

2009 Soils of Utah. In *Rangeland Resources of Utah*, edited by E. I. L. McGinty, pp. 46-48, Logan, Utah. Prepared for State of Utah Governor's Public Lands Policy Coordination Office, Salt Lake City and Utah State University Cooperative Extension Service, Logan. Copies available from the Utah State University Cooperative Extension Service, Logan. Also available online at https://extension.usu.edu/utahrangelands/files/uploads/RRU_Final.pdf.

Broughton, Jack M., David A. Byers, Reid Bryson, William P. Eckerle and David B. Madsen

2008 Did Climatic Seasonality Control Late Quaternary Artiodactyl Densities in Western North America? *Quaternary Science Reviews* 27:1916–1937.

Chambers, Jeanne C.

2001 *Pinus monophylla* Establishment in an Expanding *Pinus-Juniperus* Woodland: Environmental Conditions, Facilitation, and Interacting Factors. *Journal of Vegetation Science* 12(1):27–40.

Cinnamon, S. K.

1988 The Vegetation Community of Cedar Canyon, Wupatki National Monument, as Influenced By Prehistoric and Historical Environmental Change. Unpublished M.S. thesis, Northern Arizona University, Flagstaff.

Coats, Larry L., Kenneth L. Cole and Jim I. Mead

2008 50,000 Years of Vegetation and Climate History on the Colorado Plateau. *Quaternary Research* 70:322–338.

Cole, Kenneth L.

1990 Reconstruction of Past Desert Vegetation Along the Colorado River Using Packrat Middens. *Paleogeography, Paleoclimatology, Palaeoecology* 76:349–366.

Cole, Kenneth L., Jessica F. Fisher, Kirsten Ironside, Jim I. Mead and Peter A. Koehler

2013 The Biogeographic Histories of *Pinus edulis* and *Pinus monophylla* Over the Last 50,000 Years. *Quaternary International* 310:96–110.

Collins, Joseph and Travis Taggart

2009 *Standard Common and Current Scientific Names for North American Amphibians, Turtles, Reptiles, and Cocodilians* 6th edition ed, Center of North American Herpetology.

d'Azevedo, Warren L.

1986 *Great Basin*. Handbook of North American Indians Vol. 11: Great Basin. Smithsonian Institution Press, Washington.

D'Andrea, Robert M.

2015 Paleoecology of Utah's GSENM: Human Landscape Impacts and Implications for Resource Management on the Colorado Plateau. M.S. thesis, School of Earth Sciences and Environmental Sustainability, Northern Arizona University, Flagstaff.

Davis, O. K., Larry Agenbroad, P. S. Martin and J. I. Mead

1984 The Pleistocene Dung Blanket of Bechan Cave, Utah. In *Contributions in Quaternary Vertebrate Paleontology: A Volume in Memorial to John E. Guilday.* , edited by J. E. Guilday, H. H. Genoways and M. R. Dawson, pp. 267–282. Carnegie Museum of Natural History Special Publications No. 8. Carnegie Museum of Natural History, Pittsburgh, Pennsylvania.

Davis, William E.

1985 The Montgomery Folsom Site. *Current Research in the Pleistocene* 2:11–12.

Downs, Joseph M.

1990 *Soil Survey of Henry Mountains Area, Utah: Parts of Garfield, Kane, and Wayne counties*. U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C.

Fall, Patricia L.

1997 Timberline Fluctuations and Late Quaternary Paleoclimates in the Southern Rocky Mountains, Colorado. *Geological Society of America Bulletin* 19:1306-1320.

Fisher, D. Jerome, Charles E. Erdmann and John B. Reeside Jr.

1960 *Cretaceaous and Terirary Formation of the Book Cliffs Carbon, Emery, and Grand Counties, Utah, and Garfield and Mesa Counties, Colorado*. Geological Survey Professional Paper No. 332. United States Government Printing Office, Washington, D.C.

Flint, Richard F. and Charles S. Denny

1958 *Quaternary Geology of Boulder Mountain Aquarius Plateau, Utah.* U.S. Geological Survey Bulletin, 1061-D. U.S. Government Printing Office, Washington, D.C. Also available online at https://pubs.usgs.gov/bul/1061d/report.pdf.

Geib, Phil R.

2000 Sandal Types and Archaic Prehistory on the Colorado Plateau. *American Antiquity* 65(3):509-524.

Grayson, Donald K.

1982 Toward a History of Great Basin Mammals During the Past 15,000 Years. In *Man and Environment in the Great Basin*, edited by David B. Madsen and J. F. O'Connell, pp. 82–101. Society for American Archaeology Papers, No. 2.

1993 *The Desert's Past: A Natural Prehistory of the Great Basin*. Smithsonian Institution Press, Washington, D.C.

2000 Mammalian Responses to Middle Holocene Climatic Change in the Great Basin of the Western United States. *Journal of Biogeography* 27:181–192.

2006 Holocene Bison in the Great Basin, Western USA. *The Holocene* 16:913–925.

2011 *The Great Basin: A Natural Prehistory*. University of California Press, Berkeley.

Hall, E. Raymond

1946 *Mammals of Nevada*. University of California Press, Berkeley.

Hansen, David T.

1989 *Soil Survey of Grand County, Utah, Central Part*. U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C.

Hart, Kimberly H. and Paul A. Cox

2000 A Cladistic Approach to Ethnobotany: Dye Plants of the Southwestern United States. *Journal of Ethnobiology* 20(2):303-325.

Hasbargen, Jim

1994 A Holocene Paleoclimatic and Environmental Record From Stoneman Lake, Arizona. *Quaternary Research* 42(2):188–196.

Heaton, T. H.

1985 Quaternary Paleontology and Paleoecology of Crystal Ball Cave, Millard County, Utah: With emphasis on mammals and description of a new species of fossil skunk. *Great Basin Naturalist Memoirs* 45:337-390.

Higgins, R. W., Y. Yao and X. L. Wang

1997 Influence of the North American Monsoon System on the United States Summer Precipitation Regime. *Journal of Climate* 10:2600–2622.

Hintze, Lehi F.

1988 *Geologic History of Utah*. Brigham Young University Geology Studies, No. 7. Department of Geology, Brigham Young University, Provo, Utah.

Huckell, Lisa W. and Mollie S. Toll

2004 Wild Plant Use in the American Southwest. In *People and Plants in Ancient Western North America*, edited by P. E. Minnis, pp. 37-114. Smithsonian Books, Washington, D.C.

Janetski, Joel C., Richard K. Talbot, Deborah E. Newman, Lane D. Richens and James D. Wilde

2000 *Clear Creek Canyon Archaeological Project: Results and Synthesis*. Occasional Papers No. 7. Museum of Peoples and Cultures, Brigham Young University, Provo, Utah.

Jiménez-Moreno, Gonzalo, Peter J. Fawcett and R. Scott Anderson

2008 Millennial- and Centennial-scale Vegetation and Climate Changes During the Late Pleistocene and Holocene From Northern New Mexico (USA). *Quaternary Science Reviews* 27(13-14):1442–1452.

King, Philip B.

1977 *The Evolution of North America*. Revised ed. Princeton University Press, Princeton, New Jersey.

Leishman, Garth W., Robert H. Fish and Randy J. Lewis

2003 Soil Survey of Uintah Area, Utah-Parts of Daggett, Grand, and Uintah Counties. Available at: http://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/utah/UT047/0/UT047.pdf. Accessed May 3, 2016.

Louderback, Lisbeth A.

2014 The Ecology of Human Diets During the Holocene at North Creek Shelter, Utah. Unpublished Ph.D. dissertation, Department of Anthropology, University of Washington, Seattle.

Louderback, Lisbeth A. and David Rhode

2009 15,000 Years of Vegetation Change in the Bonneville Basin: The Blue Lake Pollen Record. *Quaternary Science Reviews* 28:308–326.

Madsen, David B.

2000 *Late Quaternary Paleoecology in the Bonneville Basin*. Utah Geological Survey Bulletin No. 130. Utah Geological Survey, Salt Lake City.

Madsen, David B. and Donald R. Currey

1979 Late Quaternary Glacial and Vegetation Changes, Little Cottonwood Canyon Area, Wasatch Mountains, Utah. *Quaternary Research* 12(2):254-270.

Madsen, David B., Charles G. Oviatt and Dave N. Schmitt

2005 A Geomorphic, Environmental, and Cultural History of the Camels Back Cave Region. In *Camels Back Cave*, edited by Dave N. Schmitt and David B. Madsen. Anthropological Papers No. 125. University of Utah Press, Salt Lake City.

Marlon, Jennifer R.

2013 Long-Term Perspective on Wildfires in the Western USA. *Proceedings of the National Academy of Science* Feb 2012:535–543.

Matson, R. G. and Brian Chisholm

1991 Basketmaker II Subsistence: Carbon Isotopes and Other Dietary Indicators from Cedar Mesa, Utah. *American Antiquity* 54(3):444-459.

McFadden, Douglas A.

2012 *Excavations at the Arroyo Site, 42Ka3976: A Pueblo II/III Virgin Anasazi Farmstead*. Utah BLM Cultural Resource Series No. 27; Grand Staircase-Escalante National Monument Special Publication No. 3. Bureau of Land Management, Utah State Office, Salt Lake City, Salt Lake City, Utah. Also available at http://archive.li.suu.edu/docs/ms130/AR/mcfadden1.pdf.

Mead, Jim I. and Larry D. Agenbroad

1992 Isotope Dating of Pleistocene Dung Deposits From the Colorado Plateau, Arizona and Utah. *Radiocarbon* 34(1):1-19.

Mead, Jim I., Larry L. Coats and Blaine W. Schubert

2003 Late Pleistocene Faunas From Caves in the Eastern Grand Canyon, Arizona. In *Ice Age Cave Faunas of North America*, edited by B. W. Schubert, J. I. Mead and R. W. Graham, pp. 64–86. Indiana University Press, Bloomington.

Menking, Kirsten M. and Roger Y. Anderson

2003 Contributions of La Niña and El Niño to Middle Holocene Drought and Late Holocene Moisture in the American Southwest. *Geology* 31(11):937–940.

Merrill, Robert K. and Troy L. Pewe

1977 *Late Cenozoic Geology of the White Mountains Arizona*. Arizona Bureau of Geology and Mineral Technology Special Paper No. 1. University of Arizona, Tucson.

Miller, Richard F. and Robin J. Tausch

2001 The Role of Fire in Juniper and Pinyon Woodlands: a Descriptive Analysis. In *Proceedings of the Invasive Species Workshop: the Role of Fire in the Control and Spread of Invasive Species.* , edited by K. E. M. Galley and T. P. Wilson, pp. 15-30. Tall Timbers Research Station, Miscellaneous Publication No. 11. Tall Timbers Research Station, Tallahassee, Florida.

Miller, W. E.

1976 Late Pleistocene Vertebrates of the Silver Creek Local Fauna from North Central Utah. *Great Basin Naturalist Memoirs* 34:387-424.

1982 Pleistocene Vertebrates from Deposits of Lake Bonneville, Utah. *National Geographic Society Research Reports* 14:473-478.

1987 *Mammut americanum*, Utah's First Record of the American Mastodon. *Journal of Paleontology* 61:168-183.

Minnis, Paul E.

2000 Famine Foods of the North American Desert Borderlands. In *Ethnobotany: A Reader*, edited by P. E. Minnis, pp. 214-242. University of Oklahoma Press, Norman.

Moab Area Travel Council

2016 discovermoab.com. Available at: http://www.discovermoab.com/activities.htm. Accessed April 6, 2016.

Moab Tourism Center

2016 Moab Tourism Center. Available at: http://www.moabtourismcenter.com/. Accessed April 6, 2016.

Mock, Cary J.

1996 Climate Controls and Spatial Variations of Precipitation in the Western United States. *Journal of Climate* 9:1111-1125.

Moerman, Daniel E.

1998 *Native American Ethnobotany*. Timber Press, Portland, Oregon.

Morris, Jesse L., Andrea Brunelle, A. Steven Munson, Jessica Spencer and Mitchell J. Power

2012 Holocene Vegetation and Fire Reconstructions from the Aquarius Plateau, Utah, USA. *Quaternary International* 310:1–13.

Morris, Jesse L., Andrea Brunelle, R. Justin DeRose, Keikki Seppa, Mitchell J. Power, Vachel Carter and Ryan Bares

2013 Using Fire Regimes to Delineate Zones in a High-Resolution Lake Sediment Core from the Western United States. *Quaternary Research* 79:24–36.

Murray, Lyndon K., Christopher J. Bell, M. Timothy Dolan and Jim I. Mead

2005 Late Pleistocene Fauna From the southern Colorado Plateau, Navajo County, Arizona. *The Southwestern Naturalis* 50(3):363–374.

National Geographic Society

1983 *Field Guide to the Birds of North America*. National Geographic Society, Washington, D.C.

Nelson, Lisa W.

1990 *Ice Age Mammals of the Colorado Plateau*. Northern Arizona University, Flagstaff.

Nelson, M. E. and J. H. Madsen, Jr.

1978 Late Pleistocene Musk Oxen from Utah. *Kansas Academy of Science Transactions* 81:277-295.

1980 A Summary of Pleistocene Fossil Vertebrate Localities in the Northern Bonneville Basin of Utah. In *Great Salt Lake: A Scientific, Historical, and Economic Overview*, edited by J. W. Gwynn, pp. 97–114. Utah Geological and Mineral Survey Bulletin 116.

1983 A Giant Short-Faced Bear (Arctodus simus) from the Pleistocene of Northern Utah. *Transactions of the Kansas Academy of Science* 86:1–9.

Northwest Research Obsidian Studies Laboratory

2016 Utah Obsidian Sources. Available at: http://www.sourcecatalog.com/image_maps/map_obsidian_utah.pdf. Accessed August 30, 2016.

Notaro, Michael and Azar Zarrin

2011 Sensitivity of the North American Monsoon to Antecedent Rocky Mountain Snowpack. *Geophysical Research Letters* 38(17).

Orme, Antony R.

2008 Pleistocene Pluvial Lakes of the American West: A Short History of Research. In *History of Geomorphology and Quaternary Geology*, edited by R. H. Grapes, D. R. Oldroyd and A. Grigelis. Geological Society, London, Special Publications Volume 301, Vol. 301. Geological Society, London, England.

Petersen, Kenneth L.

1982 Review of "Lower Timberline in Central Colorado During the Past 15,000 Years". *Southwestern Lore* 48(4):22-24.

Pewe, Troy L. and Randall G. Updike

1976 *San Francisco Peaks: a Guidebook to the Geology*. Museum of Northern Arizona., Flagstaff.

Reheis, M. C., R. L. Reynolds, H. Goldstein, H. M. Roberts, J. C. Yount, Y. Axford, L. Scott-Cummings and N. Shearin

2005 Late Quaternary Eolian and Alluvial Response to Paleoclimate, Canyonlands, Southeastern Utah. *Geological Society of America Bulletin* 117:1051-1069.

Renssen, H., H. Seppä, X. Crosta, H. Goosse and D. M. Roche

2012 Global Characterization of the Holocene Thermal Maximum. *Quaternary Science Reviews* 48:7–19.

Reynolds, Richard, Jayne Belnap, Marith Rheis, Paul Lamother and Fred Lulszer

2001 Aeolian Dust in Colorado Plateau Soils: Nutrient Inputs and Recent Change in Source. *PNAS* 98(13):7123-7127.

Richmond, Gerald M.

1962 *Quaternary Stratigraphy of the La Sal Mountains, Utah*. Geological Survey Professional Paper 324. U.S. Government Printing Office, Washington, D.C. Also available online at http://pubs.usgs.gov/pp/0324/report.pdf.

Rodbell, Donald T., Geoffrey O. Seltzer, David M. Anderson, Mark B. Abbott, David B. Enfield and Jeremy H. Newman

1999 An ~15,000-Year Record of El Niño-Driven Alluviation in Southwestern Ecuador. *Science* 283(5401):516-520.

Romer, A. S.

1928 A "Fossil" Camel Recently Living in Utah. *Science* 68:19-20.

Ryser Jr., Fred A.

1985 *Birds of the Great Basin: A Natural History*. University of Nevada Press, Reno.

Schwinning, Susan, Jayne Belnap, David R. Bowling and James R. Ehleringer

2008 Sensitivity of the Colorado Plateau to Change: Climate, Ecosystems, and Society. Ecology and Society 13(2). Available at: http://www.ecologyandsociety.org/vol13/iss2/art28/ES-2008-2412.pdf. Accessed March 4, 2015.

Shinker, Jacqueline J.

2010 Visualizing Spatial Heterogeneity of Western U.S. Climate Variability. *Earth Interactions* 14(10):1-14.

Sigler, W. F. and J. W. Sigler

1987 *Fishes of the Great Basin: A Natural History*. University of Nevada Press, Reno.

Spaulding , W. Geoffrey and Kenneth L. Petersen

1980 Pleistocene and Early Holocene Paleoecology of the Cowboy Cave Archeological Site. In *Cowboy Cave*, edited by J. D. Jennings, pp. 163-177. University of Utah Anthropological Papers No. 104. University of Utah Press, Salt Lake City.

Stegner, Mary Allison

2015 Spatial and Temporal Variation in Mammalian Diversity of the Colorado Plateau (USA). Ph.D., Department of Integrative Biology, University of California, Berkeley.

Stoffle, Richard W., Evelyn Pickering, Katherine Brooks, Kathleen Van Vlack and Christopher Sittler

2016 *Ethnographic Overview and Assessment for Arches National Park*. Final Report Draft January 2016. Copies available from the Bureau of Applied Research in Anthropology, School of Anthropology, University of Arizona, Tucson.

Stokes, William L.

1986 *Geology of Utah*. Occasional Paper No. 6, Utah Museum of Natural History. Utah Geological and Mineral Survey, Department of Natural Resources, Salt Lake City.

Thompson, R. S., C. Whitlock, P. J. Bartlein, S. P. Harrison and W. G. Spaulding

1993 Climatic Changes in the Western United States Since 18,000 yr BP. In *Global Climates Since the Last Glacial Maximum*, edited by H. E. Wright, Jr., pp. 468-513. University of Minneapolis Press, Minneapolis, Minnesota.

Toney, Jaime L. and R. Scott Anderson

2006 A Postglacial Palaeoecological Record From the San Juan Mountains of Colorado USA: Fire, Climate and Vegetation History. *The Holocene* 16(4):505–517.

Turner, Christine and Fred Peterson

2004 Reconstruction of the Upper Jurassic Morrison Formation Extinct Ecosystem: A Synthesis. *Sedimentary Geology* 167:309–355.

U.S. Geological Survey

2004 USGS National Gap Analysis Program. Southwest Reginal Gap Analysis Project (SWReGAP) – Land Cover Descriptions. Available at: http://earth.gis.usu.edu/swgap/data/atool/files/swgap_legend_desc.pdf. Accessed May 5, 2016.

University of California Davis Soil Resource Lab and Natural Resources Conservation Service U. S. Department of Agriculture

2011 SoilWEb. Available at: http://www.gelib.com/soilweb.htm. Accessed May 3, 2016.

Utah Department of Environmental Quality

2016 Utah Environmental Interactive Map. Available at: http://enviro.deq.utah.gov. Accessed April 20, 2016.

Utah Division of Wildlife Resources

2015 Wildlife Habitat Areas. Available at: http://gis.utah.gov/data/bioscience-overview/department-wildlife-resources-habitat-areas/. Accessed March 13, 2015.

Utah State University Cooperative Extension

2005a Grand County Agricultural Profile. Available at: http://extension.usu.edu/files/publications/publication/Michael_Johnson,.pdf. Accessed April 4, 2016.

2005b San Juan County Agriculture Profile Available at: https://extension.usu.edu/files/publications/publication/AG_Econ_county-2005-22.pdf. Accessed April 4, 2016.

Van Devender, Thomas R. and W. Geoffrey Spaulding

1979 Development of Vegetation and Climate in the Southwestern United States. *Science* 204(18):701–710.

Van Devender, Thomas R., R. S. Thompson and Julio L. Betancourt

1987 Vegetation History of the Deserts of Southwestern North America: The Nature and Timing of the Late Wisconsin-Holocene Transition. In *North American and Adjacent Oceans During the Last Glaciation*, edited by W. F. Ruddiman and H. E. Wright, pp. 183-193. The Geology of North America Vol. K-3. Geological Society of America, Boulder, Colorado.

Wahlquist, Wayne L.

1981 *Atlas of Utah*. Brigham Young University Press, Provo, Utah.

Waters, Michael R. and C. Vance Haynes

2001 Late Quaternary Arroyo Formation and Climate Change in the American Southwest. *Geological Society of America* 29:399–402.

Weng, C. and S. T. Jackson

1999 Late Glacial and Holocene Vegetation History and Paleoclimate of the Kaibab Plateau, Arizona. *Palaeogeography, Palaeoclimatology, Palaeoecology* 153:179-201.

Western Regional Climate Center

2016 Cooperative Climatological Data Summaries. Available at: http://www.wrcc.dri.edu/summary/Climsmut.html. Accessed March 26, 2016.

Westfall, D. A.

1987 *The Pinenut Site: Virgin Anasazi Archaeology on the Kanab Plateau of Northwestern Arizona*. Cultural Resource Series No. 4. Prepared by Bureau of Land Management, Phoenix, Arizona.

Wilson, D. E. and D. M. Reeder (editors)

2005 *Mammal Species of the World: A Taxonomic and Geographic Reference*. 3rd ed. Johns Hopkins University Press, Baltimore, Maryland.

Withers, Kim and Jim I. Mead

1993 Late Quaternary Vegetation and Climate in the Escalante River Basin on the Central Colorado Plateau. *Great Basin Naturalist* 53(2):145–161.

Wyckoff, Don G.

1977 Secondary Forest Succession Following Abandonment of Mesa Verde. *The Kiva* 42(3/4):215–23.

Zeveloff, Samuel I.

1988 *Mammals of the Intermountain West*. University of Utah Press, Salt Lake City.

CHAPTER 4. PRIOR CULTURAL RESOURCE INVESTIGATIONS

Ralph Burrillo, R. Kelly Beck, and Lisa Krussow

To create a detailed description of an area's cultural history, previously conducted archaeological research and previously gathered data must first be understood. This chapter synthesizes past archaeological investigations in the MFO planning area to create a baseline for initiating new research and investigations.

4.1 Summary of Past and Current Work

Following Spangler's (2002) Class I overview for the Uinta Basin and Tavaputs Plateau, archaeology in North America can be divided into three periods of research and analytic thought by three general types of groups: efforts by explorers, antiquarians, and early archaeologists (pre-1916); studies done by institutional archaeologists and the formation of cultural history (1916 to the 1960s); salvage archaeology, the emergence of cultural resources management, and New/Processual Archaeology (the 1960s to the present). The changes in archaeological thought reflected by these periods, combined with changing governmental goals, have affected the ways in which archaeology is conducted and have resulted in different approaches to the formulation of research questions, archaeological methods, and analysis results and conclusions. The MFO planning area has been the subject of archaeological work since the earliest efforts of explorers in western North America, and it therefore provides an illustration of the approaches taken during all three periods. Our current knowledge about the archaeology of the area has been shaped by the full spectrum of these approaches.

4.1.1 Explorers, Antiquarians, and Early Archaeologists

The first focused archaeological work in North America was conducted in conjunction with a change in how Americans perceived the importance of prehistory. This change occurred in the mid-1800s, although the early (pre-1916) period of archaeological thought, as discussed here, also encompasses all inquiries into the continent's human past conducted before that time. While some areas of the United States were the subject of earlier archaeological research (e.g., Jefferson's excavations of Mississippian Mounds in the late 1700s), these pursuits began in Utah and in the West in general with the appearance of Euro-Americans and commencement of the Historic period in the later 1800s. Euro-Americans at that time were interested in the origins of present-day Native Americans, the "first Americans" (some thought that these might be different things – see D. D. Fowler 2010:50–70) and whether evidence existed for cultural change through time. Because of such interests, many of the first Western explorers not only explored unknown lands, but also brought back objects for naturalists to study. These early archaeologists were not professionally trained, and their methods of recording varied. To be effective, many of the first explorers required education in multiple disciplines such as biology, geology, hydrology, and basic survival. Some expeditions were government supported, with the purpose of establishing military outposts, exploring for resources, and gathering information for future settlement. Many archaeological sites were excavated without the benefit of broad research goals, and no standard methodology for data collection had yet been established. Generally, archaeologists consider this a descriptive and exploratory period; much detail was recorded, but synthesizing the information and exploring questions about past lifeways were not objectives.

Some of the first Euro-American explorations into the West were expeditions by Spanish missionaries. These early missionary expeditions were essential to the development of the later fur trading and settlement periods. Indeed, most of the earliest written accounts of places in what is now the MFO planning area come from the diaries of Franciscan monks. The term *Utah* was first mentioned in the 1620s in the form of the word *Yuta* by the Franciscan missionary Father Geronimo de Zarate Salmeron (Baxter et al. 2001). The word *Yuta* referred to the Ute people in general; the various Ute bands were not differentiated by the Spanish until the eighteenth century. Expansion of the Spanish frontier into Alta California required establishing a land route—the Spanish Trail—between present-day Monterrey, California, and Santa Fe, New Mexico.

Among the earliest explorations of the MFO planning area was that of a group of Spaniards out of New Mexico in 1765. Led by Juan Maria Antonio Rivera, their route extended northwestward from Santa Fe through southwestern Colorado as far as Spanish Valley near present-day Moab (Barnes 1991). An arguably more important expedition through the region was conducted 11 years later by Franciscan friars Silvestre Vélez de Escalante and Francisco Dominguez, when they were tasked with establishing an overland trail. Although their 1776–1777 expedition did not extend into the current MFO planning area, important information about the region and its inhabitants comes from the daily diaries of the friars, and from the maps drawn by Bernardo Miera y Pacheco. Information from these sources was used by later explorers and fur trappers. Many ethnographers have referred to Escalante's diaries because of his unbiased documentation of Ute people and observations of archaeological sites. These observations are explored in detail in Warner's synthesis of the Dominguez and Escalante journals (1976).

Between the time of the Dominguez-Escalante expedition and the inhabitancy of the Colorado Plateau and Great Basin by fur traders in the 1820s, the area came into little contact with Euro-Americans. As word of a new land rich in furs spread back to the east coast, fur trappers and traders flooded into the Intermountain West region. These mountain men explored and trapped nearly every stream and lake in the area as they moved their way west of the Rocky Mountains. Although they left no permanent settlements, some of the trappers did leave behind excellent journals recounting their activities across the western frontier (e.g., Ogden 1950).

Between 1829 and 1830, Spanish-Mexican explorer Antonio Armijo led an expedition to conduct trade between New Mexico and California. He was so successful that annual expeditions were made thereafter until 1848, and his pathway now constitutes the Armijo Route of the Old Spanish Trail. Before 1830, the originally established trail included only the section from Santa Fe to the Great Basin. It had been developed in the eighteenth century by the Spanish to facilitate trade with Native Americans. This trade had begun with the Rivera Expedition of 1765, and it continued until the area was settled. Following the Spanish lead, Mexicans continued a slave trade until such activities were discouraged by the passage of laws by the territorial legislature of Utah during the 1850s (for further discussion see Chapter 5, Section 5.3.1) (Hill 1930:3). The Northern Route crossing the Colorado at Green River, Utah, was used by an expedition of American trapper-traders based in Taos, New Mexico. The expedition was led William Wolfskill and was accompanied by New Mexican trapper-traders who carried New Mexico–produced homespun woolens to trade for California horses. The New Mexicans apparently returned to New Mexico over a route crossing at Green River, a much more feasible livestock driveway than the Crossing of the Fathers route. The Crossing of the Fathers was the Colorado River crossing between Kane and San Juan Counties, Utah. Named for Atanasio Domínguez and Silvestre Vélez de Escalante, who first used the crossing in 1776, it was also used by the Armijo Expedition in 1829 (National Park Service 2001:6–7). For additional discussion of the Old Spanish National Historic Trail, see Chapter 5, Section 5.3.1.

The first Euro-American explorers of the West were tasked with taking detailed notes on their surroundings—natural and cultural—and bringing this information back to the East Coast. Many Americans were enamored with the West and believed that expansion throughout it was inevitable, a

belief known as Manifest Destiny. During the 1850s, exploration parties crossed through the MFO planning area along the Spanish Trail on an east–west path. In the fall of 1854, members of the Elk Mountain Mission entered the Grand County region and passed through Spanish Valley on their way to points farther south. A year later, "forty-one men were called by church leaders to establish an outpost in Spanish Valley and the foot of the La Sal Mountains…" (Firmage 1996:78). The settlers encountered their share of conflicts with the Utes in the months to come, and increasing mistrust and misunderstandings between the two led to fighting and abandonment of the mission by Mormons later that year.

Because of continued interest in Western expansion, noteworthy explorers such as John C. Fremont, John W. Gunnison, and John Wesley Powell traveled throughout Utah during the mid-1800s. John C. Fremont was a military officer in charge of several Western expeditions undertaken to expand the nation's knowledge of the West. His fifth and final expedition in 1854 involved surveying to discover an overland route for the transcontinental railroad. The survey route led Fremont through central Utah several months after Gunnison's 1853 Pacific railroad exploration survey through the same area (Murphy 1999:56). Information about topography and contact with Native Americans can be teased out of Fremont's writings, but it was Powell's later expeditions that chronicled more detail about the ethnography and archaeology of the area.

Military scientist John Wesley Powell was an excellent example of the early explorer who was educated in many disciplines. Powell had military training in science and engineering, but he was also interested in natural sciences and history. Powell, known for eventful trips down the Green and Colorado Rivers in 1869 and 1871, later became the director of the Bureau of Ethnology at the Smithsonian Institution, and was a curator at the Museum of the Illinois State Natural History Society. His own journals and the diaries of his crew members described archaeological sites that present-day researchers have either found or continue to search for (Bearnson 2012; Spangler 1995). Powell's trips led the way for much more exploration; William Adams has counted 35 subsequent expeditions along the Glen Canyon section of the Colorado River between 1879 and 1956 (Adams 1960), before the commencement of the Glen Canyon Project (discussed in the next section).

Many early explorers may not have intended to gather information about cultural resources beyond what was important to trapping and trading; however, from their accounts, it is possible to glean information about ethnohistorical contact, past lifeways, and the environment. In addition to early trappers Wolfskill and Yount, other important trappers and guides who crossed what is now the MFO planning area were Jedediah Smith, Kit Carson, Antonio Armijo, Ewing Young, and James Beckworth (Bishop 1997:61). However, after the eruption of hostilities and abandonment of Spanish Valley by Mormons in the 1850s, it would not be until 1874 that Euro-Americans would once again attempt to settle in the area. Prospecting, cattle ranching, and homesteading were the primary motivations for settlement in Spanish Valley. Other settlements in the region were probably sparse or absent. In 1880, the people of Spanish Valley renamed their settlement Moab, based most likely on the biblical reference.

After permanent Euro-American settlements began to appear in the region, a switch from exploration of the unknown to more systematic collection and documentation of archaeological remains occurred. Archaeologists on the East Coast had begun applying more rigorous methods and research designs to their investigations. Such techniques were already being integrated into European archaeological practice, and archaeologists in North America began to work toward establishing archaeology as a hard science, as well. Exploratory work became more standardized, and research goals became more specific and targeted. One example of this is the first recorded investigation of the Canyonlands area, which would not become a national park until 1962 (National Park Service 2015). This investigation involved University of Utah (U of U) reconnaissance-level surveys of places such as Montezuma Canyon, Fable Valley, Beef Basin, and Alkali Ridge from 1907 to 1909 (Lucius et al. 1976).

4.1.2 Institutional Archaeologists

Although early archaeologists varied in the kind of training they had received and the methodologies they used, those of the institutional and cultural history periods (1916 to the 1960s) were more uniform in possessing a determination to detail their methods and create data classifications. There was some overlap between the early-archaeologist era and the institutionalizing of archaeology as the discipline began to define itself. Institutional archaeology had started to expand greatly with the passage of the Antiquities Act of 1906, which began to set professional qualifications requirements for conducting archaeological work on Federal lands, and it expanded further with the 1916 creation of the National Park Service, a governmental body that had the authority to record and manage lands of historic significance. Archaeology continued to grow after the passage of the Historic Sites Act in 1935, and especially after World War II, when there was a resurgence of interest in exploring American history.

A common archaeological approach of this time was to place sites in chronological order on the basis of temporally diagnostic artifacts. Archaeologists hypothesized that distinct groups of people would be represented by distinct artifact assemblages that could be traced through time. Similarities and differences among sites and areas were discussed at great length, but the cultural behaviors behind the artifacts were not considered in any detail; the focus was on lists of artifact attributes without much interpretation of behavior or use. To achieve chronological goals, special care was needed in the methods of excavation so that stratigraphy could be documented. The level of detail in data collection was considerably greater in comparison to early archaeology. The establishment of the Society for American Archaeology and other organizations allowed archaeologists to publish, discuss, and further refine methodologies. With well-defined methodologies, data could be analyzed in more standard ways among researchers, and it became possible to prove archaeological hypotheses wrong as a result. This helped the discipline move into the realm of the scientific method (Meltzer et al. 1986). As archaeology gained acceptance as a scientific discipline, researchers received professional training from universities, which were by then establishing anthropology departments. However, opportunities for employment in the growing field were limited to universities and museums, with a very few positions also available at the National Park Service. Most projects conducted during this period were funded by universities and museums.

A key figure from this time period is Edgar Lee Hewitt, who played a pivotal role in early Southwestern anthropology for 40 years. Hewitt helped form the Archaeological Society of New Mexico in 1898 and later established a field school in Santa Fe that would become the School of American Archaeology and later the School of American Research. From 1909 until the 1940s, he directed both the Museum of New Mexico and the School of American Research, and he also helped found the Anthropology Department at the University of Southern California in 1934. In the summer of 1907, Harvard University students Alfred V. Kidder, Sylvanus G. Morley, and John Gould Fletcher signed on to the field school, and joined Hewitt in modern-day Bluff before they set off for McElmo and Yellowjacket Canyons. After showing them a few ruins, according to Kidder, Hewitt "waved an arm, taking in it seemed, about half the world, [and said] 'I want you boys to make an archaeological survey of this country. I'll be back in three weeks.'" (D. D. Fowler 2010:266–267). Kidder and Morley would go on to become key figures in Southwest archaeology. Kidder's culture-historical phase sequence known as the *Pecos Classification* (see Chapter 5 Cultural Resource Overview) is still used today. Hewitt, meanwhile, held a number of subsequent field schools, conducting surveys in areas like Alkali Ridge in southeastern Utah and instructing other pivotal figures like Neil M. Judd, the nephew of Byron Cummings, who was a colleague of Hewitt's. Judd would go on to explore many parts of Utah, including White Canyon in modern-day Natural Bridges National Monument just south of the planning area (D. D. Fowler 2010:257), and write general impressions of the area that researchers in following years would build upon. Judd also led several archaeological explorations down Glen Canyon for the National Geographic Society in 1923 (Adams 1960), discovering several important sites (Judd 1926) before making a name for himself as the first archaeologist to use explicitly scientific principles of investigation while working at Pueblo Bonito in Chaco Canyon (D. D.

Fowler 2010:297; see also McNitt 1966:128-123). The results of these reconnaissance surveys were later criticized as being overgeneralized (Jennings 1998), but they were unquestionably an important step in the history of archaeological investigations in the area.

An illustrative project from this time is the Claflin-Emerson Expedition, conducted from 1928 to 1931. This was a reconnaissance-level survey along the watersheds of the Colorado and Green Rivers sponsored by the Peabody Museum of Archaeology and Ethnology at Harvard University. The 1928 survey worked north along the Escalante River to the Fremont River, terminating near Torrey. During the 1928 and 1929 expeditions, Noel Morss conducted intensive-level surveys along the Fremont River (Morss 1931). Morss is generally regarded as the person who first defined the Fremont archaeological culture. During these expeditions, Morss and his team spent a week excavating and mapping the Fish Creek Cove site. Even though the center of the cave was highly disturbed, the team recovered very valuable information and artifacts (including but not limited to lithics, ground stone, pottery, baskets, and moccasins) (Murphy 1999:37–38). It would be evidence such as this, along with data recovered from various other sites within the Fremont River drainage, that would help develop his understanding of the Fremont Culture in this part of Utah (Taylor 1957). Morss documented similarities among Fremont sites and compared them to classifications being developed for the Ancestral Puebloan archaeology of the Southwest, and he was the first to propose that separate cultures were represented (Morss 1931). Henry Roberts, co-director of the Claflin-Emerson Expedition, conducted work for the Peabody Museum between 1929 and 1930 that was also significant for what is now the MFO planning area because it involved the first surveys and excavations in areas such as the Salt Creek drainage, Ruin Park, Fort and Woodruff Bottoms, and Barrier Canyon (Lucius et al. 1976).

The first Pecos Conference in 1927 would help to crystalize a lot of the information collected by previous archaeological efforts, and establish some of the traditions and methods of archaeological inquiry for the subsequent era in the Southwest. Organized by Kidder and his colleagues, the upshot of the conference was the earlier-mentioned Pecos Classification (explained in much greater detail in Chapter 6), which represented a culture-historical attempt at standardizing the hodgepodge of regional classification systems into a broad, generalized outline. The Pecos sequence has since become canon in Southwest archaeology. Morss' efforts to standardize knowledge and practice in the Fremont culture area continued apace.

With the period's focus on standardization, Harvard University conducted another survey of Alkali Ridge from 1931 to 1933 after that of Kidder, Judd, and others in 1908. Harvard University's investigations led to the Peabody Museum's Southeastern Utah Expedition, conducted by John Otis Brew (Brew 1946) of the Claflin-Emerson Expedition. Brew excavated 13 sites during that expedition, and his subsequent report "immediately became a landmark in Southwestern archaeological literature" (Woodbury 1990). Brew later returned to Beef Basin, Fable Valley, and the Dark Canyon Plateau to record 72 sites dating between the Basketmaker II and Pueblo II periods, and he conducted additional inventories in 1955 (Rudy 1955). From 1945 to 1947, Pittsburgh's Carnegie Museum of Natural History sponsored another re-survey of Fable Valley, an area investigated during the U of U's 1907–1909 field season under Hewitt's colleague Byron Cummings. Artifacts collected during this project were not analyzed or synthesized, however, until the Glen Canyon Project in the 1960s (Lucius et al. 1976).

Very little archaeological research was conducted in the Spanish Valley and Moab vicinity until World War II. Albert B. Reagan led a series of archaeological investigations throughout the Tavaputs Plateau area to the north of the MFO planning area in the early 1930s. Reagan argued forcefully for a Fremont culture separate from that of the Ancestral Puebloans, calling the Fremont a "quasi-Pueblo culture" that "never took on the orthodox Pueblo characteristics, as we know them in the Southwest" (Spangler 2002:71).

The Carnegie Expedition to southeastern Utah in the 1940s was a collection-type survey typical of the 1930s, and nothing was done with the material until an opportunity to study it was provided by the U of U as part of the Glen Canyon Project (Sharrock and Keene 1962). A 1945 archaeological survey of Fable Valley by Baldwin (1948) was hampered by a lack of decent maps, and, moreover, was aimed at gathering information for a recreation-focused study of the upper Colorado River Basin. This effort precipitated future professional and amateur visitation in the area. Construction of jeep trails and roads by ranchers and government officials ushered in an era of looting and vandalism, prompting in turn the U of U's Statewide Archaeological Survey, which, under the leadership of Jack Rudy, first surveyed and planned excavations in the Beef Basin area in 1952 and 1953 (Rudy 1955). Little archaeological work has been conducted there since.

From 1949 to 1952, Alice Hunt planned and conducted major archaeological survey work in the area. Her husband was conducting a geological survey of the La Sal Mountains east of Moab, and Hunt recognized a rare opportunity to conduct archaeological research in a mostly unknown area. She provided a useful chronology and tool typology for future researchers (see Hunt 1953). She also provided some of the stimulus for Rudy's research in the region when she and Bates Wilson surveyed Horse Canyon in the Salt Creek area of present-day Canyonlands National Park (Hunt and Wilson 1952). This work provided important information about the prehistory of the area, and was a useful tool in the formation of Canyonlands National Park in 1964. Of the 350 sites Hunt recorded, 119 lie at elevations higher than 8,000 feet, and about half of those are at elevations higher than 10,000 feet (Hunt 1953:Preface), making Hunt's survey the first serious effort to document and investigate high-elevation settlements in the area. In terms of environmental zones, the 119 previously noted sites are found in the mountain zone, 84 sites are found in the piñon-juniper zone, and 151 sites are found in the canyons (Hunt 1953:8), including 44 sites in Horse Canyon and along its tributaries in the Needles District. When later evidence of vandalism was noted, increased protection of archaeological sites became a concern (Lucius et al. 1976).

4.1.3 Salvage Archaeology and the Birth of Cultural Resources Management

As archaeology became institutionalized and data collection methods improved, the American public grew increasingly concerned that not enough was being done for the preservation of archaeological resources. Attempts to balance economic concerns, military requirements, and preservation values coalesced in the Reservoir Salvage Act of 1960. This act specifically mandated preservation of historical and archaeological data (King 2004), but it did little in the way of establishing penalties for those who violated the act, and many considered its protections inadequate given the development that was resulting from the growing United States economy. The act did, however, begin to establish several archaeological job positions within government.

Adding enforceability to the Reservoir Salvage Act, the National Historic Preservation Act (NHPA) was passed in 1966. Section 106 of the NHPA required that agencies make a good faith effort to consider the effects of projects on properties included on the National Register of Historic Places, and this led directly to the development of what is now known as cultural resources management (CRM). In 1969, the National Environmental Policy Act (NEPA) created an umbrella requiring that agencies consider all potential environmental effects of projects undertaken on public land or with federal funding. With Executive Order 11593 in 1972, the purview of Section 106 of the NHPA was greatly expanded as agencies were directed to consider effects not just on sites listed on the National Register of Historic Places but on sites that were simply eligible for the National Register of Historic Places, and to develop standards for determining eligibility (King 2004). Since that time, many private-sector CRM firms have been formed to help government agencies and, by extension, project proponents, comply with the requirements of NHPA Section 106.

These developments on the regulatory front roughly coincided with a major shift in the theoretical approach of American academic archaeology. This was the advent of the "New Archaeology" in the 1960s, which emphasized understanding the human behaviors represented in the archaeological record as opposed to simply cataloging that record. CRM archaeology helped in the development of the New Archaeology approach by adopting many of its tenets, such as systematic data collection and a concern with implementing scientific research designs (Meltzer et al. 1986). The National Park Service, the Museum of Northern Arizona, and the U of U were all connected through the Interagency Archaeological Salvage Program, which sponsored one of the most important archaeological projects conducted on the Colorado Plateau during this period: the Glen Canyon Dam salvage project. This project, which took place from 1956 to 1963, involved government agencies, museums, universities, tribal members, and many professional archaeologists. It consisted of a survey conducted jointly by the U of U and the Museum of Northern Arizona along the Colorado River and its tributaries. The project started at Hite, at the confluence of the Dirty Devil and Colorado Rivers, and finished in Page, Arizona, the southern extent of the proposed Lake Powell reservoir (Jennings 1998). Within what is now the MFO planning area, areas east of the Colorado River and its tributaries were surveyed.

One result of this project was to bring salvage archaeology to the forefront of archaeological practice in the region. It helped establish protocols for large-scale projects, and the U of U continued to conduct significant excavations in the area, such as at the Coombs Site (42GR383) (Lister and Lister 1961), in Harris Wash in the Escalante drainage (D. D. Fowler 1963), and at several sites around Kanab and St. George (Jennings 1998). These investigations were intended, in part, to build on existing syntheses of the Fremont culture (Aikens 1966; Gunnerson 1969; Morss 1931; Taylor 1957; Wormington 1955). They also resulted in the development of standardized techniques for survey, excavation, and laboratory analysis that archaeologists still employ today. Meanwhile, owing to the project's scope and the flexibility extended to project management by the National Park Service (see Spangler et al. 2010), additional significant work in the region was conducted by both the U of U and the Museum of Northern Arizona. This additional work included three surveys in the San Juan River corridor (Adams and Adams 1959) and a survey of Cedar Mesa (Lipe and Matson 1971).

Most archaeological work in the area since the early 1950s has been done on behalf of one federal agency or another. Salvage excavations were conducted on behalf of the National Park Service at the junction of the north and south forks of Mill Creek, for example, ahead of a planned—but never developed—Plainfield Reservoir in 1960 (Pendergast 1961). Little was found, however, as this was a favorite spot for looters and vandals. To the north, one of the first attempts to reexamine traditional archaeological interpretations of the Tavaputs Plateau was initiated in 1939 by H. Marie Wormington under the auspices of the Denver Museum of Natural History. Her work was synthesized and reported in 1955. It was the first significant interpretation of Fremont material culture since Morss's original definition. Among her many contributions, Wormington reexamined a site in the southern Book Cliffs (simply called *Site 1*) that was previously recorded as a "fort." Wormington rejected the idea of a defensive orientation on the grounds that the structure was vulnerable to attack from above, and, in any event, could not be held for any length of time without inducing a water shortage. This, combined with a lack of middens and diagnostic artifacts, led Wormington to conclude that the site's purpose was probably ceremonial (Spangler 2002:89).

Archaeologist and synthesizer James Gunnerson worked in the Maze District in 1955 and at Dead Horse Point in 1958 (Lucius et al. 1976). Additional studies—one in 1959 by Arches National Monument (before it was designated Arches National Park) and another in 1963 by the U of U—continued investigations in the Needles District, finding significant sites and reinforcing the need for archaeological preservation, which provided further rationale for the creation of Canyonlands National Park. As more lands were inventoried, concern for the preservation of cultural resources was growing among the

agencies and the public. Multiple small efforts, such as the Interagency Archaeological Salvage Program of 1957, were established to create some protection; however, because these programs were not unified and often were limited to one specific genus of work, they created little overall protection to significant cultural resources.

Meanwhile, as a result of legislation like NEPA and the NHPA, most federal agencies in the region have adopted a policy of avoidance rather than salvage of cultural resources, necessitating inventory ahead of land-disturbing activities. Most of these projects provide important information without being actual research projects, although the data gathered can be accessed and used by researchers. Under these terms, the BLM had the Four Corners-Huntington Power Line surveyed in 1970, the Dolores Triangle surveyed ahead of chaining in 1967 by Brigham Young University, Seven Mile Mesa surveyed in 1974, the Dolores River Canyon surveyed by David Breternitz in 1975, and numerous other such projects besides.

The U.S. Forest Service commenced surveys similar to those of the BLM during this time and for many of the same reasons. A 1976 survey by BLM personnel ahead of a chaining project in the Two Mile Creek area provided land managers with alternatives to destroying or salvaging cultural resources present in the project area. Dee Green and Evan DeBloois did a similar survey in 1970 of the Slaughter Flats, Amasa Back, and Dorry Ridge areas. They used the opportunity to develop a predictive research design involving statistical analyses, employed most notably on Elk Ridge (D. F. Green 1974). They also developed another research project in order to analyze the extent to which bulldozers destroy archaeological sites (DeBloois et al. [ca. 1975]).

The National Park Service also commenced a number of similar resource inventories during this time. Floyd Sharrock directed a survey of the Needles and Island in the Sky Districts of Canyonlands National Park in 1965 and 1966. Michael Berry directed a similar inventory and survey in Arches National Park in 1974. Berry also used data and material previously gathered by other researchers and park personnel to provide the National Park Service with an excellent local chronology and summary of the resources present. Additional cultural resource inventories conducted in or pertaining to Canyonlands National Park during this time period included an impressive effort by Richard A. Thompson to apply strictly quantitative methods that include site density predictions for the Beef Basin, Indian Creek, and Castle Valley planning units based on stratified sampling and environmental characteristics (Thompson 1978:163–164). Thompson's analysis predicts that the greatest number of sites per square mile are likely to be found in the Beef Basin unit, and subsequent inventories (e.g., Pierson 1980) have borne his prediction out.

Meanwhile, universities continued to sponsor field schools. Preliminary surveys of Cowboy Cave were conducted in 1973, leading to excavations under the direction of U of U Professor Jesse D. Jennings and his assistant, Alan R. Schroedl, during the summer of 1975 (Jennings 1980:3; Murphy 1999:27). Further research conducted two decades later, in conjunction with the data recovered in the mid-1970s (which ranged from lithic artifacts and debitage to fiber artifacts and figurines), determined that Cowboy Cave was occupied over most of the Archaic Period (7400 B.C–A.D. 650) (Jennings 1980; Murphy 1999:28–32). This research would help solidify the understanding of the site's place within the chronological time periods of the upper Colorado Plateau region.

Field schools and inventories run by universities focused on synthesizing and understanding all aspects of prehistoric lifeways in Utah, and these efforts started to become the baseline for historic contexts and research designs employed in later work conducted in the 1980s (Aikens 1966; Holmer 1978; Jennings 1978). Additionally, the first sets of excavations done on the prominent Backhoe Village (42Sv662) site began at this time (Madsen and Lindsay 1977). This is a large site that has provided much important information about the Fremont and that continues to be prominent in research today (Coltrain and Leavitt 2002; Seddon 2001; Simms 1986).

In the time between the early 1980s and the publication of this report, nearly 2,500 cultural resource inventories have been conducted in the MFO planning area, covering some 300,000 acres. The number of projects has steadily increased during the intervening time, with the overwhelming majority having been conducted by private CRM firms like Alpine Archaeological Consultants, Montgomery Archaeological Consultants Inc., and SWCA Environmental Consultants (SWCA).

The proportion of projects conducted by educational institutions dropped considerably in the 1980s. Instead, increasing numbers of construction and development projects precipitated a greater need for cultural resource inventories for NHPA Section 106 compliance, including the implementation of predictive models. In 1980, for example, the CRM firm Nickens and Associates conducted a sample-oriented cultural resource inventory of 140,960 acres in Grand County to define areas with low potential for cultural resources (Reed and Nickens 1980). One of the outcomes of their efforts was defining an area where site density was low enough to render project-specific cultural resource clearances unnecessary. The area was examined again in 1984 by archaeologists with Goodson and Associates, Inc., who conducted a Class II survey and predictive model (Bradley et al. 1984). They conducted a sample-oriented survey of 80,000 acres, initially scoped to cover a 10 percent, unstratified random sample, but the survey was modified to 5 percent when it was discovered that site density was much higher than anticipated from literature review. Their predictive model included an analysis of relationships between environmental variables and concomitant likelihood of archaeological sites, a method still employed in cultural resource inventories.

The 1980s also marked the commencement of a significant number of projects related to hazardous fuels and wildfire management, a major impetus for cultural resource inventories to this day. In 1989, for example, the Grand River Institute conducted a reconnaissance survey on 583 acres in the Ryan Creek area and 1,116 acres in the Diamond Peak area for fire rehabilitation efforts. A later and more illustrative example is the 2008 Black Ridge Fuels Treatment Project, in which the CRM firm Logan Simpson was contracted to perform Class II and Class III cultural resource surveys on 3,041 acres of BLM land ahead of hazardous fuels reduction treatments in the MFO planning area (Mullins et al. 2008). The project resulted in the identification of nearly 150 archaeological sites (16 of which were recommended as eligible for the National Register of Historic Places), and a strategy of avoidance was recommended. This exemplifies the types of inventories conducted as a part of NHPA Section 106 compliance associated with wildfire management and hazardous fuels reduction in this arid region.

Private-sector CRM archaeology was fully established in the region by the 1990s. Multiple federal undertakings were conducted, and many new CRM firms started to appear. The Class I dataset, compiled by SWCA, indicates that the number of inventory projects conducted in the MFO planning area increased even more in the 1990s, with at least 14 major (500+ acres) projects completed from 1990 to 1999. Most of these projects were conducted by CRM firms. Significant research resulting in important archaeological knowledge was also conducted by universities during the 1990s, notable among which is Utah State University's archaeological field school. A cooperative agreement between Utah State University and the Manti-La Sal National Forest supported several seasons of fieldwork at the Coombs Cave Site (42GR383) east of Moab. Excavation was conducted within the cave itself, and pedestrian survey was conducted for a large portion of the pinyon-juniper flat below the cave. Similar field schools and cooperative research projects were being conducted at the same time by Catherine Cameron of the University of Colorado and Joel Janetski of Brigham Young University in the nearby areas of Bluff and Capital Reef, respectively.

At the start of the new millennium, projects continued to increase in frequency, with at least 33 major (500+ acres) projects completed from 2000 to 2009. Again, most of these projects were conducted by private CRM firms, although the proportion of projects conducted by universities increased relative to the previous decade. In 2001, Utah State University conducted a complete cultural resource inventory on

behalf of the Utah School and Institutional Trust Lands Administration (SITLA) and the Cloudrock Land Company LLC for first stage mitigation ahead of a controversial proposal to build a luxury resort on Johnson's Up-On-Top Mesa near Moab. In 2002, the School and Institutional Trust Lands Administration itself conducted three cultural resource inventories in the MFO planning area. And in 2006, Brigham Young University conducted a complete cultural resource inventory for the Green River Land Exchange. By this time, significant amounts of the MFO planning area had been sampled, but the focus was predominantly on areas of urban development and along roads.

Between 2010 and late 2014, at least 18 major (500+ acres) projects have been completed, most conducted by private CRM firms. None was conducted by a university. Common reasons for these inventories include seismic exploration, hazardous fuels reduction, vegetation improvement, road and travel management, and grazing. Given the trend established by the start of the 2010s, it can be expected that a very large number of inventories covering substantial acreages will be undertaken during the remainder of the decade.

4.1.4 Ethnographers

Most of the ethnographic inquiries conducted in the Great Basin and Colorado Plateau areas begin with various works by Julian Steward. His numerous, in-depth, empirically based ethnographies are essential to developing a comprehensive look into Native American cultures of the region (Steward 1933, 1937, 1940, 1997). Additional baseline data can be gathered from the *Handbook of North American Indians* series (d'Azevedo 1986). Ethnographers also use the diaries of early explorers and their crew members for their observations and accounts of interaction with native groups (see section 4.1.1 [Explorers, Antiquarians, and Early Archaeologists]). Major John Wesley Powell conducted extensive ethnographic investigations during his explorations of the Colorado River and its tributaries, and in 1877 he published *Introduction to the Study of Indian Languages, with Words, Phrases, and Sentences to Be Collected*. In recognition of this and other contributions to the study and understanding of Native American peoples of the intermountain West, Powell was appointed as the first director of the U.S. Bureau of Ethnology,[1] a position he held until his death (McNamee 2016).

Early formal ethnographic research among Native Americans of the American Southwest included investigations by Frank Hamilton Cushing among the Zuni (J. Green et al. 1990), Adolph Bandelier among the Pueblo peoples of northern New Mexico (Keleher and Chant 2009), and James and Matilda Stevenson among both Pueblo peoples and the Navajo (see Stevenson et al. 1987), all of which took place in the late 1800s. In the early 1900s, formal ethnology in the American Southwest was conducted under Archer M. Huntington and colleagues of the American Museum of Natural History, resulting in several publications and a collection of artifacts still housed at the American Museum of Natural History in New York City (Snead 2004). Early archaeologists like A.V. Kidder and Nels Nelson also took a keen interest in the ethnography of the region, recognizing that an understanding of extant Pueblo and nomadic cultures was crucial for investigating and interpreting the archaeological record in this part of the world (Snead 2004:112–118). In the Great Basin, this type of ethnographic analogy also served archaeologists like Jesse Jennings who drew upon the earliest ethnographic work conducted by Julian Steward and his colleagues to help interpret the Great Basin archaeological record (Jennings 1957). Great Basin archaeology now relies more on ethnoarchaeology and behavioral ecology for interpretation of the material record (e.g., O'Connell 1975), but, in the Southwest, archaeologists continue to rely on historic and modern ethnography (Lekson 2009).

1 Ethno*graphy* is the collection and presentation of data about a particular group of people. Ethno*logy* is the systemic comparison and analysis of ethnographic datasets. The Bureau of American Ethnology was created and so-named as a federally managed, research-driven unit of the Smithsonian Institution, whose Division of Anthropology had been conducting ethnographies since the earlier 1800s.

Innumerable ethnographic investigations have been conducted among the Native American tribes claiming cultural affiliation with the MFO planning area today. Clyde Kluckhohn and Dorothea Leighton published an exhaustive ethnography on the Navajo, titled *The Navaho*, in 1946 (Kluckhohn and Leighton 1962). Information about the Navajo also comes from historic ethnographic work by Hester (1962), Spicer (1961), and Aberle (1967), and from synthetic ethnographic work by Parezo (1996). Ethnographic investigations among the Utes commenced with Steward in the 1930s. Information about the Utes also comes from Opler (1940), Schroeder (1965), and Jorgensen (1972), and from synthetic historical work by McPherson (2011). The Southern Paiute have been studied ethnographically since at least the late 1800s under the direction of Powell (1874), who paid special attention to the Kaibab, Shivwits, and Uinkarets bands to the north and northwest of the Grand Canyon (Weber 1980:25). Ethnographic information about the Southern Paiutes also comes from Gregory (1938), Stewart (1942), and Euler and Fowler (1969), and from modern synthetic work by Fowler and Parezo (1996). Finally, ethnographies of Pueblo peoples are among the oldest and most numerous in the region (e.g., the work by Cushing, Bandelier, and others), and have continued being produced well into the modern era. Cultural affiliation studies related to Pueblo connections to the planning area include Dongoske et al. (1997).

Among more modern ethnographies, one of the most invaluable for investigation of the Native American tribes claiming cultural affiliation with the MFO planning area (see section 5.2 in Chapter 5 Cultural Resource Overview) is Rosemary Sucec's 2006 ethnographic overview and assessment of tribal histories and resource use within Capitol Reef National Park. Sucec provides a detailed discussion of the Hopi, Zuni, Paiute, Ute, and Navajo. Each chapter includes archaeological accounts and tribal origin stories for that tribe. A table at the end of each chapter summarizes the resources, places, and landscapes identified as being associated with Capitol Reef National Park, as well as the special meaning that each holds for the tribe whose history is being told. Existing ethnographic and archaeological reports were examined at various institutions and agency offices across Utah to provide a literature review. The only documented personal memoirs were those of Euro-American settlers; therefore, researchers "conducted interviews with representatives from most of the associated tribes and with local county residents whose ancestors move into the area when Indians were still living there" (Sucec 2006:4).

Meanwhile, on a smaller scale, a 2004 ethnography by Stoffle et al. documents ethnographic interviews conducted by University of Arizona anthropologists with representatives of the Paiute Indian Tribe of Utah in May 2004 (Stoffle et al. 2004:x). Interviews were conducted with members of the Koosharem, Indian Peaks, Cedar City, and Shivwits bands—four of five former tribes that were terminated in the 1950s and reconstituted as one political unit in 1983.

And finally, Stoffle and additional University of Arizona colleagues conducted another ethnographic study on behalf of the National Park Service for Arches National Park, in 2016, to investigate and assess cultural affiliation and usage by modern Hopi, Zuni, Ute, and Southern Paiute peoples (Stoffle et al. 2016). This report is a recent and very important ethnographic work that pertains directly to the MFO planning area.

Studying native groups in the field is not conducted as often as it once was (mainly because very few groups or individuals still follow traditional lifeways), and the emphasis of current ethnographies includes more historical research and analysis of past ethnographers' data. However, oral interviews are still conducted and are an important tool for the Section 106 process, as documented by the ethnographic work of Sucec (Sucec 2006) and Stoffle et al. (2004).

4.2 Survey Coverage

Archaeological surveys have been conducted in many individual locations within the 2.9-million-acre MFO planning area. As discussed above, cultural resource investigations in one form or another have been taking place in the area since the eighteenth century explorations of Spanish missionaries. Documentation by trappers, traders, explorers, and early archaeologists has provided a wealth of valuable, if generalized, information about the region as well. The amount of institutional archaeological research that came later reveals "a sporadic but continual interest in the cultural resources" of the area (Spangler 2002), which has only increased over time with governmental legislation aimed at protecting resources and the resulting growth of archaeology as a field.

The data compiled for this Class I inventory indicate that 294,592 acres of the 2,856,424 total acres in the MFO planning area have been covered by at least one cultural resources project. The distribution of archaeological surveys (intensive-level and reconnaissance) in the MFO planning area is shown in Figure 4-1. Projects classified in CURES data as "complete inventories" or identified as such during SWCA's data collection for this project (see Chapter 2 Study Area Inventory) encompass 249,324 acres; these 1,997 projects are likely mostly intensive-level inventories. An additional 181 projects are intuitive or reconnaissance inventories; these encompass an additional 47,083 acres that have been at least partially inventoried. Two hundred- thirty nine of the projects identified in the data collected for this project have an unknown method (covering 5,592 acres), and 48 projects (covering 1,418 acres) are data recovery or other types of non-inventory projects. Most of the previous projects (1,511 projects covering 171,865 acres) are included in the predictive model that is presented in Chapter 8 Moab Field Office Planning Area Predictive Model and Future Inventory Strategy. These details are summarized in Table 4-1.

Table 4-1. Previous Project Types and Coverage

Project Type	Count	Acres*
Complete inventory†	1,997	249,324
Intuitive inventory‡	181	47,083
Other	48	1,418
Unknown	239	5,592
Total	**2,465**	**303,417**
Included in Predictive Model§	**1,511**	**171,865**

*All points and lines were buffered by 1 meter.

†Complete inventories are surveys conducted at an intensive or Class III level.

‡Intuitive inventories are surveys conducted at a reconnaissance, Class I, or Class II level.

§This consists of all intensive-level projects post-1985.

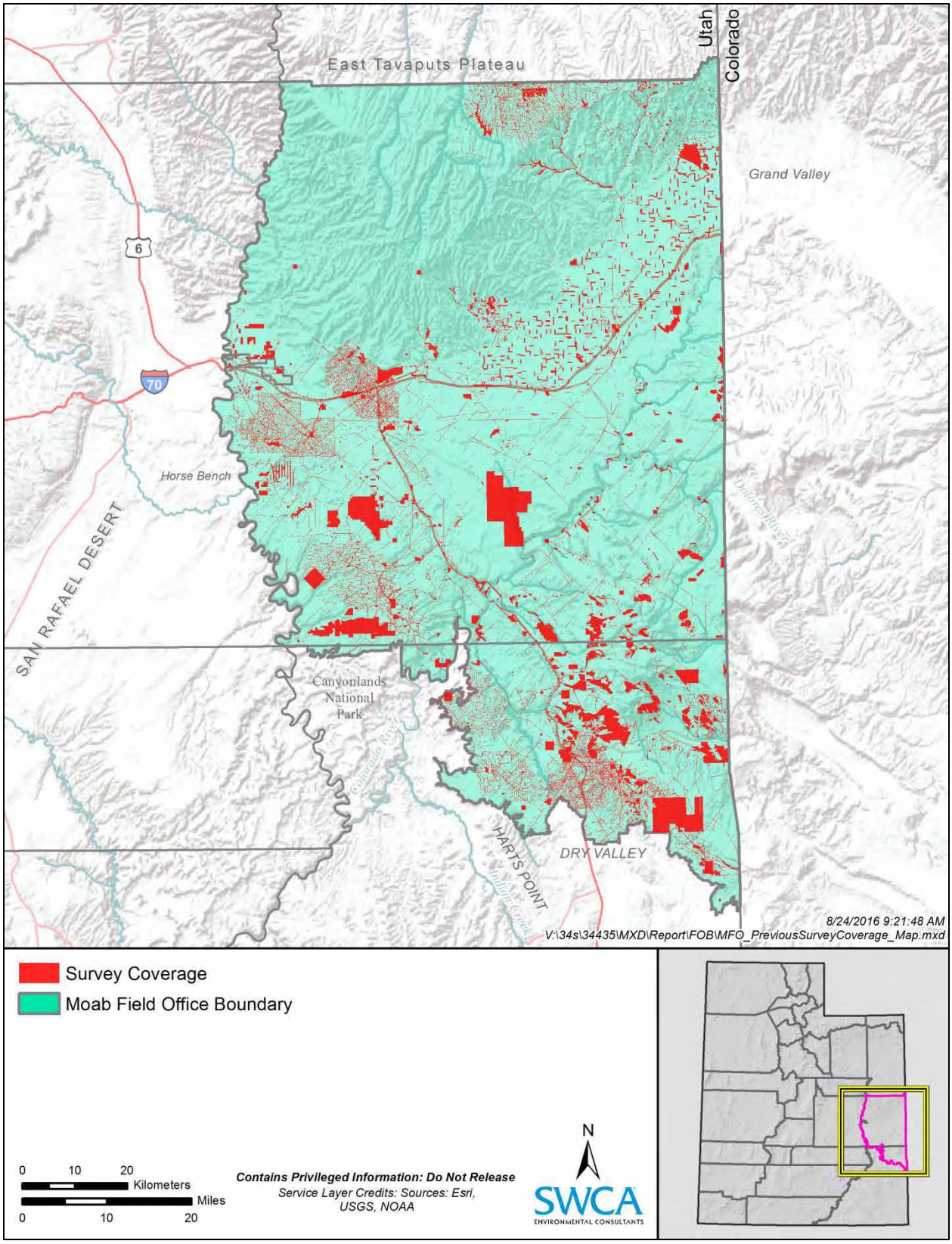


Figure 4-1. Previous survey coverage in the MFO planning area.

4.3 Present Research Emphases

While the proliferation of cultural resource inventories—and concomitant number of cultural resources documented—within the MFO planning area are increasing, critics have suggested that many of the archaeological projects conducted by CRM firms serve only to expand the gray literature and are not truly adding useful information about the area's past. Some authors (e.g., D. D. Fowler 1986) charge that the business side of CRM has created a large accumulation of site documentation and data gathering with little regard for any synthetic research goals (see also contributions in Sebastian and Lipe 2010). An important goal of SWCA's Class I report is to summarize and address some of the current research emphases in this area to facilitate and encourage their development.

As mentioned in section 4.1.3 (Salvage Archaeology and the Birth of Cultural Resources Management), a major impetus and source of funding for current resource inventories in the MFO planning area is the management of wildfire and hazardous fuels. Direct and indirect impacts to archaeological resources can occur as a result of prescribed burns and wildfire suppression activities. Alterations to the physical landscape due to burning or hazardous fuels reduction can include changes to ground cover density and increased snowmelt and frost heave, which can negatively affect archaeological sites as a result of soil deflation and erosion by wind and rain on materials that were not so openly exposed in the past. Reduction of cover can also expose archaeological sites to vandals and looters. Meanwhile, fire itself can have obvious deleterious effects on archaeological sites, including fire-cracking rock, altering the chemical composition of some stone tool material types (e.g., giving chert tools the appearance of having been fire-treated), and, of course, total destroying perishable materials like maize cobs and roof beams. Understanding the effects of fire on archaeological materials and the effects of fire prevention and treatment measures has been the focus of project-derived research reports such as Johnson's (2004) *Archaeological Sites and Fire-Induced Changes* for the Ashley National Forest. More locally, a focus on such knowledge has guided efforts like preparation of the MFO fire management plan (Bureau of Land Management 1998) and employment of fire archaeologists, whose principal role is to understand and minimize these impacts.

Another ongoing preservation concern in the MFO planning area is grazing. In the mid-1980s, National Park Service archaeologists studied the effects of livestock grazing on archaeological resources in Capitol Reef National Park by examining an assemblage of existing and experimental artifact plots during a 10-month episode of grazing (Osborn and Hartley 1986). In the early 1990s, a consortium of conservationists and attorneys cited this and similar studies in an effort to disallow grazing on BLM lands in Comb Wash, south of Moab. In 1993 an administrative law judge in the Department of the Interior issued a decision prohibiting the BLM from authorizing grazing on a small but sensitive portion of the Comb Wash Allotment (Feller 1996). Research continues into the effects of grazing on public lands and resources. Loeser et al. (2001) have argued that measurements of the effects of grazing as a function of biomass and vegetative assemblage are too simplistic, and they contend that researchers must frame the grazing debate into an assessment of the best overall socio-economic returns when balanced with environmentally sensitive practices for the Colorado Plateau as a whole.

A third ongoing preservation concern in the MFO planning area is the impact on cultural resources from developed recreational areas. Recreational use of wilderness areas in the Southwest has increased dramatically over the past several decades, precipitating research into human impacts on paleontological, cultural, and historic resources in wilderness areas (e.g., Foti and DeMillion 2004). Recreational usage of public lands has been shown to have exceedingly deleterious effects on archaeological sites (see Nickens et al. 1981 on vandalism; Sampson 2009 on off-highway vehicle usage), and off-highway vehicle usage can be particularly detrimental (Spangler and Yentsch 2008). Research efforts to understand and minimize the effects of public recreational activities on cultural resources represent a perennial inquiry by agencies like the BLM. For example, NHPA Section 106 compliance must be—and is—conducted prior

to the construction of a developed recreation area, but campers and recreationists do not just camp at public facilities and have a tendency to wander, explore, walk pets, and look for unique features. Impacts from developing a site, therefore, often exceed the area of actual disturbance for construction of facilities. BLM personnel continuously work to fund research projects focused on this topic. Related extant research efforts and reports have informed environmental assessments in places like Indian Creek (Bureau of Land Management 2005) and legislation regarding recreational activities in the MFO planning area as a whole (Whitlock 2016).

In terms of academic research, questions about settlement and subsistence patterns during the Fremont and Ancestral Puebloan periods (see Chapter 5) remain compelling reasons to study the archaeological record of the MFO planning area. For example, research by Fawcett and Bright (1996) as part of the Utah State University field school work at Coombs Cave has revealed an ancient agricultural field with linear water control features at high elevation (7,500 feet) just east of Moab. Excavations in the nearby cave recovered many diverse cultigens, and it is believed that during the first millennium A.D. human subsistence in the area varied between the extremes of full reliance on wild species and heavy use of domesticated cultigens. The Moab area forms a borderlands between the prehistoric Fremont and Puebloan traditions, with an ethnic boundary apparently having formed at about A.D. 500, as suggested by distinctive material culture traits. The nature of this relationship is a focus of ongoing investigation (e.g., Cordell and Fowler 2005; Geib 1996; Searcy and Talbot 2016).

Increasing numbers of research efforts in the MFO planning area are funded by independent organizations like the Canyonlands Natural History Association (CNHA). Since 2007, the Moab-based group has funded numerous projects in the region through the Discovery Pool grant program. The program was established to encourage and provide funding for research partnerships between qualified scientists and federal land management agencies in the area, offering renewable research grants of up to $25,000. Recent and ongoing research efforts funded by the Canyonlands Natural History Association that have demonstrable relevance to the archaeology of the MFO planning area include Dr. Laurie Webster's research on perishable artifacts from the Greater Cedar Mesa Area, Tom Windes' continued efforts to document and conduct dendrochronology on prehistoric structural wood throughout southeast Utah, and Bud Turner's multi-spectral image documentation of rock art in the area of Canyonlands National Park (Canyonlands Natural History Association 2016).

Some investigations have become popular with the general public, and there have been ongoing efforts by CRM and agency archaeologists to involve the public with significant finds. The U.S. Forest Service's Passport in Time program, community involvement opportunities, and cultural resource–focused kiosks such as the ones now found in Indian Creek are examples of outreach programs in place. Volunteer organizations are increasingly mounting efforts to involve the public in archaeological and cultural resource preservation, such as the efforts of Project Discovery in Nine Mile Canyon to the north and Wilderness Volunteers Incorporated in Labyrinth Canyon in the MFO planning area. A prime example of involving the public for educational purposes is the creation and maintenance of Fremont State Park, which opened to the public in 1987. Additionally, agencies are increasingly aware of the increase in or potential for vandalism at known sites. Several surveys, such as the Fishlake National Forest Off-Highway Vehicle (OHV) Route Designation Project, have been conducted to document the abuse of cultural resources. In that particular project, the U.S. Forest Service determined that 31 percent of 131 sites had been affected by OHV use. By designating roads for OHV use and by monitoring sites, the U.S. Forest Service hopes to lessen future impacts and prevent continued damage (Leonard et al. 2012). Along these same lines, stabilization projects have increased in number for the fragile resources, especially at highly visited National Park Service sites (Fritz 2009).

4.4 References Cited

Aberle, David F.

1967 A Scale of Alternate Genertaion Terminology. *Southwestern Journal of Anthropology* 23(3):261-276.

Adams, William Y.

1960 *Ninety Years of Glen Canyon Archaeology, 1869-1959*. Bulletin 33, Glen Canyon Series No. 2. Museum of Northern Arizona, Flagstaff.

Adams, William Y. and Nettie K. Adams

1959 *An Inventory of Prehistoric Sites on the Lower San Juan River, Utah*. Museum of Northern Arizona Bulletin No. 31, Glen Canyon Series No. 1. Northern Arizona Society of Science and Art, Flagstaff.

Aikens, C. Melvin

1966 *Fremont Promontory-Plains Relationships, Including a Report of Excavations at the Injun Creek and Bear River No. 1 Sites, Northern Utah*. Anthropological Papers No. 82. University of Utah Press, Salt Lake City.

Baldwin, Gordon C.

1948 Archaeological Survey in Southeastern Utah. *Southwestern Journal of Anthropology* 5(4):393-404.

Barnes, M.

1991 Cattle Drives. *Canyon Legacy* 11:24-26.

Baxter, Jonathon, Sheri Murray Ellis, Robert Herrmann, Gena A. Huffman, Alyssa Jemison, Rachel Orth and Matthew T. Seddon

2001 *Class III Cultural Resource Inventory for the Williams Pipe Line Project, Davis, Salt Lake, Utah, Juab, Sanpete, Carbon, Emery, and Grand Counties, Utah*. SWCA Cultural Resources Report No. 00-25, Vol. 1. Prepared by SWCA Environmental Consultants, Salt Lake City, Utah. Prepared for Williams Pipeline Company. Submitted to Bureau of Land Management, Salt Lake City, Utah. Copies available from Utah State Historic Preservation Office.

Bearnson, Margaret S.

2012 *John Wesley Powell.* In Utah History Encyclopedia. Online ed. University Press, Salt Lake City. Available at: http://www.uen.org/utah_history_encyclopedia/p/POWELL_JOHN.html. Accessed April 11, 2013.

Bishop, M. Guy

1997 *A History of Sevier County*. Utah Centennial County History Series. Utah State Historical Society, Salt Lake City.

Bradley, John E., William R. Killam, George R. Burns and Marilyn A. Martorano

1984 *A Class II Survey and Predictive Model of Selected Areas in the Cisco Desert, Grand County Utah*. Prepared by Goodson and Associates, Inc. Copies available from the Utah Division of State History, Salt Lake City and the Bureau of Land Management, Moab Field Office, Moab, Utah.

Brew, John O. (editor)

1946 *Archaeology of Alkali Ridge, Southeastern Utah* Vol. 1. Papers of the Peabody Museum of American Archaeology and Ethnography.

Bureau of Land Management

1998 *Moab Field Office Area Fire Management Plan*. Copies available from the Bureau of Land Management, Moab Field Office, Moab, Utah.

2005 *Finding of No Significant Impact and Decision Record: Environmental Assessment UT-090-00-47, Indian Creek Corridor Plan and EA, Monticello Field Office*. Copies available from the U.S. Bureau of Land Management, Monticello Field Office, Monticello, Utah and available online a http://www.blm.gov/style/medialib/blm/ut/monticello_fo/recreation/indian_creek_corridor.Par.88741.File.dat/IC%20EA%20&%20FONSI.pdf.

Canyonlands Natural History Association

2016 Discovery Pool. Available at: https://www.cnha.org/discovery-pool/. Accessed April 12, 2016.

Coltrain, Joan B. and Steven W. Leavitt

2002 Climate and Diet in Fremont Prehistory: Economic Variability and Abandonment of Maize Agriculture in the Great Salt Lake Basin. *American Antiquity* 67(3):453–485.

Cordell, Linda S. and Don D. Fowler

2005 *Southwest Archaeology in the Twentieth Century*. University of Utah Press, Salt Lake City.

d'Azevedo, W. L. (editor)

1986 *Great Basin*. Handbook of North American Indians, Vol. 11, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

DeBloois, Evan I., Dee F. Green and Henry G. Wylie

[ca. 1975] *A Test of the Impact of Pinyon-Juniper Chaining on Archaeological Sites*, Ogden, Utah. Copies available from the U.S. Forest Service, Intermountain Region, Ogden, Utah.

Dongoske, Kurt E., Michael Yeatts, Roger Anyon and T. J. Ferguson

1997 Archaeological Cultures and Cultural Affiliation: Hopu and Zuni Perspectives in the American Southwest. *American Antiquity* 62(4):600-608.

Euler, Robert C. and Don D. Fowler

1969 *John Wesley Powell and the Anthropology of the Canyon Country*. U.S. Geological Survey Professional Paper 670. U.S. Government Printing Office, Washington, D.C.

Fawcett, William B. and Jason R. Bright

1996 Prehistoric Agriculture at High Altitude on the Northern Colorado Plateau. In *Proceedings of the Third Biennial Conference of Research on the Colorado Plateau*. U.S. Geological Survey, Washington, D.C.

Feller, Joseph M.

1996 The Comb Wash Case: The Rule of Law Comes to the Public Rangelands. *Public Land and Resources Law Review* 17:25-54.

Firmage, Richard A.

1996 *A History of Grand County*. Utah Centennial County History Series. Utah State Historical Society, Salt Lake City.

Foti, Pamela E. and Marcy A. DeMillion

2004 Human Impact Inventories on the Grand Canyon-Parashant, Vermillion Cliffs, and Grand Staircase-Escalante National Monuments. In *The Colorado Plateau: Cultural, Biological, and Physical Research*, edited by Charles van Riper and Kenneth L. Cole. University of Arizona Press, Tucson.

Fowler, Catherine S. and Nancy J. Parezo

1996 The Ningwi (Southern Paiutes): The People of the Northwestern Frontier. In *Paths of Life: American Indians of the Southwest and Northern Mexico*, edited by Thomas E. Sheridan and Nancy J. Parezo. University of Arizona Press, Tucson.

Fowler, Don D.

1963 *1961 Excavations, Harris Wash, Utah*. University of Utah Anthropological Papers No. 64 (Glen Canyon Series No. 6). University of Utah Press, Salt Lake City.

1986 Cultural Resource Management in the Great Basin: What Have We Learned? In *Anthropology of the Desert West*, edited by C. J. Condie and D. D. Fowler, pp. 171–178. University of Utah Anthropological Papers No. 110. University of Utah Press, Salt Lake City.

2010 *A Laboratory for Anthropology: Science and Romanticism in the American Southwest, 1846-1930*. University of Utah Press, Salt Lake City.

Fritz, Noreen

2009 *Stabilization of the Historic Fort Bottom Cabin and River Corridor Vanishing Treasures Stabilization and Documentation Project*. Prepared by Canyonlands National Park Service, Southeast Utah Group. Copies available from Utah State Preservation Office, Salt Lake City.

Geib, Phil R.

1996 *Glen Canyon Revisited*. University of Utah Press Anthropological Papers No. 119, No. 119. University of Utah Press, Salt Lake City.

Green, Dee F.

1974 *Lithic Sites of the La Sal Mountains, Southeastern Utah*. Archaeological Report No. 3. Copies available from the U.S. Forest Service, Intermountain Region, Ogden, Utah.

Green, Jesse, Sharon W. Green and Frank Cushing

1990 *Cushing at Zuni: The Correspondence and Journals of Frank Hamilton Cushing, 1879-1884*. University of New Mexico Press, Albuquerque.

Gregory, Herbert E.

1938 *The San Juan Country: A Geographic and Geologic Reconnaissance of Southeastern Utah*. U.S. Geological Survey Professional Paper 188. U.S. Government Printing Office, Washington, D.C.

Gunnerson, James H.

1969 *The Fremont Culture A Study in Culture Dynamics on the Northern Anasazi Frontier Including the Report of the Claflin-Emerson Expedition of the Peabody Museum*. 2009. University of Utah Press, Salt Lake City, Utah.

Hester, James J.

1962 *Early Navajo Migrations and Acculturation in the Southwest*. Museum of New Mexico Papers in Anthropology Vol. No. 6. Museum of New Mexico Press, Santa Fe, NM.

Hill, Joseph J.

1930 Spanish and Mexican Exploration and Trade Northwest from New Mexico into the Great Basin 1765-1863. *Utah Historical Quarterly* 3(1):2-23.

Holmer, Richard N.

1978 A Mathematical Typology for Archaic Projectile Points of the Eastern Great Basin. Unpublished Ph.D. dissertation, Department of Anthropology, University of Utah, Salt Lake City.

Hunt, Alice P.

1953 *Archaeological Survey of the La Sal Mountains Area, Utah*. University of Utah Anthropological Papers No. 14. University of Utah Press, Salt Lake City.

Hunt, Alice P. and Bates Wilson

1952 Archaeological Sites in the Horse Canyon Area, San Juan County, Utah, Unpublished report in the survey files of the Department of Anthropology, University of Utah, Salt Lake City.

Jennings, Jesse D.

1957 *Danger Cave*. University of Utah Anthropological Papers No. 27. University of Utah Press, Salt Lake City.

1978 *Prehistory of Utah and the Eastern Great Basin*. University of Utah Anthropological Papers No. 78. University of Utah Press, Salt Lake City. Originally published 1973.

1980 *Cowboy Cave*. University of Utah Anthropological Papers No. 104. University of Utah Press, Salt Lake City.

1998 *Glen Canyon: An Archaeological Summary*. University of Utah Press, Salt Lake City.

Johnson, Clay

2004 Archaeological Sites and Fire-Induced Changes. In *Ancient and Historic Lifeways in North America's Rocky Mountains: Proceedings of the Rocky Mountain Anthropological Conference, Estes Park, Colorado*, edited by Robert H. Brunswig and William B. Butler. Department of Anthropology, University of Northern Colorado, Greeley.

Jorgensen, Joseph G.

1972 *The Sun Dance Religion*. University of Chicago Press, Chicago, Illinois.

Judd, Neil M.

1926 *Archaeological Observations North of the Rio Colorado*. Bureau of American Ethnology Bulletin No. 82, Washington, D.C.

Keleher, Julie and Elsie Ruth Chant

2009 *The Padre of Isleta*. Sunstone Press, Santa Fe, New Mexico.

King, Thomas F.

2004 *Cultural Resource Laws and Practice: An Introductory Guide*. Second ed. Heritage Resources Management Series. AltaMira Press, New York.

Kluckhohn, Clyde and Dorothea Leighton

1962 *The Navaho*. Revised ed. Doubleday Anchor Press, New York, New York.

Lekson, Stephen H.

2009 *A History of the Ancient Southwest*. School for Advanced Research Press, Santa Fe, New Mexico.

Leonard, Robert D., Wendy L. Stokes and Lydia M. Jakovac

2012 *An Archaeological Survey of the Fishlake National Forest OHV Route Designation Project*. Prepared by Fishlake National Forest, Richfield, Utah. Copies available from Utah Division of State History, Salt Lake City.

Lipe, William D. and R.G. Matson

1971 Human Settlement and Resources in the Cedar Mesa Area. In *The Distribution of Prehistoric Population Aggregations*, edited by G. Gumerman, pp. 126-151. Prescott College Anthropological Papers, No. 1. Prescott College Press, Prescott, Arizona.

Lister, Robert and Florence Lister

1961 *The Coombs Site, Part III Summary and Conclusion*. University of Utah Anthropological Papers No. 41. University of Utah Press, Salt Lake City.

Loeser, Matthew R. R., Thomas D. Sisk, Timothy E. Crews, Kurt Olsen, Craig Moran and Christina Hudenko

2001 Reframing the Grazing Debate: Evaluating Ecological Sustainability and Bioregional Food Production. In *Proceedings of the Fifth Biennial Conference of Research on the Colorado Plateau*, edited by Charles W. van Riper, K. A. Thomas and M. A. Stuart, pp. 3-18. U.S. Geological Survey, Colorado Plateau Field Station, Flagstaff, Arizona.

Lucius, William, P. Hogan and Leonard Losee

1976 Archaeological Investigations in the Maze District Canyonlands National Park, Utah. *Antiquities Section Selected Papers* III(11):75–98.

Madsen, David B. and LaMar W. Lindsay

1977 *Backhoe Village*. Utah Division of State History, Antiquities Section Selected Papers IV. Utah State Historical Society, Salt Lake City.

McNamee, Gregory L.

2016 John Wesley Powell: American Explorer, Geologist, and Ethnologist. Available at: http://www.britannica.com/biography/John-Wesley-Powell. Accessed June 11, 2016.

McNitt, Frank

1966 *Richard Wetherill: Anasazi*. University of New Mexico Press, Albuquerque.

McPherson, Robert S.

2011 *As if the Land Owned Us: An Ethnohistory of the White Mesa Utes*. University of Utah Press, Salt Lake City.

Meltzer, D. J., D. D. Fowler and J. A. Sabloff (editors)

1986 *American Archaeology Past and Future*. Smithsonian Institution Press, Washington D.C.

Morss, Noel

1931 *The Ancient Culture of the Fremont River in Utah: Report on the Explorations under the Claflin-Emerson Fund, 1928-1929*. Originally Papers of the Peabody Museum of American Archaeology and Ethnology 12(2). 2009. University of Utah Press, Salt Lake City, Utah.

Mullins, Daniel, Mark Karpinski, Jesse Adams, Nate Nelson, Jason Dabling, Elizabeth Karpinski, Ashley Grimes and Nicole Herzog-Adams

2008 *A Cultural Resources Survey of 9,080 Acres for the Black Ridge Fuels Treatment Project, San Juan County, Utah*. Prepared by Logan Simpson Design, Inc., Salt Lake City, Utah. Copies available from the Utah Division of State History, Salt Lake City and the Bureau of Land Management, Moab Field Office, Moab, Utah.

Murphy, Miriam B.

1999 *A History of Wayne County*. Utah Centennial County History Series. Utah State Historical Society, Salt Lake City, Utah.

National Park Service

2001 *Old Spanish Trail National Historic Trail Feasibility Study and Environmental Assessment*, Denver, Colorado. Copies available from the National Park Service. Also available online at https://parkplanning.nps.gov/document.cfm?parkID=454&projectID=12591&documentID=38207.

2015 National Register Information System. Electronic document. Available at: http://nrhp.focus.nps.gov/natreg/docs/All_Data.html. Accessed January 7, 2015.

Nickens, Paul R., Signa L. Larralde and Gordon C. Tucker Jr.

1981 *A Survey of Vandalism to Archaeological Resources in Southern Colorado*. Bureau of Land Management Colorado Cultural Resources Series No. 11, Montrose, Colorado. Copies available from Bureau of Land Management, Montrose District, Montrose, Colorado.

O'Connell, James F.

1975 *The Prehistory of Surprise Valley*. Anthropological Papers 4. Ballena Press, Romona, California.

Ogden, Peter Skene

1950 Peter Skene Ogden's Snake Country Journals, 1824–25 and 1825–26. In *Publications of Hudson's Bay Record Society*, edited by E. E. Rich and A. M. Johnson, Vol. 13. Hudson's Bay Record Society, London.

Opler, Marvin K.

1940 The Southern Ute of Colorado. In *Acculturation in Seven American Indian Tribes*, edited by Ralph Linton. Harper and Sons, New York, New York.

Osborn, Alan J. and Ralph J. Hartley

1986 Adverse Effects of Domestic Livestock Grazing on the Archaeological Resources of Capitol Reef National Park, Utah. In *Proceedings of the First Biennial Conference of Research on Colorado Plateau National Parks*. U.S. Geological Survey, Washington, D.C.

Parezo, Nancy J.

1996 The Diné (Navajos): Sheep is Life. In *Paths of Life: American Indians of the Southwest and Northern Mexico*, edited by Thomas E. Sheridan and Nancy J. Parezo. University of Arizona Press, Tucson.

Pendergast, David M.

1961 USAS-UCRBASP Joint Excavations in the Plainfield Reservoir. *Utah Archaeology: A Newsletter* 7(3):15-21.

Pierson, Lloyd M.

1980 *Cultural Resource Summary of the East Central Portion of Moab District 1980*. Cultural Resource Series. Vol. Cultural Resource Series No. 10. Bureau of Land Management, Utah State Office., Salt Lake City.

Poll, Richard D., Thomas G. Alexander, Eugene E. Campbell and David E. Miller

1989 *Utah's History*. Utah State University Press, Logan.

Powell, John Wesley

1874 *Report of the Explorations in 1873 of the Colorado of the West and its Tributaries*. U.S. Government Printing Office, Washington, D.C.

Reed, Alan D. and Paul R. Nickens

1980 *The Cisco Cultural Resource Study: A Sample-Oriented Inventory, East-Central Utah*. Prepared by Nickens and Assoicates, Montrose, Colorado. Copies available from the Utah Division of State History, Salt Lake City.

Rudy, Jack R.

1955 *Archaeological Excavations in Beef Basin, Utah*. University of Utah Anthropological Papers No. 20. University of Utah Press, Salt Lake City, Utah.

Sampson, Michael P.

2009 The Effects of Off-Highway Vehicles on the Cultural Resources of Red Rock Canyon State Park, California. *Proceedings of the Society for California Archaeology* 21:190-201.

Schroeder, Albert H.

1965 A Brief History of the Southern Utes. *Southwestern Lore* 30(4):53-78.

Searcy, Michael T. and Richard K. Talbot

2016 Late Fremont Cultural Identities and Borderland Processes. In *Late Holocene Research on Foragers and Farmers in the Desert West*, edited by Barbara J. Roth and Maxine E. McBrinn. University of Utah Press, Salt Lake City.

Sebastian, Lynne and William D. Lipe (editors)

2010 *Archaeology & Cultural Resource Management: Visions for the Future*. 1 ed. School for Advanced Research advanced seminar series. School for Advanced Research Press, Santa Fe.

Seddon, Matthew T.

2001 *Fremont Site Complexity at Backhoe Village: Results of Discovery Excavations and Data Analysis at the Utah Army National Guard Vehicle Maintenance Facility within Backhoe Village (42Sv662) in Richfield, Sevier County, Utah*. SWCA Cultural Resources Report No. 00-27. Prepared by SWCA Environmental Consultants, Salt Lake City, Utah. Prepared for Utah National Guard.

Sharrock, Floyd W. and Edward G. Keene

1962 *Carnegie Museum Collections from Southeastern Utah*. University of Utah Anthropological Papers No. 57. University of Utah Press, Salt Lake City.

Simms, Steven R.

1986 New Evidence for Fremont Adaptive Diversity. *Journal of California and Great Basin Anthropology* 8(2):4–5, 204–216.

Snead, James E.

2004 *Ruins and Rivals: The Making of Southwest Archaeology*. University of Arizona Press, Tucson.

Spangler, Jerry D.

1995 *Paradigms and Perspectives: A Class I Overview of Cultural Resources in the Uinta Basin and Tavaputs Plateau, Vol. 2 and 3*. Uinta Research, Salt Lake City, Utah.

2002 *Paradigms and Perspectives Revisited: A Class I Overview of Cultural Resources in the Uinta Basin and Tavaputs Plateau.* Prepared by Jerry D. Spangler, Uinta Research, Salt Lake City, Utah. Submitted to Bureau of Land Management, Vernal District, Vernal, Utah. Copies available from Uinta Research, Ogden, Utah.

Spangler, Jerry D. and Andrew Yentsch

2008 *Final Report: Baseline Site Condition and Vandalism Assessments of Archaeological Sites in Tenmile Canyon, Grand County, Utah*. Prepared by Colorado Plateau Archaeological Alliance, Ogden, Utah, Ogden, Utah. Copies available from Utah Division of State History, Salt Lake City and online at: http://suwa.org/app/uploads/10_Mile_Final_Web_Version.pdf.

Spangler, Jerry D., Andrew T. Yentsch and Rachelle Green

2010 *Farming and Foraging on the Southwestern Frontier: An Overview of Previous Research of the Archaeological and Historical Resources of the Greater Cedar Mesa Area* Vol. 9, no. 18. Utah Division of State History, Salt Lake City. Also avabilable online at https://research.libraries.wsu.edu/xmlui/handle/2376/2643.

Spicer, Edward H.

1961 *Navajo: Perspectives in American Culture Change*. University of Chicago Press, Chicago, Illinois.

Stevenson, Matilda Coxe, Richard A.V. Ahlstrom and Nancy J. Parezo

1987 Dress and Adornment of the Pueblo Indians. *Kiva: The Journal of Southwestern Anthropology and History* 52(4):275-312.

Steward, Julian H.

1933 *Archaeological Problems of the Northern Periphery of the Southwest*. Museum of Northern Arizona Bulletin No. 5. Museum of Northern Arizona, Flagstaff.

1937 Linguistic Distributions and Political Groups of the Great Basin Shoshoneans. *American Anthropologist* 39:625–634.

1940 Native Cultures of the Intermontane (Great Basin) Area. In *Essays in Historic Anthropology of North America, Published in Honor of John R. Swanton*, pp. 445–502. Smithsonian Miscellaneous Collections No. 100, Washington, D.C.

1997 *Basin-Plateau Aboriginal Sociopolitical Groups*. Bureau of American Ethnology Bulletin No. 120, Smithsonian Institution. Reprinted. University of Utah Press, Salt Lake City. Originally published 1938.

Stewart, Omer C.

1942 Culture Element Distributions, XVIII: Ute-Southern Paiute. *University of California Anthropological Records* 6(4):231–356.

Stoffle, Richard W., Kathleen A. Van Vlack and Fletcher Chmara-Huff

2004 *Quitchupah Creek Ethnographic Study For the Proposed Quitchupah Creek Coal Haul Road*. Prepared by Bureau of Applied Research in Anthropology, University of Arizona, Tucson, Arizona. Submitted to Bureau of Land Management, Richfield Field Office, Richfield, Utah and the U.S. Forest Service, Fishlake National Forest. Copies available from Bureau of Land Management, Richfield Field Office, Richfield, Utah.

Stoffle, Richard W., Evelyn Pickering, Katherine Brooks, Kathleen Van Vlack and Christopher Sittler

2016 *Ethnographic Overview and Assessment for Arches National Park*. Final Report Draft January 2016. Copies available from the Bureau of Applied Research in Anthropology, School of Anthropology, University of Arizona, Tucson.

Sucec, Rosemary

2006 *Fulfilling Destinies, Sustaining Lives: The Landscape of Waterpocket Fold*. National Park Service and U.S. Department of the Interior, Denver, Colorado.

Taylor, Dee C.

1957 *Two Fremont Sites and Their Position in Southwestern Prehistory*. University of Utah Anthropological Papers No. 29. University of Utah Press, Salt Lake City.

Thompson, Richard A.

1978 *A Stratified Random Sample of the Cultural Resources in the Canyonlands Section of the Moab District*. Cultural Resource Series No. 1. Bureau of Land Management, Utah State Office, Salt Lake City, Utah.

Warner, T. J. (editor)

1976 *The Dominguez-Escalante Journal: Their Expedition Through Colorado, Utah, Arizona, and New Mexico in 1776*. University of Utah, Salt Lake City.

Weber, Kenneth R.

1980 *Cultural Resource Narrative for Class I Cultural Resources Inventory for BLM Lands in South San Juan County, Utah*. Prepared by Centuries Research Inc., Montrose, Colorado. Copies available from Bureau of Land Management, Moab Field Office, Moab, Utah.

Whitlock, Jenna

2016 Final Supplementary Rules for Public Lands Managed by the Moab and Monticello Field Offices in Grand and San Juan Counties, Utah. *Federal Register* 81(37):9498-9505.

Woodbury, Richard B.

1990 Obituary: John Otis Brew, 1906-1988. *American Antiquity* 55:453.

Wormington, H. M.

1955 *A Reappraisal of the Fremont Culture: With a Summary of the Northern Periphery*. Proceedings of the Denver Museum of Natural History, Denver, Colorado.

CHAPTER 5. CULTURAL RESOURCE OVERVIEW

Ralph Burrillo and Stephanie Lechert

More than a century of research in the MFO planning area and the surrounding region has provided researchers with a wealth of information on the lifeways and cultural traditions of southeastern Utah. Much of this received wisdom is described and summarized in culture history sections of archaeological survey and excavation reports, in an occasional regionally specific archaeology or history textbook, and in peer-reviewed journal articles. The primary objective of this chapter is to provide a summary of this century of accumulated knowledge, organized as a regional culture history, in an effort to provide a broad, regional context for the more specific and analytical chapters that follow. The chapter summarizes 1) the prehistory of the region, or the time before Euro-American exploration and settlement; 2) the lifeways of Native Americans in the area at the time of Euro-American contact and since then; and 3) the history of Euro-Americans here. For prehistory, because the planning area represented a prehistoric borderland between the Fremont and Ancestral Puebloan material cultures, an attempt has been made to use both Great Basin and Pueblo/Pecos Classification (after Kidder 1927) culture phase sequences.

5.1 Prehistoric Cultural Sequence and Lifeways

Current archaeological evidence indicates that people first arrived in the eastern Great Basin and northern Colorado Plateau approximately 13,000 years ago, near the end of the last ice age during the terminal Pleistocene. The region has since been inhabited by a variety of prehistoric groups, Native American tribes that were encountered by Euro-American explorers, and those who currently call this portion of Utah their home. Over the last 13,000 years, the lifestyles of the people inhabiting the region have varied widely; archaeologists have determined this by studying their diets, the structures they built, the types of tools they made, and the objects they owned.

There are four broad prehistoric periods in the eastern Great Basin and northern Colorado Plateau: the Paleoindian, the Archaic, the Formative, and the Protohistoric (Table 5-1). The Protohistoric period ended when Euro-American explorers and settlers arrived in the region; their arrival marks the beginning of the Historic period. These cultural periods and the ways people lived during them are summarized in the sections that follow.

Table 5-1. Prehistoric Cultural Chronology for the Planning Area

Period	Dates
Protohistoric	A.D. 1450–1850
Formative	500 B.C.–A.D. 1450
Archaic	ca. 8,000–2,500 RCYBP
Paleoindian	>11,000–8,000 RCYBP

Note: RCYBP = radiocarbon years before present.

5.1.1 Paleoindian Hunters and Foragers of Southeast Utah

As is the case throughout North America, the earliest compelling evidence for a human presence in the Great Basin and northern Colorado Plateau dates to just before 11,000 B.P. or approximately 13,000 calendar years ago (Beck and Jones 1997; see Gilbert et al. 2008, for recently discovered earlier evidence

from the western Great Basin; Graf and Schmitt 2007; Janetski et al. 2012; Louderback 2014). The Paleoindian period represents adaptations to terminal Pleistocene environments and is characterized by small groups of relatively mobile foragers who used most sites only briefly or infrequently.

The Pleistocene environment of the Colorado Plateau and adjacent Great Basin differed in several key ways from that of the modern era (D. B. Madsen et al. 2005). On average, temperatures were 3°C to 5°C cooler and precipitation levels were 35 to 120 percent higher than today, as suggested by the elevational gradients of plant communities being lowered by as much as 800 m in parts of the Colorado Plateau (Anderson 1993; Betancourt 1984; Betancourt et al. 1990; K. L. Cole 1990). On the Colorado Plateau, mountain glaciers were present on most of the highest elevations, including the Aquarius, Fish Lake, and Thousand Lake Plateaus and the La Sal Mountains, the San Francisco Peaks, and the White Mountains, with deglaciation occurring during the terminal Pleistocene (Anderson et al. 1999; Flint and Denny 1958; D. B. Madsen and Currey 1979; Merrill and Pewe 1977; Pewe and Updike 1976; Richmond 1962).

During the terminal Pleistocene on the Colorado Plateau, subalpine and montane communities containing limber pine (*Pinus flexilus*), Douglas-fir (*Pseudotsuga menziesii*), blue spruce (*Picea pungens*), white fir (*Abies concolor*), Rocky Mountain juniper (*Juniperus scopulorum*), and common juniper (*J. communis*) dominated the elevations where woodland communities occur today, growing directly above Utah juniper (*J. osteosperma*) woodland and desertscrub communities (Betancourt et al. 1990; Thompson et al. 1993). Limber pine dominated plant communities at elevations where modern pinyon-juniper communities currently exist, and Colorado and two-needle pinyon pine (*P. edulis*) and Rocky Mountain juniper grew together at elevations that now support modern desertscrub communities south of the Grand Canyon (Betancourt et al. 1990). Ponderosa pine (*P. ponderosa*) and pinyon pine were displaced to the south at the time of the last glacial maximum, with pinyon pine expanding northward onto the Colorado Plateau during the Bolling and Allerod intervals (Cinnamon 1988; K. L. Cole et al. 2013). In addition, riparian and montane plants inhabited the lowest elevations, where modern refugia populations are still observed in well-watered outcoves (Betancourt et al. 1990).

In the adjacent eastern Great Basin during this period, woodlands dominated by limber pine (*Pinus flexilis*) covered mountain foothills, and subalpine fir (*Abies lasiocarpa*) and spruce (*Picea*) grew in canyon bottoms and along streams; such taxa today occur only at much higher elevations, and they began to be replaced by shrubs at lower elevations only toward the end of the early Holocene. In addition, the composition of shrub communities differed from the present, with big sagebrush (*Artemisia tridentata*) occurring in greater abundance relative to more xeric taxa such as shadscale (*Atriplex* sp.) and greasewood (*Sarcobatus vermiculatus*) than is the case today. Single-leaf pinyon pine (*Pinus monophylla*) did not colonize the area until the middle Holocene.

Pleistocene mammals were numerous on the Colorado Plateau and the adjacent Great Basin and included large-bodied taxa such as saber-toothed cat (*Smilodon fatalis*), horse (*Equus* spp.), camel (*Camelops hesternus*), large-headed llama (*Hemiauchenia macrocephala*), musk-ox (*Bootherium bombifrons*), giant short-faced bear (*Arctodus simus*), short-faced skunk (*Brachyprotoma brevimala*), ground sloth (*Glossotherium* spp.), and mammoth (*Mammuthus columbi)* (Heaton 1985; Mead and Agenbroad 1992; Miller 1976, 1982, 1987; Nelson and Madsen 1978, 1980, 1983; Romer 1928). These and other species went extinct as part of the mass extinction that occurred during the terminal Pleistocene, the cause of which, climate or anthropogenic impacts, remains the subject of considerable debate (Grayson 1993, 2011; Mead and Agenbroad 1992). Other large mammal taxa, such as mountain sheep (*Ovis canadensis*), pronghorn (*Antilocapra americana*), and mule deer (*Odocoileus hemionus*), which are common in late Holocene archaeological assemblages from the region, appear to have been rare on the terminal Pleistocene and early Holocene landscapes of the eastern Great Basin, perhaps due to extreme climatic seasonality during this period (Broughton et al. 2008). Smaller Pleistocene mammals that disappeared from the Great Basin at the end of the Pleistocene include the heather vole (*Phenacomys intermedius*), the

northern bog lemming (*Micromys borealis*), the pine marten (*Martes americana*), and the least weasel (*Mustela nivalis*) (Grayson 1982:86–92; 1993:170–184; 2011:186–206). Extinct Pleistocene birds that may have been present on the Colorado Plateau include flamingos (*Phoenicopterus copei; P. minutus*), stork *(Ciconia maltha*), shelduck (*Anabernicula gracilenta*), condors and vultures (e.g. *Breagyps clarki*), teratorns (*Teratornis incredibilis; T. merriami*), hawks and eagles (*Spizaëtus pliogyrps; S. willetti*), and Old World vultures (*Neogyps errans)* (Grayson 1993:166–170; 2011:181–186).

The Paleoindian toolkit of the Colorado Plateau typically included large, lanceolate (Clovis, Folsom, and Plano) projectile points (Schroedl 1991), spurred-end scrapers, gravers and borers, and crescents (Frison 1978:78; Schroedl 1991). The Paleoindian stage is further split into three traditions named for their characteristic projectile points: Clovis (ca. 13,500 to 9000 years B.C.), Folsom (9000 to 8300 years B.C.), and Plano (8300 to 7800 years B.C.). The primary difference among these traditions is the slight variability in projectile point form they exhibit, which likely resulted from changing environments and subsistence strategies. In many cases, Paleoindian-associated artifacts occur in lower elevations along major river valleys where Pleistocene megafauna, as discussed above, congregated. As climate warmed and plant communities changed during the terminal Pleistocene, Plano peoples also began to exploit resources found in higher elevations such as the La Sal Mountains. Because of their great age, Paleoindian features are normally only found in alcoves and rockshelters. The absence of specialized plant processing tools and the frequency of large projectile points best suited for killing large game animals may indicate a reliance on hunting by Paleoindian groups (Byers and Ugan 2005; Jennings 1980; Louderback 2014; Simms 1988).

The Montgomery Folsom Site (42GR1956), located south of the town of Green River in the planning area, clearly represents the Folsom tradition (Davis 1985). Bullhorn Wash in far northeastern San Juan County represents the Clovis archaeological tradition in or near the planning area (Nickens 1982:6). Outside of the planning area, west of the Colorado River in Emery County, the Dawson Site (42EM6965) was found to contain more than 222 Paleoindian-era artifacts, including Clovis, Folsom, Cody, and Western Stemmed projectile points and an extensive array of modified flake tools and scrapers (Byers 2012). One site in the planning area (42SA9799) is associated with a potential Clovis point, although certainty has not been established. Some researchers have proposed that unusual pecked figures appearing on some rock faces around the Colorado Plateau are proboscideans that likely date to the Clovis era; an iconic example of these is the so-called “Moab mastodon” from the planning area (Haynes 2002:157; but see Malotki and Weaver 2002). An extensive and significant Clovis site is located to the south near the town of Bluff, Utah. Known as the Lime Ridge Clovis Site, it was the first Clovis site on the northern Colorado Plateau where artifacts diagnostic of this period were positively confirmed (Davis 1989:66). Research conducted in the Glen Canyon area of San Juan County has also demonstrated a limited human presence there during the Paleoindian period (Geib 1996:7).

5.1.2 The Archaic Period

In the Southwest, framers of the Pecos Classification recognized that the Basketmaker II stage must have been preceded by a stage that was “pre-agricultural, yet adumbrating later developments” (Kidder 1927:490). They named this postulated stage Basketmaker I. However, in the 1940s and 1950s, when components that fit this description began to be recognized in the Southwest, the proposed Pecos terminology was not applied to them. Initially, they were placed in various local “cultures” or “complexes,” such as the “Cochise Culture” of Bryan and Toulouse (1943). From the late 1950s through the 1960s, various broader concepts were proposed to categorize the pre-ceramic, non-agricultural, non-Paleoindian phenomena throughout the Southwest and Great Basin regions. These included the Desert Culture (Jennings 1957), the Picosa Culture (Irwin-Williams 1967), and the Archaic (Willey and Phillips 1958). By the 1970s, Archaic had become the term of choice (Lipe and Pitblado 1999).

The Archaic period extends from ca. 8000 to 2500 years B.C. Matson (1991) divides the Archaic stage into four sub-periods: Early (ca. 8000 to 6000 B.C.), Middle (6000 to 4000 B.C.), Late (4000 to 3000 B.C.), and Terminal (ca. 3000 to 2500 B.C.), although most Southwest researchers refer to the Terminal Archaic instead as the early Basketmaker II era (e.g., Charles and Cole 2006). In the planning area, only Squaw Park Cave (42GR981), located approximately 4 miles west of the Colorado River near its confluence with the Dolores River, has been dated to the Archaic stage (Sharp et al. 1989). The higher, cooler, and wetter locations of Cedar Mesa, Montezuma Canyon, and Elk Ridge to the south are all noted for numerous Archaic period sites of varying size and complexity (Lipe and Pitblado 1999).

5.1.2.1 EXPANDING DIETS AND EARLY ARCHAIC FORAGING

The Early Archaic encompasses most of the middle Holocene period of warm and dry climate, which Antevs (1948) originally described as the Altithermal and which has subsequently been documented in a variety of settings (Grayson 1993, 2011). For the broad eastern Great Basin and northern Colorado Plateau regions, environmental changes during the period leading up to and including the middle Holocene have been particularly well documented at Homestead Cave (D. B. Madsen 2000). A variety of proxy paleoenvironmental records are available from this site, perhaps the most detailed of which is the raptor-deposited small mammal fauna record (Grayson 2000). These records indicate an increase in mean temperatures, increased aridity, and corresponding changes in vegetation such as a substantial increase in the abundance of shadscale relative to sagebrush. Pinyon pine approached its modern distribution during this period (Rhode and Madsen 1998). Continued low abundances of artiodactyl remains in middle Holocene archaeofaunal assemblages from the region, as well as continued low densities of artiodactyl fecal pellets in cave deposits, suggest that large mammal prey were as rare on the landscape as they were during the early Holocene, though likely due to aridity rather than to extreme climatic seasonality (Broughton et al. 2008; Byers and Broughton 2004).

With changing climates came the expansion and modification of artifact assemblages as people adapted to a wider, more dispersed animal and plant resource base. Continuing the trend that began during the later Paleoindian period, higher elevation settings began to be used even more frequently during the Early Archaic, perhaps representing further subsistence generalization; the Cowboy Cave Site in Wayne County provides an example of occupation in such a setting (Schroedl and Coulam 1994). An expansion of diet breadth is certainly indicated by the increase in the frequency of ground stone artifacts that occurs across the region during this period; this increased use of grinding tools undoubtedly reflects the incorporation of high-cost small seeds into the diet, most likely due to declines in the abundances of higher-return wetland resources (Grayson 1993, 2011; Rhode et al. 2006).

Diagnostic artifacts of the Early Archaic, in chronological order of first appearance, include Pinto points, Elko Series points, Humboldt Concave-base points, and Northern Side-notched points, all of which were likely used to tip atlatl darts and all of which were used through the end of the period (Holmer 1986). Basketry continued to be important, and netting, probably used for hunting small vertebrates, became common (e.g., Aikens 1970; also see Broughton et al. 2008; Byers and Broughton 2004). Snares, also likely used to procure small vertebrates, first appear in the archaeological record of the region ca. 5000 B.C. (e.g., Aikens 1970).

Evidence of Early Archaic occupation in the planning area is sparse, owing primarily to the unlikelihood of preservation of Early Archaic organic materials coupled with the difficulty of confidently dating non-organic materials. Early Archaic occupation of Cowboy Cave was noted by researchers via radiocarbon dating of charcoal, charred wood, and a few sandal fragments (Schroedl and Coulam 1994:12). Spangler and Yentsch (2008) noted an array of sites with probable Archaic components and potential for subsurface Archaic cultural deposits (Spangler and Yentsch 2008:56–57). In the Cedar Mesa area, to the south, Geib and Davidson (1994) report radiocarbon dates from a subsurface sandal of ca. 6000 B.C., (a date that is between the Early Archaic and the Middle Archaic), so the potential for Early Archaic subsurface materials reported by Spangler and Yentsch has precedent in the region.

5.1.2.2 MIDDLE ARCHAIC MOBILITY

The Middle Archaic period spans the remainder of the middle Holocene, and the climate continued to be, as a generalization, warm and dry. Elko Series projectile points dominate the Middle Archaic period, with the archaeological record including also Northern Side-notched, Humboldt Concave-base, Rocker Side-notched, Sudden Side-notched, and Hawken Side-notched points (Holmer 1978). Aside from the cessation of Pinto points, material culture is largely similar to that of the Early Archaic (D. B. Madsen et al. 2005). However, a slight increase in the frequency of ground stone seems to indicate a stronger reliance on plant resources than in previous periods (Matson 1991). Throughout the eastern Great Basin and northern Colorado Plateau more broadly, however, residential and logistical use of upland settings increased even beyond that seen in the Early Archaic; this is illustrated at Cowboy Cave and nearby sites (Schroedl and Coulam 1994).

Middle Holocene environmental changes reconfigured the spatial and temporal distribution of resources important to earlier occupants of the region. As a result, settlement and subsistence systems tethered to discrete locations of abundance fell apart during the Middle Archaic. Archaeological sites of Middle Archaic age are generally ephemeral in nature and are often quite difficult to adequately place in time. Accordingly, some archaeological scholars posited that the region was largely uninhabited during the middle Holocene. The more widely accepted view today instead suggests that rather than regional depopulation, the Middle Archaic was characterized by an expansive, albeit short and transient, use of nearly every available habitat. Simms (2008:159) states that Middle Archaic occupations in the Great Basin were "brief, people were mobile, and although most sites show a variety of activities, many stops were for specific tasks." On the Colorado Plateau, long-term continuity through the Middle Archaic is suggested by pre-ceramic radiocarbon dates obtained from central Plateau sites over the last few decades, with adaptive shifts and increased relative mobility being the likely explanation for gaps in the data that appear during the Middle Archaic (Geib 1995).

As for Early Archaic sites, a paucity of datable organic materials and the difficulty of dating inorganics mean that Middle Archaic sites are not definitively known for the planning area. Shroedl and Coulam note a lack of diagnostic Middle Archaic artifacts and datable materials at Cowboy Cave, and interpret this as a hiatus between short periods of higher levels of effective moisture in the area during the Early and Late Archaic periods (Schroedl and Coulam 1994:20–21). This supports the contention that the Middle Archaic is a period best characterized by migration and transient use of a broad array of settings. Spangler and Yentsch (2008:56) obtained a radiocarbon date of 4300 +/-40 B.P. on unspecified materials from an occupation located 2.2 meters below present ground surface at one site in the Tenmile Canyon drainage area, underscoring the potential for additional subsurface Middle Archaic components in the planning area.

5.1.2.3 LATE AND TERMINAL ARCHAIC POPULATIONS AND THE BEGINNINGS OF AGRICULTURE

The beginning of the Late Archaic coincides roughly with the time at which the climate began to approach modern conditions. With this cooler and more mesic climate of the late Holocene, the density of artiodactyl populations in the eastern Great Basin appears to have increased significantly, and large mammal prey become much more common in archaeofaunal assemblages from the region (Byers and Broughton 2004). Material culture of the Late Archaic in the Great Basin does not differ appreciably from that of the Middle Archaic, with the exception that Gatecliff and Gypsum point types begin to appear in tool assemblages. However, throughout much of the Colorado Plateau, the Late Archaic sees the establishment of a mixed farming-foraging subsistence economy and a concomitant increase in sedentism (Huckell 1996). Late Archaic material culture on the Colorado Plateau also includes the appearance of Gatefliff and Gypsum projectile points, as well as San Rafael Side-notched, Elko Eared, Chiricahua, and Armijo points (Lyndon 2005). Throughout the broader region, occupation of upland areas continued, and

in places such areas appear to have been used more intensively than lower elevation areas (D. B. Madsen and Schmitt 2005:125). Ground stone becomes more prominent in Late Archaic assemblages than in any previous time periods, and various lines of evidence suggest an increased reliance on plant resources (Huckell 1996; Matson 1991).

Simms (Simms 2008:167) characterizes the Late Archaic as a "culmination of the foraging way of life." Archaeological evidence indicates that nearly every kind of available resource in nearly every available place was in use. Whereas Middle Archaic foragers could respond to resource stress by adding a new item to their diet or by simply moving to a new location, Late Archaic foragers had to respond in novel ways conditioned by local conditions. In some locations, response to resource stress in the Late Archaic involved establishment of larger villages with attendant changes in social organization, whereas in others, Late Archaic foragers were able to respond with increased mobility. In the Southwest, archaeologists know much more about the Late Archaic period than they do the Early or Middle Archaic, having found an excavated many more Late Archaic sites (Charles and Cole 2006). Additionally, Late Archaic peoples more often lived in rockshelters than did more mobile earlier groups, and there the dry atmosphere preserved an array of perishable items: e.g., baskets, mats, and plain-weave sandals. The Late Archaic was also a time of trade in exotic or hard-to-find items such as obsidian, turquoise, and marine shells.

The Terminal Archaic, or Dirty Devil phase (Schroedl 1976), has an indefinite termination, but it is probably around 1500 B.C. in the Ancestral Puebloan world and around 500 B.C. in the Fremont world, when horticulture began to replace strictly hunter-gatherer modes of subsistence. With the introduction of horticulture, human occupation of the northern Colorado Plateau became more intensive as this new means of food acquisition allowed for larger population densities.

Late Archaic archaeology in the planning area is distinguished most consistently by Barrier Canyon style rock art, which is typically interpreted as antecedent to Fremont rock art on the northern Colorado Plateau (Spangler and Yentsch 2008:55). Sites with Barrier Canyon elements, as well as hardpan storage cists that potentially date to the Late Archaic, were noted by Spangler and Yentsch (2008:55) in the Tenmile Canyon drainage area, although no temporally diagnostic artifacts were observed.

5.1.3 The Formative Period

Formative period archaeology includes reliance on domesticated plants (see Coltrain and Janetski 2013; Coltrain et al. 2007), most notably corn (*Zea mays*) or "maize;" settlement in sedentary or semisedentary near areas optimal for horticulture; and the introduction of pottery (J. Horn et al. 1994; Matson 1991). The Formative era in the planning area is represented by both Fremont and Ancestral Puebloan occupations. Archaeological literature typically identifies the Fremont and Ancestral Puebloan cultural occupation areas as discrete and separate, having very little overlap, with Fremont settlement almost entirely north of the Colorado and Escalante Rivers and Ancestral Puebloan settlement almost entirely south of them (Figure 5-1) (c.f., Geib 1996; Hurst 2016). Indeed, early investigators of Fremont occupations in the area often referred to it as the Greater Southwest's Northern Periphery (e.g. Wormington 1955).

However, the dataset compiled for this Class I inventory—which includes data from investigations conducted for cultural resource management purposes and from other sources that are unlikely to be represented in the published archaeological literature—indicates that sites that have been recorded as having both Fremont and Ancestral Puebloan elements exhibit a considerable degree of overlap (Figure 5-2). Such spatial and temporal overlap suggests that much of the MFO area was used contemporaneously by presumably different cultural groups and thus makes this area a prime location for investigation of important culture contact research issues. The implications of this are numerous, including unique research opportunities discussed in Chapter 6 (Cultural Resource Synthesis and Future Research Directions). A thorough investigation of the relationship among Fremont and Ancestral Puebloan groups within what is now the MFO planning area is imperative.

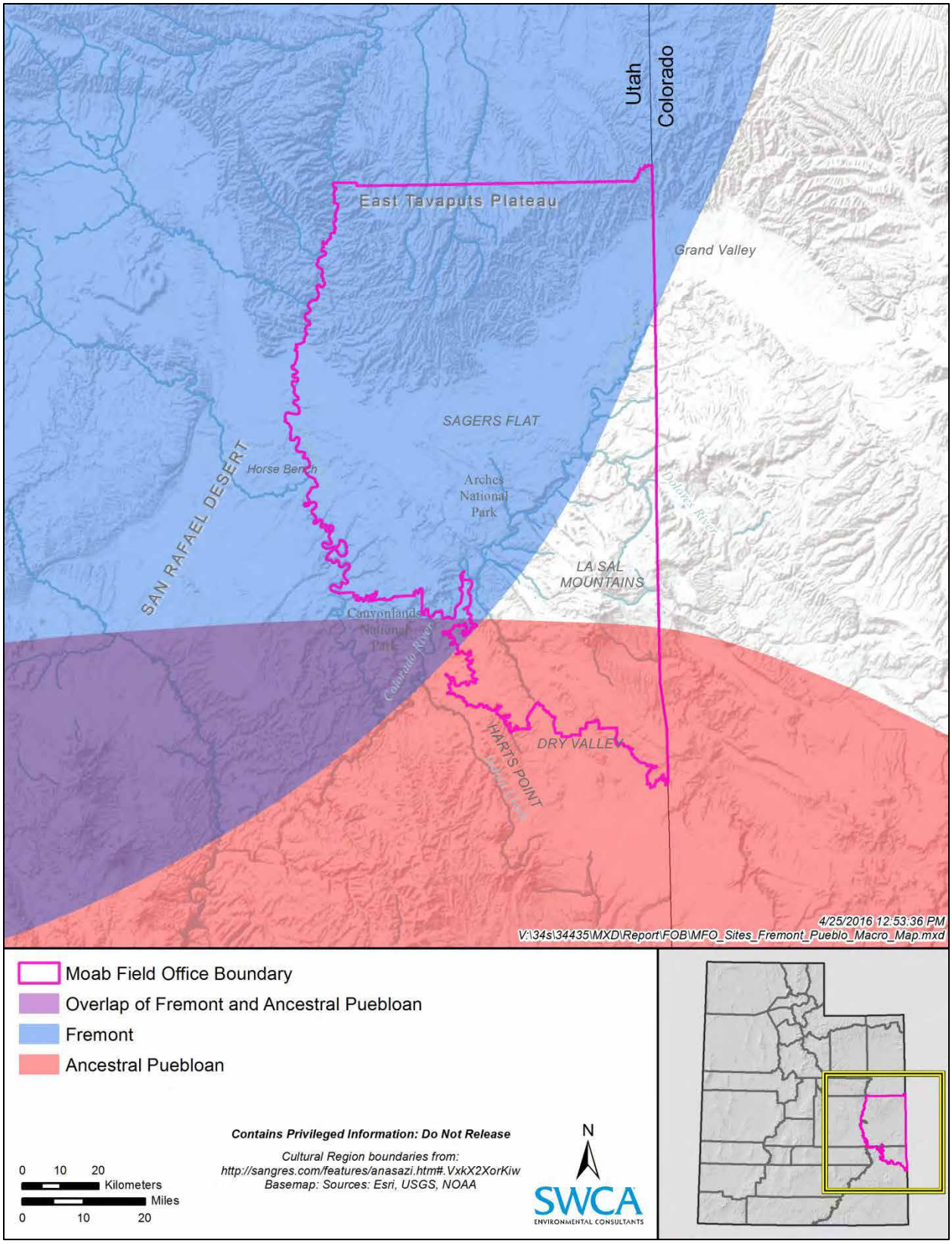


Figure 5-1. Fremont and Ancestral Puebloan occupation areas as typically represented in the literature.

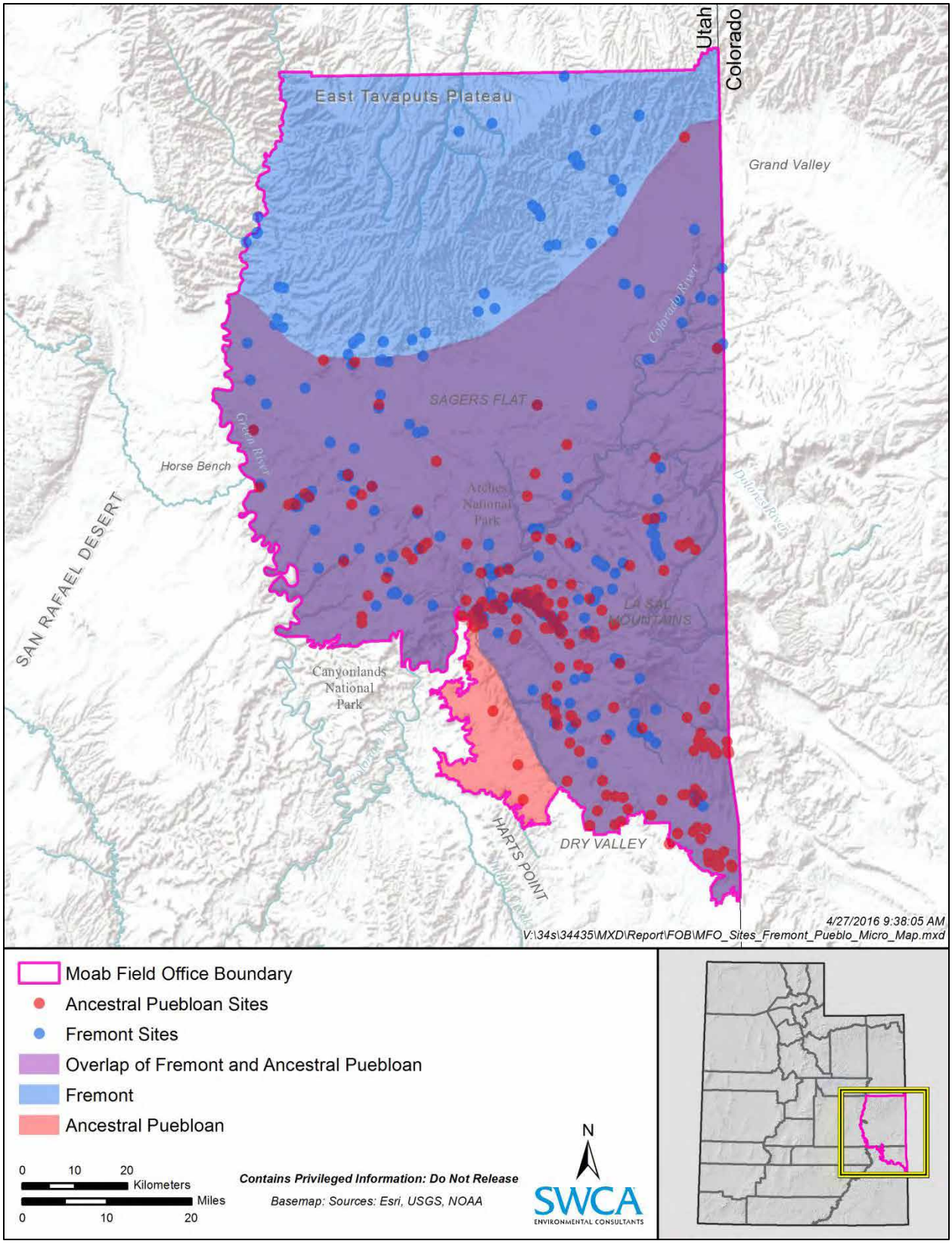


Figure 5-2. Distribution of Fremont and Ancestral Puebloan sites as reflected in the MFO Class I inventory dataset.

Fremont occupation dates to ca. A.D. 500–1250 (see also Massimino and Metcalfe 1999); Ancestral Puebloan occupation dates from ca. 1500 B.C. to A.D. 1600 (see Table 5-2 for Ancestral Puebloan date ranges). These cultural traditions are discussed in detail below.

Table 5-2. Ancestral Puebloan Chronology*

Period	Dates B.C./A.D.	Notes
Pueblo IV	A.D. 1300–1600**	Consolidation of Pueblo populations from throughout the Four Corners and the Colorado Plateau into major mesatop communities along the upper Rio Grande and in northeastern Arizona
Pueblo III	A.D. 1100–1300	Large pueblos oriented on central plaza, highly defensible cliff dwellings, elaborate black-on-white and red-on-orange ceramics
Pueblo II	A.D. 900–1100	Great houses and great kivas appear, corrugated gray decorated black-on-white ceramics dominate
Pueblo I	A.D. 750–900	Large villages and kivas appear, deep pithouses still in use, neck-banded gray ceramics dominate
Basketmaker III	A.D. 500–750	Deep pithouses, bow and arrow replaces atlatl, beans and ceramics appear
Basketmaker II	1500 B.C.–A.D. 500	Shallow pithouses, earliest maize cultivation

*This is a regional summary based on the Pecos (Kidder 1927) Classification. Regional and subregional variations do occur in the literature, but are not noted here.

**Most of the traditional Ancestral Puebloan villages in the Four Corners were abandoned by ca. A.D. 1275, including all of those in southeastern Utah. Pueblo IV occupations are not known in the MFO area.

A third archaeological tradition, the Gateway tradition (see J. Horn et al. 1994), refers to a set of archaeological sites within Montrose and San Miguel Counties in Colorado that demonstrate similarities with both the Ancestral Puebloan and Fremont traditions but are overall atypical in appearance. Archaeologists have variously attributed such sites to the Fremont, Ancestral Puebloans, or to local groups that adapted traits from both. Recent reanalysis of archaeological materials excavated at the Weimer Ranch site complex north of Norwood, Colorado, has provided convincing evidence that the Gateway tradition represents a short-term incursion of Ancestral Puebloans into west-central Colorado and east-central Utah (Gruebel et al. 2009). Gateway tradition stone-working and ceramic technologies are generally similar to those of the Northern San Juan area, with projectile points being dominated by small corner-notched varieties and pottery styles mimicking those of west-central Colorado. While now recognized as a Pueblo II–era (A.D. 900–1100) phenomenon, the Gateway tradition does vary from contemporaneous sites in the Four Corners area and represents a useful way to think about local variation in the archaeological record.

5.1.3.1 BASKETMAKER II

Richard Wetherill's recognition that the physical and cultural remains of what he initially called the "Basket People" underlie those of the "Cliff Dwellers" was among the signal events of Southwest archaeology, because it indicated that significant cultural change had occurred in the past and that such changes could be recognized and documented by archaeological study (Lipe 1999). Excavations by Kidder and Guernsey in the rockshelters of northeastern Arizona validated Wetherill's observations (Kidder and Guernsey 1919). At the 1927 Pecos conference, Basketmaker II was proposed as a widespread period or stage of Southwestern culture, characterized as "the agricultural, atlatl-using, non-pottery-making stage…" and distinguished from "Basket Maker I… a postulated stage, preagricultural, yet adumbrating later developments" (Kidder 1927:490; Lipe 1999). As mentioned above, this earlier stage is now nominally subsumed in the Archaic. Wetherill's discovery of what would come to be called the Basketmaker tradition took place in a small but important alcove called Cave 7, located in Whiskers Draw just to the south of the planning area (Hurst and Turner II 1993).

The early Basketmaker II period (ca. 1500 B.C. to A.D. 450) is marked by an increasingly sedentary settlement system, the advent of more substantial dwellings, and an increasing reliance on corn and squash horticulture. Although foraging for wild plants and hunting did not cease, there was a trend toward seasonal sedentism (Dohm 1994; Lipe 1999; Matson 1991). Matson (1991) has identified a number of Basketmaker II variants, organized around an east-west spatial division, with the planning area and greater southeast Utah representing the Western Basketmaker II traditions. Some researchers (Kidder and Guernsey 1919; Matson 1991) assert that the Western Basketmaker II period marks the intrusion of farmers, known as the White Dog variant of Basketmaker II culture, into the San Juan River area. Excavations at cave sites in southeastern Utah (Blackburn and Williamson 1997; Geib 1996) have shown that White Dog Basketmaker material culture is distinctive relative to the preceding Archaic period. White Dog Basketmaker assemblages include weft-twined cord bags, weft-face plain-weave sandals, White Dog projectile points, atlatls, S-shaped fending sticks, close-coiled basketry, more substantial houses, and substantial storage cysts and pits. Projectile points are large and similar to some dart points of the Archaic period, but typically have wider notches.

The general absence of pottery at most Basketmaker II sites in the region clearly distinguishes them from later Basketmaker III and Pueblo I sites. Some later Basketmaker II sites have small quantities of pottery, albeit a brown ware that contrasts with the later Basketmaker III gray wares. Wilson and Blinman (1994) note that similar pottery occurs fairly widely in the Mogollon area between ca. A.D. 250 or A.D. 300 and ca. A.D. 500 but that such occurrences are rarer in Ancestral Puebloan sites of this same time period in areas like southeast Utah. At this time, there are no known Basketmaker III sites in the planning area.

Basketmaker II subsistence was characterized by a semisedentary mixed strategy of foraging and cultivation of maize and squash, although beans wouldn't become a part of Colorado Plateau agriculturasuites until the Basketmaker III period (Burrillo 2016). Stable carbon and nitrogen analysis on human remains from sites to the south and east of the planning area indicate that Basketmaker II people were heavily reliant on maize by 400 B.C., with their degree of dependence being similar to that of Pueblo II and III farmers of the Four Corners region (Coltrain et al. 2007). Agricultural strategies throughout southeastern Utah during the Basketmaker II period were almost undoubtedly limited to forms of dry-farming (Matson 1991).

Generally, Basketmaker II settlement was characterized by significant, long-term use of rockshelters and alcoves throughout the region. During the early centuries A.D., settlement became focused on open sites with basic but fairly large surface and pit structures, occurring as isolated structures or in loose neighborhoods or tight "proto-village" clusters, often with substantial storage features. Such sites are assigned to the Grand Gulch Phase in the area west of Comb Ridge and north of the San Juan River, and to the Lolomai Phase in the Black Mesa area south of the San Juan River (Dohm 1994; Matson 1991; Smiley 2002). In southeast Utah, the Basketmaker II culture period is best represented on Cedar Mesa. In the planning area, survey and testing projects related to the La Sal Mountains site group identify an occupation span of between 460 B.C. and A.D. 410 (Charles and Cole 2006). Characteristic Basketmaker II sites in the planning area include the Orchard Pithouse Site (42GR2206) in downtown Moab, from which 11 wood charcoal dates range between 460 B.C. and A.D. 375 (Louthan 1990); and the Sandy Ridge Site (42SA18500) south of Moab in Dry Valley, charcoal samples from which indicate occupation occurred at ca. A.D. 200 (Richens and Talbot 1989).

5.1.3.2 BASKETMAKER III

Basketmaker remains were well recognized early in Southwestern archaeological research (Lipe 1999), but delineating between Basketmaker and Pueblo was difficult for early researchers. Sites belonging to the "Post-Basketmaker" and "Pre-Pueblo" periods were the focus of many excavations in the 1920s, and by the time of the 1927 Pecos Conference, Kidder had devised a classification that marked the end of Basketmaker developments with a stage termed "Basketmaker III."

The Basketmaker III period (A.D. 450–750) can be distinguished from the preceding period by the introduction of three new cultural traits: the use of the bow and arrow, the cultivation of beans, and the production of well-made gray and white ware pottery—all of which imply a more settled and sedentary way of life (Nichols 2002; Reed 2000; Wilshusen 1999b).

Ceramics at the earliest Basketmaker III sites in the northern San Juan region are typically brown wares, or ceramic wares that are often brown but more importantly are constructed from self-tempered alluvial clays. The similarities to potentially contemporary Mogollon brown wares has led some authors to conclude that the presence of this ceramic type in the upper San Juan drainage area might indicate the immigration of Mogollon peoples from farther south in New Mexico or Arizona (Wilshusen 1999b). Others have argued that some of the similarities are due to the nature of the alluvial clay of each ware, and that the similarities do not necessarily support Mogollon migration northward into areas like southeastern Utah (Wilshusen 1999b). By the late sixth century A.D. both early gray and white wares are evident in Basketmaker III sites in southeast Utah. Gray ware is distinguished from the earlier brown wares by its generally grayish color when fired and its construction from geologic clays and added tempers. Ceramic assemblages from this era include plain gray jars and simple black-on-white bowls (Chapin Gray and Chapin Black-on-white in the northwestern San Juan area, with similar analogous types produced elsewhere).

During the Basketmaker III period, site types also demonstrated a suite of characteristic variability. The most common type of late Basketmaker site is the hamlet, or residential site. They account for the overwhelming majority of the known Basketmaker III sites in the region (Wilshusen 1999b). Pit structures for this period typically have the features and debris associated with a single household, but in some cases there is evidence of two distinct households, especially when the antechamber has been converted into a second domestic area. Domestic architecture itself changed from simple basin-shaped depressions or informal pits covered with a mud and wood superstructure to more substantial, bi-lobed pithouses constructed over house pits up to approximately 1 meter deep. A typical pit house contained a shelf around the rear section of the main room, an antechamber that was connected to the main chamber by a short passageway, and a ladder that enabled entry into the house via a smoke/entry hole in the roof. The tool, faunal, and macrobotanical inventories from Basketmaker III sites indicate continued exploitation of wild resources, but farming had become the predominant subsistence activity.

Throughout this period, population began to grow, and in Southeast Utah, numerous sites of this period can be found on both the mesa tops and in the valley bottoms. In some areas, settlements cluster into clear communities, sometimes with extraordinarily large pit structures or great kivas that may have served community integrative functions. Basketmaker III communities have been studied extensively on Elk Ridge and in Montezuma Canyon to the south of the planning area (see Montoya 2008). Basketmaker III sites were investigated on Alkali Ridge by Brew (1946). However, in general, Basketmaker III sites are concentrated in higher, wetter parts of the region (e.g., Elk Ridge) and in association with deeper soils, which usually are found on the divides between major drainages (Matson and Lipe 1978). Cedar Mesa, while being densely populated during the preceding Basketmaker II area, was all but abandoned during Basketmaker III as populations moved to higher and wetter locations. The same is likely true of the lower elevation zones of the planning area.

5.1.3.3 PUEBLO I

Research on Pueblo I sites dates back almost to the beginning of formal archaeological work in the Four Corners area. As early as 1913 to 1914, Earl Morris excavated or tested a number of Pueblo I sites, recognizing them as representing a potential transitional site type between earlier Basketmaker sites and the later cliff dwellings in places like Mesa Verde. Efforts were made to describe and standardize Pueblo I as an identifiable stage of cultural development at the 1927 Pecos Conference, where it was characterized

by a population that practiced cranial deformation and lived in rectangular masonry pueblos (Wilshusen 1999a). Sites of this stage could be identified by gray pottery with neck-banding. Otherwise, efforts to delineate Pueblo I by a discrete attribute list are stymied and halting; as Fred Plog (1979:115) described it, the archaeology of Pueblo I is "diverse and disparate, if not contradictory" (Chuipka 2008:30).

The primary changes identified with the Pueblo I period (A.D. 750–900) occur in settlement systems, ceramics, and architecture (e.g. Wilshusen 1999a). Architecturally, there were many changes from the preceding period. Pueblo I habitations commonly consisted of an arc of jacal, adobe, and/or stone masonry rooms with one or more pit structures located in an unenclosed plaza or courtyard area to the south. The shallow, bi-lobed Basketmaker III pit structure was replaced by a deep (around 2 m), generally subrectangular structure with a true ventilator shaft complex. Villages consisted of multiple households with contiguous aboveground living and storage rooms, sometimes with an associated oversized pit structure or great kiva, rock art panels, and landscape features, such as shrines and plaza areas.

Wilshusen (1999a) notes that Pueblo I populations in some areas were aggregated into large villages of 75 to 400 rooms, while populations in other districts continued to occupy dispersed hamlets of 3 to 20 rooms scattered across the landscape. Some areas appear to have been largely vacated at this time. In southeast Utah, Pueblo I populations appear to have concentrated in large settlements along major drainages, and in a remarkable concentrations of sites in the uplands surrounding the upper reaches of South Cottonwood Wash. Other nearby areas, including Cedar Mesa, appear to have been mostly uninhabited (Matson et al. 1988). This pattern may represent a response to drought conditions during the A.D. 800s, with low precipitation and extended growing seasons favoring settlement along major drainages and in upland areas with higher effective precipitation (e.g., K. L. Peterson 1988).

Pueblo I ceramic assemblages are marked by the addition of neck-banded gray ware, more refined white ware, and a new and remarkably sophisticated red ware technology to the ceramic inventory. The early gray and white ware styles that made up the total inventory of Basketmaker III sites continued to be produced, but were replaced through time by the newer styles. Neck-banded gray ceramics at first exhibited wide, flat neck-bands (Moccasin Gray), with wide, distinctly clapboarded neck coiling (early Mancos Gray) appearing and becoming dominant during the late A.D. 800s. A distinctive, fine-line white ware type unique to southeastern Utah (White Mesa Black-on-white) also made its appearance during the mid– to late–A.D. 800s. The most striking addition to the ceramic inventory, however, were the unslipped San Juan Red Ware types Abajo Red-on-orange (early in the period) and Bluff Black-on-red (or, technically, Black-on-orange) during the A.D. 800s.

Pueblo I sites are well documented in the high upland areas on and around of Elk Ridge, just south of Beef Basin in the southern portion of the planning area. The type site for Pueblo I in Utah is Brew's (1946) Site 13 on Alkali Ridge, south of the planning area (see Chapter 4 [Prior Cultural Resource Investigations]). This extensive settlement consisted of more than 300 contiguous jacal and slab-foundation surface structures enclosing three large plazas. The plazas contained small rectangular pit structures nearly identical those of Basketmaker III dwellings, as well as three large, deep, circular pit structures now recognized as great kivas (see Wilshusen 1999a, 1999b). Pottery included the neck-banded gray ware that typifies Pueblo I ceramic assemblages, along with red-on-orange bowls and effigies. No additional Pueblo I sites of this size are currently known in Utah, although the unexcavated Pillars Site (42SA11800), a Pueblo I village on Elk Ridge just outside the planning area, comes close: it consists of at least 50 identified features, including several room blocks that may contain hundreds of rooms (Allison et al. 2012:47–48). However, as with the preceding Basketmaker III period, Pueblo I sites are most often found in higher, wetter locations with deep soils—e.g., Elk and Alkali Ridges—and are not well represented in lower-uplands settings characteristic of the Ancestral Puebloan cultural zone of the planning area.

5.1.3.4 PUEBLO II

In the Pecos Classification of 1927, Kidder envisioned Pueblo II as one stage in a progressive continuum culminating in the large communities of the "Pueblo III, or Great Period" (Lipe and Varien 1999a). In its entirety, the Pecos Classification definition of Pueblo II is: "Pueblo II—the stage marked by widespread geographical extension of life in small villages; corrugation often of elaborate technique, extended over the whole surface of cooking vessels" (Kidder 1927:490). The notion that the Pecos sequence represented gradual, progressive change was reinforced by subsequent research. However, advancements in tree-ring dating came to show that the Pueblo II period was much more complex than the "developmental" model implied. Large structures like Pueblo Bonito and Chetro Ketl at Chaco Canyon were shown to date to the late A.D. 1000s, making them contemporaneous with small-house sites in other locations and placing them at least 200 years *before* the major Mesa Verde cliff dwellings like Square Tower House (Lipe and Varien 1999a). Since then the Pueblo II period has come to represent an era of population and settlement expansion with a number of both differences and similarities across the region.

The Pueblo II period spans the interval from ca. A.D. 900 to 1150. Around A.D. 890, a climatic change to cooler, drier conditions seems to have been the cause of a shift in settlement pattern (Benson and Berry 2009). Early Pueblo II populations dispersed over much wider areas to seek out those ecological niches where their form of subsistence could still be practiced, resulting in a new settlement pattern characterized by small hamlets. Habitation sites of this period are not common and regional populations appear to have been low. During the A.D. 1000s, the climate appears to have been prevailingly hospitable to subsistence farmers, with adequate and relatively predictable growing seasons and precipitation, causing a marked increase in regional population and the proliferation of settlement in most localities.

Architecturally, this period is identified by full-height, coursed masonry structures, although early in the period surface rooms frequently had walls with stone masonry for their lower portions and jacal construction forming their upper portions. Rectilinear forms replaced the curvilinear room blocks characteristic of the Pueblo I period. Most noteworthy is the evolution of the pit structure into a structure that archaeologists call a "kiva," which presumably served as a focus of ritual activity (but see Cater and Chenault 1988; Lekson 1988 for an alternative view of "kivas" as domestic pithouses). Kivas are generally round with a surrounding bench, six masonry pilasters, a hearth, ventilator shaft, and sipapu (Cordell 1984). Subterranean or semisubterranean mealing rooms are frequently associated with kiva facilities.

While much of the population continued to occupy small, dispersed habitations, the Chacoan form of community organization emerged in some areas, suggesting higher levels of community integration and interaction. Chacoan influence was recognized as early as the 1920s in the greater San Juan Basin, but only in the 1970s did researchers recognize that the iconic central sites were systematically related to numerous "Chacoan outliers" located in and around the Basin (Lipe and Varien 1999a:243). In these communities, great houses, roads, and great kivas form central elements for a surrounding community of dispersed households and farmsteads (see Chapter 6 [Cultural Resource Synthesis and Future Research Directions]). Chacoan great houses and segments of Chaco-style roads have been found on and around Cedar Mesa, to the south of the planning area (Cameron 2009; Hurst and Till 2011).

Significant ceramic changes are evident in all three major technological wares. Narrow coil neck-banded gray ware (late Mancos Gray) dominated early Pueblo II assemblages, giving way quickly to boldly indented corrugated styles then fully corrugated styles with coils carefully pinched together to create an indented pattern. White Mesa Black-on-white gave way early in the period to Cortez Black-on-white (uncommon west of Montezuma Canyon), which was in turn replaced by Mancos Black-on-white, with diverse and variable surface treatment and design styles. Red ware underwent a very interesting evolution, with the regionally local type Deadmans Black-on-red (which had replaced Bluff Black-on-red early in

the period) being replaced during the A.D. 1000s by the Tsegi Tusayan Black-on-red and other related types of the Tsegi Orange Ware series, manufactured and imported from south of the San Juan River. Ceramic imports are common in most late Pueblo II sites, most notably Tsegi Orange Ware and Tusayan White Ware types from the Kayenta region.

Late Pueblo II to early Pueblo III sites are common in this region. Sizable Pueblo II communities have been documented on Cedar Mesa (Matson et al. 1988) and at Natural Bridges National Monument (McVickar 2002) to the south. Numerous sites dating to this period occur along Mill Creek and in Spanish Valley in the planning area. Site 42GR2897, situated on the floor of Mill Creek Canyon in Moab, dates contemporaneously with Pueblo II occupations elsewhere on the Colorado Plateau, with radiocarbon samples derived from charred maize kernels providing a date between A.D. 890 and 1155 (S. J. Cole and Moe 1999; Montgomery 2010). Beef Basin is also known to have an impressive assemblage of Pueblo II–Pueblo III period sites, including L-House (42SA207) dating to A.D. 1233; the Ridge Site (42SA45) dating to the early A.D. 1200s; and the Ledge Site (42SA227) dating to A.D. 1223 or later (Pierson 1980).

5.1.3.5 PUEBLO III

The early Pueblo III period (A.D. 1150 to1300) witnessed the aggregation of dispersed communities into arrays of linear room blocks with associated kivas, somewhat reminiscent of their Pueblo I predecessors. The middle and late Pueblo III period then saw the development of complex agglomerations of room blocks, towers, and kivas in tightly aggregated pueblos clustered on canyon rims in direct proximity to springs, often with associated towers (e.g., Adler 1996; Lipe and Varien 1999b; Lipe and Ortman 2000). Masonry wall construction was a well-developed craft by the beginning of the period, with compound, double-coursed and occasionally core-veneer walls faced with stones exhibiting varying degrees of facial smoothing and/or pecking. Habitation sites (particularly the larger villages) often boasted more than one story, and circular, multistoried towers became increasingly common.

After an apparent episode of depopulation in the middle A.D. 1100s, the Puebloan culture of Southeast Utah appears to have flourished during the Pueblo III period. Populations in the San Juan region probably reached their peak around A.D. 1200. Subsequent decades witnessed drastic changes, however. Populations continued to aggregate into larger and more compact and architecturally complex settlements, often defensively sited or constructed. Long-distance trade appears to have declined markedly, and midden deposits attest to a shift in dietary emphasis from large game to small, locally accessible game and turkeys (e.g. Lipe et al. 2016). Settlements often aggregated around springs, in a possessive posture that appears to mark a pronounced departure from settlement location protocols that had discouraged settlement in direct proximity to springs in earlier periods.

These developments may have been caused, and were in any case certainly exacerbated by, population pressure on an environment whose carrying capacity was reduced by a succession of dry years (Benson and Berry 2009). Tree-ring studies indicate that drought prevailed throughout most of the second half of the thirteenth century A.D., with a particularly destructive, cold and dry period between A.D. 1276 and 1299 (Benson and Berry 2009). For still-uncertain reasons—although they likely included, but were not limited to, climatic/environmental stress—Puebloan populations withdrew completely from the San Juan Basin area by the end of the A.D. 1300s (Glowacki 2015). The abandonment was apparently a gradual process, occurring first in the western and northern provinces and last in the Mesa Verdean heartland of southwestern Colorado (Varien 2010). These populations probably moved to the south, eventually joining other groups in large communities along the Rio Grande and Little Colorado Rivers and their tributaries in New Mexico and Arizona, and where their descendants continue to occupy Pueblo villages to the present day (Adler 1996).

During the Pueblo III period, an increase in site size is notable, and sites are found in a variety of areas including canyon rims, in rock shelters and alcoves, on talus slopes, and in canyon bottoms (Cordell 1984). Multi-story habitations with kivas, wholly or partially enclosed by rooms or walls, became more frequent and Mesa Verde keyhole-shaped kivas tend to replace the circular forms found during the Pueblo II period. Site types and features include tri-wall structures, towers, large plaza-oriented pueblos, reservoirs, shrines, stone check dams, and field houses (Cordell 1984:103). These developments signal increased population aggregation, a change in social organization, increased ceremonialism, and an intensification of the agricultural subsistence base.

Throughout the Four Corners region, pottery types became quite distinct in design, layout and form. Pueblo III ceramic assemblages include Mesa Verde Corrugated, McElmo Black-on-white, and Mesa Verde Black-on-white. Trade wares, including Kayenta-area polychromes and white wares, are not uncommon in early Pueblo III sites but are very rare in late Pueblo III assemblages. Vessel forms show some evolution from the previous period, most notably the replacement of pitcher forms by mugs.

Pueblo III settlements in southeastern Utah were considerably less spectacular than the ruins of the great centers like Mesa Verde and Chaco, but nonetheless indicate a heavy occupational density (Brew 1946). Numerous Pueblo III period sites have been identified in open air and alcove settings throughout southeast Utah (Lipe and Varien 1999b), including Cedar Mesa (Matson et al. 1988), Natural Bridges National Monument (McVickar 2002), and elsewhere. Although these include some of the most architecturally compelling and interesting sites in the region, few have been subjected to focused investigation. Pueblo III sites have been investigated at Westwater 5-Kiva and Big Westwater Ruins near Blanding (Lindsay 1981). Nearer the planning area, in Salt Creek Canyon the All-American Man Site (42SA1614) was initially recorded as late Pueblo II–Pueblo III, with accelerator mass spectrometry (AMS) radiocarbon dates from it and nearby Bighorn Sheep Ruin (42SA1563) pointing more firmly at the Pueblo III period (Chaffee et al. 1994).

5.1.3.6 FREMONT COMPLEX FARMERS AND FORAGERS

The Fremont archaeological complex represents an extension of agricultural adaptations into the far northern Colorado Plateau, the Wasatch Plateau, and the eastern Great Basin. The distribution of Fremont ceramics covers an even larger area, ranging from what is now central Nevada into southern Idaho and southwestern Wyoming (e.g., Hockett and Morgenstein 2003).

Although there is evidence for considerable adaptive diversity in the eastern Great Basin and surrounding areas throughout prehistory, this is especially the case for the Fremont period. As Madsen and Simms (1998) note, groups attributed to the Fremont complex adopted a variety of subsistence and mobility strategies, and individuals within those groups may have pursued a range of strategies within their lifetimes (see also Barlow 2002; Coltrain and Leavitt 2002). Fremont sites range from fairly large, settled villages, particularly on either side of the Wasatch Plateau, to more ephemeral camps that suggest a high degree of mobility; caves also continued to be used during the Fremont period (e.g., Aikens 1970; A. L. Bryan 1977). The full range of subsistence strategies from pure hunting and gathering to relatively intensive farming is evident at Fremont sites. Barlow (2002) suggests that such variability in the importance of agriculture was due to variability over time and space in the productivity of wild resources, noting that intensive agriculture would have been economical only when and where high-return wild resources were encountered infrequently.

A few characteristics of material culture that are found throughout the Fremont area provided the basis for the original definition of Fremont as an archaeological complex (see discussion in D. B. Madsen 1989; D. B. Madsen and Simms 1998). It is important to point out, however, that not all of these characteristics are found at all Fremont sites; indeed, there may be no single site where all of them occur together. Moreover, most archaeologists who study the Fremont would agree that the “behavioral approach” to

studying variability within Fremont material culture that Madsen and Simms (1998) advocate is more useful than the typological approach of culture historians. With these points in mind, distinctive characteristics of the Fremont complex include gray ware pottery, of which five major types are generally accepted; one-rod-and-bundle basketry; deer- or sheep-hide moccasins; an art style consisting of trapezoidal figurines depicted in rock art and on clay figurines; and "Utah-type" metates characterized by a small secondary grinding surface. Residential structures vary considerably. Villages near the Wasatch Plateau include multi-room adobe pueblos after ca. A.D. 800; these were preceded by pithouses with adjacent aboveground granaries and even earlier, before A.D. 500 or so, by ephemeral structures with subterranean storage pits. Substantial structures become uncommon as one moves west from the Wasatch Plateau.

Maize appears in the archaeological record of the southern Wasatch Plateau ca. 150 B.C. (see discussions in Barlow 2002; D. B. Madsen and Simms 1998), long after it began to be farmed in parts of the Southwest to the south (e.g., Hard and Roney 1998; Smiley 1994). Maize and associated technology such as pottery, basin-shaped metates, and subterranean storage pits then spread throughout much of the rest of the Fremont area—including into the planning area—by ca. A.D. 500. It is debated whether the introduction of domesticates and associated technology into the Fremont area and their subsequent spread across the region were the result of adoption by indigenous hunter-gatherers or of a migration of populations who brought farming with them (also see the overview in Coltrain et al. 2007; see references in D. B. Madsen and Simms 1998:260). If the latter is true, it is likely due to a breakdown in the ethnic barrier between Fremont and Ancestral Puebloan peoples formed by the Colorado River, as suggested at nearby rock art panels like Newspaper Rock that have both Fremont and Ancestral Puebloan elements and as demonstrated in the archaeology of other borderlands areas like the Glen Canyon drainage (Geib 1996; Hurst and Till 2011; Lohman 1974:12) (see also Section 6.4 in Chapter 6 [Cultural Resource Synthesis and Future Research Directions] for more information about Fremont-Pueblo borderlands phenomena).

Genetic evidence suggests that Fremont populations near Great Salt Lake shared an ancestral population with at least some Ancestral Puebloan groups, possibly with a homeland to the southwest of the Fremont region, and that the Fremont and Ancestral Puebloan populations were separated long enough, with sufficiently little gene flow between them, for genetic differences to emerge through drift (Carlyle et al. 2000; Parr et al. 1996). However, the existing genetic data do not speak directly to the debate over indigenous adoption vs. migration because it is possible that the divergence among Fremont and Ancestral Puebloan populations occurred before the appearance of domesticates in the region; that is, the migration of Fremont ancestors may have taken place before the spread of domesticates into the Fremont region.

Fremont subsistence practices were locally variable, but, as a generalization, the wild plant and animal resources that were harvested earlier in the region continued to be used along with domesticates (D. B. Madsen et al. 2005:42–43). Prehistoric human population densities in the eastern Great Basin, Wasatch Plateau, and northern Colorado Plateau were likely at their highest during the Fremont period, and consequent high harvest rates appear to have reduced local abundances of artiodactyls (Janetski 1997). In addition, it also appears that, in at least some parts of the Fremont area, climatic variability influenced decisions about vertebrate prey choice and large mammal carcass processing (Ugan 2005).

Numerous important Fremont sites or sites with Fremont components have been reported within and adjacent to the planning area. At the Turner-Look Site, near the Utah-Colorado border, excavations by Wormington established a correlation between Fremont agriculturalists and rock art depicting decorative shields (Loendorf and Conner 1993:216). Horn et al. (1994) report that only one site south of the Colorado River in this area yielded Fremont ceramics, whereas 20 sites north of the Colorado River did. Extensive Fremont occupations are known from Fisher and Castle Valleys to the northeast of Moab (see Figure 6-3 in Chapter 6 [Cultural Resource Synthesis and Future Research Directions]). Fremont rock art

adorns many panels throughout the area, including the well-known Dancing Bear (42GR799) and Moab Owl (42GR3238) panels in Kane Creek, extensive panels along Potash Road (e.g., 42GR3649) and Courthouse Wash (e.g., 42GR4228), and at the Sego Panels in Thompson Wash (42GR275-277).

5.1.3.7 THE PROTOHISTORIC PERIOD

In the Ancestral Puebloan chronology, the Pueblo IV period (A.D. 1300–1600) is denoted by large, plaza-oriented pueblos in Rio Grande and western Pueblo areas and the emergence of the Kachina cultural phenomenon. The Colorado Plateau experienced widespread depopulation of most Pueblo communities and aggregation into large villages or "supracommunities," like at Hopi and Zuni, most likely due to resource depression compounded by drastic climatic changes (see Benson and Berry 2009; Varien 2006). In the Fremont chronology, this same time period marks the abandonment of agriculture and sedentary settlement systems. The abandonment of a sedentary, horticultural lifeway among the Fremont and return to a hunter-gatherer subsistence pattern by ca. A.D. 1300 is a perplexing problem, although coincident timing with the abandonment of most of the Pueblo world and aggregation into supracommunities like at Hopi is suggestive of regional climatic factors (Glowacki 2015; Spangler 1995; Varien 2006). In the planning area, neither Fremont nor Pueblo Formative groups are documented after ca. A.D. 1350 (Montgomery 2010).

During the Protohistoric period, it is commonly believed that the Numic-speaking Utes were the primary occupants of eastern Utah and westernmost Colorado (J. Horn et al. 1994:130). Evidence from linguistic and archaeological investigations suggest that Numic-speaking peoples immigrated into the region by ca. A.D. 1100, or shortly before the depopulation of Formative communities in the area, and researchers have historically attributed this to an expansion of Numic-speaking populations from homelands in the southwestern Great Basin (Spangler 1995:599). Currently, however, there is little consensus about the timing of the Numic expansion, how it occurred, why it occurred, the relationship of Numic-speaking populations to pre-existing populations, how settlement patterns and subsistence strategies differed from pre-Numic populations, and whether or not a "Numic expansion" indeed even occurred (Spangler 1995:599).

In the planning area, evidence of early Ute occupation includes sparse lithic scatters with low quantities of expedient brown ware ceramics, diagnostic rock art, and occasionally characteristic wickiup remains. In addition to the fingertip-impressed brown wares, other diagnostic artifact include Uncompahgre Brown Water, Desert Side-notched, and Cottonwood Triangular projectile points (Buckles 1971). The traditional Navajo (Diné) homeland is located south of the planning area in the Four Corners, although historic records mention Navajo inhabitants farming parts of Spanish Valley in 1855 until as late as the 1870s (Firmage 1996). Small amounts of yellow ware pottery characteristic of the Hopi have been found at three sites in the MFO planning area (J. Horn et al. 1994), and the Hopi tribe also maintains ancestral ties to the planning area.

5.2 The Southeast Utah Ethnographic Record

Numerous Native American groups claim cultural affiliation with the planning area. A cultural affiliation study for the nearby Canyons of the Ancients National Monument (Gilpin et al. 2002) included the Uintah-Ouray, Southern, and Ute Mountain bands of Ute; the Pueblos of Hopi, Zuni, Acoma, Cochiti, Isleta, San Felipe, Santa Ana, Santo Domingo, Jemez, Laguna, Sandia, Zia, Nambe, San Juan, Pojoaque, San Ildefonso, Santa Clara, Tesuque, Picuris, and Taos; the Jicarilla Apache; and the Navajo. More locally, an ethnographic overview for Arches National Park (Stoffle et al. 2016) focused exclusively on the Hopi, Zuni, Ute, and Southern Paiute as having made traditional historic use of the Arches area, while also acknowledging a likely but unverified Navajo presence.

To more easily quantify the broad array of individual cultural representations in this region, many researchers write instead about language groups—e.g., Numic speakers, Athabascan speakers, and Kiowa speakers—and their respective migration histories (e.g., Ambler and Sutton 1989). The study of linguistic evolution and transition as a function of geography can serve as a useful tool for reconstruction of population movement (see Stubbs 1994 for an excellent review of the Native American languages of San Juan County). Other researchers have had some success in studying modern and ancient Native American DNA to reconstruct aboriginal population movements (e.g. Carlyle et al. 2000; Torroni et al. 1992), in which case indigenous populations are more objectively referenced in terms of haplogroups. However, as Worley-Hood and Noyes (2013:4–5) contend, these sorts of demographic reconstructions overlook an important element of the mechanics of culture:

> "Although researchers tend to focus on the origins of the Navajo's Athapaskan ancestry, the ancestry of the Navajo likely incorporated many different peoples, cultures, and cultural traits."

While the ancestors of the Navajo and Ute did not herd sheep or ride horses, respectively, these traits were nonetheless readily adopted from other groups and were important and sacred elements of their respective cultures by the Historic period (Jefferson et al. 1972; McPherson 2009, 2011). Further, some Navajo lineages have been traced to ancestors of the Pueblo peoples of Hopi, Zuni, Acoma, Laguna, and Jemez, and some of the Keres and Tewa pueblos (Worley-Hood and Noyes 2013:5). Lastly, cultural diffusion of guns from the east and horses from the southwest transformed Native American cultures of the Plains so drastically that it "attracted or affected numerous groups in the surrounding physiographic regions" (Weber 1980:18), including the planning area. This in turn led to aggregations, alliances, disbanding, and conflicts to such an extent that linking modern or historic Native American tribes with discrete pre- or protohistoric culture groups in this region is challenging.

Therefore, to simplify the issue and avoid these sorts of demographic reconstructive problems, this section will present ethnographic data in terms of language groups. What follows is a discussion of the modern-day Native American tribes and their affiliates that were present in the planning area upon European contact, as well as tribes representative of those that claim cultural affiliation. The purpose of this section is to present an ethnographic sample for the planning area, rather than a comprehensive and exhaustive survey.

5.2.1 The Numic People

With the exception of the Navajo, all Native American tribes currently residing in Utah belong to the Numic-speaking branch of the greater Uto-Aztecan language family (Cuch 2000). This includes Ute, Paiute, and Shoshone groups. Prior to the adoption of the horse, these three groups were culturally similar, subsisting on plant-gathering—particularly seeds—and small game, including insects. Ethnographic and ethnohistoric accounts demonstrate that ancestors of modern Utes and Southern Paiutes utilized lands and resources within the study area (Stoffle et al. 2016:27–30). It is believed that the Numic people entered what is now known as Utah around A.D. 1300 (Janetski 1994). According to most scholars, and some of the oral histories of the people themselves, Numic-speaking peoples probably migrated out of the Death Valley area of California (McPherson and Yazzie 2000). Today, Southern Utes and Southern Paiutes speak similar languages with various dialectical differences. With the acquisition of the horse, some Ute and Shoshone bands began adopting cultural traits of the Plains people, such as buffalo-hunting and tepees. The Southern Paiute and those Ute and Shoshone bands that did not adopt the horse still lived a hunting and gathering lifeway, collecting plants and hunting small game.

5.2.1.1 SOUTHERN PAIUTE

The traditional homeland of the Southern Paiute covered much of what is now south-central Utah, northern Arizona, southern Nevada, and Southern California. Early ethnographic work on the Southern Paiute was conducted starting in 1870 by John Wesley Powell, who was especially knowledgeable about the Kaibab, Shivwits, and Uinkaret bands; i.e., groups located to the northeast of the Grand Canyon (Weber 1980:25). Powell's studies were followed by those of Edward Palmer in 1875, Edward Sapir in 1910, Robert H. Lowie in 1914, and S.A. Barrett in 1916 (Kelly and Fowler 1986:396). The most comprehensive work was conducted by Isabel T. Kelly from 1932 to 1933, from which data on only the Kaibab, San Juan, Kaiparowits, and Panquitch were published in 1964. Carobeth Laird compiled notes on the Chemehuevi from 1919 to 1940. Omer Stewart provided culture element distribution for four groups in 1942. Phillip Drucker added data on the Shivwits and Chemehuevi in 1937 and 1941. Robert C. Euler and the Inter-Tribal Council of Nevada analyzed pertinent documentary sources for a Southern Paiute ethnohistory in 1966 and 1972. George Roth also analyzed documentary sources for the Chemehuevi in 1976. Finally, in 1970, Martha Knack provided data and analyses of the socioeconomic conditions for the Utah Southern Paiute (Kelly and Fowler 1986).

The Southern Paiute diet "was varied and subsistence often precarious; practically all groups named starvation foods" (Kelly and Fowler 1986:370). Small game was the primary source of protein and included rabbits, wood rats, mice, gophers, squirrels, chipmunks, and birds. Fish was not a primary food source, except for the Panguitch Lake group. The large game animals that were hunted were deer, mountain sheep, and antelope. Magical devices (gifts to the spirits and songs) were used to ensure a good hunt (Kelly and Fowler 1986:970).

Of the plant foods consumed by the historic Southern Paiutes, roots, berries, cacti, agave, and seeds were common, and pine nuts were a primary staple (Kelly 1964:44-45; Kelly and Fowler 1986:970). Eventually, native agriculture was introduced and provided maize, squash, beans, winter wheat, melons, and sunflowers (Kelly and Fowler 1986:370–371). The historic Southern Paiute used floodplain farming where feasible, and also planted crops along the edges of lakes or used irrigation (Kelly and Fowler 1986:971).

The Southern Paiutes had an annual cycle, living in temporary camps depending on the season (Kelly 1964:371). "Their mobile lifestyle included moving frequently, primarily according to the seasons and plant harvests and animal migration patterns" (American West Center and Marriott Library at the University of Utah 2008). Winter meant finding a location "where snow was deep, fuel plentiful, and pine nut stores at hand" for many Historic Southern Paiutes. Spring meant the beginning of hunting and gathering because cached stores were likely depleted. It also meant the planting of gardens. Summer was the time to hunt big game and gather seeds, fruits, and berries. Late summer and early fall meant harvesting the gardens, storing foods, and beginning to collect pine nuts. Fall was a highly-mobility time and included moving around to hunt or gather precious resources to prepare for the "winter and recurrent spring famine" (Kelly and Fowler 1986:371).

Shelters reflected the transient nature of the settlement patterns. During the winter, many tried to live in caves or built houses by leaning juniper posts against the horizontal limb of a tree. For the rest of the year, a "dome-shaped shade or a rectangular shad (flat roof on posts), or a circular brush enclosure" was home (Kelly 1964:158). Canvas- or skin-covered tepees were not introduced until around 1855 by the Utes (Kelly and Fowler 1986:373).

The historic Southern Paiutes did not have central political control. Recurrent residences were located in at least one fixed area, with houses closely grouped and occupants related by blood or marriage (Kelly and Fowler 1986:380). Springs were considered private property and inherited. The nuclear family was

the basic unit for many historic Southern Paiutes, but some cases of polygyny and polyandry existed. The overall number of children per family varied, but could be in the double digits. Large economic clusters had a headman or chief. The chief would advise the people and receive visitors. Typically, chiefly succession tended to run in the family and could be male or female, but personality was a deciding factor in who was selected. The new chief was chosen by "a group of elder men of the group, sometimes in consultation with people from neighboring economic clusters" (Kelly and Fowler 1986:380).

Clothing was made primarily of animal skins or vegetable fiber, with bark dresses and leggings reported in some instances. Footwear consisted of sandals or moccasins of bark or yucca. An early snowshoe had a slab of the inner wood of the Joshua tree for a sole. Body paints in red, black, white, yellow, and blue were used for protection and ceremonial reasons. Sticks, bones, and shells were used as earrings.

Southern Paiute basketry included all the Great Basin forms: the conical burden basket typically made of willow (*Salix* spp.), the fan-shaped tray for winnowing and parching, the seed beater, and the water jug with pinyon pitch coating. The baskets were mostly twined, but some were coiled. Cordage was created from *Apocynum* sp., cliffrose, juniper bark, or milkweed fiber. Yucca fiber was used for rope. Ceramics consisted of ephemerally shaped vessels, which were used sun dried and unfired. Women were potters, men made their own tobacco pipes, and children made effigies and miniature vessels (Kelly and Fowler 1986:375). The chief vessel type was a cooking pot, typically flat bottomed, but it could have a conical or sub-conical bottom (Kelly and Fowler 1986:377). Burden baskets are associated with Southern Paiute origin myths (Stoffle et al. 2016).

According to Dutton (1983), the Southern Paiutes likely arrived in the Southwest around A.D. 1000 and occupied territories adjacent to the Ancestral Puebloans, from whom they learned maize agriculture. Rock art depicting iconic Southern Paiute "burden baskets" has been identified along the Colorado River within the planning area, as well as rock art depicting traditional Southern Paiute knotted "counting strings," or tapitcapi (Stoffle et al. 2016:28–29). The first contact that Southern Paiute individuals had with Europeans was with Spanish explorers in 1756, when Spanish explorer Juan Rivera was guided by a Paiute in his explorations of the Colorado River through the planning area (see also Kelly and Fowler 1986:386; Stewart 1973:13–14; Stoffle et al. 2016:30). Rivera also encountered Mouache and Sabuagana Utes while exploring the area (Stoffle et al. 2016:30). Over the next century or so there are few accounts of the Southern Paiutes in the planning area, although the establishment of the Spanish Trail from Santa Fe to Los Angeles certainly had an enormous impact on local Native American cultures.

During the Protohistoric period, the Old Spanish Trail crossed the Colorado River at what is now called Ute Crossing within the planning area (Stoffle et al. 2016:31). The Spanish brought epidemic diseases, like smallpox, as well as slavery. Given the location of the Southern Paiutes along the Old Spanish Trail, they faced slave raiders who decimated their populations in the early nineteenth century (Kelly and Fowler 1986: 386; Weber 1980:25). Active measures taken by the Mormons after their arrival in 1847 aided in ending the slave trade and slave raiding activities. Meanwhile the presence of the Trail also brought severe resource depletion and consequent population movement away from its vicinity, and in the arid Southwest traders and trappers often followed the old or pre-existing trails of Native Americans in search of food or water (Weber 1980:26). This precipitated not only competition between local indigenous populations and Euro-American trappers and traders, but also competition between indigenous peoples and the herd animals driven by the traders. Sheep and horses cropped the grasses, and consistently drank or fouled the water on which the Southern Paiutes depended. Indeed, early accounts note that traders passing along the Trail would often tether their animals directly in the sparse vegetable and maize patches the Southern Paiutes were able to maintain in that area (Weber 1980:26).

The first attempt to move the Southern Paiutes to a reservation occurred in 1865, when the Treaty of Spanish Fork was negotiated by Utah Superintendent of Indian Affairs Oliver H. Irish and six Southern Paiutes. The treaty said the Southern Paiutes would "relinquish all right of occupancy in and to all lands heretofore claimed and all occupied by them … within the defined borders of the Territory of Utah" and move to the Uintah Reservation in northeast Utah (Kelly and Fowler 1986:387). In exchange, the Southern Paiutes were promised instruction in farming and equipment and supplies. However, the Southern Paiutes did not move to the reservation because the Utes were their old enemies, and they did not want to leave their lands (Kelly and Fowler 1986:387). In 1872, a reservation was established by executive order in Nevada. Only the Moapa band of Paiutes moved to the reservation (Kelly and Fowler 1986:388). Other Paiute bands were subsequently confined to small reservations throughout the state.

5.2.1.2 UTE

The Utes once called approximately 225,000 square miles home, from Fillmore, Utah, on the west, to Colorado Springs, Colorado, on the east, and from Baggs, Wyoming, on the north, to Abiquiu, New Mexico, on the south (Duncan 2000:173–174). More than 11 different Ute bands existed: Moache, Capote (Kapota), Weeminuche, Uncompahgre (Tabeguache), White River (Parusanuch and Yamparika), Uintah, Pahvant, Timanogots, Sanpits (or San Pitch), Moanunts, and Sheberitch (Duncan 2000:175–176; Simmons 2000:17–22). While linked by a common language, a common culture, and sometimes by intermarriage, each of these bands was nonetheless autonomous and had its own geographically circumscribed territory: the Moache lived farthest east and occupied areas near the Sangre de Cristo Mountains, the Capote lived around the San Juan River in northeastern New Mexico and Southwestern Colorado, and the Weeminuche lived west of the Continental Divide below the Gunnison River as far south as the Navajo homeland (Duncan 2000:175–176; Simmons 2000:17–22). Within the planning area itself, the Sheberitch band traditionally occupied the area immediately surrounding Moab and were the most desert adapted of the greater Ute cultural complex (Southern Ute Indian Tribe 2016).

As with the Paiutes, the earliest ethnographic information about the Utes comes from early Spanish explorers (Callaway et al. 1986:367). Other descriptions were provided by various explorers and surveyors, including Jedediah Smith, John C. Fremont, Howard Stansbury, E. G. Beckwith, and John Wesley Powell. More recent ethnographic efforts include those by Anne M. Smith, Omer C. Stewart, and Joseph Jorgensen (Callaway et al. 1986:367).

State-wide, historic Utes hunted a wide selection of animals, including "buffalo [bison], jackrabbits, cottontails, mountain sheep, mule deer, whitetail deer, elk, antelope, and moose" (Callaway et al. 1986:337). In the planning area, hunted animals included elk, desert bighorn and mountain sheep, wild turkey, rabbits, badger, porcupine, wildcat, beaver, and bear (McPherson 2011:39). Deer were especially important to the Utes, as they provided food, shelter (from skins), and tools (from bone and antler); favorite deer-hunting places in/around the planning area included Elk Ridge and the La Sal, Blue (Abajo), Navajo, and Sleeping Ute Mountains (McPherson 2011:36–38). Pronghorn antelope were hunted locally in the Dry Valley area. Hunters would take deer and antelope in a variety of ways, including stalking, ambush attack, driving them over cliffs in the manner of Folsom bison hunters (e.g., Carlson and Bement 2013), and—after horses were introduced from the Plains—running them down on horseback (McPherson 2011:36). Animals that were considered sacred or otherwise culturally important, and were therefore not hunted or killed, included coyotes and snakes (McPherson 2011:40).

In addition to vertebrate game, crickets, grasshoppers, and locusts were collected when available (Callaway et al. 1986:337). A variety of plants were consumed by the Utes, including chokecherry, wild raspberry, gooseberry, prickly pear cactus, sego (mariposa) lily, yellow pond lily, yampa or Indian carrot, Indian potato, wild onion, pine nuts, and buffaloberry. In addition, Ute women used seeds from various flowers or grasses, such as amaranth, and add them to soup. The three-leaf sumac, known colloquially as

"squaw sumac" or "lemonade bush," was used in tea for special events (Callaway et al. 1986:338; Simmons 2000:27; Southern Ute Indian Tribe 2016). Indian ricegrass was among the most important foraged foods to Utes in the planning area; this is a plant that prefers dry, sandy soil, intense summer heat, and intermittent moisture (McPherson 2011:43). Processing of Indian ricegrass is relatively easy, consisting of beating the seeds into a basket and breaking their husks with a mano before winnowing them, and archaeologists studying Ancestral Puebloan subsistence in the region have suggested that this practice dates back well into the prehistoric era. The Utes also harvested the inner bark of the ponderosa pine for making healing compresses, tea, and for healing, among a variety of other uses (McPherson 2011:44; Southern Ute Indian Tribe 2016). Like other groups in the intermountain west, pine nuts were an extremely important foodstuff, harvested during the summer and consumed throughout the winter (Callaway et al. 1986:343; Simmons 2000:27). Emergency or "starvation foods" among Utes in the planning area included the seed pods of yucca, juniper berries, and the aforementioned inner park of ponderosa pine (McPherson 2011:43). So far as is known, the Utes did not practice agriculture of any kind (Opler 1940:123–126).

Utes would use earthen ovens that consisted of a 4-foot-deep hole lined with stones. A fire was built on top of the stones, and food was placed in layers of damp grass and heated rocks on top of the fire. These items would then be covered with dirt to cook overnight (Southern Ute Indian Tribe 2016). The Utes also cached foods in storage platforms in coniferous trees and in grass- or bark-lined pits. Many times, a fire was built over the pit to help conceal the pit (Callaway et al. 1986:344–345).

Some Utes lived "in domed willow houses throughout the year," but all bands had "tripod or conical houses with a three or four-pole foundation and a circular ground plan" that were approximately 10 to 15 feet in diameter and covered with brush or bark (Callaway et al. 1986:348). Most authors refer to these as wikiups (Hurst and Willian 2011). Utah Valley Ute structures with skin coverings were documented in Spanish Fork Canyon in 1826 (Callaway et al. 1986:348:348). Tepees were eventually adopted from Plains tribes and offered a more portable housing option well suited to the Utes' mobile lifeway (Callaway et al. 1986:348–35; see also Hurst and Willian 2011 on Ute "tipis" in Comb Ridge area archaeology).

Ute residence groups typically consisted of 50 to 100 people, with larger numbers during the winter. Winter camps were estimated at 20 to 30 households, or 100 to 150 people (Callaway et al. 1986:352). "Bands consisted of several residential units joined under the leadership of a headman who solicited advice from a council of other deme leaders" (Callaway et al. 1986:354). No central political structure existed for the Utes (Duncan 2000:173). "Bands readily moved to new locations, and individuals easily changed band membership" (Callaway et al. 1986:354).

> Before they acquired the horse, the Utes used basic tools and weapons which were made of stone and wood. These tools included digging sticks, weed beaters, baskets, bows and arrows, flint knives, arrow heads, throwing sticks, matates and manos for food preparation. They traded with the Puebloans for pottery to use for food and water storage and transport. They became very skilled at basket weaving, making coiled containers sealed with pitch for water storage. As expert hunters they used all parts of the animal. Elk and deer hides were used for shelter covers, clothing and moccasins. The hides the Utes tanned were prized and a sought after trade item. The Ute women became known for their beautiful quill work, which decorated their buckskin dresses, leggings, moccasins, and cradleboards. (Southern Ute Indian Tribe 2016)

The most momentous event in Ute history was the acquisition of horses, which allowed the Utes to expand their seasonal circuits, to carry more items as they traveled, to improve and increase trade relationships, and to embrace horseback warfare (Simmons 2000:29–30), as well as adopt the deer- and bison-hunting strategies noted above. There is considerable debate over when Utes in the region of the

planning area adopted horses, with some archaeologists believing that it didn't occur until the mid- to late-eighteenth century. Although the Spanish first introduced the horse to the Americas in the early 1500s, the Utes do not appear to have adopted them until much later, with the first documented use occurring in 1692 (McPherson 2011:41). In the planning area, historic and protohistoric Ute occupation is best demonstrated by iconic rock art panels depicting riders on horseback, numerous examples of which can be found near Moab (Stoffle et al. 2016:28).

Other domesticated animals include the dog and the goat, but although turkey husbandry was practiced among Ancestral Puebloans in other parts of the planning area as early as the Pueblo II period (Lipe et al. 2016), turkeys do not appear to have been adopted by the Utes in this region. Dogs were important to the Utes as pets, as camp scavengers, and as limited beasts of burden before the introduction of the horse (McPherson 2011:41). The likely reason for the adoption of the goat, as opposed to the turkeys favored by the Ancestral Puebloans or the sheep favored by the Navajos, is that the latter two animals are relatively sedentary while the goat was more suitable to the considerably mobile Ute hunter-gatherers (McPherson 2011:42).

The earliest documented contact between Utes and Europeans was with the Spanish expedition under Juan de Oñate in 1626 (Duncan 2000:180). The relationship between the Utes and the Spanish in those early days was a curious one. Spanish towns like Sante Fe and Taos cropped up in the midst of the Rio Grande Pueblos, with whom the Utes had traded for centuries, and these towns came to serve as nexuses for trade between the "wild" or non-Pueblo tribes and the Spanish (McPherson 2011:72–73). Horses were chief among trade goods, and represented the deciding factor in power struggles between rival bands and tribes. Moreover, as McPherson (2011:73) point out:

> Meat and hides, staples of exchange with Pueblos and other Indian groups, did not fetch a big price from the Spanish. One horse required a huge amount for payment. This left two options. The first was to maintain friendly relations with the Spanish and find something that was of high value to trade. The second was to ally with the Spanish and steal horses from other Indian groups. The Utes did both.

Thus began an era of conquest by the Utes, fighting alongside the Spanish against the Apaches, helping to quell Pueblo unrest, aligning with the Comanches to force the Apaches the rest of the way out into the Plains, fighting against the Navajo, turning against the Spanish, turning against the Comanches, and so on throughout the late-1600s and 1700s (see McPherson 2011:72–74). They were also involved in the slave trade with the Southern Paiutes (see last section), sometimes in the role of captors and other times in the role of captives (McPherson 2011:75). When in the role of "captors," Utes would kidnap women and children from other tribes, including the Southern Paiutes, and sell them to the Spanish (Hittman 2013:289–290; Simmons 2000). Eventually, American traders, trappers, and explorers began to appear more frequently in Ute territory in the early 1800s, with the Mormons arriving in 1847 to begin settling the Utah Territory.

After the Four Corners region fell into the hands of the United States government with the treaty of Guadalupe Hidalgo, a military fort—Fort Massachusetts—was established near the base of Mount Blanca in Colorado. The Utes, having become a dominating force in the Four Corners through shifting allegiances and other strategic means (McPherson 2011:89), were not happy about either the military fort or the settlers in their territory. Hostilities flared in the Ute War of 1854–1855, starting with a massacre at Fort Pueblo on the Arkansas River and culminating with significant losses among the Utes in skirmishes in Colorado and northern New Mexico (Jefferson et al. 1972:19–20). Subsequent treaties were established between the U.S. government and the Capote and Moache bands in 1855 (Jefferson et al. 1972:19–20).

Still, major conflicts involving the Utes continued in the region, especially after the end of the Civil War saw many veterans and refugees from the East flooding into the West. Tensions between Anglos and Utes in the Four Corners came to a boiling point with the Pinhook Draw fight of 1881, which occurred in the La Sal Mountains within the planning area (Section 5.3.2.2, see also McPherson 2011:139–148; Salmon and McPherson 2001:4–28).

Conflicts over cattle were probably the source of the greatest contention among Southern Utes, Navajos, and Euro-American ranchers during the subsequent era. Though these conflicts were small in degree, they were characterized by fierce and bloody violence. The later conflicts of the 1910s and 1920s saw the formation of extreme vigilantism against real and perceived threats from a small group of Southern Utes who were successful in cattle and horse raids near Bluff, Utah. As a result of heightened tensions, Southern Utes and Paiutes fled their homes for the rough canyon country of Navajo Mountain (McPherson and Yazzie 2000).

Utes place religious and traditional importance on many land features in other locations throughout southeastern Utah. Significant places of traditional use within or in the vicinity of the project area include Water Canyon or River-Flowing-From the Sunrise (San Juan River), Sagebrush Canyon or Crows Canyon (Montezuma Canyon), Slick Rock Mound (Comb Ridge), Two Rocks Canyon (Cow Canyon), Where-the-Sun-Sets-Last (Mount Tukuhnikivats in the La Sal Mountains), and the Purple Sage Traditional Cultural Property near Arches National Park (Stoffle et al. 2016). Bitter Root Mountain (Sleeping Ute Mountain) and the Colorado River are mythical places. Blue Mountain and Standing-Alone-Mountain (Navajo Mountain) are considered to be places of worship to the Utes. Mancos (Jim) Mesa and Spanish Mossback Mesas were used in historic times as Ute fortresses in times of conflict (McPherson and Yazzie 2000).

5.2.2 Southern Athapaskans

The Navajo and Apache people living today in Arizona, New Mexico, and Utah speak related languages that are part of the Athapaskan language group. Their shared ancestors are thought to have originated in west-central Canada. Although archaeologists agree that Athapaskan speakers were comparatively late arrivals in the northern Southwest, they disagree substantially on when they arrived and by what route they traveled (Bailey and Bailey 1986; Seymour 2012; Wilcox 1981). Three temporal windows have been suggested: 1) A.D. 800–1000, 2) A.D. 1200–1400, and 3) the 1540 arrival of the Spaniards in the Southwest. Various migration routes have been postulated including "an intermountain route through western Colorado and eastern Utah" (Bailey and Bailey 1986:11). Linguistic data suggest that the two southern Athapaskan groups split approximately 500 years ago, but archaeologists disagree about whether the two groups split before or after their arrival in the Southwest (Gunnerson and Gunnerson 1971; Hale and Harris 1979; Hoijer 1971).

5.2.2.1 NAVAJO

The Navajo Nation includes portions of present-day Utah, Arizona, and New Mexico, covering more than 27,000 square miles (Navajo Nation Tourism Office 2011). Navajo presence in the planning area is known from historic sources as early as the 1850s with the Elk Mountain Mission near Moab, although Navajo groups undoubtedly passed through the area much earlier on their way south, where tree-ring dates place the earliest Navajo hogans in the Natural Bridges area in the 1600s (Spangler et al. 2010). Archaeological data from the Comb Ridge area suggest that their presence in or near the planning area dates back to at least the early to mid-1800s (Hurst and Willian 2011). Navajo oral histories place them on lands west of the Grand Canyon long before the archaeological record does, and some evidence suggests Ancestral Puebloan heritage in at least a few Navajo lineages (Sucec 2006:210–211; Worley-Hood and Noyes 2013:5). Relatively little is known of the early population size and range of the Navajo, as most knowledge comes from historic Spanish accounts that are biased toward front-country trading relations and away from far-flung or mobile communities (Weber 1980:34).

According to the Navajo Nation, they emerged in the Southwest; they did not migrate or bring their unique material culture from elsewhere. The Navajo Nation states that its own archaeological evidence dates Navajo sites to the early A.D. 1300s based on tree-ring dates, and speculates that for such an archaeological pattern to emerge, at least two additional earlier centuries would have been necessary, placing site origins in the early twelfth century A.D. (Sucec 2006:209). Some traditional beliefs and behaviors of the Navajo have their cultural roots in Ancestral Puebloan lifeways in the planning area (Worley-Hood and Noyes 2013), lifeways which date back thousands of years. Navajo oral histories hold that their ancestors spent time "emerging through four levels of worlds, to currently reside in the fourth level, the 'glittering world'" (Navajo Nation Tourism Office 2015). They believe that holy beings created mountains and rivers so that they could be inhabited, and that these deities currently live within these mountains and rivers, answering prayers and acting as guardians. The San Juan and Colorado Rivers are believed to be home to such deities (Sucec 2006:209).

The Navajo never functioned as a discrete political unit prior to resettlement on their reservation, but were instead delineated by extended families or several related extended families who enjoyed autonomous control and influence over their particular area (Weber 1980:35). This was a problem for Euro-Americans, who assumed a level of centralized rule that simply was not there. The acquisition of sheep from the Spanish further complicated territoriality issues, as increasing sheep herds meant expansion of land usage by local groups for grazing. When coupled with the adoption of horticulture from the Pueblos, this also precipitated increasing population density and an expanding territorial base that have characterized the Navajo right up to the modern era (Weber 1980:35).

The Navajo reservation landscape is characterized by low-lying sagebrush and greasewood, as well as pinyon and juniper trees against a backdrop of highly colored mesas, canyons, buttes, volcanic necks, and igneous mountain ranges; such vegetation is typical of elevations between 5,500 and 6,500 feet. Lower elevations are characterized by typical desert flora, punctuated with lone or clumped cottonwoods along intermittent watercourses. Rainfall is scant, averaging 8 inches per year, with the rainy season during the late summer months.

The Navajo economy was historically based on livestock, predominantly the sales of lamb, sheep, and wool, with a smaller percentage of income from cattle, horses, pelts and butchered meat. Since World War II, however, more and more Navajo families obtain their income from wage work (Kluckhohn and Leighton 1974). Agriculture has remained the basis of the Navajo subsistence economy for the last 300 years. Almost every family raises some amount of their own food, with many families able to subsist off their own produce for weeks. Maize and squash are the staple crops, supplemented by potatoes, beans, melons, pine nuts, and tree fruits. Crops for livestock are also raised, including alfalfa and wild hay, but most livestock graze on wild plants throughout the reservation (Kluckhohn and Leighton 1974).

Like every other Native American tribe in this region, the Navajo's earliest contact with Europeans was with Spanish explorers and colonists in the sixteenth century. According to explorer maps, Navajo territory extended much farther north into Utah than presently designated. These maps show Navajo settlements as far north as the modern-day town of Green River, Utah. The relationship between the Navajo and the Spanish was typical of the time: the Spanish largely used conquered Navajo as slaves and mining labor, and the Navajo conducted raids and armed warfare against Spanish colonists and military. Once the Spanish turned power in the region over to the Mexican government in the early 1800s, Mexican officials generally followed the policy toward Native Americans established by the Spanish but with violent disputes occurring more frequently (Maryboy and Begay 2000).

Many Navajos believed that when the United States won territory held by Mexico in the late 1840s, their treatment would improve. While the U.S. federal government may have had more humane intentions for treatment of Native Americans, U.S. agents in charge of Navajo affairs acted in their own self-interest, often leading to awful brutality. Due to the difficulty in translating Navajo to English, treaties often led to gross misunderstanding between the two groups. Slave raiding from other tribes, livestock and mining disputes with Euro-American settlers on Navajo land were the cause of great tribulation for the Navajo

people. Desiring their land for agriculture and industry, government leaders took to severe measures to relocate the Navajo to Fort Sumner and Bosque Redondo in New Mexico. The forced march of the majority of the Navajo to Fort Sumner is known as the Long Walk, and is a bitter memory of starvation and abuse for the Navajo (Maryboy and Begay 2000). While some resisted the federal government, escaping the Long Walk, or Fort Sumner, over 3,000 Navajos died under federal stewardship at Fort Sumner by 1868. In that same year, negotiations began for their release and return to Navajo homeland (called *Dinétah*), and in June 1868, the Navajo people began to return to their homes.

Though the Navajo were released from captivity, and returned to their homeland, the history that follows is characterized by the same problems that plagued them before the Long Walk: land disputes over mining and grazing rights. Being astute pastoralists, the Navajo people successfully raised large numbers of sheep on their land, allowing a greater comparative degree of prosperity. Euro-American concerns of overgrazing and land infringement allowed tensions to fester between the two groups from the 1870s into the early 1900s, especially since the federal government granted additional reservation land to the Navajos to meet their grazing needs.

The early 1900s were also a time of transition in the Navajo community, when forced assimilation into the dominant Euro-American culture was seen by government officials as a way to promote prosperity in a monetarily poor community. Education policies were developed that sent Navajo children—mainly the ones that were weaker or in some ways less valuable to Navajo homesteads—to out-of-state schools that were run with the discipline of a draconian military installation. Opposition to this method of assimilation resulted in armed conflict, bloodshed, and the arrest of several Navajos (who were later acquitted) in 1906 (Maryboy and Begay 2000). In the years prior to World War II, Navajo leaders organized their tribal government following the United States Constitution and introduced a chapter system to subdivide and more effectively govern their expansive reservation. In this way, the Navajos were better able to handle disputes with private landowners and government agents.

The value of Navajo service in World War II was immeasurable, as the U.S. Army successfully used Navajos as "Code Talkers" to defeat Japan in the Pacific War Theatre. Many Navajos also served as infantrymen in some of the most famous battles of the war, including Guadalcanal, Bougainville, Iwo Jima, Saipan, and Okinawa. Altogether, some 3,600 Navajo men served in the Army and many women served in the Women's Army Corps. Shortly after the war, in 1946, Congress established the Indian Claims Commission, which authorized the tribes to file claims on the government for lands taken without compensation. In order to gain compensation, many had to give up all rights to that land or area, and claims filed took decades to complete (Maryboy and Begay 2000).

In the last decades of the twentieth century, the Navajos successfully fought against increasingly harmful industrialism such as uranium mining, but only after some tragic losses. After uranium was discovered on the Navajo reservation, enterprising industrialists managed to keep the Navajo discoverers out of their share of claims, hiring them as manual workers without conveying the dangerous nature of uranium handling. Radiation illness and uranium poisoning often led to early death. Despite these losses, the Navajo have succeeded in obtaining some recompense from those responsible, including the U.S. government. One major success was the creation of a Superfund Cleanup Program designed to remove all radioactive mining tailings in and around the reservation boundaries. Finally during the socially active 1960s, inroads were made to direct additional public attention to the community needs of the Navajo people. Since that time education, social services, and economic development on the reservation have improved dramatically, though heath care, human rights, and environmental issues are still of great concern to this large community (Maryboy and Begay 2000).

Although there are no known Navajo places of traditional or religious significance in Grand County, many places in the nearby Monticello Field Office planning area are considered extremely important to the Navajo (see Gilpin 2001; Weber 1980). Where the importance of the landscape to Navajos begins and ends is therefore somewhat ambiguous, and it is likely that historic or protohistoric Navajo archaeological materials can be found within the planning area.

5.2.3 The Western Pueblos

Anthropologists typically categorize modern Puebloan communities into the Eastern and Western Pueblo groups based on historical differences in social organization (e.g., Eggan 1950). The Western Pueblos consist of Hopi, Zuni, Acoma, and Laguna; the first two of these are the Pueblo groups with homelands closest to the planning area and are discussed here. The Eastern Pueblos consist of several groups located along the Rio Grande, members of which speak either Keresan or one of the three Tanoan languages: Tewa, Tiwa, or Towa.

Among the Western Pueblos, clans are the principal social groups, crosscutting, organizing, and unifying villages. Among the Eastern Pueblos, moieties (dual divisions of villages) and sodalities (men's societies) are the principal social groups serving these functions. In the Western Pueblos, each village comprises several matrilineal clans, and each clan controls a ceremony and the kiva associated with that ceremony. Eggan (1950) thought that the Western Pueblo system was older than the Eastern Pueblo system, dating perhaps as recently as the Spanish entrada into the Southwest. However, Ware and Blinman (2000) date the Eastern Pueblo System earlier, to the A.D. 1300 reorganization of the Southwest. According to Ware and Blinman (2000), the Tiwa developed in situ, an argument they note was made earlier by Ford, Schroeder, and Peckham (1972). The Northern Tiwa pueblos, Taos and Picuris, never adopted the Kachina ritual and also lack Keresan-style medicine societies.

5.2.3.1 HOPI

The Hopi occupy 12 villages on First, Second, and Third Mesas, which are part of the southern escarpment of Black Mesa in northeastern Arizona (Brew 1979:515; The Hopi Tribe 2015b). Much ethnographic work has been conducted with the Hopi. This includes the work of H. R. Voth, who documented Oraibi religious ceremonies from 1893 to 1902; Mischa Titiev, who documented Oraibi society from 1944 to 1972; and Fred Eggan's classic study of western Pueblo social organization in 1950 (Whiteley 1988:xix). Other Hopi ethnographers include Florence H. Ellis, who described the history and use of Hopi lands, Harold S. Colton, who described Hopi history and ethnobotany in 1973, and Peter M. Whitely, who described Hopi cultural changes through the 1906 Oraibi split in his 1988 publication.

As with all of the other Pueblo groups, the first exchanges between Euro-Americans and Hopis were with the Spanish military and missionaries. Territorial issues also occurred between the Spanish Crown and the Hopi prior to U.S. federal intervention in the mid-1800s. The Spanish did not reassert themselves with the Hopis after the Pueblo Revolt of 1680, as they did with the Pueblos of New Mexico, due to the Hopis' more remote location in Arizona. As a result, the Hopi Pueblo became the refuge for all Pueblo people unwilling to reconcile with the Spaniards (Brew 1979). No other Spanish attempts at converting the Hopi to Christianity succeeded, and the Hopi Pueblo successfully resisted every subsequent Spanish political or religious overture.

The Hopis remained relatively isolated from Euro-American contact until the middle of the nineteenth century (Brew 1979; Dockstader 1979). However, following the end of the Mexican War in 1848, American encroachment into Hopi country increased, as evidenced by the establishment of Fort Defiance in 1851, a Moravian mission at the village of Oraibi in 1870, the Mormon outpost of Tuba City in 1878, and a Hopi Indian Agency in 1883. On December 16, 1882, President Arthur signed an executive order that established a reservation for the Hopi.

Pre-contact Hopi society is noted for its artistic use of murals and pottery, mining, and use of coal, as well as specialized agricultural practices that rely on agricultural plants with particular adaptations (Brew 1979:515). They farmed strains of plants with deep taproots, including maize and beans, and planted in areas with a large quantities of aeolian loess soils that had less runoff after rain and more permanent

springs than other soils in the area (Bradfield 1971). The moisture content of these aeolian loess soils was relatively high, but the environment was windy, so the crops had to be protected from shifting dune sand by wind breaks. Archaeological records at the Hopi Mesas indicate this was an ancient practice.

The Hopi utilized other methods of agriculture as well, and still do. They practiced floodwater farming in the valleys of major streams and at the mouths of arroyos; irrigation farming in artificial terraces irrigated by ditch or hand; and dry agriculture in upland areas, relying on rain to water their crops (Brew 1979:515; Sucec 2006:72, 81). Productive plots of land for dry farming were identified by the presence of saltbrush, greasewood, and rabbitbrush (Sucec 2006:81).

Hopi mythology permeates their worldview. According to the Hopi:

> When the Hopi emerged into the present world (Fourth World) from the Sipapuni (a limestone cone in the gorge of the Little Colorado River near the Grand Canyon) they encountered *Maa'saw*. They made a spiritual pact with this deity to be stewards of the earth, which included placing their footprints throughout their migrations. Their spiritual journeys led the Hopi through the Southwest and beyond, as they remained in each place for a period of time until their priests received signs that it was time to continue onward, until eventually they arrived at the Hopi Mesas, their rightful place. The placing of Hopi 'footprints'—physical evidence such as potsherds—showed that they had vested the area with their stewardship, fulfilling their part of the pact with Maasaw. The Hopi tended the earth by establishing ritual springs, sacred trails, shrines, and petroglyphs. They hold that the physical evidence in archaeological sites verifies their clan histories and religious beliefs, and they believe that these sites are not abandoned but are still the resting place of their ancestors, who continue to maintain a spiritual guardianship over these places. (Griffin-Pierce 2000:101).

The Hopi Footprint concept indicates that the Hopi consider all archaeological sites to be traditional cultural properties. "Ceramics, architecture, and shrines are some of the tangible signs that reveal the path of early Puebloans" (Bernardini 2008; Colwell-Chanthaphonh and Ferguson 2006; Sucec 2006). At Northern Arizona University in Flagstaff, Arizona, the Hopi Footprints Project represents an extensive and ongoing "collaboration between Hopi Cultural Preservation Office, educators, elders, tribal cultural professionals, anthropologists, and archaeologists, all working together to develop a curriculum focusing on culture education, technology integration, and action research in classrooms" (Northern Arizona University 2016).

Some pictographs and petroglyphs are recognized by modern Hopi as clan symbols, passed down through generations. Others are related to migration and history of the Hopi (Sucec 2006:60). Areas referred to as habitation or residential areas by archaeologists are known as "resting places" to the Hopi (Sucec 2006:81). Some of these resting places are noted like a map in the petroglyphs and pictographs for other migrating Hopi. They also indicated what "clans had been there, how long, and where they went"(Bernardini 2008; Sucec 2006:81). Bands who considered traveling together, but were unknown to one another, would test their ceremonial skills prior to joining on "behalf of the welfare of the entire group" (Sucec 2006:83). When a group left a resting place, they would leave seeds (typically corn, squash, and beans) in granaries for the next group to stay there. In addition, the leader would leave a handprint on a rock wall (Sucec 2006:83).

Oral histories provided by Hopi informants are consistent with the archaeological record of the region around the planning area (Sucec 2006). Hopi oral narratives have four forms: Navoti is "knowledge of events gained through the personal experience of the speaker." Tutavo is "theological teachings and guidance." Wuknavoti is "the knowledge known as prophecy." Tuuwusti includes "oral history learned from another person as well as narratives that are labeled by Euro-Americans as myths, legends, or folk

tales" (Sucec 2006:59). The Hopi have passed a formal resolution declaring their relationship with the peoples who lived in the regions during the Paleoindian through Formative periods (Sucec 2006:56). According to the Hopi, the first people to emerge into the present world were the *Motisinom*, from whom many Hopi clans are descended. The *Motisinom* are associated with the Paleoindian and Archaic periods and are part of a complex concept that is not shared with uninitiated Hopis or non–Native Americans (Sucec 2006:63).

Places of religious and traditional importance for the Hopi have not been formally identified in the planning area. However, the Hopi claim to be culturally affiliated with the Ancestral Puebloan and Fremont occupants of archaeological sites in the area. Hopi ancestral affiliation with the planning area has been documented through identification of Hopi elements in rock art panels in places like Arches National Park (Downum 2011; Stoffle et al. 2016:27). Hopi tribal representatives have also expressed interest in having several areas and landforms in and around the planning area formally recognized as culturally important to them, including Arches National Park and the La Sal and Henry Mountains. In the case of the former, they point out the evident resemblance between natural arches and rainbows, as well as the presence of blue Mancos shale—which they traditionally use as body paint (Stoffle et al. 2016:41,114). In the latter case, formal interest is based on the two mountain ranges' abundance of traditionally important plants like greasewood (*Sarcobatus* ssp.) and willow (*Salix* ssp.)—the latter of which is also a traditionally important component of Southern Paiute basketry (see Section 5.2.1.1) and, in prehistoric times, with split-twig figurines (Jett 1991).

5.2.3.2 ZUNI

The area currently occupied by the Zuni lies in western New Mexico, just west of the Continental Divide on the banks of the Zuni River (Woodbury 1979:467). The area traditionally used by the Zuni extended 35 miles east and northeast into the high-rising Zuni Mountains, and 50 miles west and south into lower, drier lands. There is a long history of Zuni ethnography, including Matilda Coxe Stevenson's (1904) early twentieth century account of Zuni mythology, esoteric fraternities, and ceremonies and Edmund J. Ladd's Zuni Religion and Philosophy (1983).

Similar to Hopi creation stories, Zuni oral tradition states that the Zuni people were created in the "fourth world, or womb," and were led by immortal gods through a succession of wombs before stepping onto the surface of Mother Earth into the light of this world (Ferguson and Hart 1985). As summarized by Ferguson and Hart (1985), Zuni origin stories describe how the Zuni emerged onto the earth surface from a hole in the Grand Canyon along the Colorado River just below the mouth of the Little Colorado River. From there they went south to the San Francisco Peaks and then east to Canyon Diablo. Continuing east toward Zuni, they followed the Little Colorado River. Somewhere along the middle Little Colorado River, the Zuni split into three groups, each of which went in a different direction: one group went south and never returned; a second group went straight to Zuni; a third group went southeast to Escudilla Peak, then northeast to the El Morro Valley, and finally arrived at Zuni from the northeast. Throughout their migrations, sometimes splitting into groups, sometimes accommodating others, the Zuni were always heading for and searching for their middle place, or center of the world (Hart 1980). Their petroglyph symbols and abandoned pueblos throughout their migration routes are still visible today.

Euro-American contact with the Zuni began in 1536 with Franciscan priest Marcos de Niza, whose slave Estevan was killed in advance of his arrival at the Pueblo of Hawikuh (Woodbury 1979:469). At the time of Spanish contact with Zuni in 1540, Spanish explorers found six Zuni villages at the hub of a well-established, complex trading network, which extended from Mexico to the Great Plains to the California coastline. The Zuni, therefore, had extensive knowledge of a large area (Hart 1980), and Spanish explorers, military units, and traders often used Zunis to guide them on their travels. The next three centuries were characterized by conflict with the Franciscans, who ceaselessly attempted to convert the

Zuni; however, the Zuni remained self-sufficient. During this time, the Zuni adopted technology from the Spaniards, including metal tools, agricultural crops—among which wheat, oats, and peaches were particularly important—and sheep and burros.

American pressures on the Zuni increased in the mid-nineteenth century as evidenced by a visit from James S. Calhoun, the first superintendent of Indian affairs, in 1849; Zuni's first American resident, A.F. Banta, in 1865; and Mormon missionaries in 1876 (Eggan and Pandey 1979:474–475). By 1881, the Atlantic and Pacific Railroad reached Gallup, approximately 40 miles to the north, and greatly facilitated the influx of traders, missionaries, and settlers to the region. The Zuni had originally been granted 17,635 acres of land by the Spanish Crown in 1689, and this was recognized by the treaty of 1848, confirmed by the U.S. government, and later augmented to 406,697 acres, which the Zuni currently occupy (Eggan and Pandey 1979:475; Pueblo of Zuni-Information Technology 1999b).

Zuni mythology explains their relationship to other tribes in the area. Their creation story contends that the Zuni, or *A'shiwi*, passed through three worlds before arriving in their current world (Stevenson 1904:28). The Hopi arrived in the fourth world 4 years after the Zuni, the Coconino Pimas (this may be the Bureau of Ethnology name used for the Havasupai or Pai at the time this ethnography was written) arrived 4 years after the Hopi, and the Navajo arrived 4 years after the Coconino Pimas (Stevenson 1904:28). Their mythology also accounts for the presence of Mexicans. In addition, Zuni mythology explains the arrival of agricultural plants, with witches having originally given an ear each of yellow corn, blue corn, red corn, white corn, multicolored corn, black corn, sweet corn; squash seeds; watermelon seeds; and muskmelon seeds to the corn maidens.

The Zuni farm the Zuni River Valley and its tributaries, raising primarily corn, squash, and beans, among other vegetables (Pueblo of Zuni-Information Technology 1999a). A focus is placed on raising plants native to the Zuni Reservation. Hunting and fishing are major forms of recreation. Livestock raising is also common, and the reservation is divided into 88 individual cattle allotments. The Zuni acknowledge the presence of their people in the region for thousands of years.

Many sites held sacred by the Zuni represent shared beliefs with ancestral and other contemporary Puebloans. In 1995, the Zuni Tribal Council passed a resolution declaring that they are descendants of the peoples who lived in the region during the Paleoindian, Archaic, and Formative periods (Sucec 2006:28). Like the Hopi, the Zuni assert that elements of Ancestral Puebloan rock art in places like Arches National Park are suggestive of Zuni origins (Stoffle et al. 2016:27).

5.2.4 Tribes Today

Today, Southern Paiutes live in small groups and take full advantage of modern American material culture, but also retain many of their ancestral crafts (e.g., their distinctive basketry) and ritual dances (Fowler and Parezo 1996:184). Band names are still employed in Southern Paiute communities. The San Juan and Kaibab Paiutes have made significant efforts toward resolidifying their culture by attempting to overcome poverty and reclaim their lands. The San Juan Paiutes in particular struggle to maintain their own language and sense of tribal identity while living within the much larger Navajo Nation (Fowler and Parezo 1996:185). Their goals include economic development within their own reservation and increased autonomy. They numbered around 200 individuals at the last census in 1990, most of them living in two areas in the Navajo Nation: a sandy, pinyon-juniper southern stretch they call Atitsiv (meaning "the sands") and a northern stretch called Kaivyuaxaru, or "the Mountain Place," which extends around Navajo Mountain and to the shores of Lake Powell in southeast Utah (Glen Canyon NHA). While the tribe had long maintained an almost entirely traditional form of government, when they fought for and won federal recognition in 1989 they were compelled to change their system of governance to one that meets the U.S. government's official guidelines for tribal governments. Such positions as "president," "chairman," or "chief" must now involve democratic elections. Litigation to establish a reservation of their own continues to this day.

Utes living in and around the planning area, meanwhile, do not live in a reservation. Instead, groups of Utes in southeastern Utah have settled in what is now called White Mesa, a community located approximately 11 miles south of Blanding. The Utes of White Mesa are technically part of the Ute Mountain Ute tribe of southwestern Colorado, and they have a seat on the latter's council (McPherson 2011). By the early 1980s they could boast a nine-member elected tribal board, as well as a Headstart program, a daycare center, adult education classes, health clinics, a senior citizen program, a recreation program, police protection, and a monthly visit from a tribal judge (McPherson and Yazzie 2000). Today, this community includes approximately 350 people and has undergone substantial changes. White Mesa has modern housing with electricity and running water. Many of the White Mesa Utes are employed in the education and service sectors, others operate a cattle company and a small store along the highway, and still others work for the tribal council (McPherson 2011). Future plans include increased access to water via a proposed 7-mile pipeline extending from White Mesa to Recapture Reservoir (McPherson and Yazzie 2000).

The Navajo Nation population has surpassed 250,000, and has one of the largest governments of any U.S. tribe. The Navajo Nation government operates as a three-branch system (executive, legislative, and judicial), with the Council Chambers hosting 88 council delegates that represent 110 Navajo Nation chapters or communities (Navajo Nation Tourism Office 2011). Given the size of their reservation and their prominence in the region, the Navajos more than any other Native American tribe are constantly faced with the challenge of adjusting to the rapidly-changing outside world while trying to maintain their own traditional cultural values (Parezo 1996:32–33). While more and more Navajos own small businesses both on and off the reservation, the reservation also has one of the highest unemployment rates in the country. For this reason, survival often means moving away from their homes and their families to cities like Farmington, New Mexico, and Flagstaff, Arizona, in search of work. Overgrazing also continues to be a problem, and there are continual conflicts over mineral and occupancy rights in joint-use areas involving Navajos, Hopis, and Southern Paiutes (Parezo 1996:32).

The Hopi reservation comprises 1.5 million acres in northeastern Arizona's Coconino and Navajo Counties and consists of 12 villages on three mesas (The Hopi Tribe 2015b). The Hopi tribal government consists of a unicameral government, whose powers are all vested in the Hopi Tribal Council. The Council consists of 14 representatives from the villages of Moenkopi, Bacavi, Kykotsmovi, and Mishongnovi (The Hopi Tribe 2015a). Many Hopis are moving off the reservation to urban areas in search of jobs and/or modern culture, and Hopi culture encourages men and women to become skilled carpenters, painters, masons, and mechanics, etc. to secure work in non-Hopi communities with little difficulty. Considerable income is also derived from carving figurines, watercolor painting, basketry, jewelry, and weaving (Dutton and Olin 1994:37). As mentioned above, there are also continuing conflicts between them and the Navajo over mineral and occupancy rights in joint-use areas.

The Zuni Tribe currently occupies a reservation that spans approximately 450,000 acres in McKinley and Cibola Counties in the western part of New Mexico, and also has land holdings in Catron County, New Mexico, and Apache County, Arizona (Pueblo of Zuni-Information Technology 1999a). The Zuni government consists of an elected governor, a lieutenant governor, and a six-member Tribal Council; elections are held every 4 years. Zuni continues to observe an elaborate ceremonial organization centering on six kiva groups (one for each direction—North, South, East, West, Up, and Down) and priesthoods, all of which cut across clans and households (Dutton and Olin 1994:33). Although traditionally one of the most isolationist of the Pueblos, in recent decades the Zuni have begun to allow for limited development and tourism. Zuni has paved and well-maintained roads, public utilities, and a school district (Dutton and Olin 1994:33). Still, the Zuni also remain one of the most traditionalist of the Pueblo groups, observing many traditional rituals and holidays (such as the *Shalako* ceremony) and considering many places and resources throughout the Southwest to be sacred (e.g., Stoffle et al. 2016:2).

5.3 Historic Period Lifeways

The Historic period refers to the time recorded by Euro-American written history. The Historic period in Utah started with the first Euro-American explorers trekking through the state and continues to the present. An overview of the Historic period in the MFO planning area is presented here. This discussion focuses primarily on Grand County, which constitutes the majority of the planning area, though because a small portion of San Juan County is also included in the planning area, the history of this county is discussed to a lesser extent as well. The history of the planning area can be divided into five major periods: the Early Exploration and Settlement period (1775–1870), the Industry and Growth period (1871–1929), the Great Depression period (1929–1940), the World War II period (1940–1945), and the Postwar period (1945–present). For more detailed information on these periods in the counties in the planning area, see Firmage (1996), McPherson (1995), and Tanner (1976).

5.3.1 Early Exploration and Settlement (1775–1880)

The earliest known non-aboriginal explorations in the planning area were conducted by Juan María Antonio de Rivera, who led two expeditions through the area at the request of Santa Fe Governor Tomás Vélez Cachupín (Firmage 1996:56; Jacobs 1992:202–203). The expedition members dressed as traders to avoid alerting the Ute and other groups to the true purpose of the excursion: military reconnaissance (Jacobs 1992:203). Rivera and his group visited the Aneth area in June and July of 1765 and then the Colorado River area in what is now Grand County as well as the La Sal Mountains later that fall (Firmage 1996:56–57).

During the second trek, Rivera learned of a trail the Ute used to visit the Spanish on the Lower Colorado River (Jacobs 1992:220). This trail may have been used later by Fathers Francisco Atanasio Dominguez and Silvestre Velez de Escalante during their expedition in 1776–1777 in search of a route from Santa Fe, New Mexico, to the California coast (Black and Metcalf 1986:18). The Dominguez-Escalante expedition represents the northernmost forays by Spaniards in the western United States. The Spanish encountered Numic-speaking people practicing a mixed strategy of horticulture and hunting and gathering and living in wikiups. During the 1820s, Euro-American trappers and traders began venturing into the Four Corners region and interacting with the Native Americans who lived there. Trappers and traders such as Etienne Provost, Jedediah Smith, William H. Ashley, and Antoine Leroux regularly intermarried, traveled, and traded with the Utah tribes (Holzapfel 1999). Primarily to exploit economic opportunities, these early entrepreneurs frequently changed alliances with local tribes and bands to keep pace with the ever-changing local political and economic conditions (Spangler 1995).

Some of the early traders and trappers left diaries and other documentation of their experiences and interactions with the tribes they encountered. Most of these writings concern encounters with the Ute, who appear to have become active participants in the Euro-American–dominated fur and slave trades. General William H. Ashley, a trapper and co-owner of the St. Louis-Missouri Fur Company, initiated the annual "rendezvous," a gathering of Native American and Euro-American traders and trappers in which furs could be acquired through trade rather than contract. In 1825, Ashley wrote about encountering mounted Utes near the confluence of Nine Mile Creek in east-central Utah. He stated that not only were the Utes well mounted, they also possessed English guns (Spangler 1995). Inevitably, as Euro-American occupation of the region accelerated, conflicts with local Native American groups increased. Aboriginal lifeways that had been documented during Spanish exploration changed dramatically, culminating in concentration of surviving Native American groups within the reservation system.

It was not until a half-century later, in 1826, that Spanish merchants established a trade route from their communities in New Mexico to the California coast. A branch of this trade route known as the Old Spanish Trail crosses through what are now Grand and San Juan Counties (McPherson 1995:78–79).

"The Old Spanish Trail was primarily a horse and burro pack route between Santa Fe and Los Angeles, which developed partly from a network of American Indian and Hispanic trade routes" (National Park Service 2001:5). The heaviest usage of the Old Spanish Trail was between 1829 and 1848 (National Park Service 2001:8). Caravans would start their journey in the fall and return the following year (National Park Service 2001:8). Woolen goods produced in New Mexico were traded for horses and mules in California (National Park Service 2001:8).

Important locations along the Old Spanish Trail routes in the planning area include Casa Colorado, Kane Springs, the Antoine Robidoux (also spelled Robideaux) inscription (described below), and the Colorado River crossing in Moab (U.S. Department of Interior et al. 2016:22). Casa Colorado is considered a prominent landmark along the Old Spanish Trail and was noted by John Macomb during 1858 (Crampton 1979:366). Kane Springs is a natural spring that provided water for travelers (Crampton 1979:368).

Among the earliest non–Native American trappers and explorers in the region was Denis Julien, an American fur trapper of French descent (Pierson and Louthan 1990). Julien is also known for his many inscriptions documented across eastern Utah, including one dating to 1836 near the mouth of Hell Roaring Canyon in southwest Grand County (Pierson and Louthan 1990). This inscription includes a one-masted boat, which is believed to depict Julien's mode of transportation along the Green River (Pierson and Louthan 1990). In addition, Julien also left inscriptions in the Dark Angel vicinity of what is now Arches National Park (dated 1844) and in Canyonlands National Park (dated 1836) (Mehls 1986a, 1986b). (The National Register of Historic Places form for the inscription in Canyonlands National Park notes that the signature is possibly fake.) Julien's inscriptions were likely created to claim the area for trapping, but they serve as an important indicator of Euro-American activities in the planning area prior to permanent settlement of Utah (Pierson and Louthan 1990). Julien was frequently employed by Antoine Robidoux or at least based at one of Robidoux's forts in the region (Firmage 1996:64). Robidoux is known for establishing Fort Uncompahgre in Colorado by 1828 for the purpose of trading with the Ute Indians of Colorado, and he is known as an influential fur trader along the Santa Fe Trail (Barton 2008:5; National Park Service 2001:6). Leaving the fort in his brother's charge, Robidoux began trapping in the Uintas. Realizing the profit to be made, Robidoux established another trading fort by 1832 called Fort Robidoux (also known as Fort Uinta, Fort Winty, or Twinty) (Barton 2008). Robidoux purchased furs from the various trappers and traders and transported them to New Mexico to sell and restock both of his forts (Barton 2008:13). Robidoux, like Julien, also left an inscription in Grand County along the Westwater Creek in the Book Cliffs area (Sammons Lohse 1980). The inscription is dated November 13, 1837, and indicates Robidoux passed through "to establish a trading post at the Green River or White" (Sammons Lohse 1980). Historians interpret this variously; some think the inscription meant Robidoux intended to build a fort near present-day Ouray, and others believe it meant Fort Uinta was not built until 1837 or 1838 (Hafen and Hafen 1954:102–103; Sammons Lohse 1980). Sammons Lohse noted in the National Register of Historic Places form for the Robidoux Inscription that there were no published references to Fort Uinta until 1837 and that, therefore, the 1831 or 1832 construction dates to which many historians refer may be incorrect and further research should be conducted to confirm the construction date (1980). Regardless of the date Fort Uinta was constructed, the Northern Branch of the Old Spanish Trail was used occasionally to supply Forts Uinta and Uncompahgre (National Park Service 2001:6–7). The fur trade continued in the region until the 1840s when the market for beaver pelts ended (J. Horn et al. 1994:1).

In 1848, Orville Pratt, commissioned by the U.S. government, organized an expedition and traveled the Old Spanish Trail to "assess its merits as well as those of the country (including portions of future Grand County) through which he passed" (Firmage 1996:67). Also traveling the Old Spanish Trail in 1848 was Lieutenant George Brewerton, with Kit Carson in the party. Brewerton's trek provided "descriptions of trading caravans on the Trail as well as the difficult crossing at the Green River" (Firmage 1996:67).

Trade of food items, fabrics, livestock, and Paiute Indian slaves continued regularly along the trail until 1848. At that time, the signing of the Treaty of Guadalupe Hidalgo ended the Mexican-American War and ceded much of the western United States, including the future state of Utah, to the U.S. government (McPherson 1995:80–81). With this cession, the use of the Spanish Trail changed character, and portions of the Old Spanish Trail in southeastern Utah were still used for exploration, settlement, and trade (Firmage 1996). Two documented portions of the Old Spanish National Historic Trail—the Northern Route and the Northern Branch—run through the planning area. Other segments of trail in the region may be referred to as the Old Spanish Trail, but they are not part of the Old Spanish National Historic Trail designated by Public Law 107-235. The Northern Route enters the planning area at the Utah-Colorado border in San Juan County and proceeds northwest past La Sal Junction and Kane Springs; a couple of route variations pass south of the La Sal Mountains. This portion of the trail roughly follows a portion of the modern alignment of Utah 163 just south of La Sal Junction and proceeds northwest until it turns west-northwest toward the town of Green River, approximately 15 miles south of Crescent Junction. The Northern Route continues on a west-northwest trajectory once it reaches the Green River, but turns west-southwest near Castle Dale and continues out of Emery County.

The Northern Branch of the Old Spanish Trail enters the planning area at the Utah-Colorado border from Grand Junction and proceeds west until it meets up with the Northern Route at Green River. The Northern Branch is the approximate alignment for U.S. Route 6/50, Interstate 70, and the Denver & Rio Grande Western Railroad. For more detailed histories and alignment maps of the Old Spanish Trail, see Crampton and Madsen (1994), Hafen and Hafen (1954), National Park Service (2001), and Sanchez (1997). In addition, *Spanish Traces*, the official journal and newsletter of the Old Spanish Trail Association, is available from the association's website, which offers issues for 1995 through 2015.

In 1853, Edward F. Beale, a surveyor and Indian agent, would lead the first of three survey parties to search for potential railroad routes through the region. Beale began his survey at the request of Missouri Senator Thomas Hart Benton and trekked along the thirty-ninth parallel (Firmage 1996:69).

The next party was the Gunnison-Beckwith Expedition, which was initiated in 1853 under the direction of the Secretary of War to explore and survey "the most practical and economical route for a railroad from the Mississippi River to the Pacific Ocean," according to acts of Congress (Beckwith 1855). Captain John W. Gunnison, of the Corps of Topographical Engineers, was selected to lead this expedition with the assistance of First Lieutenant Edward G. Beckwith, Third Artillery, and "such civil assistants as the Secretary of War may approve" (Beckwith 1855:10). The expedition began in mid-June of 1853 from Fort Leavenworth in Kansas with Gunnison and Beckwith occasionally each leading groups to investigate multiple route options at the same time (Beckwith 1855:11, 19–22).

Hafen and Hafen note that when the expedition reached the San Luis Valley in Colorado in early September, Gunnison followed the North Fork of the Old Spanish Trail and would be "the first to traverse a large section with a wagon train and the first to officially survey and map it" (1954:302). Alpine Archaeology disputes this, stating,

> It should be remembered that at the point the Gunnison Expedition encountered the Spanish Trail they were on a route of their own creation and were not following the Northern Branch of the Spanish Trail. Traveling without their guide, Antoine Leroux once they entered Utah from Colorado, they were anxious to reach the main Spanish Trail and turned southward in order to encounter it sooner than they would have following the Northern Branch. (J. C. Horn et al. 2011:16)

Beckwith first mentions the Spanish Trail in his September 13, 1853, entry in reference to the "Salt peak" being "directly upon the noted Spanish trail leading from California to Abiquiu, New Mexico…and a favorite resort for the Utah and Navajo Indians for trade" (1855:54). The expedition record notes on

September 22 that Antoine Leroux, the expedition guide, had not returned from his effort to find the best road to the Spanish Trail (Beckwith 1855:58–59; Hafen and Hafen 1954:305). On September 29, the expedition followed "the noted Spanish Trail [the main line] which passes the foot of Salt Mountain [La Sal Mountains] and they proceeded to follow the trail west-northwest" (Beckwith 1855:61; Hafen and Hafen 1954:305). The expedition reached Roan Mountains (also referred to in this source as the Book Mountains) on September 30 and then forded the Green River on October 1, 1853, noting that they are camped "on the Spanish Trail" (Beckwith 1855:61–62). The expedition forded the river approximately 3 or 4 miles north of present-day Green River, Utah (Hafen and Hafen 1954:306). The expedition left "the old Trail to make a circuitous, but better-watered route, to Price River (then called the White) and circled as far north as the site of Wellington, before turning southwest to again pick up the Old Spanish Trail near Huntington Creek in Castle Valley" before rejoining "the Trail about five miles southwest of Castle Dale on October 10, 1853" (Hafen and Hafen 1954:306–307). The expedition proceeded west until October 26, 1853, when Captain Gunnison and a small party, who had left the main party to explore the Sevier Lake area, were reported by a lone survivor to have been massacred (Beckwith 1855:72–74). It was later determined that the party had been attacked by a band of Pahvant Indians in revenge for an earlier attack against them by a party of white emigrants (B. D. Madsen 1991:283–284). Beckwith continued the survey and ended fieldwork for the year on November 8, 1853, in Salt Lake City, Utah, due to weather conditions (Beckwith 1855:75–78).

The third survey party was led by John C. Fremont in 1853. Unfortunately, Fremont's party was trapped by snow but eventually made it to Panguitch after "great suffering and hardship" (Firmage 1996:69–70).

Mormon missionaries attempted to settle in what is now Grand County in June 1855 by establishing the Elk Mountain Mission at a location that is now on the northern edge of the town of Moab (Firmage 1996:73–74). Despite peaceful relations with the Ute and Navaho in the region initially, the relationship between the Mormon missionaries and the tribes quickly soured by September 1855 (Firmage 1996:77–87). After a confrontation about where the Mormon cattle were grazing, James Hunt, one of the missionaries, went to get his horse. Once out of sight of the mission fort, Charles, a son of Chief St. John, shot Hunt in the back (Firmage 1996:85–87). The missionaries managed to recover Hunt, but were attacked by a group of Elk Mountain Ute, leading to a gun battle. The missionaries learned that two missionaries who had accompanied an Elk Mountain Ute hunting trip were killed (Firmage 1996:85–87). The missionaries left the fort early the next day after giving six head of cattle to the Native Americans for a guarantee of safe passage. The last of the Mormon group reached Manti in October 1855, after posting notes along various routes warning travelers to avoid the Elk Mountain Mission (Firmage 1996:85–87). It would be the 1870s before any permanent settlement was established (Grand County 2016).

In July 1858, Colonel W. W. Loring set out from Camp Floyd, Utah, with a military detachment of 50 wagons and 300 men heading to Fort Union, New Mexico (Loring and Hafen 1946:49). The detachment would be the first big wagon train to travel this route, along which three separate parties, led by Gunnison, John C. Fremont, and Edward F. Beale, had traveled in 1853 (Loring and Hafen 1946:49). Antoine Leroux, the Gunnison-Beckwith expedition guide, accompanied Loring's group and pointed out the direction the Gunnison-Beckwith expedition had taken up White River in 1853, but Loring noted that no road remained (Loring and Hafen 1946:59). Loring also noted the old Mormon Road, indicating the wagon road used to reach the Elk Mountain Mission (Loring and Hafen 1946:60). Along the way, the detachment cut roads on the side of at least one mountain ridge with the intent of "making a solid and permanent road" (Loring and Hafen 1946:61). Further road upgrades made by the detachment included sections of dry-laid stone retaining walls and wood and stone box culverts constructed of railroad ties (J. C. Horn et al. 2011:19). Alpine Archaeology identified several older road segments in 2011 that, based on Loring's notes, likely represent the original route Loring and his men built or improved along the route of the Old Spanish Trail in 1858 (J. C. Horn et al. 2011:19). In 1875, a survey led by Ferdinand V. Hayden extended into southeastern Utah and the La Sal Mountains (C. S. Peterson 1975:23–24). The survey thoroughly documented the La Sal Mountains, but, unfortunately, the crew had to dump their equipment and records to run from a group of Native Americans near Dry Valley (C. S. Peterson 1975:23–24).

Euro-American settlement of the area occurred sporadically. Conflict with local Ute bands has been cited as one of the primary reasons for the punctuated development of southeastern Utah (McPherson 1995:97). However, the remote and dry nature of the area was likely more influential in discouraging permanent settlement. White settlers re-entered what is now Grand County and tried to establish homes and settlements as early as 1874. Many of the settlers came from Utah, but some came from Colorado, and a large portion of these settlers were looking for cattle ranching potential. There is some disagreement about who came to the Moab area first. Crispen Taylor's descendants claim Taylor traveled to the Moab area "in 1874 to look the land over after hearing about it from John and James Ivie, members of the Elk Mountain Mission" (Firmage 1996:103). The Green brothers (Silas and George) reportedly trekked out to the Moab area in 1875 with 400 head of cattle (Firmage 1996:103–104). Regardless of start date, the Green brothers' time in Moab Valley was cut short by death during the winter of 1876–1877. It was suspected the Greens were "killed by Indians," but their cause of death was never verified (Firmage 1996:103–104). Two years later, the Taylors moved their families to Moab Valley along with several hundred head of cattle (Daughters of Utah Pioneers 1972:79).

William Grandstaff, also known as "Nigger Bill" or "Negro Bill," arrived in Spanish Valley accompanied by "Frenchie," a trapper, in 1877 and was among the first to establish a permanent residence in the area (Daughters of Utah Pioneers 1972:10). Grandstaff had a few cows with him. Grandstaff and Frenchie each claimed half of the fort at the Elk Mountain Mission and half of the valley. Grandstaff "would drive his cattle east along the southern edge of the Grand River until he came to a stream of clear mountain water, with grass lining its banks for miles upstream, where he left the cows" a place that is now named "Negro Bill Canyon" in his honor (Daughters of Utah Pioneers 1972:10).

A. G. Wilson and his son Alfred arrived in 1878 to scout the area for cattle range (Firmage 1996:107). The Wilsons purchased the lands claimed by Frenchie and returned later in the fall of 1878 with their cattle. The Wilsons then learned that Frenchie, prior to leaving the area, had also traded or sold the same land to Walter Moore (Firmage 1996:107). The Wilsons and Moore amicably split the property (Firmage 1996:107). Other ranchers, like John H. Shafer and C. M. Van Buren, began settling portions of Grand Valley in 1878 (Tanner 1976:69). Enough people had moved to the region by spring of 1879 that a formal request for a post office was filed with the U.S. government. It was granted and "the Plainfield Post Office was established in the upper valley" (Tanner 1976:71). Eventually, the post office was moved to the lower valley where the majority of the region's residents lived.

Moab, Utah, was founded by 1879, placed on a regular mail route, and had an official post office by 1880 (Daughters of Utah Pioneers 1972:12–16; Firmage 1996:110–111; Tanner 1976:89). Because there was no official directive from the Church of Jesus Christ of Latter Day Saints (LDS) to settle the area, settlers were a mix of Mormon and non-Mormon people, many of whom were cowboys or prospectors. Moab did not follow the typical Mormon layout of "small town lots surrounded by farm and range lands" (Firmage 1996:110). While the streets were laid out in the typical Mormon grid, additional off-grid streets, like the Ouray Wagon Road**,** wound through the town, and the land patents ranged in size from 40 to 160 acres (Firmage 1996:110). Moab became part of Grand County in 1890 when it was formed from part of Emery County (Grand County 2016).

The earliest settlers in the northern part of what is now San Juan County established themselves sometime during the late 1870s at the southern end of the La Sal Mountains on Coyote Creek (Firmage 1996:105; McPherson 1995:96; Tanner 1976:78). Several homesteaders, including the Ray, Maxwell, and McCarty families, built their homes in the general area of what is now La Sal, Utah, originally known as Coyote (McPherson 1995:96; Tanner 1976:75). These families were part of a post–Civil War westward migration of people searching for good cattle lands (Tanner 1976:75). La Sal was also added to the regular mail route in 1879 (Firmage 1996:111). La Sal became part of San Juan County in 1880 when the county was created out of portions of Iron, Kane, and Paiute Counties by the Utah territorial legislature (McPherson 1995:319).

5.3.2 Industry and Growth (1880–1929)

By the time Utah became the 45th state on January 4, 1896, the focus of the inhabitants of southeastern Utah shifted from the establishment and survival of fledgling communities to the expansion of the economic base and infrastructure. The residents of Utah were involved in a variety of enterprises by this time, ranging from agriculture to service industries. Commercial agriculture saw the additions of alfalfa, grains, meadow grass, and potatoes to the list of Utah's cash crops. One of the emergent San Juan County markets was the livestock industry. With ample rangeland, both Grand and San Juan Counties saw a rise in the number of residents involved in sheep and beef industries. As the counties began to grow, the railroad made its way into the area and aided that growth.

5.3.2.1 INTRODUCTION OF THE RAILROAD

Initial surveys for the transcontinental railroad through Utah were conducted by the Gunnison-Beckwith Expedition (see Section 5.3.1 [Early Exploration and Settlement] for more detail) in 1853 (Bishop 1997:62). The Transcontinental Railroad arrived in Utah in 1869, and branches were built throughout the territory not long after (Newell 1999:96). Within a few years, rail lines, many of which were local interurban lines built and owned by Utah-based entrepreneurs, wove their way throughout the Utah Territory, connecting the once-remote Mormon settlements to the national landscape.

The development of the railroad network both spurred and responded to discoveries in the mining industry in the 1870s and 1880s. During these early years, the Union Pacific Railroad Company dominated the freight transport sector, owning, operating, or otherwise controlling most of the major rail trunk lines that carried mineral products to buyers outside of Utah. The vast wealth pouring out of Utah mines and smelters and into Union Pacific Railroad Company coffers attracted a lot of attention from the free market, and soon eager entrepreneurs appeared on the stage.

The Denver & Rio Grande Railroad incorporated in Colorado in 1870 to construct a Pacific Coast–bound route out of Denver and began examining the possibility of a rail line between Denver and Salt Lake City (Carr and Edwards 1989:188). To oversee this line, the Denver & Rio Grande Railroad created a subsidiary company, the Denver & Rio Grande Western Railroad (D&RGW). Under the auspices of the D&RGW, Ellis Clark surveyed a proposed railroad route in 1881 (Watt 1997:28). Construction of the narrow-gauge track followed shortly thereafter, with the line entering Utah at Westwater on the Utah-Colorado border and passing through Green River and Price and over Soldier Summit into Provo; the track reached Salt Lake City in June 1883 (Salt Lake Tribune 1882). The D&RGW began service via the narrow-gauge line through Grand County by 1882 (Carr and Edwards 1989:188–194).

Known railroad stations, camps, and towns along the narrow-gauge line in Grand County included Acheron, "West Water," Cottonwood Station, Cisco, Whitehouse Station, Sagers Station, Thompson Springs, Crescent Station, Little Grande Station, and Solitude Station (Firmage 1996:135). Chinese, Italian, and Mexican workers are known to have worked along this segment (Firmage 1996:135–136; J. Horn et al. 1994:16; Vileisis 1992:29–33). By 1890, this line was upgraded to standard gauge and allowed D&RGW to be connected from Ogden, Utah, to Grand Junction, Colorado, on a single gauge type (Carr and Edwards 1989:189–190; Pierson and Jamison 1993:37). The upgrade added a station at Agate, located northwest of Cisco (Firmage 1996:141; J. Horn et al. 1994:22). Several existing stations, such as Westwater, Cottonwood Station, and Cisco, all moved to be closer to the new standard gauge line, which built was south of the narrow gauge line (Firmage 1996:141). In 1911, a standard gauge branch, known as the Ballard & Thompson Railroad, was built between Thompson and Sego through the Thompson and Sego Canyons to allow coal mined in the Book Cliffs at the American Fuel Company mine to be brought down to the D&RGW for use on their lines (Carr and Edwards 1989:195; Strack 2013).

Despite considerable persistence, the residents of Moab were unsuccessful in their lobbying for a railroad spur to improve their importance in the region and their financial situation (Firmage 1996:134). Once they realized they would not receive the railroad spur they desired, local leaders worked to improve the road between Moab and Thompson (Firmage 1996:134). A significant portion of the Moab to Thompson Road followed the alignment of the Old Spanish Trail. The road north of Moab splits, with one road leading north to Thompson; the other northwest to Green River, Utah. Site 42GR697, known as Upper Courthouse Spring, is an important watering hole for those travelling along the trail; it is found along the Moab to Thompson Road, and the Green River runs to the north of the site. The road to Green River follows the Northern Route of the Old Spanish Trail. The road to Green River has a stop at Brink Spring, a water hole with good grazing for livestock.

In spite of the distance to the nearest station, the railroad brought a number of advantages to Moab, including the efficient movement of a variety of goods, ease of travel, and growth in the various businesses that supported the railroad industry or took advantage of locations and opportunities around depots. Perhaps most importantly during the late 1800s and early 1900s, the railroad brought with it the ability to exploit mineral resources and livestock and move large quantities of these resources to markets in a fast and efficient manner.

5.3.2.2 PINHOOK DRAW

During the summer of 1881, a group of Native Americans, thought to be Utes, Navajos, and Paiutes, stole livestock and other goods from white settlers in the Moab–La Sal area. The La Sal Mountains are considered traditional hunting areas by the Ute and were used for protection when returning to their homelands (Salmon and McPherson 2001:6). The establishment of ranches and farms in the mountains by white settlers reduced Ute hunting territory and encroached on the homelands. Tensions had risen over large numbers of cattle being killed by the raiding group of Native Americans. In addition, newspapers of the time fanned the flames by writing incendiary articles about needing to deal with the "Indian problem" (Salmon and McPherson 2001:8–10).

Accounts of the time indicate that Dick May and Byron Smith were visiting John Thurman to purchase horses in May 1881 (Salmon and McPherson 2001:13). The Native American raiding group had been accused of stealing horses by Thurman a few days before, and they showed up and killed May at Thurman's cabin after an intense fight. Thurman's body was found half a mile away. The cabin was burned, and money, horses, flour, guns, ammunition, and other goods were taken (Salmon and McPherson 2001:13). A Ute account of the event indicates May started the fight by grabbing one Native American and throwing him to the ground and killing two of the Utes horses (Salmon and McPherson 2001:11). It is assumed Smith was killed as well, but his body was never found (Salmon and McPherson 2001:12). May's brothers George and Billy, along with several others, went to retrieve the bodies and figure out what happened several days later.

The Native American raiding group was observed stealing more livestock near Monticello days later. A posse formed by Joshua B. Hudson, one of the ranchers who had horses stolen, tracked the group to Blue Mountain (Salmon and McPherson 2001:14). Another Euro-American group from Colorado, led by Bill Dawson and Billy May, also came looking for stolen livestock at the same time (Salmon and McPherson 2001:14). Both groups seemed intent on fighting the Indians, not just reclaiming their livestock and other stolen property. Eventually, the posse led by Dawson and May caught up with the Native American group at Pinhook Valley (Rattle and Notarianni 1982:8-5). The Indians opened fire and eventually killed 10 of the cowboy posse members (Rattle and Notarianni 1982:8-5). The posse escaped and when they returned the next day to collect the dead, the Native Americans were waiting for them and opened fire, resulting in a second day of bloodshed (Rattle and Notarianni 1982:8-5).

An additional eight were killed and three wounded. Hudson's party arrived a day later, but the Native American group had escaped (Rattle and Notarianni 1982:8-5). Four months later, eight of those killed during the fight were officially buried in Pinhook Valley (Salmon and McPherson 2001:27). None of the members of the Native American group were ever identified by the settlers or subsequently tried for the battle deaths (Tanner 1976:145–146). The fight in Pinhook Valley remains the most notorious conflict between whites and Native Americans in the MFO planning area.

5.3.2.3 FARMING

A few of the settlers in the La Sal and Moab areas were interested in raising crops. Many of the settlers began growing fruit. The growing season in the MFO planning area is longer than in other areas of Utah, though orchards still required irrigation as in the rest of the state. O.W. Warner is credited with bringing the first fruit trees to the area when he came to the Spanish Valley (Tanner 1976:191). Warner planted many of these trees, but he also gave them to other families to plant (Tanner 1976:191). The region produced large numbers of apples, pears, grapes, strawberries, and peaches (including the Stewart peach, developed by Randolph H. Stewart) which were shipped to markets as far away as England (Firmage 1996:169; Tanner 1976:191–193). Not only were they plentiful, but also very large and award winning. Fruit from what is now the MFO planning area won prizes at multiple competitions across the country (Firmage 1996:207–208; Tanner 1976:192). John Peterson, a fruit grower, opened a canning factory in 1911 after being "appalled at the tremendous waste in this product [fruit]" (Daughters of Utah Pioneers 1972:106). The factory employed 20 people and produced approximately 5,000 cans a day (Daughters of Utah Pioneers 1972:106).

Some corn, also prize winning, was grown in the Moab area. Overall, agricultural production data by county are difficult to find for this period. However, Grand County was not a major farming region; most crops were grown in home plots, not on a large scale. Crops known to be planted include potatoes, barely, wheat, oats, rye, and sugar beets (Firmage 1996:208). During the 1920s, a turkey farm operated near Moab (Daughters of Utah Pioneers 1972:108).

This time period represents a shift from traditional agricultural practices toward commercial production. This movement began as early as the 1870s and 1880s in other parts of the nation (Ellis 2003:11). The establishment of a land grant college (now Utah State University) in Logan changed the nature of agriculture in the state (C. S. Peterson 2012). Founded in 1887, the college concentrated its efforts toward solving the unique problems of agriculture in Utah's arid environment. The scientific approach to agriculture promoted by the college championed increased efficiency and production through "modern" technology and bioengineering (Ellis 2003:11; C. S. Peterson 2012).

5.3.2.4 RANCHING

The vast majority of settlers in what is now the MFO planning area came looking for lands on which to graze cattle and places to build ranches (Firmage 1996:107). The earliest permanent herd was brought into the Spanish Valley by either the Taylors or Greens in the 1875 (Firmage 1996:103). Many of the early ranchers likely learned of the valley from Texas cattlemen driving their cattle across the region on their way to other locations, such as California or Missouri, as early as the mid-1860s (Beckstead 1991:33–39; Firmage 1996:107). The Texas cattle drives through Utah declined by the late 1870s due to the high number of cattle that became established in Utah (Beckstead 1991:40–45). The Taylor family cattle operation, later known as the Taylor Livestock Company, became one of the largest operations in Grand County (Daughters of Utah Pioneers 1972:78–79). Many other settlers brought their animals to the area and "gradually built up large cattle herds" (Daughters of Utah Pioneers 1972:79). These cattlemen likely wanted to take advantage of the Colorado beef prices of the time as

well as the available grazing lands (Firmage 1996:115). Preston Nutter, a cattleman originally from Virginia, began to run cattle in the Thompson-Cisco area of Grand County in 1883 (C. S. Peterson 1975:80). Nutter, orphaned at age nine, headed west with a wagon train in St. Louis, eventually attended business college in San Francisco, and worked as a hostler at the same time (Price and Darby 1964:234). Nutter would first come to Utah as part of the ill-fated Alfred Packer–led trek to prospect in the Colorado Territory's San Juan District (Price and Darby 1964:234–235). While he never ended up prospecting, Nutter returned to Utah in 1883 with a large herd of cattle from Montrose, Colorado (Price and Darby 1964:236). Nutter chose the "vicinity of Thompson's Spring and north to Hill Creek" to run his cattle because there were few settlers in the area and because of the new rail head at Thompon's Spring (Price and Darby 1964:236). It is difficult to know exactly how many cattle were in the region encompassed by the MFO planning area during the late 1800s due to incomplete or nonexistent records and chronic underreporting of cattle numbers to tax collectors (Beckstead 1991:47). A number of corporate cattle companies ran outfits in southeastern Utah in the 1880s, including the Pittsburgh Land and Cattle Company (Beckstead 1991:83).

Many of the large cattle companies chose to leave Utah due to a price drop and competition for grazing lands between 1887 and 1915 (Beckstead 1991:211). Nutter went into business with Ed Sands and Tom Wheeler to form the Grand Cattle Company in 1888, but he bought out his partners by 1889 and "extended his operations further into the Hill Creek and Book Cliff areas" (Price and Darby 1964:239). One of the largest cattle companies that was created and thrived during this time was formed by Al and Jim Scorup in the early 1890s (Beckstead 1991:213). The Scorups started in White Canyon, in present day San Juan County. The Scorups bought out the Indian Creek Cattle Company and formed a partnership with the Somerville brothers and Jacob Adams, resulting in the Scorup-Somerville Cattle Company (Beckstead 1991:211–215).

Given turbulence in the cattle industry, not all ranches raised only cattle; several also raised sheep. Arthur Taylor brought sheep into what is now the MFO planning area in 1895 after cattle prices began to drop (Beckstead 1991:85; Daughters of Utah Pioneers 1972:80). Sheep could produce lambs and wool for the market each year, whereas cattle took 4 years to mature and be ready for market (Beckstead 1991:208). Unfortunately, sheep can cause more destruction than cattle in grazing areas, which resulted in deadly battles between sheepherders and cowboys (Beckstead 1991:208–209). When Taylor began running cattle and sheep near Moab, law enforcement was brought in to help keep the peace (Beckstead 1991:209).

Throughout the West in the early part of the twentieth century, the stresses of uncontrolled grazing were taking a toll on pasturelands. In 1903, the federal government stepped in to protect remaining forests and watersheds; numerous forest reserves, later known as national forests, were created by proclamation. The La Sal National Forest was designated during this period of federal expansion. The development of U.S. Forest Service lands placed regulations on how, when, and where ranchers grazed livestock (Alexander 1987:26). Forests were still open to grazing but on a regulated scale, with application requirements for grazing permits. Cycles of drought, overgrazing, and episodic declines in the livestock market contributed to a temporary lull in the San Juan County ranching industry (McPherson 1995:180).

5.3.2.5 MINING

Although agriculture was a key component of the region's economy, mineral extraction was also important in the development of southeastern Utah. Coal, gold, silver, copper, and a variety of minerals have been mined in the region, but oil, uranium, vanadium, and potash have been among the most profitable.

Gold was discovered in Miner's Basin in the La Sal Mountains around 1879, and as late as 1929 near Floy Wash, but not in large enough quantities for commercial mining (Daughters of Utah Pioneers 1972:84–85; Tanner 1976:204). Copper was discovered in the 1890s in the Lisbon Valley, with the Big Indian mining district formed in 1892 (Hahn and Thorson 2006:511). Coal mining began at Sego around 1900 because extensive coal deposits were discovered in the Book Cliffs. The mine at Sego thrived despite several management changes and was still producing 1,500 tons of coal a day in 1928 (Firmage 1996:251). The Sego location produced coal for the D&RGW railroad, and a spur line was built directly to the mine (Carr and Edwards 1989:195; Strack 2013). Potash was mined to a limited extend prior to World War I in Grand County, but this activity expanded after major discoveries were made west of Thompson in 1925 (Firmage 1996:249). BLM records indicate that permits for potash exploration "were issued after 1926 for areas that are now part of Arches National Park" (Firmage 1996:249). Initial oil production in the Moab area in 1920 was hindered by poor quality. Oil production was hit or miss during the 1920s, with incidents such as the Frank Shafer No. 1 well catching fire and destroying the drilling equipment (Firmage 1996:253).

5.3.2.5.1 Radioactive Resources

Radium and uranium deposits were discovered in 1898 by John Wetherill in western San Juan County during an archaeological expedition (Shumway 1970:1–2). While Wetherill left a claim note on the uranium deposit he found, he never officially recorded his claim (Shumway 1970:2). Wetherill told Preston Redd about this discovery years later, and Redd relocated Wetherill's claim in 1943. This claim had rich uranium deposits and became the Blue Lizard Mine (Kampf et al. 2015:2; Shumway 1970:2). The French discovered that the addition of uranium or vanadium to iron created ferro-alloys, resulting in fine steel (Shumway 1970:2).

The earliest attempt to mine radium in Utah was in 1900 by Steven T. Lockwood of Buffalo, New York (Robison 2015:127). Lockwood contacted men named Welsh and Loftus, who had discovered carnotite in 1898 near Richardson, Utah, and convinced them to establish a mining company, the Welsh-Loftus Uranium and Rare Metals Company (Robison 2015:127). This company changed its name to the Rare Metals Reduction company in 1903 (Robison 2015:127). Lockwood built an extraction facility in Lackawanna, New York, which produced its first triuranium octoxide (yellowcake is one of the more popular forms) and iron vanadate salts in 1904 (Robison 2015:127). Unfortunately, poor vanadium sales, an inability to obtain enough carnotite, and the poor quality uranium and radium resulted in the failure of the Rare Metals Reduction Company, and the deposit at Richardson was abandoned (Robison 2015:127). Uranium-vanadium ore was discovered on the Lisbon Valley anticline in 1913, and vanadium was mined initially at the Divide and Service Berry mines (Chenoweth 2006:536).

In 1923, the Yellow Circle Mining Company received an order for "four carloads of carnotite ore containing at least three percent uranium" from the United States Radium Corporation of Orange, New Jersey (Royce 2012:29). The Yellow Circle Mining Company was founded by Howard W. Balsley, a former forest ranger from Moab, Utah, who had been "grubstaking [providing supplies or funds to a mining prospector on promise of a share in his discoveries] radium, vanadium, and uranium miners since the turn of the twentieth century" (Amundson 2002:5; Merriam-Webster 2015; Taylor and Taylor 1970:118–119). While this order raised the hopes of miners in the region, no mining boom emerged by late 1924 (Royce 2012:29). Balsley and a small crew would continue to mine uranium on a small scale for eastern companies, providing the ore for luminous compounds and medicines (Royce 2012:30). Uranium and vanadium mining would return during World War II.

5.3.2.6 REGIONAL OUTLAWS

The Moab-La Sal region was used as a hideout for early outlaws such as Butch Cassidy and his Wild Bunch, including Harry Longabaugh (also known as the Sundance Kid), George "Flat Nose" Curry, Matt Warner, Mont Butler, Bert Madden, Tom and Billy McCarthy, and Tom Roach (Tanner 1976:148). Most of these outlaws started out as cowboys and ranchers, but eventually turned to bank and train robberies, horse stealing, and cattle rustling sometime in the 1870s (Tanner 1976:149). The outlaws hid out at the McCarthy Ranch near Coyote Creek in the La Sals when they were being pursued by the law (Tanner 1976:78, 151). Other nearby hideout locations were Robber's Roost and Brown's Hole, and rustled livestock were grazed at Bull Pasture, Sam's Mesa Canyon, and the Twin Corral Box (Tanner 1976:149–150). Local ranchers and cattlemen, such as Preston Nutter, hired "the outlaws to work as cowhands during their 'cooling off' periods" in an attempt to prevent rustling (Price and Darby 1964:241). Because most outlaws had cowboy experience, they were typically top-notch hands (Price and Darby 1964:241). By the 1920s, most of the outlaws had been "victims of violence," moved out the area, or became regular citizens (Tanner 1976:165–166).

5.3.2.7 OTHER INDUSTRY AND GROWTH

Traffic increased along existing roads in what is now the MFO planning area due to farmers and miners transporting their goods to the Thompson Springs rail station. The road between Moab and Thompson Springs frequently washed out and was one of many roads maintained at a local level until Utah's statehood in 1896 (Firmage 1996:184–185). The State of Utah began appropriating funds for road improvements and repairs in 1897, while the federal government provided funds for the construction and maintenance of postal roads (Firmage 1996:184–185). Unfortunately, the available funds never seemed to be enough to build or repair all the roads. Local individuals, including Samuel King, thus created a stock company to build a toll road between Moab and Castle Valley and Cisco (also known as the Grand River Toll Road) to provide for much more reliable transportation of goods (Firmage 1996:187–188). This road never caught on as an alternate route, likely due to the overall distance. An inscription reading "Kings Toll Road" remains on a boulder along the modern Highway 128. In 1912, a bridge was built across the Colorado River (known then as the Grand River) at Moab using a combination of state and local bonds (Firmage 1996:226–227).

In 1913, a legislation designation created the Midland Trail across Utah and appropriated $50,000 for a special construction fund for the outlying sections of the road (Knowlton 1963:155). Construction on the Grand County portion of the Midland Trail, which ran from the Colorado border through Cisco and Green River and eventually to the Nevada border, was completed in 1914 (Knowlton 1963:155–157). The Midland Trail route would eventually be replaced by U.S. Route 6/50 and Interstate 70, though some segments or bridges may remain. Funds to improve the road between Moab and Thompson Springs in 1919 came courtesy of the Federal Highways Act of 1916 (Firmage 1996:229).

Automobiles began to appear in the area in the 1910s, and a transportation service was started in 1916. This service used two Buick trucks, which could each hold six passengers, and ran between Monticello and Thompson Springs (Firmage 1996:229). In addition, the Baldwin Brothers Company, owned by Dennis and Clarence Baldwin, started selling Ford cars in 1916 (Firmage 1996:229).

Communication technology began trickling into southern Utah by 1900, when Grand County received its first telephone line, which ran from Moab to Thompson. This line connected "with the Denver & Rio Grande Western Railroad and the Western Union Telegraph Company and was the only means of communication in this section of southeastern Utah" (Tanner 1976:245). The next lines connected Moab with Castleton, Miner's Basin, and the La Sal district; these were built by the La Sal Mountain Telephone

and Electric Company sometime after 1903 (Tanner 1976:245). In 1908, a line was completed connecting Moab to Monticello (Tanner 1976:245). By 1915, the telephone lines were operated by the Midland Telephone Company, but it would be after World War II before the system expanded again (Tanner 1976:245).

5.3.3 The Great Depression (1929–1940)

Like much of the West, the economy of the Four Corners region was firmly established on resource extraction. The severe financial blow toward the close of the 1920s severely affected these industries. The crash of the stock market in late 1929 heralded the onset of the Great Depression. It was a couple of years before the full impact of these events was felt in Utah, at which time the local economy reached its lowest point. Having already entered a post–World War I slump, San Juan County was ill-equipped to deal with further economic strain. The lack of a substantial manufacturing and industrial base further aggravated the situation.

The Depression did not impact Grand County as much as it did the rest of Utah initially. "The livestock industry remained the major economic base" in Grand County, with the railroad industry also still providing some support (Firmage 1996:266–267). Mining and oil production activities in Grand County came to a halt due to lack of funding (Firmage 1996:289). In April 1929, Arches National Monument was established northwest of Moab (Firmage 1996:255). Nearly a year later in 1930, the news announced that U.S. Route 6/50 would be built across Grand County (Firmage 1996:255). The monument designation and road announcement was among the few positive economic developments the area experienced for a decade.

The growth in tourism that occurred following the establishment of Arches National Monument was surprising. The monument provided local leaders with the opportunity to promote their towns as destinations for those who wished to visit it (Firmage 1996:267–268). Moab's Lion's Club formed in July of 1930, and one of their first initiatives was to help increase "tourism to the region while it lobbied for an enlargement of the new attraction and better access to the area" (Firmage 1996:268). Improvement of roads to facilitate tourists occurred in the early 1930s with a gravel road from Grand Junction, Colorado to Moab constructed in 1931 and U.S. Route 6/50 completed in 1934, providing an east-west route across Utah (Firmage 1996:271). The Moab-Thompson Springs road running south from U.S. Route 6/50, now Highway 191, was "paved in the late 1930s, greatly facilitating access to the monument and to Moab itself" (Firmage 1996:271). Another piece in the tourism puzzle was the 1931 Supreme Court ruling that the Colorado River is a navigable stream (Firmage 1996:272–273). Utah won "control of the river's banks and bed within the state and the right to develop them" (Firmage 1996:273). The ruling also benefited tourist riverboat enterprises that trekked up and down the river (Firmage 1996:273).

As income decreased during the Great Depression, local farmers and ranchers could not afford to purchase seeds and equipment or maintain herds of livestock. Despite roads connecting farmers to the railroad in Thompson Springs, many found the cost of hauling their crops to the railroad prohibitive, especially those dry farming in San Juan County (Perkins et al. 1957:276). Agriculture did not contribute significantly to the overall economic health of Grand County. Produce was not widely exported outside of the county (Firmage 1996:280).

In the years prior to the 1930s, few restrictions regulated grazing on public lands. As a result, large-scale ranchers effectively took control of much of the prime range. In 1934, the federal government passed the Taylor Grazing Act, which regulated the use of public grazing land and established the Grazing Service, a precursor to the BLM (Hull and Avery 1980:56; Muhn and Stuart 1988:35–41). The purpose of the Taylor Grazing Act, and a mission of the Grazing Service, was to stabilize the volatile livestock industry by preventing misuse and abuse of public lands through regulatory control (Muhn and Stuart 1988:35–

41). With beef and wool prices at unprecedented lows, hundreds of area ranchers could not afford the price of permits to graze their livestock on public lands. On January 24, 1935, the local newspaper, the Times-Independent, reported that Grand and San Juan Counties were now part of the newly created Grazing District #6 (Firmage 1996:275). Local ranchers welcomed the new regulations since they would help with range degradation issues and intense competition. One consequence of the grazing act was that "many small and marginal ranching outfits either quit or were forced off the land after they failed to secure permits for grazing land" (Firmage 1996:277). Those without grazing rights sold off up to an estimated 75 percent of the sheep in Grand County in 1935 (Firmage 1996:277). Ranchers began taking better care of the land and started fencing off their grazing parcels in the 1940s (Firmage 1996:277). Fencing helped reduce cattle rustling as well (Firmage 1996:277).

While many companies were made idle by the Depression, Howard Balsley's uranium operation continued apace, negotiating a contract with Vito Manufacturing of Canonsburg, Pennsylvania, to provide uranium ore "for use as pigment in pottery and glass factories" in 1934 (Amundson 2002:5; Royce 2012:31). Balsley's mining enterprise used more than 300 miners across the Colorado Plateau and had warehouses in Blanding, Monticello, Moab, Cisco, Thompson, and Green River, Utah, as well as in several Colorado towns (Amundson 2002:5). Balsley was "the only ore buyer on the Colorado Plateau who paid for both the uranium and vanadium in the same ore" during his 11-year affiliation with Vito (Royce 2012:31).

As the nation continued to languish in the throes of the Great Depression, the U.S. government set about establishing programs of institutional relief. As part of President Franklin Roosevelt's New Deal, various forms of federal aid poured into struggling communities. In general, Western states received more financial support than eastern states, with Utah ranking ninth overall in federal aid per capita (Holzapfel 1999:215). In addition to social welfare programs, including federally run programs as well as those operated by the LDS Church for the benefit of its members, a wide variety of work relief programs benefited local residents. Works Progress Administration (WPA) and Civilian Conservation Corps (CCC) crews engaged in numerous community betterment activities, including road construction and maintenance, bridge construction, snow shoveling, wood chopping, and trails and parks development. In both Grand and San Juan Counties, the CCC made significant contributions to water control infrastructure and roads by constructing reservoirs, improving wells and springs, and creating miles of truck trails through the Abajo Range (McPherson 1995:224). Camp F-20 was established at Warner Lake and built a road along Brumley Ridge toward Geyser Pass (Baldridge 1971:92; Firmage 1996:275). When that project was completed, the company stationed at Camp F-20 moved to Camp PE-214, just outside of Moab, and worked on an erosion-control project on Mill Creek (Baldridge 1971:92; Firmage 1996:275). Camp DG-32 (also known as the Dalton Wells Camp), located just outside of Moab, was also responsible for the creation of the Little Mule Shoe Cattle Trail which aided ranchers "in moving their cattle between summer pastures on the LaSal Mountains and winter pastures in the Flat Iron Mesa and Hatch Point vicinities" (Baldridge 1971:368; Bennett 2006; Firmage 1996:281). DG-32 also built the east-west-trending Cane Springs CCC Livestock Trail "connecting the upper reaches of Kane Springs Creek with the lower segments of Kane Springs Creek canyon" (Turnipseed and Turnipseed 2006). Camp 953, which was transferred for the winter from Idaho to Moab, conducted reclamation and flood-control work, particularly on Mill Creek (Firmage 1996:275). Moab had as many as three CCC camps operating in its vicinity at one point and always had at least one camp nearby during the entire period from 1933 to 1942 (Firmage 1996:282–285). The residents of Moab welcomed the camps knowing what the CCC could provide the region (Firmage 1996:282). The presence and importance of the WPA, CCC, and other work relief programs in Utah remains evident today in buildings, water storage and transportation features, sidewalks, landscaping, and parks. These facilities are physical reminders of a significant period in the history of the region.

One interesting experiment conducted in Grand and San Juan Counties during the Depression was a form of socialized medical care (Firmage 1996:280). Families purchased medical contracts for $25 a family, "which fee was matched by the counties and guaranteed medical care for all members of the participating families for a year" (Firmage 1996:280). Despite doctors being overworked, the system was a success. The program was ended with the start of World War II and an increase in prosperity for the region (Firmage 1996:280).

5.3.4 World War II (1940–1945)

For southeastern Utah, as was the case for many parts of the country, the recovery from the Great Depression was accelerated by the demands of World War II. In addition to enlisting as troops, residents of Grant and San Juan Counties joined the nation in rationing programs and scrap drives, bought war bonds, and volunteered to serve on local committees organizing the civic war efforts (Firmage 1996:294). Increased demand for agricultural products helped the county recover from the economic downturn that had followed World War I. Cattle prices were restored to pre-Depression levels, and demand for wool increased prices (McPherson 1995:182–183). Although the local timber industry was small, it experienced a boom as the military bought lumber for the construction of bridges, equipment, barracks, shipping crates, and other necessities (McPherson 1995:225). For a time, the residents of the region enjoyed a strong economy based on industries that had become established over the past century. When World War II ended, many communities correspondingly experienced economic slowdowns.

As the gears of war began to turn for World War II, government contracts for vanadium created a small mining boom in Grand County. In 1941, the local news touted the various mineral resources being mined including carnotite and magnesium (Firmage 1996:292). In addition, "the government classified vanadium as a strategic metal and created a government-sponsored buying program to boost exploration and production of the mineral" in 1941 (Amundson 2002:8). The Metals Reserve Company (MRC) was created in 1942 and set a base price for vanadium ores (Amundson 2002:8). In January 1942, the news celebrated the vanadium deposits (Firmage 1996:292). Buying stations were established in Moab, Thompson, and Monticello as mining activities increased (Amundson 2002:8). The largest vanadium producer in Grand County was United States Vanadium Company, with Yellow Cat as the largest individual producer (Daughters of Utah Pioneers 1972:89). While vanadium production continued to ignore the uranium, Howard Balsley's company continued to collect and sell the ore. In 1942, Balsley was contacted by the U.S. Army Corps of Engineers's Manhattan Engineer District to purchase Balsley's "stockpile of high-grade uranium ore" (Amundson 2002:8). This ore was taken to Colorado for processing into a crude uranium sludge and used for the development of the atomic bomb (Amundson 2002:8–11). The vanadium boom was short lived, however. By 1944, the government had a surplus of vanadium and stopped purchasing it at midnight on February 28, 1944 (Daughters of Utah Pioneers 1972:89). The Manhattan Engineer District would continue to purchase uranium even after the vanadium production in the region was halted, thanks to Balsley's early recognition of uranium's value (Amundson 2002:9).

The U.S. Agricultural Census from 1945 shows a trend toward fewer farms after the Depression ended. Grand County only had 91 farms in 1945, down from 155 only 5 years before, the second lowest number of farms in a county in Utah (Firmage 1996:295; U.S. Census Bureau 1946:20–21). Ranching numbers also indicated declines in sheep raising and wool production as well as in cattle production in Grand County (Firmage 1996:295). San Juan County did not fare much better, as it lost 55 percent of its farms between the 1940 and 1945 censuses, dropping from 675 farms to 306 (U.S. Census Bureau 1946:20–21).

As the war drew to a close, both returning soldiers and a decreased national demand for agricultural products and uranium resulted in an inevitable shift in the economy. A decline in the demand for wool led to yet another weak period for the sheep industry. The revelation that uranium was at the heart of the

bombs dropped on Nagasaki and Hiroshima to end the war excited the region (Amundson 2002:11). Uranium was plentiful in what is now the MFO planning area, but President Harry Truman issued a prohibition on the sale of all known uranium-containing lands on September 20, 1945 (Firmage 1996:295–296). An earlier, little-known prohibition on the sale of uranium ore for private industrial purposes had been established in 1942, resulting in the government being the only legal customer for the ore in the interests of national security (Amundson 2002:xvii; Firmage 1996:296). Despite this single customer option, the rumbles of an impending mining boom loomed over southeastern Utah.

5.3.4.1 MOAB RELOCATION CENTER

The Moab area was briefly the site of a Japanese-American relocation camp during World War II. "After the riot at the Manzanar Relocation Center [a relocation camp in California] in December 1942, the War Relocation Authority (WRA) decided to remove so-called troublemakers from the relocation centers" (National Park Service et al. 2000). Accordingly, on January 11, 1943, 16 men arrived at the recently-closed CCC Camp at Dalton Wells, approximately 13 miles north of Moab (National Park Service et al. 2000). The camp, referred to as the Moab Relocation Center in WRA documents (but also known as the Moab Citizen Isolation Center or the Moab Isolation Center), was "used as-is, with no fence or other improvements," despite it having been shuttered for just over a year (Louthan et al. 1994; National Park Service et al. 2000). "Thirteen more from Gila arrived on February 18, followed six days later by 10 more from Manzanar" (Louthan et al. 1994:Section 8, Page 4). Fifteen more arrived from the Tule Lake camp on April 2 (Louthan et al. 1994:Section 8, Page 4). "At peak occupancy in late April 1943, the relocation center held 49 men" (Louthan et al. 1994:Section 8, Page 5; National Park Service et al. 2000). All of the internees were transferred to an old Indian school in Leupp, Arizona, on April 27, 1943 under the guise of "bringing together the families of those persons sent to Moab" (National Park Service et al. 2000). The camp was abandoned after all of the men were transferred (Louthan et al. 1994).

5.3.5 The Post-War Period (1945–Present)

Soldiers began returning home in late 1945 to a revived economy. The wartime Office of Price Administration made purchasing goods difficult after the war because they maintained wartime price control. The higher pricing remained in effect until the end of 1946 on all consumer items, except for sugar, rice, and rents, in an effort to prevent an unstable economy (Bishop 1997:201–202). Agriculture and mining were able to respond to the shifting economy to limited degrees, but the nature of the changes meant an adaptation in technology, which resulted in a decrease in the number of employees required. Beginning in the 1950s, farms began to consolidate, working fewer holdings of greater acreage (Bishop 1997:229).

One of the few post-war industrial booms was in uranium mining, which occurred across the Colorado Plateau in the 1950s and 1960s. The other boom, one closely tied to tourism, was provided by Hollywood. The film industry came to Utah looking for picturesque backdrops and cheap prices. The earliest movie shot in Grand County was *The Wagonmaster* in 1949. Film making provided temporary jobs as extras and economic stimulus through housing and feeding the actors and film crews (Firmage 1996:304). Archaeological sites such as 42GR2192 (the Rio Grande Movie Set) have been identified in the region that are likely associated with this period in Moab history. Local leaders realized the potential benefits and publicity for the region and formed the Moab Film Commission in 1949 (Firmage 1996:305). The film industry could have expanded further in the region, but efforts were hampered by the uranium boom, which stretched local resources thin (Firmage 1996:306).

The Cold War arrived in Grand County in 1963 with the announcement of a missile-launching contract from the government. The launch complex would be built in Grand County on the east side of the Green River, directly across from the town of Green River (Firmage 1996:342). The complex was known as the

Green River Test Site or the White Sands Launch Complex and eventually covered 2.2 million acres (Godby 2016). The Green River Test Site was an "off-range facility that supported the Advanced Ballistic Re-entry System test program and Pershing test firing in the 1960s and 70s" (Godby 2016). "Missiles would be fired from there to a target site at White Sands, New Mexico" (Firmage 1996:343). While the missiles were launched near Green River, Utah, the "first stage or 'booster' impact zone" was located south-southwest of Moab, west of U.S. Highway 191, and encompassed portions of what is now Canyonlands National Park and a portion of the southwest MFO planning area (Chamberlain and McPherson 2015:125). The location became inactive around 1975 due to advancing technologies and was officially decommissioned in 1983 (Chamberlain and McPherson 2015:135). The test site is scheduled for demolition by the military after mitigation measures are completed (Building Technology Incorporated 1984; Godby 2016).

Among the excitement of the uranium mining, oil exploration increased after the news of a well at Cisco striking oil (Firmage 1996:317). While oil production never reached the same frenzied levels as uranium, it did significantly contribute to Grand County's economy (Firmage 1996:318). Potash mining increased through the 1960s and 1970s as well (Firmage 1996:336). Potash produced in Grand County was only a small fraction of the amount produced in San Juan County (Firmage 1996:350). These mining activities resulted in land being worth too much to use for agriculture (Firmage 1996:328–329).

The construction and use of the Interstate 70 link between Interstate 15 and Denver, Colorado, have been a continuing boon to the region (Bishop 1997:241). Constructed primarily from 1971 to 1976, with a couple of sections near Elgin not completed until 1983, the highway has brought tourism and shipping revenue to the region (Firmage 1996:364, 378–379). The attraction of tourism and recreation in the area has boosted the economy and helped stabilize and reverse earlier population declines. "By 1970, 80 percent of Utah's population was living in heavily urban areas" (May 1987: 185). Regional leaders have developed plans to continue the expansion of the economic base and to improve the quality of life offered to the residents well into the next century.

5.3.5.1 THE URANIUM BOOM

In 1946, "Congress established the United States Atomic Energy Commission…to foster and control the peacetime development of atomic science and technology" (Buck 1983:1). Soon after, the Atomic Energy Act of 1946 was signed into law and went into effect January 1, 1947. The law gave the Atomic Energy Commission civilian control of atomic energy, effectively allowing peacetime development of the new resource (Buck 1983:1–2; Ringholz 2002:8). With the signing of the Atomic Energy Act of 1954, "liberal licensing provisions, greater access to technical data, and the right to own reactors provided the essential conditions for the private development of nuclear power in the United States" (Buck 1983:7). Despite these changes, private companies "did not gain the right to own fissionable material" (Buck 1983:7). These changes in law helped to spur research and development using materials like uranium in the United States.

The Four Corners region was one of the few areas in and around Utah to enjoy an economic boom during the post-war period, fueled by the U.S. government's drive to establish a domestic stockpile of refined yellowcake uranium oxide. "In 1948, an ore buying station was opened at Monticello, Utah to purchase ores from that area" (Chenoweth 2006:536). Prospecting occurred along Lisbon Valley, among other locations, and "uranium-bearing exposures in the upper portion of the Cutler Formation were discovered" in 1948 "along the central part of the southwestern flank of the anticline" (Chenoweth 2006:536). This discovery led to the 1948 reopening of the Service Berry mine (Chenoweth 2006:536).

The uranium boom overtook Moab in the 1950s. Charlie Steen, after numerous attempts, discovered uranium in the basal Chinle Formation in July 1952 at his Mi Vida claim (Chenoweth 2006:536; Ringholz 2002:1–15, 57–63). Steen sank a test shaft near the discovery hole in October 1952 and shipped his first

ore in December 1953 (Chenoweth 2006:536–537; Ringholz 2002:67–70). Charlie Steen's UTEX Exploration Company (UTEX) headquarters were established in Moab in 1953 (Firmage 1996:313). UTEX provided bunkhouse facilities and board at the Mi Vida mine for their mine employees without charge. Many of these employees had families in Moab they would visit on the weekends (Steen et al. 1953:3). In addition, G&G Mining Company, a lessee, provided trailer houses for their employees on a site provided by UTEX (Steen et al. 1953:).

Stories of uranium deposits drew in hundreds of prospectors hoping to strike it rich. Schools, gas stations, and even the electrical lines all heaved with the stress of so many additional people. Brownouts were a regular occurrence. Another school was built to accommodate the influx of students. Moab had a sewage plant built, 10,000 feet of sewer line installed, 13,000 feet of new water lines installed, upgraded electrical lines installed, and the local long distance telephone system upgraded to meet the needs of the increased population by the mid- to late-1950s (Firmage 1996:320–321). San Juan County is located at the center of the southwestern United States' uranium districts. The uranium boom resulted in the development and improvement of the regional transportation system based on the need for roads and bridges able to carry ore trucks and heavy equipment year-round. The paved road from Monticello to Blanding was completed between 1952 and 1953 (McPherson 1995:261).

Between 1952 and 1957, domestic production of uranium increased from 700 tons to 17,800 tons per year, and 40 percent of San Juan County became staked with uranium mining claims (McPherson 1995:256). In 1955, 79 uranium-related companies operated out of Moab; by late 1956, only 32 remained (Taylor and Taylor 1970:101). As of 1957, the principal companies "mining in the district included UTEX, Standard Uranium Corporation, Homestake Mining Company, Hecla Mining Company, Lisbon Uranium Corporation, Continental Materials Corporation, Hidden Splendor Mining Company, LaSal Mining and Development Company, and E. L. Cord" (Chenoweth 2006:537). In October 1957, the Atomic Energy Commission announced in they had "arrived at a point where it is no longer in the interest of the government to expand the production of uranium concentrate" (Taylor and Taylor 1970:252). This announcement meant that "no new discoveries would be accepted" by the Atomic Energy Commission (Taylor and Taylor 1970:252). Only established mines were allowed to sell their ore but with quotas imposed based on past production (Taylor and Taylor 1970:252). Federal buying programs and production incentives drove companies to produce a surplus, which was achieved by the mid-1960s. "Beginning in 1971, all uranium concentrate produced in the United States was for use in nuclear power plants and in nuclear research reactors" (Chenoweth 2006:541). This marked the beginning of "an open market with competition among all producers" (Chenoweth 2006:541).

The Arab Oil Embargo of 1973 and the resultant energy crisis prompted nationwide concern about the nation's dependence on foreign energy resources. The Carter Administration took immediate steps to further subsidize domestic energy production. These subsidies supported uranium production despite the waning market for the product (Hedden 1998:16). By then, the United States had a sufficient stockpile of weapons-grade uranium.

By the mid-1970s, public awareness of the health risks associated with uranium mining and processing spread. Increasing pressure prompted enactment of the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA) (Christie 1998:16–17). The Department of Energy (DOE), the successor to the heritage of the Atomic Energy Commission, was tasked with the remediation of abandoned uranium mills. Companies still in operation were responsible for their own cleanup under direction of the newly founded Nuclear Regulatory Commission (NRC), and were required to generate environmental impact statements addressing the effects of continued operation. Although federal funds were granted to the DOE, NRC projects were to be funded by the generators responsible for the hazards. As a result, American taxpayers were responsible for $1.6 billion of remediation at abandoned mill sites, while mill generators were responsible for 100 percent of the cost of remediating sites active at the time the UMTRCA was ratified (Christie 1998:17). The growing costs associated with long-term adverse effects of uranium milling, a

more than sufficient stockpile of uranium oxide, and President Reagan's steps to eliminate federal subsidies for specific industries resulted in a near total collapse of the domestic uranium industry in 1984. Atlas Minerals, one of the largest mining companies, closed all of its mines and its mill at Moab in 1984 due to the price collapse (Chenoweth 2006:542).

The processing mill constructed by the Uranium Reduction Company near Moab in 1956 and later sold to the Atlas in 1962 stood until 1984 when "Atlas demolished the processing buildings and buried them in the southern corner of the tailings pile and placed an interim cover over the pile as part of decommissioning activities conducted between 1988 and 1995" (U.S. Department of Energy 2016:2). Atlas had proposed to cap the contaminated area, but declared bankruptcy in 1998 before they could start the process. The U.S. Nuclear Regulatory Commission (NRC) became responsible for the property at that point, but had to appoint a trustee, PricewaterhouseCoopers, since the NRC could not regulate a site it possessed. The U.S. Department of Energy (DOE) was responsible for the clean-up of the site, and after an extensive environmental impact statement process to fulfill National Environmental Policy Act requirements, a plan was approved to remove the mill tailings pile and other contaminated materials from the former mill site to an off-site disposal location near Crescent Junction, Utah (U.S. Department of Energy 2016:3). The disposal is scheduled to be completed in 2025, with long-term custodial care planned after disposal completion (U.S. Department of Energy 2010).

5.4 Contemporary Culture

The two counties that comprise the MFO planning area are in the mid-range of Utah's population rankings, and communities in the area thrive in large part due to the region's rich history and a strong sense of place. This final section of this chapter briefly summarizes the demographic and social contour of the MFO planning area and concludes with brief summaries of three key drivers in the regional economy.

At present, tourism is the most vibrant industry in the Four Corners region, due in part to the creation of Lake Powell in the early 1960s. Rainbow Bridge, Arches National Park, Natural Bridges National Park, and Canyonlands National Park are among the most popular tourist attractions in the country, but the marinas at Hite, Hall's Crossing, and Paiute Farms also draw large numbers of visitors to San Juan County. Moab has emerged as a gateway community visited by tourists who come to visit Grand and San Juan Counties and plays host to mountain bikers, hikers, climbers, off-road vehicle enthusiasts, rafters, and sightseers. The larger communities of San Juan County share this role, although to a lesser extent than Moab. This trend has resulted in a more stable, sustainable economy for many located near the region's population centers; however, many of the available jobs are in the relatively low-paying service industry.

5.4.1 Socioeconomic Profile

Grand and San Juan Counties consist of rural communities characterized by agricultural landscapes, small towns, and untouched vistas. The population of these counties accounts for only 2.1 percent of Utah's total population. Grand County has a population of 9,516, while San Juan County has a population of 15,772 as of 2015 (U.S. Census Bureau 2016a, 2016b). For people 25 years old or older, more than 90 and 83 percent in Grand and San Juan Counties, respectively, are high school graduates (U.S. Census Bureau 2014b). In addition, homeownership rates are between 67 and 79 percent (U.S. Census Bureau 2014b). As of the 2000 Census, more than 78 percent of residents in Grand County and 73 percent in San Juan County are employed in sales, office, service, management, professional, and related occupations (U.S. Census Bureau 2014a). The remaining portion is employed in natural resources, construction, maintenance, production, transportation, and material moving occupations (U.S. Census Bureau 2014a). The farming, fishing, and forestry occupations account for 1.9 to 8.1 percent of employment in each

county (U.S. Census Bureau 2014a). "In 2013, area national park visitor spending contributed to an estimated $55.7 million in labor income," which is approximately 21.7 percent of the total labor earnings in Grand County for 2013 (Headwaters Economics 2015:14). In fiscal year 2013, local tax revue from traveler spending was $7.4 million, while the transient room tax resulted in $2.1 million collected, the resort tax resulted in $2.4 million collected, and the restaurant tax brought in approximately $352,000 for Grand County (Headwaters Economics 2015:24, 29).

> The general sales tax also generates significant revenue locally with sales taxes on accommodations, food services and drinking establishments, and arts, entertainment, and recreation, and other tourism related industries accounting for about half of local taxable sales ($154 million in taxable sales, and about $1.6 million in direct local sales tax collections to local governments in Grand County). (Headwaters Economics 2015:29)

5.4.2 Livestock Grazing and Agriculture

Alfalfa, oats, wheat, other small grains, grapes, vegetables (including asparagus), pistachios, and cattle are major agricultural products in the MFO planning area (Utah State University Cooperative Extension 2005a, 2005b). Grazing allotments in the area are as follows:

> A total of 84 allotments occur within the boundaries of the Moab Field Office. Of these allotments, 74 are administered by the Moab FO, four are administered by the Vernal Field Office, and six are administered by the Grand Junction, Colorado, Field Office. Seventy-seven of the allotments are available for use by domestic livestock, and seven allotments were made unavailable for grazing by domestic livestock in 1995 and 1996. (M. F. O. Bureau of Land Management 2015)

Of the lands in the grazing allotments, only 77 percent (approximately 1.8 million acres) are BLM lands (M. F. O. Bureau of Land Management 2015).

5.4.3 Minerals and Energy

Potash mining and oil and gas exploration and production are major industries supporting the economy of the region (DrillingEdge 2016; Intrepid Potash 2016). Oil and gas exploration is primarily concentrated north of Interstate 70 in the northeast portion of Grand County with some proposed wells in the southwest corner of Grand County (Utah Automated Geographic Reference Center 2016). Copper cathodes are produced by the Lisbon Valley Mining Company in Lisbon Valley (Lisbon Valley Mining Company 2013). Approximately 20 locations in the MFO planning area have active gold, silver, travertine, hematite, carnelian agate, or black humates mining operations (Utah Division of Natural Resources 2016).

5.4.4 Recreation and Tourism

Recreational activities in the area include four-wheel drive and all-terrain vehicle (ATV) trail riding, mountain biking, hiking, fishing, hunting, boating, camping, horseback riding, and many other outdoor activities in or on parks, forests, lakes, and rivers (Moab Area Travel Council 2016; Moab Tourism Center 2016). ATV and four-wheel drive trails include the White Wash Sand Dunes, Chicken Comers, Gemini Bridges, Poison Spider Mesa, and Moab Rim trails (Moab Area Travel Council 2016). In addition, the region has forest lands managed by the Manti-La Sal National Forest, national parks, such as Arches and Canyonlands, and Dead Horse Point State Park. According to the National Park Service, there were 1,082,866 visits to Arches National Park and 462,242 visits to Canyonlands National Park during the 2013 fiscal year (Headwaters Economics 2015:13). The BLM estimates there were 1,179,500 visits to lands managed by the MFO during the 2007 fiscal year (Headwaters Economics 2015:14). Collections from BLM campground payments increased by more than 200 percent between 2000 and 2010, with an 85 percent increase between 2006 and 2010 (Headwaters Economics 2015:15). More than 150 requests

for special recreation permits or permit renewals in the recreational and visitor services category from 2015 and 2016 appear in the National Environmental Policy Act project summary list in the BLM's ePlanning system, demonstrating the high demand for recreation on BLM-managed lands (Bureau of Land Management 2016). Sixty-eight film permits were requested during the 2015–2016 time span for projects ranging from social media to commercial still photography to exercise videos, demonstrating the visual value of BLM-managed lands (Bureau of Land Management 2016).

5.5 Summary

The area that is now the MFO planning area has been home to Native Americans for at least 13,000 years. The lifeways of aboriginal peoples over this very long period of time were tremendously diverse, varying as a result of such things as environmental changes, the adoption of agricultural crops, and the migrations of different groups. Euro-Americans began to explore the region in the 1600s and 1700s, establishing permanent settlements beginning in the late 1800s. Very low population densities and an economy based on the region's abundant and significant natural resources—important for farming, ranching, mining, and recreation, among other things—have been hallmarks of communities here since that time.

5.6 References Cited

Adler, Michael A.

1996 "The Great Period": The Pueblo World during the Pueblo III Period, AD 1 150 to 1350. In *The Prehistoric Pueblo World, A.D. 1150-1350*, edited by Michael A. Adler, pp. 1. University of Arizona Press, Tucson.

Aikens, C. Melvin (editor)

1970 *Hogup Cave*. University of Utah Anthropological Papers No. 93. University of Utah Press, Salt Lake City.

Alexander, Thomas G.

1987 *The Rise of Multiple-Use Management in the Intermountain West: A History of Region 4 of the Forest Service*. U.S. Department of Agriculture, Forest Service, Washington, D.C.

Allison, James R., Winston B. Hurst, Jonathan D. Till and Donald C. Irwin

2012 Meanwhile in the West: Early Pueblo Communities in Southeastern Utah. In *Crucible of Pueblos: The Early Pueblo Period in the Northern Southwest*, edited by R. H. Wilshusen, G. Schachner and J. R. Allison. Cotsen Institute of Archaeology Press Monograph 71. University of California Press, Los Angeles.

Ambler, J. Richard and Mark Q. Sutton

1989 The Anasazi Abandonment of the San Juan Drainage and the Numic Expansion. *North American Archaeologist* 10(1):39-53.

American West Center and Marriott Library at the University of Utah

2008 Early Peoples: The Paiutes. Available at: http://www.utahindians.org/archives/paiutes/earlyPeoples.html. Accessed January 26, 2015.

Amundson, Michael A.

2002 *Yellowcake Towns: Uranium Mining Communities in the American West*. University Press of Colorado, Boulder.

Anderson, R. Scott

1993 A 35,000 Year Vegetation and Climate History from Potato Lake, Mogollon Rim, Arizona. *Quaterary Research* 40:351-359.

Anderson, R. Scott, Jim Hasbargen, Peter A. Koehler, Eric J. Feiler and S. Anderson

1999 Late Wisconsin and Holocene Subalpine Forests of the Markagunt Plateau of Utah, Southwestern Colorado Plateau, U.S.A. *Arctic, Antarctic, and Alpine Research* 31(4):366-378.

Antevs, Ernst

1948 Climatic Changes and Pre-White Man. *The Great Basin with Emphasis on Post-Glacial Times* 38(20):167–191.

Bailey, Garrick and Roberta Glenn Bailey

1986 *A History of the Navajos: The Reservation Years*. School of American Research Press, Santa Fe, New Mexico.

Baldridge, Kenneth W.

1971 Nine Years of Achievement: The Civilian Conservation Corps in Utah. Dissertation, Department of History, Brigham Young University, Provo.

Barlow, K. Renee

2002 Predicting Maize Agriculture among the Fremont: An Economic Comparison of Farming and Foraging in the American Southwest. *American Antiquity* 67(1):65–88.

Barton, John D.

2008 Antoine Robidoux -- Buckskin Entrepreneur. Available at: http://ocw.usu.edu/History/History_of_Utah/Utah_History__Antoine_Robidoux.pdf. Accessed August 17, 2016.

Beck, Charlotte and George T. Jones

1997 The Terminal Pleistocene/Early Holocene Archaeology of the Great Basin. *Journal of World Prehistory* 11:161−236.

Beckstead, James H.

1991 *Cowboying: A Tough Job in a Hard Land*. University of Utah Press, Salt Lake City.

Beckwith, Edward G.

1855 *Report of Explorations for a Route for the Pacific Railroad, Capt. J. W. Gunnison, Topographical Engineers, Near the 38th and 39th Parallels of North Latitude, From the Mouth of the Kansas River, Mo., to the Sevier Lake, in the Great Basin*. Reports of Explorations and Surveys, to Ascertain the Most Practicable and Economical Route for a Railroad From the Mississippi River to the Pacific Ocean, Made Under the Direction of the Secretary of War, in 1853-4, According to Acts of Congress of March 3, 1853, May 31, 1854, and August 5, 1854. Vol. II. A.O.P. Nicholson, Washington, D.C.

Bennett, Lee

2006 *IMACS Form for Site 42SA026851*. Prepared by Bennett Management Services, LLC, Monticello, Utah. Copies available from Utah Division of State History, Salt Lake City.

Benson, Larry V. and Michael S. Berry

2009 Climate Change and Cultural Response in the Prehistoric American Southwest. *Kiva: The Journal of Southwestern Anthropology and History* 75(1):89-119.

Bernardini, Wesley

2008 *Hopi Social Memory in Stone: The Tutuveni Petroglyph Site*. University of Arizona Press, Tucson.

Betancourt, Julio L.

1984 Late Quaternary Plant Zonation and Climate in Southeastern Utah. *The Great Basin Naturalist* 44(1):1–35.

Betancourt, Julio L., Thomas R. Van Devender and Paul S. Martin

1990 *Packrat Middens: The Last 40,000 Years of Biotic Change*. University of Arizona Press, Tucson.

Bishop, M. Guy

1997 *A History of Sevier County*. Utah Centennial County History Series. Utah State Historical Society, Salt Lake City.

Black, Kevin D. and Michael D. Metcalf

1986 *The Castle Valley Archaeological Project: An Inventory and Predictive Model of Selected Tracts*. Bureau of Land Management Cultural Resource Series No. 19, Salt Lake City, Utah.

Blackburn, Fred M. and Ray A. Williamson

1997 *Cowboys & Cave Dwellers: Basketmaker Archaeology in Utah's Grand Gulch*. School of American Research Press, Santa Fe, New Mexico.

Blinman, E. and C. D. Wilson

1994 Additional Ceramic Analyses. In *Across the Colorado Plateau: Anthropological Studies Along the Transwestern Pipeline Route, Volume XVI, Interpretation of Ceramic Artifacts*, edited by J. E. Ericson and T. G. Baugh, pp. 189-194. Maxwell Museum of Anthropology and Office of Contract Archeology, University of New Mexico, Albuquerque.

Bradfield, Maitlaind

1971 *The Changing Pattern of Hopi Agriculture*. Royal Anthropological Institute, London, United Kingdom.

Brew, John O. (editor)

1946 *Archaeology of Alkali Ridge, Southeastern Utah* Vol. 1. Papers of the Peabody Museum of American Archaeology and Ethnography.

1979 Hopi Prehistory and History to 1850. In *Southwest*, edited by Alfonso Ortiz, pp. 514–523. Handbook of North American Indians, Vol. 9, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Broughton, Jack M., David A. Byers, Reid Bryson, William P. Eckerle and David B. Madsen

2008 Did Climatic Seasonality Control Late Quaternary Artiodactyl Densities in Western North America? *Quaternary Science Reviews* 27:1916–1937.

Bryan, Alan L.

1977 Smith Creek Cave. In *The Archaeology of Smith Creek Canyon, Eastern Nevada*, edited by Donald R. Tuohy and Doris L. Rendall. Nevada State Museum Anthropological Papers No. 17. Nevada State Museum, Carson City.

Bryan, Kirk and Joseph A. Toulouse

1943 The San José Non-Ceramic Culture and its Relationship to a Puebloan Culture in New Mexico. *American Antiquity* 8(3):269-280.

Buck, Alice

1983 The Atomic Energy Commission. Available at: http://energy.gov/sites/prod/files/AEC%20History.pdf. Accessed May 10, 2016.

Buckles, William G.

1971 The Uncompahgre Complex: Historic Ute Archaeology and Prehistoric Archaeology on the Uncompahgre Plateau in West Central Colorado. Unpublished Ph.D. dissertation, Department of Anthropology, University of Colorado, Boulder.

Building Technology Incorporated

1984 *Historic Properties Report: White Sands Missle Range, New Mexico and Subinstallation Utah Launch Complex, Green River, Utah*, Silver Spring, Maryland. Prepared for United States Materiel Development and Readiness Command. Copies available from http://www.dtic.mil/dtic/tr/fulltext/u2/a175824.pdf.

Bureau of Land Management

2016 ePlanning Project Search. Available at: https://eplanning.blm.gov/epl-front-office/eplanning/nepa/nepa_register.do. Accessed August 24, 2016.

Bureau of Land Management, Moab Field Office

2015 Grazing. Available at: http://www.blm.gov/ut/st/en/fo/moab/grazing.html. Accessed April 6, 2016.

Burrillo, Ralph E.

2016 Beans, Baskets, and Basketmakers: Testing the Assumption that Ceramics were Necessary for Adoption of Bean Agriculture in the Prehistoric Colorado Plateau. *Southwestern Lore* 82(2&3).

Byers, David A.

2012 The Dawson Site: A Paleoindian Camp in the San Rafael Desert. *Utah Archaeology* 25(1):1-14.

Byers, David A. and Jack M. Broughton

2004 Holocene Environmental Change, Artiodactyl Abundances, and Human Hunting Strategies in the Great Basin. *American Antiquity* 69:235–257.

Byers, David A. and Andrew Ugan

2005 Should We Expect Large Game Specialization in the Late Pleistocene? An Optimal Foraging Perspective. *Journal of Archaeological Science* 32(11):1624-1640.

Callaway, Donald, Joel C. Janetski and Omer C. Stewart

1986 Ute. In *Great Basin*, edited by Warren L. d'Azevedo, pp. 336–367. Handbook of North American Indians, Vol. 11, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Cameron, Catherine M.

2009 *Chaco and After in the Northern San Juan: Excavations at the Bluff Great House*. University of Arizona Press, Tucson.

Carlson, Kristen and Leland Bement

2013 Organization of Bison Hunting at the Pleistocene/Holocene Transition on the Plains of North America. *Quaternary International* 297:93–99.

Carlyle, Shawn W., Ryan L. Parr, M. Geoffrey Hayes and Dennis H. O'Rourke

2000 Context of Maternal Lineages in the Greater Southwest. *American Journal of Physical Anthropology* 113(1):85–101.

Carr, Stephen L. and Robert W. Edwards

1989 *Utah Ghost Rails*. Western Epics, Salt Lake City, Utah.

Cater, John D. and Mark L. Chenault

1988 Kiva Use Reinterpreted. *Southwestern Lore* 54(3):19-32.

Chaffee, Scott D., Marian Hyman, Marvin W. Rowe, Nancy J. Coulam, Alan R. Schroedl and Kathleen Hogue

1994 Radiocarbon Dates on the All American Man Pictograph. *American Antiquity* 59(4):769-781.

Chamberlain, A. Chase and Robert S. McPherson

2015 Desert Cold Warriors: Southeastern Utah's Fight Against Communism, 1951-1981. *Utah Historical Quarterly* 8d3(2):116-141.

Charles, M. C. and S. J. Cole

2006 Chronology and cultural variation in Basketmaker II. *Kiva: The Journal of Southwestern Anthropology and History* 72(2):167-216.

Chenoweth, William L.

2006 Lisbon Valley, Utah’s Largest Uranium District. *Mining Districts of Utah: Utah Geological Association Publication 32*:534–550.

Christie, Lance

1998 As the Tailings Leach. *The Zephyr* August/September: 20-21: 20-21. Moab, Utah.

Chuipka, Jason P.

2008 Exploring Village Organization in the Northern San Juan Region of the American Southwest, A.D. 750-840. Unpublished M.A. Thesis, Department of Anthropology University of Colorado at Boulder, Boulder.

Cinnamon, S. K.

1988 The Vegetation Community of Cedar Canyon, Wupatki National Monument, as Influenced By Prehistoric and Historical Environmental Change. Unpublished M.S. thesis, Northern Arizona University, Flagstaff.

Cole, Kenneth L.

1990 Reconstruction of Past Desert Vegetation Along the Colorado River Using Packrat Middens. *Paleogeography, Paleoclimatology, Palaeoecology* 76:349–366.

Cole, Kenneth L., Jessica F. Fisher, Kirsten Ironside, Jim I. Mead and Peter A. Koehler

2013 The Biogeographic Histories of *Pinus edulis* and *Pinus monophylla* Over the Last 50,000 Years. *Quaternary International* 310:96–110.

Cole, Sally J. and Jeanne M. Moe

1999 *Utah Canyons Rock Art Project, August 1–15, 1999*. Prepared for Earthwatch/Bureau of Land Management, BLM Order #J910P81034. Photocopy of report on file at Edge of the Cedars State Park Museum, Blanding, Utah.

Coltrain, Joan B. and Steven W. Leavitt

2002 Climate and Diet in Fremont Prehistory: Economic Variability and Abandonment of Maize Agriculture in the Great Salt Lake Basin. *American Antiquity* 67(3):453–485.

Coltrain, Joan B. and Joel C. Janetski

2013 The Stable And Radio-Isotope Chemistry of Southeastern Utah Basketmaker Ii Burials: Dietary Analysis Using the Linear Mixing Model Sisus, Age and Sex Patterning, Geolocation and Temporal Patterning. *Journal of Archaeological Science* 40:4711-4730.

Coltrain, Joan B., Joel C. Janetski and Shawn W. Carlyle

2007 The Stable- and Radio-Isotope Chemistry of Western Basketmaker Burials: Implications for Early Puebloan Diets and Origins. *American Antiquity* 72(2):301–321.

Colwell-Chanthaphonh, Chip and T. J. Ferguson

2006 Memory Pieces and Footprints: Multivocality and the Meanings of Ancient Times and Ancestral Places among the Zuni and Hopi. *American Anthropologist* 108(1):148-162.

Cordell, Linda S.

1984 *Prehistory of the Southwest*. Academic Press, New York, New York.

Crampton, C. Gregory

1979 Utah's Spanish Trail. *Utah Historical Quarterly* 47(4):361–383.

Crampton, C. Gregory and Steven K. Madsen

1994 *In Search of the Spanish Trail: Santa Fe to Los Angeles, 1829-1848*. Gibbs-Smith Publishers, Layton, Utah.

Cuch, Forrest S.

2000 *A History of Utah's American Indians*. Utah Division of Indian Affairs and the Utah Division of State History, Salt Lake City, Utah.

Daughters of Utah Pioneers

1972 *Grand Memories*. Utah Printing Company, Salt Lake City, Utah.

Davis, William E.

1985 The Montgomery Folsom Site. *Current Research in the Pleistocene* 2:11–12.

1989 The Lime Ridge Clovis Site. *Utah Archaeology* 2(1):66-76.

Dockstader, Frederick J.

1979 Hopi History, 1850–1940. In *Southwest*, edited by Alfonso Ortiz, pp. 524–532. Handbook of the North American Indians, Vol. 9, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Dohm, Kahn M.

1994 The Search for Anasazi Village Origins: Basketmaker II Dwelling Aggregation on Cedar Mesa. *Kiva: The Journal of Southwestern Anthropology and History* 60(2):257-276.

Downum, Christian E.

2011 *Hisat'sinom: Ancient Peoples in a Land Without Water*. School for Advanced Research, Santa Fe, New Mexico.

DrillingEdge, Inc.

2016 Oil & Gas Production in Grand County, UT. Available at: http://www.drillingedge.com/utah/grand-county. Accessed May 10, 2016.

Duncan, Clifford

2000 The Northern Utes of Utah. In *A History of Utah's American Indians*, edited by Forrest S. Cuch, pp. 167–224. Utah Division of Indian Affairs and Utah Division of State History, Salt Lake City.

Dutton, Bertha P.

1983 *American Indians of the Southwest*. University of New Mexico Press, Albuquerque.

Dutton, Bertha P. and Caroline Olin

1994 *Myths & Legends of the Indians of the Southwest: Navajo, Pima, Apache*. Bellerophon Books, Santa Barbara, California.

Eggan, Fred

1950 *Social Organization of the Western Pueblos*. University of Chicago Press, Chicago, Illinois.

Eggan, Fred and T.N. Pandey

1979 Zuni History, 1850-1970. In *Southwest*, edited by Alfonso Ortiz. Handbook of North American Indians, Vol. 9, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Ellis, Sheri Murray

2003 *A Research Design for Conducting A Selective Reconnaissance Level Survey of Historical Agricultural Properties Within the Mountain View Corridor Study Area, Western Salt Lake County, Utah*. Prepared by SWCA Environmental Consultants, Salt Lake City, Utah. Prepared for Utah Department of Transportation, Region Two.

Ferguson, T. J. and E. Richard Hart

1985 *A Zuni Atlas*. University of Oklahoma Press, Norman, Oklahoma.

Firmage, Richard A.

1996 *A History of Grand County*. Utah Centennial County History Series. Utah State Historical Society, Salt Lake City.

Flint, Richard F. and Charles S. Denny

1958 *Quaternary Geology of Boulder Mountain Aquarius Plateau, Utah.* U.S. Geological Survey Bulletin, 1061-D. U.S. Government Printing Office, Washington, D.C. Also available online at https://pubs.usgs.gov/bul/1061d/report.pdf.

Ford, Richard I., Albert H. Schroeder and Stewart L. Peckham

1972 Three Perspectives on Puebloan Prehistory. In *New Perspectives on the Pueblos*, edited by A. Ortiz, pp. 19-39. University of New Mexico Press, Albuquerque.

Fowler, Catherine S. and Nancy J. Parezo

1996 The Ningwi (Southern Paiutes): The People of the Northwestern Frontier. In *Paths of Life: American Indians of the Southwest and Northern Mexico*, edited by Thomas E. Sheridan and Nancy J. Parezo. University of Arizona Press, Tucson.

Frison, George C.

1978 *Prehistoric Hunters of the High Plains*. New World Archaeological Record Vol. 1. Academic Press, New York.

Geib, Phil R.

1995 Radiocarbon record for Archaic occupation of the central Colorado Plateau. In *Proceedings of the Second Biennial Conference on Research in Colorado Plateau National Parks*, edited by Charles van Riper, pp. 89–136. Transactions and Proceedings Series NPS/NRNAU/NRTP-95/11. United States Department of the Interior, National Park Service, Washington, D.C.

1996 *Glen Canyon Revisited*. University of Utah Press Anthropological Papers No. 119, No. 119. University of Utah Press, Salt Lake City.

Geib, Phil R. and Dale Davidson

1994 Anasazi Origins: A Perspective from Preliminary Work at Old Man Cave. *Kiva* 60(2):191-202.

Gilbert, M. Thomas P., Dennis L. Jenkins, Anders Götherstrom, Nuria Naveran, Juan J. Sanchez, Michael Hofreiter, Philip Francis Thomsen, Jonas Binladen, Thomas F. G. Higham, Robert M. Yohe II, Robert Parr, Linda Scott Cummings and Eske Willerslev

2008 DNA from Pre-Clovis Human Coprolites in Oregon, North America. *Science* 320(5877):786–789.

Gilpin, Dennis

2001 The Talking Rocks of Carson's Wall: Navajo History and Settlement as Revealed at a Multicomponent Rock Art Site in the Chinle Valley, Arizona. In *American Indian Rock Art*, edited by Steven M. Freers and Alanah Woody, pp. 59–66, Vol. 27. American Rock Art Research Association, Whittier, California.

Gilpin, Dennis, Susan E. Perlman, Louise M. Senior and Lynn A. Neal

2002 *Cultural Affiliation Study for Canyons of the Ancients National Monument, Southwest Colorado*. Prepared by Two Rivers Consultants, Nashville, Tennessee, and SWCA Environmental Consultants, Flagstaff, Arizona. Copies available from the Bureau of Land Management, Canyons of the Ancients National Monument, Anasazi Heritage Center, Dolores, Colorado.

Glowacki, Donna M.

2015 *Living and Leaving: A Social History of Regional Depopulation in Thirteenth-Century Mesa Verde*. University of Arizona Press, Tucson.

Godby, Bill

2016 WSMR Receives Recognition for Preservation of the Past. Available at: http://www.alamogordonews.com/story/news/local/community/2016/04/02/wsmr-receives-recognition-preservation-past/82560858/. Accessed May 11, 2016.

Graf, Kelly E. and Dave N. Schmitt (editors)

2007 *Paleoindian or Paleoarchaic? Great Basin Human Ecology at the Pleistocene/Holocene Transition*. University of Utah Press, Salt Lake City.

Grand County

2016 History. Available at: http://www.grandcountyutah.net/387/History. Accessed Accessed April 5, 2016.

Grayson, Donald K.

1982 Toward a History of Great Basin Mammals During the Past 15,000 Years. In *Man and Environment in the Great Basin*, edited by David B. Madsen and J. F. O'Connell, pp. 82–101. Society for American Archaeology Papers, No. 2.

1993 *The Desert's Past: A Natural Prehistory of the Great Basin*. Smithsonian Institution Press, Washington, D.C.

2000 The Homestead Cave Mammals. In *Late Quaternary Paleoecology in the Bonneville Basin*, edited by David B. Madsen, pp. 67–89. Utah Geological Survey, Salt Lake City.

2011 *The Great Basin: A Natural Prehistory*. University of California Press, Berkeley.

Griffin-Pierce, Trudy

2000 *Native Peoples of the Southwest*. University of New Mexico Press, Albuquerque.

Gruebel, Rand A., Alan D. Reed and Bradford W. Andrews

2009 Gaining Ground on the Gateway Tradition: Analysis of Materials from the Weimer Ranch, a Prehistoric Farming Community in West-Central Colorado. *Colorado Archaeology* 75(1 & 2):30-61.

Gunnerson, James H. and Dolores A. Gunnerson

1971 Apachean Culture: a Study in Unity and Diversity. In *Apachean Culture History and Ethnohistory*, edited by Keith H. Basso and Morris E. Opler, pp. 7-22. Anthropological Papers of the University of Arizona No. 21. University of Arizona Press, Tucson.

Hafen, LeRoy R. and Ann W. Hafen

1954 *Old Spanish Trail: Santa Fe to Los Angeles*. Arthur H. Clark Company, Glendale, California.

Hahn, G. A. and J. P. Thorson

2006 Geology of the Lisbon Valley Sandstone-Hosted Disseminated Copper Deposits, San Juan County, Utah. *Mining Districts of Utah: Utah Geological Association Publication 32*:511–533.

Hale, Kenneth and David Harris

1979 Historical Linguistics and Archaeology. In *Handbook of North American Indians*, edited by A. Ortiz, pp. 170-177, Vol. 9. Smithsonian Institution, Washington, D. C.

Hard, Robert J. and John R. Roney

1998 A Massive Terraced Village Complex in Chihuahua, Mexico, 3000 Years Before Present. *Science* 279:1661–1664.

Hart, E. Richard

1980 *Boundaries of Zuni Land: With Emphasis on Details Relating to Incidents Occurring 1846-1946. Expert Witness Testimony Submitted December 1980 to the U. S. Court of Claims on Behalf of the Zuni Tribe, 2 vols., Zuni Tribe v. United States of America*. Institute of the North American West, Sun Valley, Idaho.

Haynes, G.

2002 *The Early Settlement of North America: The Clovis Era* Cambridge University Press, New York, New York.

Headwaters Economics

2015 The Economic Value of Public Lands in Grand County, Utah. Available at: http://headwaterseconomics.org/wphw/wp-content/uploads/GrandCounty_Report_March2015.pdf. Accessed August 18, 2016.

Heaton, T. H.

1985 Quaternary Paleontology and Paleoecology of Crystal Ball Cave, Millard County, Utah: With emphasis on mammals and description of a new species of fossil skunk. *Great Basin Naturalist Memoirs* 45:337-390.

Hedden, Bill

1998 Atlas Politics. *The Zephyr* August/September: 16-17: 16-17. Moab, Utah.

Hittman, Michael

2013 *Great Basin Indians: An Encyclopedic History*. University of Nevada Press, Reno.

Hockett, Bryan S. and Maury Morgenstein

2003 Ceramic Production, Fremont Foragers, and the Late Archaic Prehistory of the North-Central Great Basin. *Utah Archaeology* 16:1–36.

Hoijer, Harry

1971 The Position of the Apachean Languages in the Athapaskan Stock. In *Apachean Culture, History, and Ethnology*, edited by Keith H. Basso, Morris E. Opler and William Y. Adams, pp. 3-6. Anthropological Papers of the University of Arizona No. 21. University of Arizona Press, Tucson.

Holmer, Richard N.

1978 A Mathematical Typology for Archaic Projectile Points of the Eastern Great Basin. Unpublished Ph.D. dissertation, Department of Anthropology, University of Utah, Salt Lake City.

1986 Common Projectile Points of the Intermountain West. In *Anthropology of the Desert West, Essays in Honor of Jesse D. Jennings*, edited by C. J. Condie and D. D. Fowler, pp. 89–115. University of Utah Anthropological Papers No. 110. University of Utah Press, Salt Lake City.

Holzapfel, Richard Neitzel

1999 *A History of Utah County*. Utah Centennial County History Series. Utah State Historical Society, Utah County Commission, Salt Lake City.

Horn, J., A. Reed and S. M. Chandler

1994 *Grand Resource Area Class I Cultural Resource Inventory*. Prepared by Alpine Archaeological Consultants, Montrose, Colorado. Copies available from the Bureau of Land Management, Moab Field Office, Moab, Utah.

Horn, Jonathon C., Michael Prouty, Jack E. Pfertsh and John Zachman

2011 *National Historic Trails Inventory Project Tasks 4, 5, and 6 Memo Report for Utah Main Route, Northern Branch, and Armijo Route of the Old Spanish Trail Emery, Grand, Kane, Piute, San Juan, and Sevier Counties, Utah*. Prepared by Alpine Archaeological Consultants, Inc., Montrose, Colorado. Prepared for AECOM, Fort Collins, Colorado. Copies available from the Bureau of Land Management, Moab Field Office, Moab, Utah and the Utah Division of State History, Salt Lake City.

Huckell, B. B.

1996 The Archaic Prehistory of the North American Southwest. *Journal of World Prehistory* 10(3):305-373.

Hull, Frank W. and Alec Avery

1980 *Cultural Resources Existing Data Inventory: Richfield District, Utah. Report of Investigations 80-19*, Salt Lake City, Utah.

Hurst, Winston B.

2016 Anasazi. Available at: http://historytogo.utah.gov/utah_chapters/american_indians/anasazi.html. Accessed June 21, 2016.

Hurst, Winston B. and Christy G. Turner II

1993 Rediscovering the “Great Discovery:” Wetherill’s First Cave 7 and its Record of Basketmaker Violence. In *Anasazi Basketmaker: Papers from the 1990 Wetherill-Grand Gulch Symposium, Bureau of Land Management Cultural Resources Series No. 24*. Department of the Interior, Bureau of Land Management, Utah State Office, Salt Lake City.

Hurst, Winston B. and Jonathan D. Till

2011 Geography, Society, and Cosmology in the Puebloan Northwest: Monumental Features on Cedar Mesa, Utah. Paper presented at the 76th Annual Meeting of the Society for American Archaeology, Sacramento, California.

Hurst, Winston B. and J. Willian

2011 Ute and Navajo Archaeology in the Comb Ridge Area. *Blue Mountains Shadows* 44(Fall 2011):49–57.

Intrepid Potash

2016 Intrepid Potash History. Available at: https://www.intrepidpotash.com/AboutUs/History.aspx. Accessed May 10, 2016.

Irwin-Williams, Cynthia

1967 Picosa: The Elementary Southwestern Culture. *American Antiquity* 32(4):441-457.

Jacobs, Clell G.

1992 The Phantom Pathfinder: Juan Maria Antonio de Rivera and His Expedition. *Utah Historical Quarterly* 60(3):200–223.

Janetski, Joel C.

1994 Recent Transitions in the Eastern Great Basin: The Archaeological Record. In *Across the West: Human Population Movement and the Expansion of the Numa*, edited by David B. Madsen and D. Rhode, pp. 157−178. University of Utah Press, Salt Lake City.

1997 Fremont Hunting and Resource Intensification in the Eastern Great Basin. *Journal of Archaeological Science* 24:1075–1088.

Janetski, Joel C., Mark Bodily, Bradley Newbold and David Yoder

2012 The Paleoarchaic to Early Archaic Transition on the Colorado Plateau: The Archaeology of North Creek Shelter. *American Antiquity* 77(1):125–159.

Jefferson, J., R. W. Delaney and G. C. Thompson

1972 *The Southern Utes: A Tribal History*. Southern Ute Tribe, Ignacio, Colorado.

Jennings, Jesse D.

1957 *Danger Cave*. University of Utah Anthropological Papers No. 27. University of Utah Press, Salt Lake City.

1980 *Cowboy Cave*. University of Utah Anthropological Papers No. 104. University of Utah Press, Salt Lake City.

Jett, Stephen C.

1991 Split-Twig Figurines, Early Maize, and a Child Burial in East-Central Utah. *Utah Archaeology* 4:23−31.

Kampf, Anthony R., Anatoly V. Kasatkin, Jiří Čejka and Joe Marty

2015 Plášilite, Na(UO2)(SO4)(OH)·2H2O, a New Uranyl Sulfate Mineral From the Blue Lizard mine, San Juan County, Utah, USA. *Journal of Geosciences* 60(1):1-10.

Kelly, Isabel T.

1964 *Southern Paiute Ethnography*. University of Utah Anthropological Papers No. 69 (Glen Canyon Series No. 21). University of Utah Press, Salt Lake City.

Kelly, Isabel T. and Catherine S. Fowler

1986 Southern Paiute. In *Great Basin*, edited by Warren L. d'Azevedo, pp. 368–397. Handbook of North American Indians, Vol. 11, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Kidder, Alfred V.

1927 Southwestern Archaeological Conference. *Science* 66(1716):489-491.

Kidder, Alfred V. and Samuel J. Guernsey

1919 *Archeological Explorations in Northeastern Arizona*. Smithsonian Institution Bureau of American Ethnology Bulletin No. 65. U.S. Government Printing Office, Washington, D.C.

Kluckhohn, Clyde and Dorothea Leighton

1974 *The Navaho*. Harvard University Press, Cambridge, Massachusetts. Originally published 1946.

Knowlton, Ezra C.

1963 *History of Utah Highway Development in Utah*. Utah State Department of Highways, Salt Lake City, Utah.

Ladd, Edmund J.

1983 Zuni Religion and Philosophy. In *Zuni El Morro: Past and Present*, edited by David Grant Noble, pp. 26–31. School of American Research Press, Santa Fe.

Lekson, Stephen H.

1988 The Idea of the Kiva in Anasazi Archaeology. *Kiva: The Journal of Southwestern Anthropology and History* 53(3):213-234.

Lindsay, La Mar

1981 Big Westwater Ruin. In *Excavations of Two Anasazi Sites in Southern Utah, 1979-1980*, edited by R. E. Fike and D. B. Madsen. Bureau of Land Managment, Utah State Office, Salt Lake City, Salt Lake City, Utah.

Lipe, William D.

1999 Basketmaker II (1000B. C.-AD 500). In *Colorado Prehistory: A Context for the Southern Colorado River Basin.*, edited by W. D. Lipe, M. Varien and R. H. Wilshusen. Colorado Council of Professional Archaeologists, Denver, Colorado.

Lipe, William D. and Bonnie L. Pitblado

1999 Paleoindian and Archaic Periods. In *Colorado Prehistory: A Context for the Southern Colorado River Basin* edited by W. D. Lipe, M. Varien and R. H. Wilshusen, pp. 95-131. Colorado Council of Professional Archaeologists, Denver, Colorado.

Lipe, William D. and Mark D. Varien

1999a Pueblo II (AD 900–1150). In *Colorado Prehistory: A Context for the Southern Colorado River Basin*, edited by W. D. Lipe, M. Varien and R. H. Wilshusen, pp. 242-289. Colorado Council of Professional Archaeologists, Denver, Colorado.

1999b Pueblo III (AD 1150–1300). In *Colorado Prehistory: A Context for the Southern Colorado River Basin*, edited by W. D. Lipe, M. Varien and R. H. Wilshusen, pp. 290-352. Colorado Council of Professional Archaeologists, Denver, Colorado.

Lipe, William D. and Scott G. Ortman

2000 Spatial Patterning in Northern San Juan Villages, A.D. 1050-1300. *Kiva: The Journal of Southwestern Anthropology and History* 66(1):91-122.

Lipe, William D., R. Kyle Bocinsky, Brian S. Chisholm, Robin Lyle, David M. Dove, R. G. Matson, Elizabeth Jarvis, Kathleen Judd and Brian M. Kemp

2016 Cultural and Genetic Contexts for Early Turkey Domestication in the Northern Southwest. *American Antiquity* 81(1):97-113.

Lisbon Valley Mining Company

2013 Lisbon Valley Mining Company. Available at: http://www.lisbonvalley.com/. Accessed May 24, 2016.

Loendorf, Lawerence L. and Stuart W. Conner

1993 The Pectol Shields and the Shield-Bearing Warrior Rock Art Motif. *Journal of California and Great Basin Anthropology* 15(2):216-224.

Lohman, S. W.

1974 *Geology of Canyonlands*. Geological Survey Bulletin No. 1327. U.S. Government Printing Office, Washington D.C.

Loring, W. W. and LeRoy R. Hafen

1946 Colonel Loring's Expedition Across Colorado in 1858. *Colorado Magazine* 23(2):49-76.

Louderback, Lisbeth A.

2014 The Ecology of Human Diets During the Holocene at North Creek Shelter, Utah. Unpublished Ph.D. dissertation, Department of Anthropology, University of Washington, Seattle.

Louthan, Bruce D.

1990 Orchard Pithouse. *Canyon Legacy* 7:24-27.

Louthan, Bruce D., Lloyd M. Pierson and Kurt Wall

1994 *National Register of Historic Places Registration Form for the Dalton Wells CCC Camp/Moab Relocation Center*, Washington, D.C. Copies available from Utah Division of State History and the National Park Service. Also available online at: http://focus.nps.gov/AssetDetail/NRIS/94000366.

Lyndon, Michael G.

2005 Projectile Points as Indicators of Preceramic Occupation of the Coconino Plateau. Unpublished M. A. Thesis, Department of Anthropology, Northern Arizona University, Flagstaff.

Madsen, Brigham D.

1991 John W. Gunnison's Letters to His Mormon Friend, Albert Carrington. *Utah Historical Quarterly* 59(3):264-285.

Madsen, David B.

1989 *Exploring the Fremont*. University of Utah Occasional Papers No. 8. Utah Museum of Natural History, Salt Lake City.

2000 *Late Quaternary Paleoecology in the Bonneville Basin*. Utah Geological Survey Bulletin No. 130. Utah Geological Survey, Salt Lake City.

Madsen, David B. and Donald R. Currey

1979 Late Quaternary Glacial and Vegetation Changes, Little Cottonwood Canyon Area, Wasatch Mountains, Utah. *Quaternary Research* 12(2):254-270.

Madsen, David B. and Steven R. Simms

1998 The Fremont Complex: A Behavioral Perspective. *Journal of World Prehistory* 12(3):255–336.

Madsen, David B. and Dave N. Schmitt

2005 *Buzz-Cut Dune and Fremont Foraging at the Margin of Horticulture*. Anthropological Papers No. 124. University of Utah Press, Salt Lake City.

Madsen, David B., Charles G. Oviatt and Dave N. Schmitt

2005 A Geomorphic, Environmental, and Cultural History of the Camels Back Cave Region. In *Camels Back Cave*, edited by Dave N. Schmitt and David B. Madsen. Anthropological Papers No. 125. University of Utah Press, Salt Lake City.

Malotki, Ekkehart and Donald E. Weaver

2002 *Stone Chisel and Yucca Brush: Colorado Plateau Rock Art*. Kiva Publishing, Walnut, California.

Maryboy, Nancy and David Begay

2000 The Navajos of Utah. In *A History of Utah's American Indians*, edited by Forrest S. Cuch. Utah State University Press, Logan, Utah Division of Indian Affairs, Salt Lake City, Utah Division of State History, Salt Lake City.

Massimino, Jacquelyn and Duncan Metcalfe

1999 New Form for the Formative. *Utah Archaeology* 12:1–16.

Matson, R. G.

1991 *Origins of Southwestern Agriculture*. University of Arizona Press, Tucson.

Matson, R. G. and William D. Lipe

1978 Settlement Patterns on Cedar Mesa: Boom and Bust on the Northern Periphery. In *Investigations by the Southwestern Anthropological Research Group: An Exercise in Archeological Cooperation*, edited by R. Euler and G. Gumerman, pp. 1-12. Museum of Northern Arizona Bulletin No. 50. Museum of Northern Arizona, Flagstaff.

Matson, R. G., William D. Lipe and W. R. Haase

1988 Adaptational Continuities and Occupational Discontinuities: The Cedar Mesa Anasazi. *Journal of Field Archaeology* 15(3):245-263.

May, Dean L.

1987 *Utah: A People's History*. University of Utah Press, Salt Lake City.

McPherson, Robert S.

1995 *A History of San Juan County: In the Palm of Time*. Utah Centennial County History Series. Utah State Historical Society, Salt Lake City.

2009 *Comb Ridge and Its People: The Ethnohistory of a Rock*. Utah State University Press, Logan.

2011 *As if the Land Owned Us: An Ethnohistory of the White Mesa Utes*. University of Utah Press, Salt Lake City.

McPherson, Robert S. and Mary Jane Yazzie

2000 Chapter Six – the White Mesa Utes. Available at: http://www.historytogo.utah.gov/people/ethnic_cultures/the_history_of_utahs_american_indians/chapter6.html. Accessed May 31, 2016.

McVickar, Janet L. (editor)

2002 *An Archaeological Survey of Natural Bridges National Monument, Southeastern Utah*. Intermountain Cultural Resources Management Professional Paper No. 64. National Park Service, Intermountain Region, Santa Fe, New Mexico.

Mead, Jim I. and Larry D. Agenbroad

1992 Isotope Dating of Pleistocene Dung Deposits From the Colorado Plateau, Arizona and Utah. *Radiocarbon* 34(1):1-19.

Mehls, S. F.

1986a *National Register of Historic Places Registration Form for the Julien Inscription, Canyonlands National Park, San Juan County, Utah*. Copies available from the National Register of Historic Places and the Utah Division of State History, Salt Lake City. Also available online at http://npgallery.nps.gov/nrhp/AssetDetail?assetID=1d1c28bb-2d37-4947-821d-475364da0c99.

1986b *National Register of Historic Places Registration Form for the Julien Inscription Panel, Dark Angel Vicinity, Grand County, Utah*, Moab, Utah. Copies available from the National Register of Historic Places and the Utah Division of State History. Also available online at http://npgallery.nps.gov/nrhp/AssetDetail?assetID=310ccca1-8864-4c4d-ae15-6e22a460f7f5.

Merriam-Webster, Incorporated

2015 Grubstake. Available at: http://www.merriam-webster.com/dictionary/grubstake. Accessed August 23, 2016.

Merrill, Robert K. and Troy L. Pewe

1977 *Late Cenozoic Geology of the White Mountains Arizona*. Arizona Bureau of Geology and Mineral Technology Special Paper No. 1. University of Arizona, Tucson.

Miller, W. E.

1976 Late Pleistocene Vertebrates of the Silver Creek Local Fauna from North Central Utah. *Great Basin Naturalist Memoirs* 34:387-424.

1982 Pleistocene Vertebrates from Deposits of Lake Bonneville, Utah. *National Geographic Society Research Reports* 14:473-478.

1987 *Mammut americanum*, Utah's First Record of the American Mastodon. *Journal of Paleontology* 61:168-183.

Moab Area Travel Council

2016 discovermoab.com. Available at: http://www.discovermoab.com/activities.htm. Accessed April 6, 2016.

Moab Tourism Center

2016 Moab Tourism Center. Available at: http://www.moabtourismcenter.com/. Accessed April 6, 2016.

Montgomery, Jacki A.

2010 *Class I Existing Data Review for Utah Department of Transportation's Proposed Fiber Optic Line Along US 191 Between Moab and Crescent Jct., Grand County, Utah*. Prepared by Montgomery Archaeological Consultants, Inc., Moab, Utah. Copies available from the Utah Division of State History, Salt Lake City.

Montoya, Donald G.

2008 Hidden Village (42SA2112): A Basket Maker III Community in Montezuma Canyon, Utah. Unpublished M. A. thesis, Department of Anthropology, Brigham Young University, Provo, Utah.

Muhn, James and Hanson R. Stuart

1988 *Opportunity and Challenge: The Story of BLM*. U.S. Dept. of the Interior, Bureau of Land Management, Washington, D.C.

National Park Service

2001 *Old Spanish Trail National Historic Trail Feasibility Study and Environmental Assessment*, Denver, Colorado. Copies available from the National Park Service. Also available online at https://parkplanning.nps.gov/document.cfm?parkID=454&projectID=12591&documentID=38207.

National Park Service, Jeffery F. Burton, Mary M. Farrell, Florence B. Lord and Richard W. Lord

2000 Citizen Isolation Centers. Available at: https://www.nps.gov/parkhistory/online_books/anthropology74/ce14.htm. Accessed May 10, 2016.

Navajo Nation Tourism Office

2011 History. Available at: http://www.navajo-nsn.gov/history.htm. Accessed August 27, 2015.

2015 Navajo Culture & History. Available at: http://www.discovernavajo.com/navajo-culture-and-history.aspx. Accessed August 27, 2015.

Nelson, M. E. and J. H. Madsen, Jr.

1978 Late Pleistocene Musk Oxen from Utah. *Kansas Academy of Science Transactions* 81:277-295.

1980 A Summary of Pleistocene Fossil Vertebrate Localities in the Northern Bonneville Basin of Utah. In *Great Salt Lake: A Scientific, Historical, and Economic Overview*, edited by J. W. Gwynn, pp. 97–114. Utah Geological and Mineral Survey Bulletin 116.

1983 A Giant Short-Faced Bear (Arctodus simus) from the Pleistocene of Northern Utah. *Transactions of the Kansas Academy of Science* 86:1–9.

Newell, Linda King

1999 *A History of Piute County*. Utah Centennial County History Series. Utah State Historical Society, Salt Lake City, Utah.

Nichols, D. L.

2002 Basketmaker III: Early Ceramic-Period Villages in the Kayenta Region. In *Prehistoric Culture Change on the Colorado Plateau: Ten Thousand Years on Black Mesa*, edited by S. Powell and F. E. Smiley, pp. 66-76. University of Arizona Press, Tucson.

Nickens, Paul R.

1982 A Summary of the Prehistory of Southeastern Utah. In *Contributions to the Prehistory of Southeastern Utah*, edited by S. G. Baker, R. E. Fike and B. Louthan, pp. 1-188. Bureau of Land Managment, Utah State Office, Salt Lake City.

Northern Arizona University, Department of Anthropology

2016 Archaeology Research: The Hopi Footprints Project. Available at: https://nau.edu/sbs/anthropology/research/archaeology. Accessed August 21, 2016

Opler, Marvin K.

1940 The Southern Ute of Colorado. In *Acculturation in Seven American Indian Tribes*, edited by Ralph Linton. Harper and Sons, New York, New York.

Parezo, Nancy J.

1996 The Diné (Navajos): Sheep is Life. In *Paths of Life: American Indians of the Southwest and Northern Mexico*, edited by Thomas E. Sheridan and Nancy J. Parezo. University of Arizona Press, Tucson.

Parr, Ryan L., Shawn W. Carlyle and Dennis J. O'Rourke

1996 Ancient DNA Analysis of Fremont Amerindians of the Great Salt Lake Wetlands. *American Journal of Physical Anthropology* 99:507–518.

Perkins, Cornelia Adams, Marian Gardner Nielson and Lenora Butt Jones

1957 *Saga of San Juan*. San Juan County Daughters of Utah Pioneers and Mercury Publishing Company, Monticello, Utah.

Peterson, Charles S.

1975 *Look to the Mountains: Southeastern Utah and the La Sal National Forest*. Brigham Young University Press, Provo, Utah.

2012 Agriculture in Utah. Available at: http://www.uen.org/utah_history_encyclopedia/a/Agriculture.html. Accessed January 21, 2015.

Peterson, K. L.

1988 *Climate and the Dolores River Anasazi: A Paleoenvironmental Reconstruction from a 10,000-Year Pollen Record, La Plata Mountains, Southwestern Colorado*. University of Utah Anthropological Papers No. 113. University of Utah Press, Salt Lake City.

Pewe, Troy Lewis and Randall G. Updike

1976 *San Francisco Peaks: a Guidebook to the Geology*. Museum of Northern Arizona, Flagstaff.

Pierson, Lloyd M.

1980 *Cultural Resource Summary of the East Central Portion of Moab District 1980*. Cultural Resource Series. Vol. Cultural Resource Series No. 10. Bureau of Land Management, Utah State Office., Salt Lake City.

Pierson, Lloyd M. and Bruce D. Louthan

1990 *National Register of Historic Places Registration Form for the Denis Julien Inscription, Hell Roaring Canyon, Grand County, Utah*, Moab, Utah. Copies available from the National Register of Historic Places and the Utah Division of State History, Salt Lake City. Also available online at http://npgallery.nps.gov/nrhp/AssetDetail?assetID=b69c2d39-4170-4bc1-b400-515a8b320638.

Pierson, Lloyd M. and Lyle E. Jamison

1993 Nothing But Desert: The Denver and Rio Grande Western Railroad Narrow Gauge Between Grand Junction, Colorado, and Desert Switch, Utah, 1880-1990 (Mss B 1609). Manuscript on file, Utah State Historical Society, Salt Lake City.

Plog, Fred

1979 Prehistory: Western Anasazi. In *Southwest*, edited by Alfonso Ortiz, pp. 108–130. Handbook of North American Indians, Vol. 9. Smithsonian Institution, Washington, D.C.

Price, Virginia N. and John T. Darby

1964 Preston Nutter: Utah Cattleman, 1886-1936. *Utah Historical Quarterly* 32(3):232-251.

Pueblo of Zuni-Information Technology

1999a About Us. Available at: http://www.ashiwi.org/AboutUs.aspx. Accessed September 1, 2015.

1999b Chronological History of Zuni. Available at: http://www.ashiwi.org/ChronologicalHistory.aspx. Accessed September 1, 2015.

Rattle, Paul S. and Philip F. Notarianni

1982 Pinhook Battleground National Register of Historic Places Inventory-Nomination Form. Available at: http://focus.nps.gov/pdfhost/docs/NRHP/Text/82004125.pdf. Accessed April 12, 2016.

Reed, Paul F., (editor)

2000 *Foundations of Anasazi Culture: The Basketmaker-Pueblo Transition*. University of Utah, Salt Lake City.

Rhode, David and David B. Madsen

1998 Pine Nut Use in the Early Holocene and Beyond: The Danger Cave Archaeological Record. *Journal of Archaeological Science* 25:1199–1210.

Rhode, David, David B. Madsen and Kevin T. Jones

2006 Antiquity of Early Holocene Small-Seed Consumption and Processing at Danger Cave. *Antiquity* 80:328–339.

Richens, Lane D. and Richard K. Talbot

1989 Sandy Ridge: An Aceramic Habitation Site in Southeastern Utah. *Utah Archaeology* 2(1):77-88.

Richmond, Gerald M.

1962 *Quaternary Stratigraphy of the La Sal Mountains, Utah*. Geological Survey Professional Paper 324. U.S. Government Printing Office, Washington, D.C. Also available online at http://pubs.usgs.gov/pp/0324/report.pdf.

Ringholz, Raye C.

2002 *Uranium Frenzy: Saga of the Nuclear West*. Utah State University Press, Logan.

Robison, Roger Frank

2015 *Mining and Selling Radium and Uranium*. Springer, Cham, Switzerland.

Romer, A. S.

1928 A "Fossil" Camel Recently Living in Utah. *Science* 68:19-20.

Royce, Craig E.

2012 *Uranium Seekers: A Photo-Essay Tribute to Miners*. AuthorHouse, Bloomington, Indiana.

Salmon, Rusty and Robert S. McPherson

2001 Cowboys, Indians, and Conflict: The Pinhook Draw Fight, 1881. *Utah Historical Quarterly* 69(1):4-28.

Salt Lake Tribune

1882 Denver & Rio Grande. *Salt Lake Tribune* December 17, 1882. Salt Lake City, Utah.

Sammons Lohse, Dorothy

1980 *National Register of Historic Places Registration Form for the Robidoux Inscription, Grand County, Utah*, Salt Lake City, Utah. Copies available from the National Register of Historic Places and the Utah Division of State History, Salt Lake City. Also available online at http://npgallery.nps.gov/nrhp/AssetDetail?assetID=fe2c455a-5bdd-4130-bd19-993d5ca58f6a.

Sanchez, Joseph P.

1997 *Explorers, Traders, and Slavers: Forging the Old Spanish Trail, 1678-1850*. University of Utah Press, Salt Lake City.

Schroedl, Alan R.

1976 The Archaic of the Northern Colorado Plateau. Unpublished Ph.D. dissertation, Department of Anthropology, University of Utah, Salt Lake City.

1991 Paleo-Indian Occupation in the Eastern Great Basin and Northern Colorado Plateau. *Utah Archaeology* 4:1–15.

Schroedl, Alan R. and Nancy J. Coulam

1994 Cowboy Cave Revisited. *Utah Archaeology* 7(1):1-34.

Seymour, Deni J.

2012 Gateways for Athabascan Migration to the American Southwest. *Plains Anthropologist* 57(222):149-161.

Sharp, Nancy D., K. D. Lupo and Duncan Metcalfe

1989 *Interim Report: Excavations at Squaw Park*. University of Utah Archaeological Center Reports of Investigations, No. 89-3. Copies available from the Bureau of Land Management, Moab Field Office, Moab, Utah.

Shumway, Gary Lee

1970 A History of the Uranium Industry on the Colorado Plateau. Unpublished Ph.D. dissertation, History Department, University of Southern California, Los Angeles.

Simmons, Virginia McConnell

2000 *The Ute Indians of Utah, Colorado, and New Mexico*. University Press of Colorado, Boulder.

Simms, Steven R.

1988 Conceptualizing the Paleoindian and Archaic in the Great Basin. In *Early Human Occupation in Far Western North America: The Clovis-Archaic Interface*, edited by J. A. Willig, C. M. Aikens and J. L. Fagan, pp. 41–48. Anthropological Papers No. 21. Nevada State Museum, Carson City.

2008 *Ancient Peoples of the Great Basin and Colorado Plateau*. Left Coast Press Inc., Walnut Creek, California.

Smiley, Francis E.

1994 The Agricultural Transition in the Northern Southwest: Patterns in the Current Chronometric Data. *Kiva* 60:165–202.

2002 The First Black Mesa Farmers: The White Dog and Lolomai Phases. In *Prehistoric Culture Change on the Colorado Plateau: Ten Thousand Years on Black Mesa*, edited by S. Powell and F. E. Smiley. University of Arizona Press, Tucson.

Southern Ute Indian Tribe

2016 History of the Southern Ute. Available at: https://www.southernute-nsn.gov/history/. Accessed June 15, 2016.

Spangler, Jerry D.

1995 *Paradigms and Perspectives: A Class I Overview of Cultural Resources in the Uinta Basin and Tavaputs Plateau, Vol. 2 and 3*. Uinta Research, Salt Lake City, Utah.

Spangler, Jerry D. and Andrew Yentsch

2008 *Final Report: Baseline Site Condition and Vandalism Assessments of Archaeological Sites in Tenmile Canyon, Grand County, Utah*. Prepared by Colorado Plateau Archaeological Alliance, Ogden, Utah, Ogden, Utah. Copies available from Utah Division of State History, Salt Lake City and online at: http://suwa.org/app/uploads/10_Mile_Final_Web_Version.pdf.

Spangler, Jerry D., Andrew T. Yentsch and Rachelle Green

2010 *Farming and Foraging on the Southwestern Frontier: An Overview of Previous Research of the Archaeological and Historical Resources of the Greater Cedar Mesa Area* Vol. 9, no. 18. Utah Division of State History, Salt Lake City. Also avabilable online at https://research.libraries.wsu.edu/xmlui/handle/2376/2643.

Steen, Charles A., Jr. Dix, George P., Scott W. Hazen and Russell R. McLellan

1953 *Uranium-mining Operations of the Utex Exploration Co. in the Big Indian District, San Juan County, Utah*. U.S. Dept. of the Interior, Bureau of Mines, Washington, D.C.

Stevenson, Matilda Coxe

1904 The Zuni Indians: Their Mythology, Esoteric Fraternities, and Ceremonies. In *Twenty-Thrid Annual Report of the Bureau of American Ethnology*, pp. 13-60. 1970. U.S. Government Printing Office, Washington, District of Columbia. Originally published 1904.

Stewart, O. C.

1973 *Anthropologists as Expert Witnesses for Indians: Claims and Peyote Cases*. Indian History Press, San Francisco, California.

Stoffle, Richard W., Evelyn Pickering, Katherine Brooks, Kathleen Van Vlack and Christopher Sittler

2016 *Ethnographic Overview and Assessment for Arches National Park*. Final Report Draft January 2016. Copies available from the Bureau of Applied Research in Anthropology, School of Anthropology, University of Arizona, Tucson.

Strack, Don

2013 Ballard & Thompson Railroad. Available at: http://utahrails.net/utahrails/ballard-thompson.php. Accessed April 12, 2016.

Stubbs, Brian

1994 The Native American Languages of San Juan County. *Blue Mountain Shadows: The Magazine of San Juan County History* 13:63-67.

Sucec, Rosemary

2006 *Fulfilling Destinies, Sustaining Lives: The Landscape of Waterpocket Fold*. National Park Service and U.S. Department of the Interior, Denver, Colorado.

Tanner, Faun McConkie

1976 *The Far Country: A Regoinal History of Moab and La Sal, Utah*. Olympus Publishing Company, Salt Lake City, Utah.

Taylor, Raymond W. and Samuel W. Taylor

1970 *Uranium Fever: or No Talk Under $1 Million*. Macmillan Company, New York, New York.

The Hopi Tribe

2015a Tribal Government. Available at: http://www.hopi-nsn.gov/tribal-government/. Accessed September 1, 2015.

2015b Welcome to the Hopi Website. Available at: http://www.hopi-nsn.gov/. Accessed August 31, 2015.

Thompson, R. S., C. Whitlock, P. J. Bartlein, S. P. Harrison and W. G. Spaulding

1993 Climatic Changes in the Western United States Since 18,000 yr BP. In *Global Climates Since the Last Glacial Maximum*, edited by H. E. Wright, Jr., pp. 468-513. University of Minneapolis Press, Minneapolis, Minnesota.

Torroni, A., T. G. Schurr, C. C. Yang, E. J. E. Szathmary, R. C. Williams, M. S. Schanfield, G. A. Troup, W. C. Knowler, D. N. Lawrence, K. M. Weiss and D. C. Wallace

1992 Native American Mitochondrial DNA Analysis Indicates That the Amerind and the Nadene Populations Were Founded By Two Independent Migrations. *Genetics* 130(1):153-162.

Turnipseed, Donna and Norm Turnipseed

2006 *IMACS Form for Site 42SA27013*. Prepared by Bureau of Land Management, Moab Field Office. Copies available from Utah Division of State History, Salt Lake City and the Bureau of Land Management, Moab Field Office, Moab, Utah.

U.S. Census Bureau

1946 *United States Census of Agriculture, 1945: Utah and Nevada, Statistics for Counties* Vol. 1, Part 31. U.S. Government Printing Office, Washington, D.C.

2014a Selected Economic Characteristics: 2010-2014 American Community Survey 5-Year Estimates. Available at: http://factfinder.census.gov/. Accessed April 5, 2016.

2014b Educational Attainment: 2010-2014 American Community Survey 5-Year Estimates. Available at: http://factfinder.census.gov/. Accessed April 4, 2016.

2016a QuickFacts: Grand County, Utah. Available at: http://www.census.gov/quickfacts/table/PST045215/49019. Accessed April 4, 2016.

2016b QuickFacts: San Juan County, Utah. Available at: http://www.census.gov/quickfacts/table/PST045215/49037. Accessed April 4, 2016.

U.S. Department of Energy

2010 Moab UMTRA Project Timeline Available at: http://www.gjem.energy.gov/moab/documents/Moab%20timeline%20narrow_0210.pdf. Accessed May 24, 2016.

2016 Fact Sheet: Overview of Moab UMTRA Project. Available at: http://www.gjem.energy.gov/moab/documents/factsheets/20160504OVERVIEW.pdf. Accessed May 24, 2016.

U.S. Department of Interior, National Park Service - National Trails Intermountain Region and Bureau of Land Management - Utah State Office

2016 *Old Spanish National Historic Trail: Final Comprehensive Adminstrative Strategy*. Copies available from the National Park Service. Also available online at https://parkplanning.nps.gov/document.cfm?parkID=454&projectID=12591&documentID=74062.

Ugan, Andrew

2005 Climate, Bone Density, and Resource Depression: What is Driving Variation in Large and Small Game in Fremont Archaeofaunas? *Journal of Anthropological Archaeology* 24:227–251.

Utah Automated Geographic Reference Center

2016 Utah Oil and Gas Map. Available at: http://mapserv.utah.gov/oilgasmining/#x=649625&y=4260004&scale=577791. Accessed June 20, 2016.

Utah Division of Natural Resources

2016 Utah Mineral Mines. Available at: http://www.arcgis.com/home/webmap/viewer.html?webmap=6b3e262bbe4c43d1a71288b5e297353c&extent=-115.8372,37.7772,-107.7238,41.9084. Accessed June 20, 2016.

Utah State University Cooperative Extension

2005a Grand County Agricultural Profile. Available at: http://extension.usu.edu/files/publications/publication/Michael_Johnson,.pdf. Accessed April 4, 2016.

2005b San Juan County Agriculture Profile Available at: https://extension.usu.edu/files/publications/publication/AG_Econ_county-2005-22.pdf. Accessed April 4, 2016.

Varien, Mark D.

2006 Turbulent Times in the Mesa Verde World. In *The Mesa Verde World: Explorations in Ancestral Pueblo Archaeology*, edited by D. G. Noble. School of American Research Press, Santa Fe, New Mexico.

2010 Depopulation of the Northern San Juan Region: Historical Review and Archaeological Context. In *Leaving Mesa Verde: Peril and Change in the Thirteenth-Century Southwest*, edited by T. A. Kohler, M. D. Varien and A. M. Wright, pp. 1-52. University of Arizona Press, Tucson.

Vileisis, Ann E.

1992 Working on Desert Rails: A Social and Environmental History. Unpublished M.A. thesis, Department of History, Utah State University, Logan.

Ware, John A. and Eric Blinman

2000 Cultural Collapse and Reorganization: The Origin and Spread of Pueblo Ritual Sodalities. In *The Archaeology of Regional Interaction: Religion, Warfare, and Exchange Across the American Southwest and Beyond*, edited by M. Hegmon, pp. 381. University Press of Colorado, Niwot, Colorado.

Watt, Ronald G.

1997 *A History of Carbon County*. Utah Centennial County History Series. Utah State Historical Society, Salt Lake City, Utah.

Weber, Kenneth R.

1980 *Cultural Resource Narrative for Class I Cultural Resources Inventory for BLM Lands in South San Juan County, Utah*. Prepared by Centuries Research Inc., Montrose, Colorado. Copies available from Bureau of Land Management, Moab Field Office, Moab, Utah.

Whiteley, Peter M.

1988 *Deliberate Acts: Changing Hopi Culture Through the Oraibi Split*. The University of Arizona Press, Tucson, Arizona.

Wilcox, David R.

1981 The Entry of Athapaskans into the American Southwest: the Problem Today. In *The Protohistoric Period in the North American Southwest, A. D. 1450-1700*, edited by D. R. Wilcox and W. B. Masse, pp. 213-256. Anthropological Research Paper No. 24. Arizona State University, Tempe.

Willey, Gordon R. and Phillip Phillips

1958 *Method and Theory in American Archaeology*. University of Chicago Press, Chicago, Illinois.

Wilshusen, Richard H.

1999a Pueblo I (AD 750–900). In *Colorado Prehistory: A Context for the Southern Colorado River Basin*, edited by W. D. Lipe, M. Varien and R. H. Wilshusen, pp. 196-241. Colorado Council of Professional Archaeologists, Denver, Colorado.

1999b Basketmaker III (AD 500–750). In *Colorado Prehistory: A Context for the Southern Colorado River Basin*, edited by W. D. Lipe, M. Varien and R. H. Wilshusen. Colorado Council of Professional Archaeologists, Denver, Colorado.

Woodbury, Richard B.

1979 Zuni Prehistory and History to 1850. In *Handbook of the North American Indians*, edited by Alfonso Ortiz, pp. 467-473. Handbook of North American Indians, Vol. 9, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Worley-Hood, Graham and Gavin Noyes

2013 *Academic Literature Review of Land and Resource Use of the Utah Navajo*. Prepared by Round River Conservation Studies, Salt Lake City, Utah. Copies available from Bureau of Land Management, Richfield Field Office, Richfield, Utah.

Wormington, H. M.

1955 *A Reappraisal of the Fremont Culture: With a Summary of the Northern Periphery*. Proceedings of the Denver Museum of Natural History, Denver, Colorado.

This page intentionally blank

CHAPTER 6. CULTURAL RESOURCE SYNTHESIS AND FUTURE RESEARCH DIRECTIONS

Ralph Burrillo, Stephanie Lechert, and R. Kelly Beck

Available site records for the planning area indicate the presence of no fewer than 8,017 archaeological sites. These sites provide evidence of human occupation spanning virtually the entire period of human occupation in the American west. Such a rich record of the human experience in the planning area has provided, and continues to afford, many opportunities for research that enhances our collective understanding of what it is to be us. This chapter provides a brief recap of each culture-historical period presented in Chapter 5 (Cultural Resource Overview) and then summarizes the available data for the planning area for each period. Sites are discussed by time period and cultural affiliation based on the inferences about these things that are recorded on Intermountain Antiquities Computer System (IMACS) forms and earlier types of site recording forms (see Chapter 2 [Study Orientation] for data collection methods). After looking back at the received wisdom of the region's culture history and taking a look at those localities in the planning area that are associated with each culture historical period, the sections in this chapter take a quick glance forward to summarize a few of the key research issues that look to guide future scholars working in this area.

6.1 First Order Research Questions

The term "first order research question" comprises basic questions asked of nearly every archaeological site, both prehistoric and historic in age. Questions about the age and structure of a site are important, and other site characteristics must also be understood prior to addressing more specific temporally derived or pan-cultural research questions of a higher order. Oftentimes, the presence or absence of temporally discrete archaeological components will determine whether data from a site can be used to address higher order questions, as will descriptive analysis of a site's technological organization, faunal and/or botanical assemblages, and descriptive analysis of other discrete artifact classes common to the area, such as ground stone and ceramic assemblages. Although first order research questions often require some degree of recovering, analyzing, and synthesizing a variety of data about a site, they do not address the same class of research questions as other issues. Instead, they are designed primarily to associate a property with a historic context or research issue. A significant objective when pursuing first order research questions at any given site is to determine which higher order questions may be effectively addressed with data from that site. In many instances, however, descriptive analyses like those needed to address first order questions are the only concentrated archaeological investigation to happen at a site because the precise site characteristics and preservation conditions necessary to provide sufficient relevant data to address higher order questions are necessarily stringent. As a result, much of our collective knowledge about variation in the archaeological record comes from exploration of first order research questions, and these provide the essential backbone for nearly all subsequent analysis. First order questions also inform the datasets that land management agencies use to determine cultural resource density, management and leasing strategies, and comparative relevance of given areas and landforms to local, regional, and national interests (cf. 36 Code of Federal Regulations 800). Because these first order questions are basic to subsequent investigation regardless of culture historical association, they are presented here prior to our presentation of more temporally constrained research questions.

First order research questions applicable to all sites include the following:

- When was the site occupied? Does available evidence suggest a single temporal component? Or are multiple temporal periods present?
- What is the site stratigraphy? Are there buried archaeological deposits, or is the site a surface manifestation only?

- What is the site's geomorphological setting, and how did that contribute to site formation processes?
- What other natural or cultural activities or processes contributed to site formation?
- What resources were used by occupants of the site? Are faunal remains present at the site, and can they be adequately characterized? Are there contexts where botanical remains can be collected and analyzed?
- What technologies (e.g., ceramic, lithic) were employed by occupants of the site?
- What is the site structure and organization in terms of features, artifact disposal areas, etc.?
- Does the archaeological evidence for other key characteristics of site inhabitants (status, gender, economic activities and specialization, resource choice, etc.) support, deny, or refine existing archaeological knowledge or, for Historic period sites, ethnographic or archival data?

6.1.1 Data Needs

Addressing first order research questions requires collection, characterization, and analysis of standard archaeological data classes (i.e., lithic, faunal, botanical, etc.). Careful attention must be given to the provenience of artifacts because first order inferences regarding site structure significantly affect decisions about whether a given site may potentially provide data relevant to one or more of the higher order research questions presented below. Chronometric placement of sites and site components is also critical during assessment of first order research questions, and all efforts should be made to acquire the most precise dates as possible for these sites. The dating methods that are applicable to any given site will depend on the types of materials present at that site; however, methods that have the potential to be informative about the age of sites in the MFO planning area include, in rough order of increasing precision, artifact cross-dating (primarily involving projectile points or ceramics), obsidian hydration, luminescence dating (primarily involving ceramics or sediments), radiocarbon dating (using either conventional or accelerator mass spectrometry [AMS] radiocarbon techniques), archaeomagnetic dating, and dendrochronology. Information about site stratigraphy and geomorphology is also critical.

6.2 The Paleoindian Period

As is the case throughout North America, the earliest compelling evidence for a human presence in the Great Basin and northern Colorado Plateau dates to just before 13,000 calendar years ago (Beck and Jones 1997; see Gilbert et al. 2008, for recently discovered earlier evidence from the western Great Basin; Graf and Schmitt 2007). Early evidence for human occupation of the eastern Great Basin and northern Colorado Plateau corresponds roughly to the beginning of the Younger Dryas stadial. This apparently global, or at least northern hemisphere–wide cold period began ca. 9000 B.C., interrupting the warming trend that followed the Last Glacial Maximum (ca. 20,000 years before present), and it lasted until approximately 8000 B.C. Terminal Pleistocene and early Holocene environments of the region differed in significant ways from those of the modern era (Madsen et al. 2005). Woodlands dominated by limber pine (*Pinus flexilis*) covered mountain foothills, and subalpine fir (*Abies lasiocarpa*), and spruce (*Picea* sp.) grew in canyon bottoms and along streams. In addition, the composition of shrub communities differed from the present, with big sagebrush (*Artemisia tridentata*) occurring in greater abundance relative to more xeric taxa such as shadscale (*Atriplex* sp.) and greasewood (*Sarcobatus vermiculatus*) than is the case today. Pinyon pine (*Pinus monophylla*) did not colonize the area until the middle Holocene.

Diagnostic artifacts of the Paleoindian period in the planning area toolkit include large, lanceolate (Clovis, Folsom, and Plano) projectile points (Schroedl 1991), spurred-end scrapers, gravers and borers, and crescents (Frison 1978:78; Schroedl 1991). This stage is further split into three traditions named for their characteristic projectile points: Clovis (ca. 13,500 to 9000 years B.C.), Folsom (9000 to 8300 years B.C.), and Plano (8300 to 7800 years B.C.). The primary difference between these traditions is the variability in projectile point form that they exhibit, which likely resulted from changing environments and subsistence strategies. In many cases, Paleoindian-associated artifacts occur in lower elevations along major river valleys where Pleistocene megafauna such as mammoths, sloths, horses, bison, sheep, deer, and bear congregated. As climate warmed and vegetation changed, Plano peoples also began to exploit resources found in higher elevations such as the La Sal Mountains. Because of their great age, Paleoindian features are normally only found in alcoves and rock shelters. The absence of specialized plant processing tools and the frequency of large projectile points best suited for killing large-game animals may indicate a reliance on hunting by Paleoindian groups (Byers and Ugan 2005; Jennings 1980; Louderback 2014; Simms 1988).

Archaeological sites with evidence for Paleoindian use are not common in the planning area. To date, only about 30 sites with Paleoindian components have been documented. The locations of these sites are shown in Figure 6-1. Paleoindian sites in the planning area are scattered widely with no apparent patterning. The only apparent aggregations of Paleoindian sites occur in the Deadman Point/Blue Hills area in the western part of the planning area and in the Lisbon Valley area south of the La Sal Mountains. No other spatially discrete aggregations of Paleoindian sites are evident, and additional sites are distributed in the foothills of the La Sals, the Green River corridor, the Colorado River corridor, Grand Valley, and on top of the southern Tavaputs Plateau. The Folsom tradition of the Paleoindian period is represented by the Montgomery Folsom Site (42GR1956) just south of Green River (Davis 1985), although there appear to be no recorded sites representative of the Clovis or Plano traditions in the planning area. Outside of the planning area, west of the Colorado River in Emery County, the Dawson Site (42EM6965) was found to contain more than 222 Paleoindian-era artifacts, including Clovis, Folsom, Cody, and Western Stemmed projectile points, and an extensive array of modified flake tools and scrapers (Byers 2012). One site in the planning area (42SA9799) is associated with a potential Clovis point, although certainty has not been established.

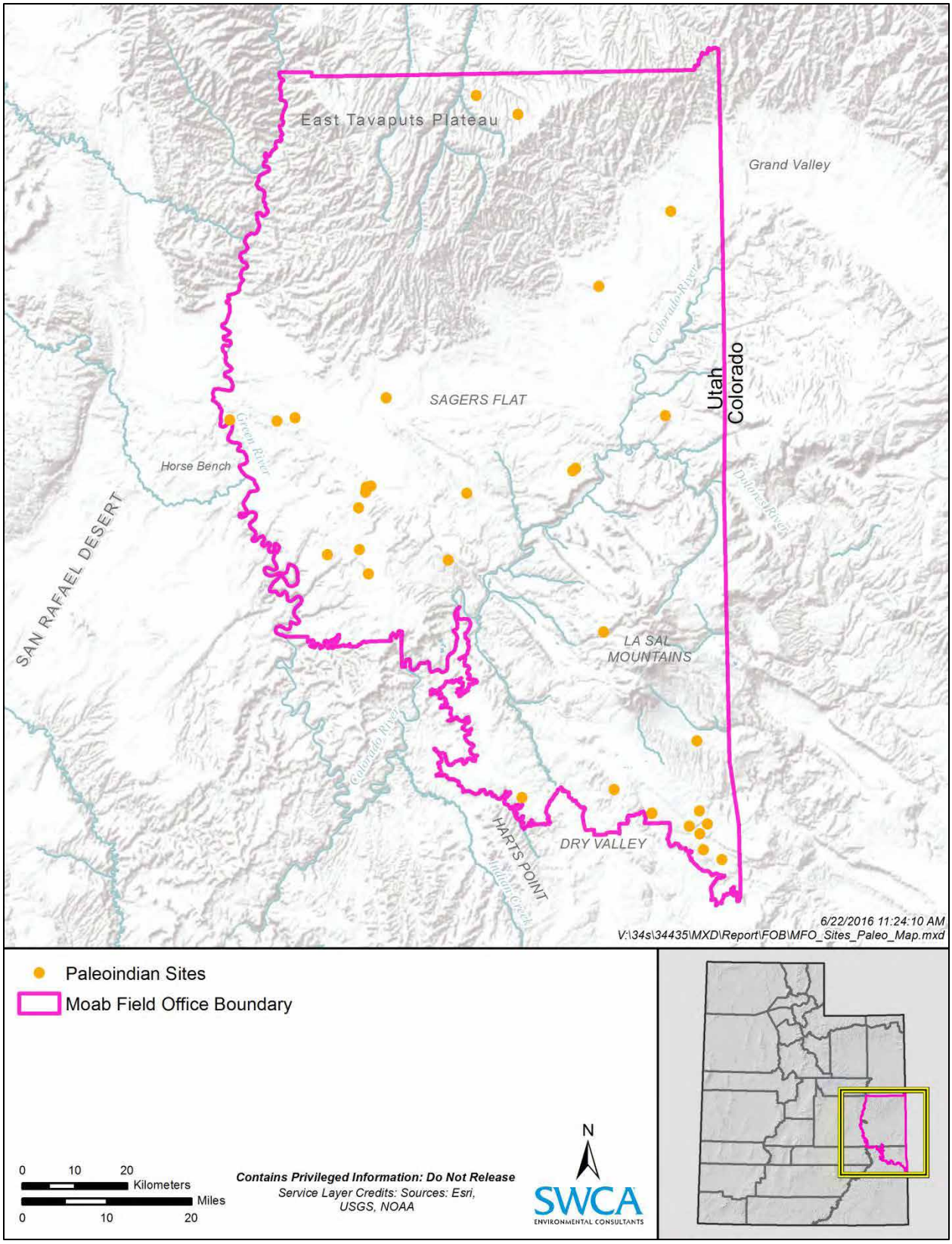


Figure 6-1. Locations of Paleoindian period archaeological sites in the MFO planning area.

In spite of the shortage of Paleoindian sites in the planning area, additional research has the potential to address some important issues. Primarily, sites in the planning area could help inform questions regarding Paleoindian settlement patterns and could help refine the Paleoindian projectile point chronology. Pivotal to such studies is the identification of additional Paleoindian sites. If the Paleoindian period represents a span of as much as 2,500 years, the small number of occurrences that have been identified, despite the distinctive nature of the projectile points, suggests that the area was utilized infrequently.

Although uncommon in the planning area, Paleoindian sites may provide data relevant to a number of important research issues, which can largely be grounded theoretically using the framework of evolutionary ecology, such as the following:

- Paleoindian sites in other regions are often found in areas that likely contained pluvial lakes and/or wetland habitats. What areas other than pluvial lake or wetland contexts were occupied by Paleoindian foragers? How did they make use of arid Southwest environments?
- What is the temporal relationship between classically recognized Paleoindian-aged fluted projectile points and the more locally common Great Basin Stemmed Series points? Furthermore, what are the temporal relationships between recognized Paleoindian projectile point styles and those commonly affiliated with the Early Archaic? What cultural relationships are reflected by temporal and spatial variability in point types used by the earliest archaeologically visible inhabitants of the region?
- What evidence is available that can better inform on the range of variation present in Paleoindian subsistence strategies? Were Paleoindian foragers more or less obligate big game hunters, or were Paleoindian diets considerably more diverse and conditioned by local contexts?
- How mobile were Paleoindian foragers? Was Paleoindian mobility more logistically oriented with short-term campsites located in areas favorable to the collection of certain resources? Or was Paleoindian mobility more residentially oriented with longer term habitation centers?

6.2.1 Data Needs

Paramount to addressing questions about the Paleoindian period in the planning area is identification of more sites with clear Paleoindian components. The most effective datasets to address such questions come from single, well-defined Paleoindian components. Such components may be most likely to occur in cave or rockshelter sites, as evidenced by North Creek Shelter, which is located on the Colorado Plateau to the west of the planning area. Geoarchaeological efforts to identify other areas with Paleoindian deposits would also be useful. Identification of such components during subsequent projects should be appropriately considered when making recommendations of National Register eligibility for such sites. Once identified, standard archaeological data classes (i.e., lithic, faunal, botanical, etc.) should be collected, characterized, and analyzed. In addition, paleoenvironmental data collected both from archaeological sites and from other contexts are critical for better understanding the environmental context of Paleoindian adaptations, and efforts should be made to collect such data from sources such as wood rat middens, pollen cores, and paleontological assemblages.

6.3 The Archaic Period

The Archaic period encompasses most of the middle Holocene and extends into the late Holocene—a nearly 7,000-year record of prehistoric human activity. In an effort to conceptualize such a vast span of time, researchers have typically divided the Archaic period into four subsets of time termed the Early Archaic, Middle Archaic, Late Archaic, and Terminal Archaic. Although some variation in the archaeological record is observable across these sub-periods, they are, for the most part, simply convenient analytical devices to help researchers make sense of such time depth.

The Early and Middle Archaic correspond to the relatively hot and arid middle Holocene climate period, which was originally described as the Altithermal by Antevs (1948). For the broad eastern Great Basin and northern Colorado Plateau region, available climate records for the middle Holocene suggest an increase in mean temperatures and general aridity relative to the early Holocene (Reheis et al. 2005). Plant communities responded to these changing climatic conditions, with xeric species increasing relative to mesic species (Betancourt 1984), Amaranthaceae expanding into areas previously dominated by sagebrush communities (Grayson 1993, 2011; Louderback and Rhode 2009), pinyon pine approaching near modern distributions (Rhode and Madsen 1998), and upslope migration of montane mesphytes to near modern elevations (Betancourt et al. 1990; Thompson et al. 1993). Animal populations responded to changing climates as well, with a dramatic reduction of mammalian taxonomic richness in the Great Basin, and some populations of animals that preferred the cooler and moister climate of the early Holocene diminishing during this time (Grayson 2000). However, continued low abundances of artiodactyl remains in middle Holocene archaeofaunal assemblages suggest that large mammal prey were as rare on the landscape as they were during the early Holocene (Broughton et al. 2008; Byers and Broughton 2004).

The Late and Terminal Archaic, in contrast, coincides roughly with the time at which the climate began to approach modern conditions, which are cooler than the middle Holocene, but not as moist and cool as the early Holocene (Grayson 1993, 2011). In addition, seasonality changed with cooler and drier summer conditions and warmer and wetter winter conditions (Barron and Anderson 2011), and climate became influenced by a strengthening and increase in the frequency of El Niño Southern Oscillation (ENSO) (Thompson et al. 1993; Waters and Haynes 2001). Plant communities responded to this changing climate, with elevational ranges of subalpine forests once again decreasing (Fall 1997; Madsen and Currey 1979). In addition, animal populations responded to the cooler and more mesic climate, with the density of artiodactyl populations increasing significantly, as suggested by the presence of large-mammal prey becoming much more common in archaeofaunal assemblages from the region during this time (Byers and Broughton 2004).

During the Early Archaic, human occupation continued in places where lakeshore and other wetland habitats remained; however, such habitats were becoming increasingly scarce. As evidenced by sites like Cowboy Cave, a broader array of settings began to be used even more frequently during the Early Archaic, perhaps representing subsistence generalization. An expansion of diet breadth is certainly indicated by the increase in the frequency of ground stone artifacts that occurs across the region during this period, as well as the appearance of a broader array of lithic tool types among Colorado Plateau farmer-foragers. Subtle environmental changes at the close of the middle Holocene reconfigured the spatial and temporal distribution of resources important to earlier occupants of the region and, as a result, settlement and subsistence systems tethered to discrete locations of abundance fell apart during the Middle Archaic. Archaeological sites of Middle Archaic age are generally ephemeral in nature and are often quite difficult to adequately place in time, but they do provide evidence for the use of nearly every available habitat. The beginning of the Late Archaic coincides roughly with the time at which the climate began to approach modern conditions. The Terminal Archaic is marked in most places by the adoption of maize agriculture, which marks the end of Late Archaic broad-spectrum foraging patterns and the beginning of the Formative period. Throughout the broader region, occupation of upland areas continued. Archaeological evidence indicates that nearly every kind of available resource in nearly every available place was in use. In some locations in the Great Basin, response to reduced foraging efficiency in the Late Archaic involved establishment of larger villages with attendant changes in social organization; whereas in other locations, Late Archaic foragers were able to respond to reduced foraging efficiency with increased mobility. Meanwhile on the Colorado Plateau, this same response to reduced foraging efficiency likely precipitated the origins of a mixed foraging and agricultural economy, as increasing amounts of trade goods and cultivars made their way into the region from further south (Huckell 1996).

Whereas archaeological sites with evidence for Paleoindian use are not common in the planning area, sites with evidence for Archaic occupation are abundant. Site records for no fewer than 640 sites in the area indicate evidence for Archaic use. The locations of sites with recorded Archaic period archaeological materials are shown in Figure 6-2. Locations of sites with Archaic components track closely with the distribution of archaeological surveys (see Figure 4-1 in Chapter 4 [Prior Cultural Resource Investigations). In other words, archaeological surveys in the planning area commonly identify Archaic period sites. Aggregations of Archaic period sites in the planning are difficult to discern given the dense coverage, but they do appear to cluster far more densely in the southern portion than in the northern portion. Areas of apparent intense aggregation include the lower Lisbon Valley and Middle Mesa areas, the La Sal Creek corridor, and the Fisher and Salt Valley areas. Other areas with Archaic period archaeological materials include parts of the Colorado, Green, and Dolores River corridors; the foothills of the La Sal Mountains; the Book Cliffs and Sagers Flat areas abutting the lower portion of the Tavaputs Plateau, along with a few sites on top of the Plateau; and the Hatch Point area. There is also considerable potential for the Tenmile and Spring Canyon drainages to contribute to research questions about the Archaic period in the planning area (Spangler and Yentsch 2008).

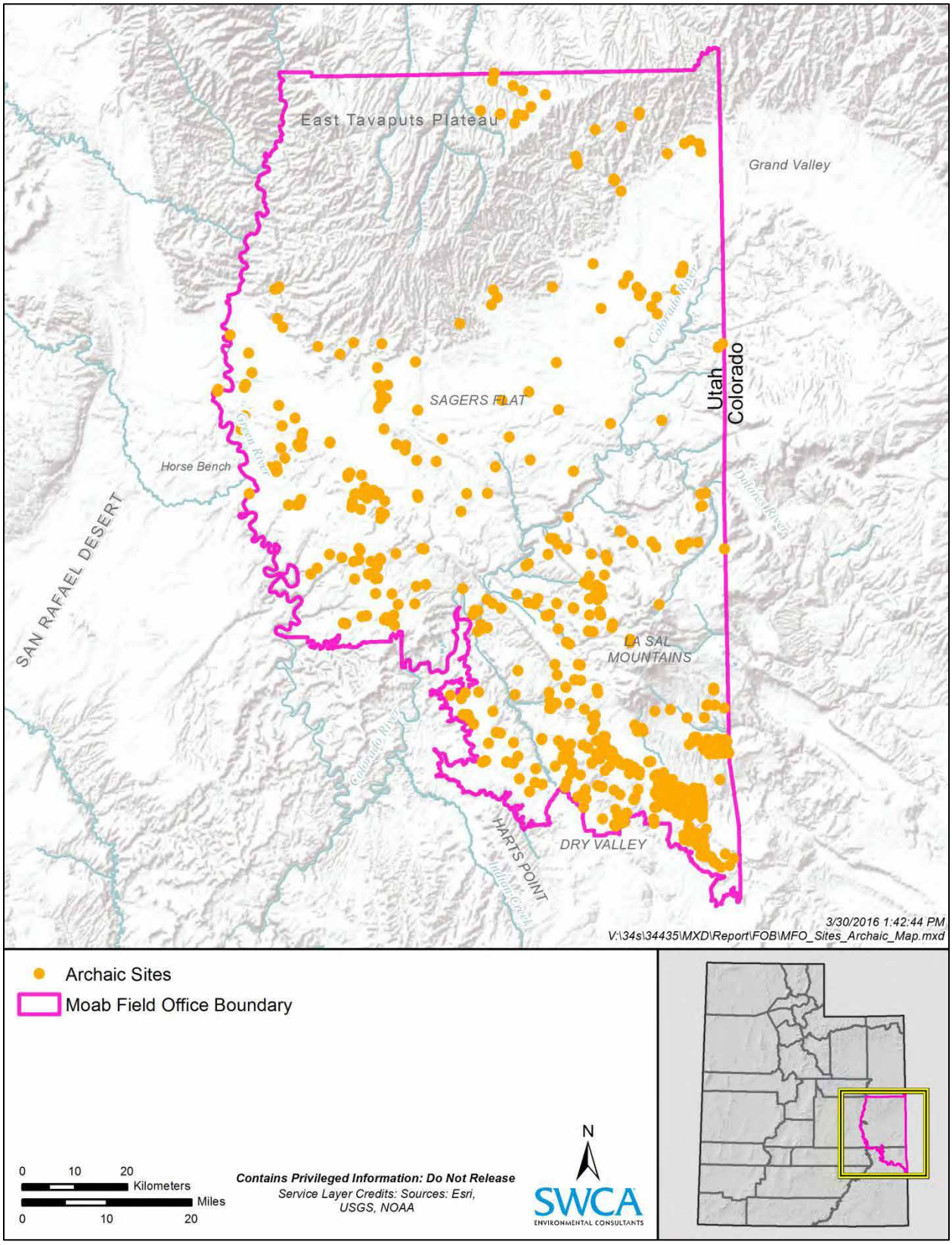


Figure 6-2. Locations of Archaic period archaeological sites in the MFO planning area.

Although the relative paucity of known sites in the planning area has limited Paleoindian research, the frequency of Archaic sites in the region has made this archaeological period an important research topic. Hunt (1960) reported on numerous Pinto projectile points recovered in the Moab area, and the number of known Archaic period sites thereabouts has increased significantly since then. Archaic sites in the planning area are found in nearly every available habitat, making Archaic period research in the area particularly useful. Although there is no shortage of relevant research issues to be explored at Archaic period sites, four general themes are particularly salient: 1) paleoenvironmental reconstruction, 2) foraging and subsistence, 3) the Paleoindian-Archaic transition, and 4) the Archaic-Formative transition.

Archaic period archaeological sites in the planning area can provide information for a number of significant archaeological issues and questions, which can largely be grounded theoretically using the framework of evolutionary ecology, including the following:

- Much variation in Archaic period sites in the broader eastern Great Basin and northern Colorado Plateau appears to have been structured or at least influenced by variation in local environmental conditions; however, detailed paleoenvironmental reconstructions for the planning area are sparse. What is the paleoenvironmental record of the planning area? Does environmental variation during the Archaic track closely with Antevs's broader regional climate model? Is there evidence for considerable local variation in Archaic climate?
- Temporal variability in subsistence strategies across the Archaic suggest a general broadening of the diet and inclusion of more and more costly foods. Is this temporal trend consistent across all areas of the MFO planning area? Does the general regional pattern for broadening diets during the Archaic vary spatially in different portions of the planning area? What is the relationship between diet breadth and human population density, and between diet breadth and environmental productivity?
- Late Archaic subsistence patterns were likely at the forefront of the adoption of domesticated plants at the Late Archaic–Early Formative transition. What are the characteristics of Late Archaic subsistence-related archaeological assemblages? Do such assemblages suggest intensive use of highly marginal resources? Is there spatial variation in apparent intensification of resource use at the Late Archaic–Early Formative transition?
- What are the defining characteristics of Archaic period settlement patterns in the MFO planning area? What is the range of temporal and spatial variation in settlement pattern, and, more important, what caused that variation? Can long-term residential sites or base camps be identified? Is Archaic settlement residentially or logistically structured?
- Berry and Berry (1986) propose a chronological model that argues for considerable regional variation in population density and movement across the broader Southwest during the Archaic. Does the planning area archaeological record support or contradict their pan-regional settlement model?
- The Archaic period encompasses a vast seven-millennium span of time. Can Archaic projectile point chronologies be refined to provide more precise temporal control? What additional chronometric methods can be employed to provide more precise temporal control?

6.3.1 Data Needs

As with Paleoindian sites, identification of clear, single-component Archaic localities is paramount to addressing many Archaic period research questions, and any such site with such components should be considered carefully when making recommendations of National Register eligibility. Once identified, standard archaeological data classes should be collected, characterized, and analyzed. Given the central importance of paleoenvironmental context to many Archaic period research questions, special attention should be given to those datasets (i.e., faunal, botanical, dendrochronological, etc.) that can provide data for such paleoenvironmental reconstructions. Moreover, larger-scale data recovery projects that may

occur in the planning area that involve Archaic-aged sites may well consider including a specific paleoenvironmental research theme in project designs. In addition, it would be useful to develop approaches that allow for the large number of Archaic isolated artifacts that are known from the region be incorporated into addressing research questions about the period.

6.4 The Formative Period

The Formative period archaeological record of the planning area provides evidence of two major archaeological complexes: 1) Ancestral Puebloan farmers of the greater Southwest, and 2) Fremont foragers and farmers of the eastern Great Basin and northern Colorado Plateau. Figure 6-3 shows the distribution of sites that have been identified on site recording forms as being associated with the Fremont complex, and Figure 6-4 shows the locations of sites that have been identified as having Ancestral Puebloan material remains. Fremont sites are found across the planning area, appearing in nearly every geographic and environmental context. Still, there are a few visibly discrete clusters of Fremont sites, most notably clustered along the Mill Creek corridor on the northeastern boundary of Spanish Valley. Extensive Fremont occupation is also known from the literature to occur in Castle and Fisher Valleys. Meanwhile, Ancestral Puebloan sites are also found across the planning area, likewise appearing in nearly every geographic and environmental context, although they tend overwhelmingly to occur in the south half of the area. Ancestral Puebloan sites cluster most densely in two locations in the planning area: an arc stretching from the Porcupine Rim area around through Moab itself into the upper Kane Springs Creek area, and the lower Lisbon Valley area.

Available site records for the planning area indicate that no fewer than 554 documented archaeological sites provide at least some evidence for Formative period use. Of these, 236 sites have been inferred to be associated with the Fremont complex, and 318 provide evidence for Ancestral Puebloan use. Formative sites as a whole are widely distributed across the planning area, and as expected, the locations of Formative sites tracks very closely with the distribution of cultural resources surveys. Stated another way, archaeological surveys in the planning area are very likely to identify Formative period archaeological sites.

Because somewhat different historical trajectories are evidenced by the Ancestral Puebloan and Fremont complexes, research questions for each are discussed separately below. However, as mentioned in section 5.1.3 (the Formative Period), there are many locations within the planning area that evince both Fremont and Ancestral Puebloan elements, suggesting a considerable amount of overlap. Thus, this area likely represents a unique opportunity to address research questions about Fremont–Ancestral Puebloan interactions, including the following:

- Looking at the Glen Canyon area as a whole, Geib (1996:112) notes that any semblance of a distinct cultural boundary between these two primary culture complexes breaks down after about A.D. 1000–1050, and that the subsequent mixing of cultural traits thereafter deserves considerable attention. Which traits appear to have moved in which direction?
- Research by Carlyle et al. (2000) suggests that clustering in some of the Fremont and Ancestral Puebloan DNA they investigated indicates either common lineage or genetic interaction between the two culture complexes. Is this reflected in the archaeology? Does material or artistic evidence suggest intermarriage between the two?
- Both Ancestral Puebloan and Fremont groups adopted, and were heavily reliant upon, maize agriculture within the planning area. By about A.D. 1300 the Ancestral Puebloan communities of most of the Colorado Plateau were abandoned, with resettlement and aggregation occurring in the massive mesa-top villages of places like Acoma and Hopi where maize farming continued into the present era. The Fremont, however, appear to have abandoned maize agriculture itself and returned to hunter-gatherer subsistence strategy. Does comparative archaeology between the two culture complexes within the planning area provide any clues about this discrepancy? Did they tend to occupy different environmental niches?

6.4.1 Ancestral Puebloan

The Ancestral Puebloan regional variants most closely aligned with the planning area are the Kayenta branch to the south and the Mesa Verde branch to the east. As with most Ancestral Puebloan variants, the culture historical sequence of these two archaeological complexes aligns closely with the regional Pecos Classification. Basketmaker III period sites, dating from ca. A.D. 500 to 800, are often characterized by shallow pithouses with central clay-lined hearths located on ridges or mesa tops in the Mesa Verde region and near well-watered canyons and alluvial valleys in the Kayenta region. Basketmaker III settlements appear to have increased in size relative to earlier Basketmaker II settlements, though archaeological evidence does not suggest substantial changes in lifeways during the transition. Pueblo I, from A.D. 800 to 950, is characterized by increasing settlement aggregation and the development of aboveground surface structures of clay and jacal. Pueblo II sites date to ca. A.D. 950–1150 and are structurally similar to Pueblo I sites with aboveground clay and jacal structures. During Pueblo II, however, areas previously void of occupation become saturated with primarily small settlements. Geib (2011:47) presents a demographic profile for the northern Kayenta region, which indicates that the regional population reached a peak during Pueblo II. Evidence for the Mesa Verde region, in contrast, suggests an overall population decline. The final Ancestral Puebloan culture historical period that is well-represented in the planning area, Pueblo III, dates to ca. A.D. 1150–1300 and shows significant population changes. Initially marked by an apparent decline, by ca. A.D. 1200, populations in the northern Kayenta region grew substantially, reaching a second population peak sometime ca. A.D. 1270. Population size also appears to have grown significantly during this same time period in the Mesa Verde region.

Maize farming was a central feature of Ancestral Puebloan lifeways, starting during the Basketmaker II era (Coltrain et al. 2007) and continuing up to the abandonment of the upper Colorado Plateau in the terminal Pueblo III era. Beans and squash entered into the agricultural suite by the Basketmaker III era. There is considerable debate about whether the introduction of these cultivars into the Ancestral Puebloan world was the result of cultural transmission or the physical migration of farmers from the south (see Coltrain et al. 2007; Kohler et al. 2008). The utilization of non-domesticated plants and animals by Ancestral Puebloan peoples remained extensive throughout the time of occupation. It is probable that as agricultural techniques were perfected—and depression of wild resources increased as a result of consequent population expansion—reliance on wild resources diminished (see Reynolds 2012).

Ancestral Puebloan farmers practiced a number of different agricultural strategies, the principal types of which were floodwater farming, dry-farming, and irrigation. Floodwater farming involves indirect manipulation of water sources by planting crops in fields watered by surface runoff. Fields watered in this manner generally occur in one of five types of locations: on alluvial fans, at arroyo mouths, along the source of shallow arroyos or rivers, in the lower terraces of arroyos, and in the bottom of arroyos. In the Four Corners area, the success or failure of these fields depends on the rainfall pattern in a given watershed, which determines the stream-flow or flooding volume. “Water and soil control sites,” like terraces and checkdams, are typical archaeological markers of this sort of strategy (Winter 1977). Dry-farming most often occurred on mesa tops where deep soil profiles are found. This method of agriculture is characterized by a lack of constructed archaeological features, unfortunately, and is therefore difficult to identify in the archaeological record except possibly through stable isotope analysis (Williams et al. 2005). Finally, irrigation involves direct manipulation of water sources by taking water from rivers, springs, or slope wash and transporting it through excavated ditches or canals to fields. Prehistoric ditches have been noted at Mesa Verde (Rohn 1963:51–55), though they are not known to occur in the planning area, suggesting that this practice was likely of far lesser importance in this area than was floodwater or dry-farming (see also Matson 1991).

Because Ancestral Puebloan sites are common in the planning area, there is considerable potential for archaeological sites in this area to contribute significantly to a number of current research issues, which can largely be grounded theoretically using a range of explicit frameworks, including the following:

- The transition from dispersed, semi-subterranean pithouses to aggregated, above-ground pueblo villages characterizes the Basketmaker-Pueblo temporal horizon. Although hypotheses abound (see Reed 2000), researchers have yet to reach a consensus explanation for this phenomenon. To what extent was this the result of environmental factors? Why did it occur in some major drainage systems but not in others?
- The adoption of maize agriculture during the early Basketmaker II era has been a central issue for archaeologists since the commencement of research in the area. Under what conditions is farming viable and preferable to foraging? How did farming move into the area? What farming techniques were more or less successful in different times and places?
- Trade and exchange of high-quality raw materials for lithic tools and ceramic tempers can yield significant information about trade and exchange networks during the Formative period. In Ancestral Puebloan archaeology, researchers have focused on sourcing of obsidian artifacts to reconstruct interactions and migrations throughout the Mesa Verde area (Arakawa et al. 2011). Did the networks identified there extend into the planning area? If not, where did planning area Ancestral Puebloans procure obsidian?
- Populations appear to have expanded, splintered, migrated, and aggregated throughout the Pueblo II–III era. Are these population movements and fluctuations real, or are they the product of survey methods and/or differential survey coverage? To what extent can the depopulation events of the Pueblo II period and ultimate abandonment in the Pueblo III period be explained by environmental change, and to what extent are they rooted in regional sociocultural, political, and demographic changes?
- The study of toolstone procurement patterns helps to develop a regional database for lithic tool use and production, and can provide information about land use, territoriality, and interactions between different communities and regions (Arakawa 2006). Are lithic procurement areas known to occur in the planning area? And how were lithic materials moving across the social and geographic landscape of the planning area during the Formative period?
- Regional spheres of cultural interaction and influence were extensive and well developed during the Pueblo era, as evidenced by the discovery of artifacts from Mesa Verde and construction events similar to those at Chaco Canyon throughout southeastern Utah. To what extent did the emergence of massive communities like those at Chaco, Mesa Verde, and Aztec affect the greater Four Corners area? How can researchers detect these effects?
- Warfare is a major factor that must be considered in attempting to understand Ancestral Puebloan social organization (LeBlanc 1999, see also discussion of Cave 7 in Chapter 5). Did violence increase or decrease as a result of population movements? Does it correlate with environmental factors? How did it shape the Pueblo world in terms of aggregation and "defensive" architecture and settlement patterning?
- Small nuclear family organization seems to have been common in both the Fremont and Ancestral Puebloan cultural occupations of the planning area. However, there was likely a more robust and complex social organization at higher levels than the nuclear family. At what level were Ancestral Puebloan societies structured beyond simple family-level organization? Were Ancestral Puebloan groups structured locally, or were they subject to a broader, region-wide organization?

- The planning area contains abundant standalone rock art localities. In addition, the presence of rock art panels associated with multiple household villages is a defining characteristic of the transition from Basketmaker III to Pueblo I times. Can the function of Ancestral Puebloan rock art in the area (communication purposes, conveyance of beliefs, etc.) be derived from ethnographic accounts from tribes claiming cultural affiliation to Ancestral Puebloans (i.e., the Hopi, the Zuni, and the Navajo)?

6.4.2 Fremont

The Fremont period corresponds to the span of time during which at least some groups of the eastern Great Basin, Wasatch Plateau, and northern Colorado Plateau practiced agriculture. There is evidence for considerable adaptive diversity in the eastern Great Basin and surrounding areas throughout prehistory, and this is especially the case for the Fremont period. Although farming is often considered the hallmark of Formative period lifeways, as Madsen and Simms (1998) note, groups attributed to the Fremont complex adopted a variety of subsistence and mobility strategies, and individuals within those groups may have pursued a range of strategies within their lifetimes (see also Barlow 2002; Coltrain and Leavitt 2002). Fremont sites range from fairly large, settled villages, particularly on either side of the Wasatch Plateau, to more ephemeral camps that suggest a high degree of mobility; caves also continued to be used during the Fremont period (e.g., Aikens 1970; Bryan 1977). The full range of subsistence strategies from pure hunting and gathering to relatively intensive farming is evident at Fremont sites.

Still, maize farming is a central feature of broadly cast Fremont archaeological research. Maize appears in the archaeological record of the southern Wasatch Plateau ca. 150 B.C. (see discussions in Barlow 2002; Madsen and Simms 1998), long after it began to be farmed in parts of the Southwest to the south (e.g., Hard and Roney 1998; Smiley 1994). There is some debate as to whether the introduction of domesticates and associated technology into the Fremont area and their subsequent spread across the region were the result of adoption by indigenous hunter-gatherers or, rather, a migration of populations who brought farming with them (also see the overview in Coltrain et al. 2007; see references in Madsen and Simms 1998: 260).

Fremont subsistence practices were locally variable, but, as a generalization, the wild plant and animal resources that were harvested earlier in the region continued to be used along with domesticates (Madsen et al. 2005:42–43). Barlow (2002) suggests that such variability in the importance of agriculture was due to variability over time and space in the productivity of wild resources, noting that intensive agriculture would have been economical only when and where high-return wild resources were encountered infrequently. An example of how the Fremont may have experienced low rates of encounter with high-return resources comes from work conducted by Janetski (1997), who suggests that prehistoric human population densities in the eastern Great Basin, Wasatch Plateau, and northern Colorado Plateau were likely at their highest during the Fremont period, and that consequent high harvest rates appear to have reduced local abundances of artiodactyls. Such high densities of Fremont foragers would have likely affected the broader social environment in which these people lived as well.

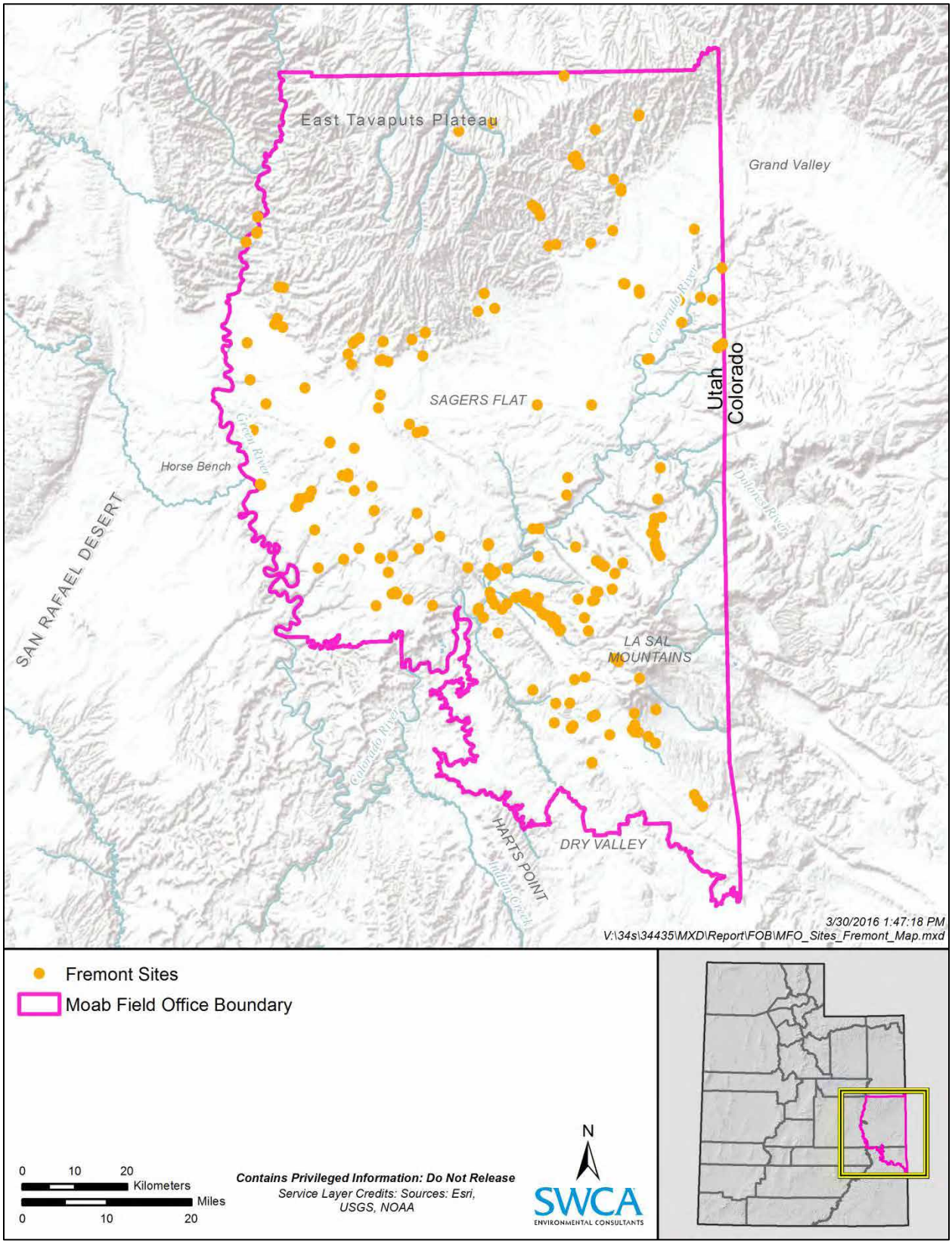


Figure 6-3. Locations of Fremont complex sites in the MFO planning area.

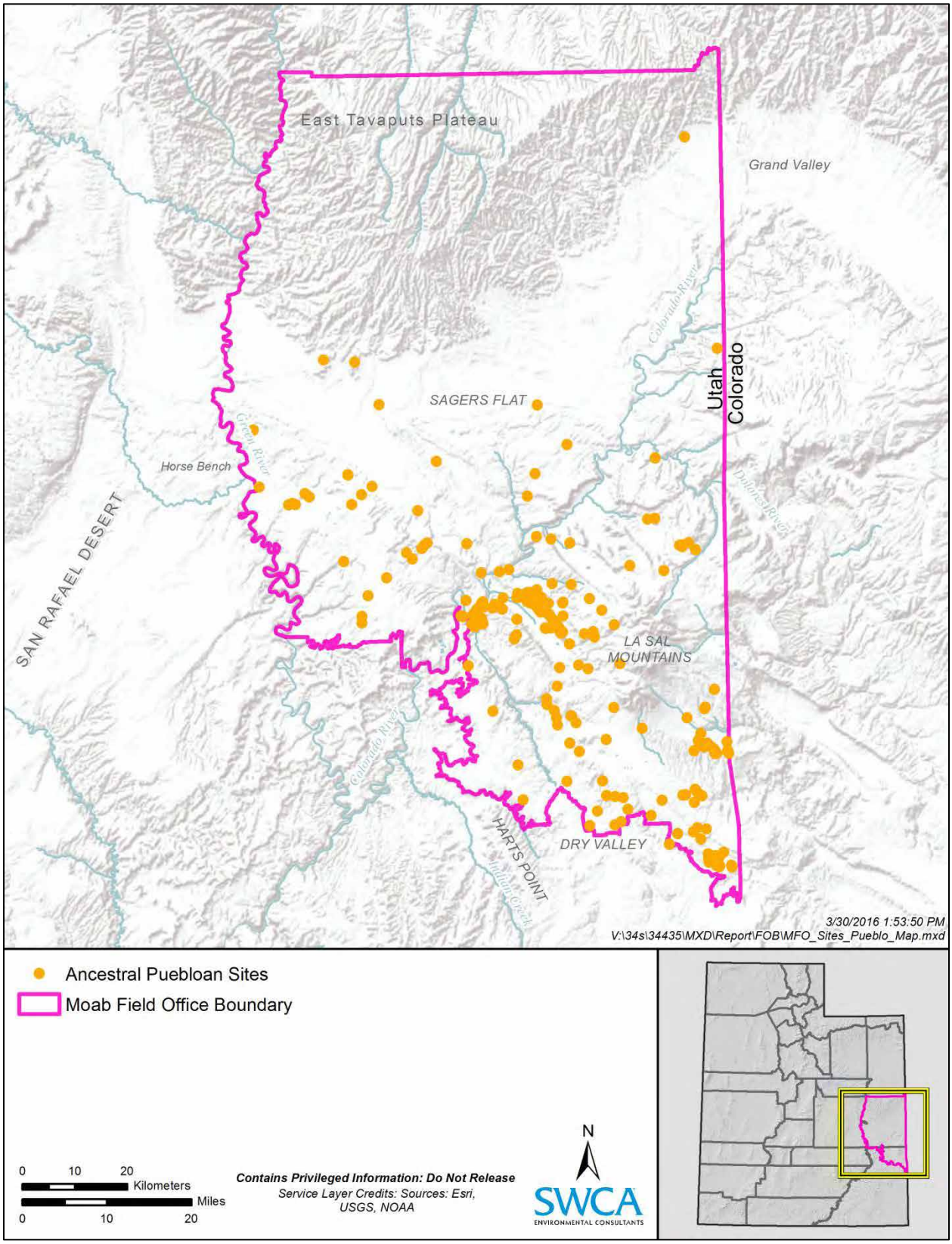


Figure 6-4. Locations of Ancestral Puebloan archaeological sites in the MFO planning area.

Because Fremont sites are common in the planning area, there is considerable potential for archaeological sites in the area to contribute significantly to a number of current research issues, which can largely be grounded theoretically using a range of explicit frameworks, including the following:

- The transition from foraging to agricultural production has been a central question for archaeological researchers in every context in which farming is apparent from the archaeological record. Under what conditions is farming a viable subsistence alternative to the hunter-gatherer pattern of earlier time periods? How did the presence of farmers impact the lifeways of foragers, and vice versa?
- Some research suggests that variability in the importance of agriculture to the Fremont was due to variability over time and space in the productivity of wild resources. If this is so, how did the productivity of wild resources in the planning area vary across space and through time? Is this variability reflected in apparent variation in the importance of farmed foods?
- Early Fremont research tended to focus on identifying specific characteristics that could be used to differentiate between regional variants. More recently, researchers have suggested that a more productive research trajectory for Fremont scholarship is exploration of complex adaptive diversity—that is, investigating those conditions in which Fremont behavior may have varied and why. What sorts of variability are found in the Fremont archaeology of the planning area? How do they relate to those indicated by the broader Fremont literature? What do they say about the ways in which Fremont populations articulated with the local environment?
- Small nuclear family organization seems to have been common in both the Fremont and Ancestral Puebloan regions of the planning area and surrounding environs. However, there was likely a more robust and complex social organization at levels higher than the nuclear family. At what level were Formative period societies structured beyond simple family-level organization? Were Formative period groups structured locally, or were they subject to broader, region-wide organization?
- Trade and exchange of high-quality raw materials for lithic tools and ceramic tempers can yield significant information about trade and exchange networks during the Formative period. In Fremont archaeology, researchers have focused on the movement of ceramic temper (Geib and Lyneis 1996) and perishable items like textiles (L. V. Benson et al. 2006) throughout the region. Did the networks evidenced by the distribution of these types or materials extend into the planning area? And if not, where did planning area Fremont individuals procure these materials? If organized regionally, how were goods moved from place to place? Were items like ceramics moved through the region via direct or down-the-line trade? How were exchange networks structured at both local and regional scales?

6.4.3 Data Needs

Like directed research addressing any specific temporal period, confronting Formative period research questions requires identification of discrete Formative period components. Once identified, standard archaeological data classes must be collected, characterized, and analyzed. Given the importance of the foraging-to-farming transition to understanding patterns of human behavior, special attention must be given to careful recovery and analysis of subsistence-related datasets, particularly faunal and botanical assemblages. The introduction and proliferation of ceramics during the Formative period also introduces potentially important data beyond stylistic assignment of ceramic types. Effective consideration of important issues regarding Formative period trade and exchange requires artifact provenience information that can be acquired through petrographic analysis of ceramic artifacts. Moreover, ceramic artifacts can provide chronometric data when subject to luminescence dating. Considerations of population movement, migration and aggregation, subsistence and settlement patterning, trade, and even warfare in this region

have all invoked environmental and climatic variables as likely influencing factors. Paleoenvironmental context is therefore just as important to studies of the Formative period as they are to the Archaic, and special attention should be given to those datasets (i.e., faunal, botanical, dendrochronological, etc.) that can provide data for such paleoenvironmental reconstructions. Moreover, larger-scale data recovery projects that may occur in the planning area that involve Formative-age sites may well consider including a specific paleoenvironmental research theme to project designs. Lastly, microanalysis of obsidian and ceramic materials have shown considerable promise for understanding Ancestral Puebloan and Fremont trade patterns, respectively, and special attention is therefore warranted to the identification and analysis of such materials.

6.5 The Protohistoric Period

The Protohistoric period begins with the disappearance of agriculture amongst the Fremont and the depopulation of Ancestral Puebloan sites, and it lasts until the Historic period. The Colorado Plateau experienced widespread depopulation at most Pueblo communities and aggregation into large villages or "supracommunities," like at Hopi and Zuni, most likely due to resource depression compounded by drastic climatic changes (see L. V. Benson and Berry 2009; Varien 2006). In the Fremont chronology, this same time period marks the abandonment of agriculture and sedentary settlement systems. The disappearance of a sedentary, horticultural lifeway among the Fremont and return to a hunter-gatherer subsistence pattern around A.D. 1300 or 1400 is a perplexing problem, although coincident timing with the abandonment of most of the Pueblo world and aggregation into supracommunities like at Hopi is suggestive of regional climatic factors (Glowacki 2015; Spangler 1995; Varien 2006). In the planning area, neither Fremont nor Pueblo Formative groups are documented archaeologically after about A.D. 1350 (Montgomery 2010). It is commonly believed that the Utes were the primary occupants of eastern Utah and western Colorado during the Protohistoric period (Horn et al. 1994), with linguistic evidence suggesting a Ute presence by about A.D. 1100—or shortly before the disappearance of Formative groups.

Available site records for the planning area indicate 256 documented archaeological sites with evidence for Protohistoric or Late Prehistoric use. The locations of these sites are shown in Figure 6-5. As with other temporally associated sites in the planning area, Protohistoric sites are scattered widely across the region, but show a few clear aggregations: in the Lisbon Valley area, and throughout the drainage systems to the west and northwest of Moab.

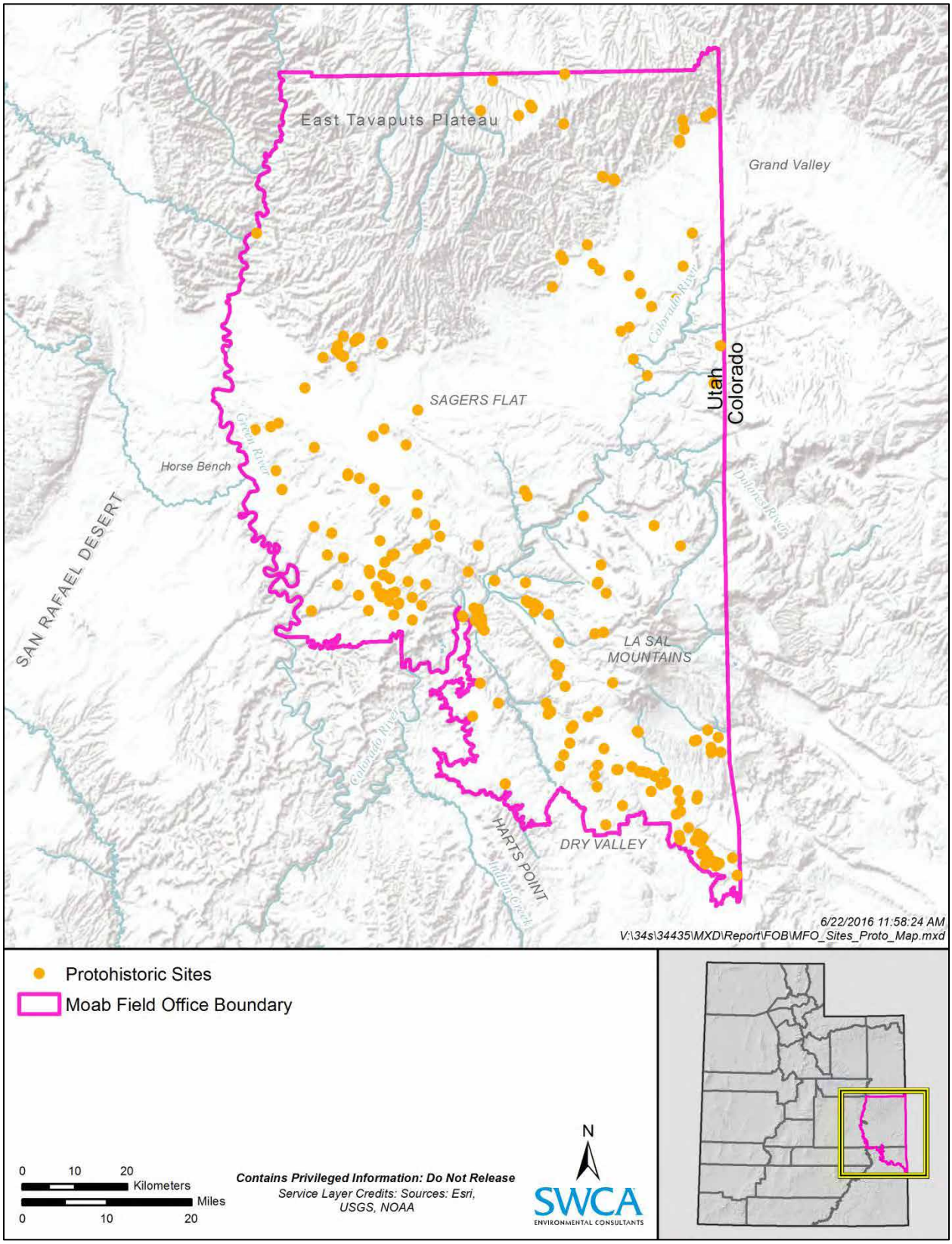


Figure 6-5. Locations of Protohistoric archaeological sites in the MFO planning area.

Protohistoric period archaeological sites are not common in the planning area. Nonetheless, this important time of transition can be effectively explored with data from both known and yet-to-be-discovered archaeological sites in the area. Investigations should address important research questions and themes such as the following:

- A major theme in archaeological research into the Great Basin and northern Colorado Plateau region has been that of the Numic expansion. What archaeological evidence supports the idea of significant population movement during this time period? In what ways do the archaeological and ethnohistoric data converge or differ?
- The Navajo were known to be in the area by at least the 1800s and probably before, and most researchers identify the 1300s and 1400s as the time period when they and other Athabascan-speaking peoples began to arrive in the Southwest. The findings from archaeology suggest at least two migration routes, including an intermountain route through western Colorado and eastern Utah (Seymour 2012). Was there a Navajo or other Athabascan-speaking presence in the planning area during the Protohistoric period? Was there cultural interaction between them and Numic-speaking populations?
- An apparent decrease in radiocarbon dates after roughly A.D. 1700 has been suggested as evidence for depopulation, possibly correlated with the introduction of Western diseases. Is there a clear decrease in radiocarbon dates suggesting regional depopulation, or is the apparent decrease a function of sampling error? If it does reflect depopulation and not just sampling error, to what extent did various factors such as introduced diseases and environmental change play a role?

6.5.1 Data Needs

Identification of single-component Protohistoric sites or site components is of paramount importance to addressing research issues such as those just outlined. Owing to the continuation of material and behavioral traits from the Protohistoric well into the Historic period, ethnographic information—particularly historic ethnographic information—is invaluable for identifying these sorts of resources. Hurst and William (2011) have documented historic and protohistoric Navajo and Ute occupation in the Comb Ridge area, to the south, through identification of hogans, sweat lodges, wikiups, and teepee rings consistent with those featured in historic ethnographies. And in the San Rafael Swell, to the west, an iconic artifact stash known as the Sitterud Bundle (42EM1194) was dated to approximately A.D. 1300. The Sitterud Bundle consisted of diagnostic chipped stone implements such as knives, scrapers, fleshers, and drills, as well as lithic manufacturing items inside an elk hide bag (M. P. Benson 1982).

Once Protohistoric components are identified, standard archaeological data classes must be collected, characterized, and analyzed. The span of time considered for Protohistoric period research is relatively short, and use of precise chronometric dating methods such as dendrochronology is important. More radiocarbon dates in general from suspected Protohistoric occupational contexts will be extremely helpful in addressing the issue of regional depopulation and its severity. It is also possible, given their short span, that the archaeological signatures of Protohistoric period occupations at multicomponent sites are being overwhelmed by earlier occupations. Scientific excavation of such sites, especially those in environments known to be preferred during the ethnographic present—such as riparian or lakeside wetlands—may yet yield evidence of later occupations. Study of the Early Historic period would benefit from additional synthetic research of documentary evidence, which could, in turn, direct archaeological investigations at Protohistoric sites. Such studies could be helpful in evaluating the relative persistence of traditions, despite the upheaval of contact, in light of current research in the broader literature of culture contact.

6.6 Ethnography

Numerous Native American groups have inhabited or migrated through the lands managed by the MFO. The first people were those that archaeologists refer to as Paleoindian, Archaic, Fremont, and Ancestral Puebloan. Today's Puebloan people—for example, from the Rio Grande pueblos, Zuni Pueblo, and the Hopi Mesas, claim these early inhabitants as their ancestors (Molenaar et al. 2005). At the time of Euro-American contact, the Native Americans inhabiting the planning area were Numic-speaking people identified as Ute and Southern Paiute. The Navajo also inhabited some parts of southeastern Utah during historic times. These and numerous other modern Native American tribes claim cultural affiliation to the planning area and vicinity (see Gilpin et al. 2002; Stoffle et al. 2016). In keeping with many researchers in the area (e.g., Ambler and Sutton 1989), this report presents ethnographic data in terms of language groups.

Except for the Navajo, all Native American tribes now living in Utah are descended from Numic-speaking peoples. This includes the Ute, Paiute, and Shoshone groups. Before they adopted the use of the horse, these three groups were culturally similar, primarily subsisting on plant-gathering and small game (Molenaar et al. 2005). It is generally thought by scholars and is relayed in various Native American oral histories that the Numic-speaking predecessors of modern Ute, Paiute, and Shoshone people came from the Death Valley area of southern California (McPherson and Yazzie 2000). Today, Southern Utes and Southern Paiutes speak similar languages with various dialectical differences. With the acquisition of the horse, some of the Ute and Shoshone bands began adopting cultural traits of the Plains people, such as buffalo-hunting and tepees (Molenaar et al. 2005). The Southern Paiute and those Ute and Shoshone bands that did not acquire the horse continued to live a simple hunting and gathering lifeway, collecting plants and hunting small game.

The Navajo people living today in Arizona, New Mexico, and Utah speak a language that is part of the Athapaskan language group, and are linguistically related to the Apache groups who live in Arizona and New Mexico. Shared ancestors of the Navajo and Apache are thought to have originated in west-central Canada. Although archaeologists agree that Athapaskan speakers arrived in the Southwest later than Numic-speaking or Pueblo peoples, they disagree considerably on when and how they arrived (Bailey and Bailey 1986; Wilcox 1981). Navajo people adopted maize agriculture from the Pueblo people with whom they interacted when they arrived in the area, and later adopted sheep herding from the Spanish.

Despite the plenitude of Ancestral Puebloan sites in southeastern Utah, it is unlikely that Pueblo groups occupied this region during the Historic period. However, the Hopi, the Zuni, and some of the Rio Grande pueblos claim cultural affiliation to the prehistoric people that occupied the area, and have an array of oral histories about ancient ancestors who migrated from "the north." The Pueblo peoples located in northern New Mexico (except the Zuni) are known as the Eastern Pueblos; Zuni and Hopi are regarded by some as the Western Pueblos (Molenaar et al. 2005). Eggan (1950) considers the Western Pueblos to be Hopi, Zuni, Acoma, and Laguna, and has demonstrated that they historically have had different types of social organization than the Rio Grande pueblos. All Pueblo groups are traditionally horticulturalists.

Although Historic period data related to the Pueblos do not appear in the archaeological record of the planning area, Pueblo consultants have nonetheless demonstrated cultural affiliation with and significant cultural importance of the planning area (Stoffle et al. 2016). Archaeological components found within the planning area (Figure 6-6) are associated with historic Ute and Paiute occupation (Stoffle et al. 2016), and a number of archaeological sites in the Monticello area to the south have been assigned to historic Navajo occupation (e.g., Hurst and Willian 2011).

Assembling additional data relevant to modern Native American groups claiming cultural affiliation to the planning area would require further ethnographic study. Ethnography can be a powerful tool in helping to establish and enrich ties between Native American groups and land management agencies, can assist in facilitating the tribal consultation element of the National Environmental Policy Act compliance process, and can help outside researchers and Native Americans understand and curate important cultural knowledge (cf. Molenaar et al. 2005; Stoffle et al. 2016; Sucec 2006). Ethnographic investigations should address important research questions and themes such as the following:

- The Southern Paiute are celebrated for their basketry, and burden basket imagery appears in many historic Paiute rock art panels within and near the planning area. These baskets were often crafted from pliable willow branches, as were split-twig figurines in prehistoric times (Jett 1991). The Hopi, meanwhile, consider the La Sal and Henry Mountains to be of considerable cultural importance for their abundance of willow and greasewood (Stoffle et al. 2016:114). What other plants are of significant cultural importance to Native American groups in this area? Are they also known to occur in abundance in or around certain landforms?
- Although archaeological evidence of Historic period Navajo occupation has not been found in the planning area itself, both scientific inquiry and oral histories confirm that the Navajo migrated south through this area, and Historic period Navajo archaeology has been found in the Monticello area to the south. Given this articulation between a gap in the archaeological record and Navajo oral history, what can the oral histories of other Native American groups contribute to current archaeological datasets?
- Hopi tribal consultants report that Mancos blue shale was an important element of their ritual practices, primarily as a source of face paint (Stoffle et al. 2016:41,114) What other rocks or minerals in the planning area are of significant cultural value to Hopi or other Native American groups?
- Land-use issues represent on ongoing issue between Native American groups and land management agencies (e.g., Worley-Hood and Noyes 2013). Understanding where and why Native Americans engage in traditional cultural practices can help in identifying traditional cultural properties (TCPs), such as the Purple Sage TCP in Arches National Park, which was designated primarily on the basis of its being "one of three known Ute gathering areas for purple sage in the Southwest" (Stoffle et al. 2016:3). Navajo and Hopi tribal consultants have also expressed concern over the issue of access to medicinal plant–gathering areas (Molenaar et al. 2005). What other sorts of practices can be quantified and associated with specific areas? What management recommendations can Native American traditional practitioners offer to land managers for these areas?
- An increasing number of Native Americans are becoming trained as cultural anthropologists and archaeologists (e.g., Balenquah 2008). As the historic rift between these groups continues to narrow, how are traditionalist Native Americans coming to view Native American anthropologists? How can Native American anthropologists help to facilitate better relations between Native American citizens and land management agencies?

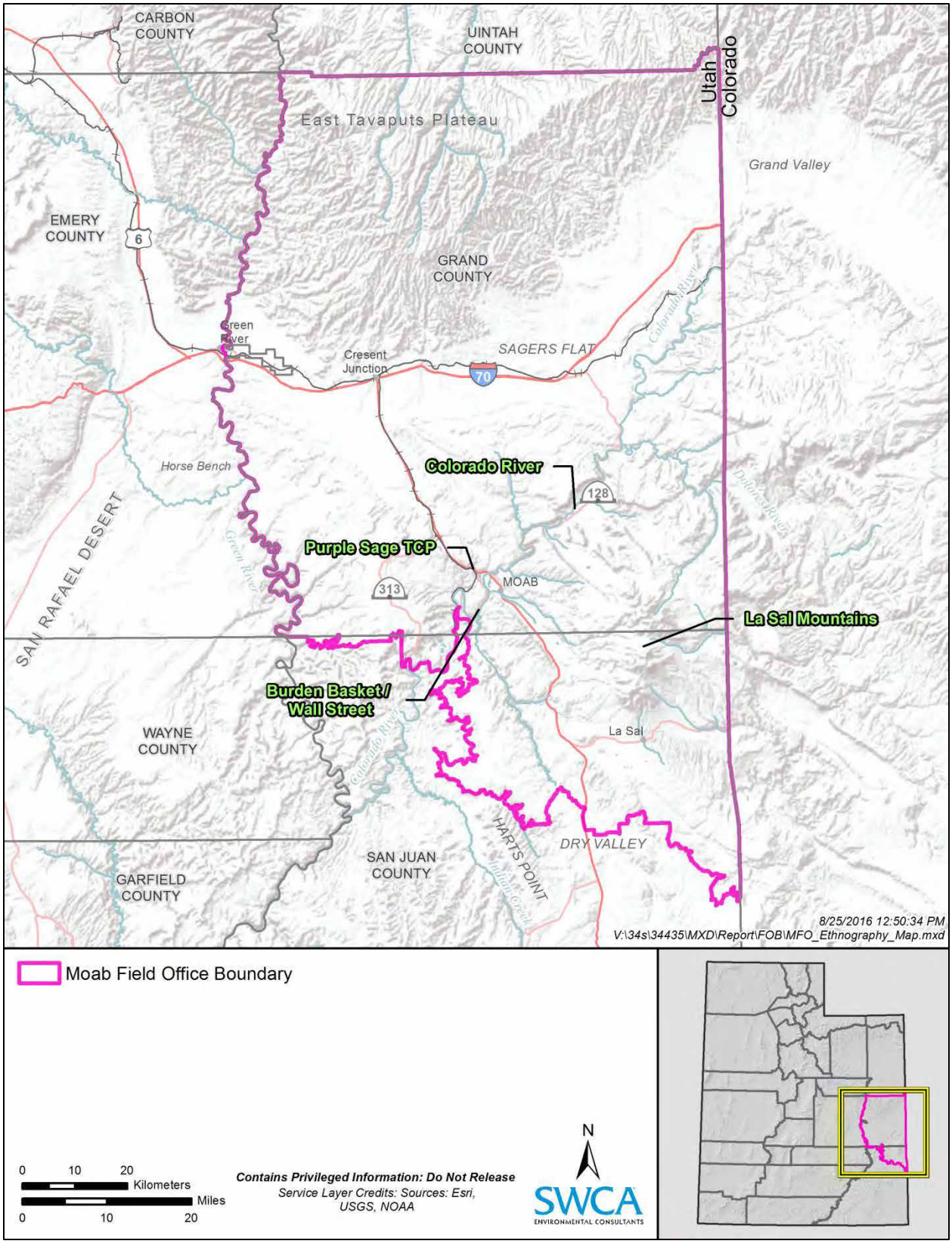


Figure 6-6. Locations of important ethnographic sites in the MFO planning area.

6.6.1 Data Needs

Establishing a friendly and respectful working relationship is paramount for successful ethnographic investigation by federal land management personnel and contractors (Sucec 2006). Oral history consists of the systematic collection of living peoples' testimony about their own lives and experiences. As with any type of cultural resource survey, preliminary research of the relevant literature is important for strategizing methods and informing central research questions. Successful and productive collection of oral histories requires identification of a central question or issue, evaluation of time and equipment needs to collect the data, identification of processing and analytical methods, and allotment of resources for these methods and for publication. Field interviews and focal follows can also be extremely useful for understanding a traditional body of knowledge (see Stoffle et al. 2016:4–8).

Special attention should be given to research questions and to oral and field data that assist land management agencies in the following (summarized from Molenaar et al. 2005:6):

1. Identifying places considered by tribal groups to be culturally significant and that may exist within the boundaries of the planning area
2. Incorporating both published literature and new information concerning these types of places that could be ascertained from oral interviews and field follows
3. Compiling a list of known places of cultural significance within or near the planning area that may or may not be documented in the current literature
4. Building an annotated bibliography and updated, comprehensive dataset regarding ethnographic and ethnohistoric resources in and near the planning area

Once oral and field data have been collected, further consultation and an open dialogue between Native American cultural informants and ethnographers is encouraged (see Molenaar et al. 2005:5). Cultural informants and collaborators should be allowed and encouraged to engage in processing and analyzing ethnographic data to ensure that the resulting information is accurate and relevant. Written copies of reports and published material should also be provided to Native American cultural informants and collaborators. Such studies could be helpful in evaluating the presence and importance of areas and resources that have ongoing traditional importance to Native American groups and that would therefore be invaluable for facilitating consultation and management processes.

6.7 The Historic Period

Sections 5.3 and 5.4 of Chapter 5 (Cultural Resource Overview) discuss the Historic period in Utah in depth, beginning with the first Spanish explorations of the region in the mid- to late 1700s. The earliest Euro-American settlement attempts began in 1855 and focused on securing water and lands for farming and raising livestock. Eventually, transportation routes were established, and the residents of the region were able to regularly receive supplies and ship agricultural products. The discovery of valuable minerals led to a mining and extraction boom cycle in the area, which attracted more settlers to the area. The Great Depression resulted in the loss of farms and ranches as well as a population loss as people left to find jobs in bigger cities. World War II created an upswing in mining production and processing for the region, which has remained somewhat stable economically to the present, at least compared with earlier boom and bust cycles.

Of the 8,017 known archaeological sites within the MFO planning area that are included in the dataset compiled for this Class I inventory, 728 (9.1 percent) are historic and 364 (4.5 percent) are multicomponent (i.e., they contain both historic and prehistoric materials). Examining the cultural affiliation as reported on site recording forms for both the historic sites and the historic components of

multicomponent sites, most—919 sites—are Euro-American. Another 158 are of unknown affiliation, three are Basque, one is Chinese/Asian, three are Mexican, seven are Navajo, two are Numic (general), and one has an affiliation of "Other." The Numic and Navajo affiliated sites could date to the Protohistoric period, but they are classified on site forms as historic. The historic and multicomponent sites in the dataset are reported on site forms to be associated with 24 major historic themes (Table 6-1).

Table 6-1. Historic Themes for Historic and Multicomponent Sites in the MFO Planning Area

Theme	IMACS Code	Theme 1 Count	Theme 2 Count
Architecture	AR	11	0
CCC/WPA (conservation in general)	CC	21	5
Community development	CD	1	1
Commerce/industry	CI	7	5
Cultural landscape	CL	1	1
Communication	CM	17	0
Conservation/natural resources	CO	2	0
Engineering	EN	1	3
Exploration (pre-1850)	EX	2	0
Federal administrative site	FA	1	0
Farming/ranching (agriculture)	FR	448	26
Funerary	FU	0	1
Logging/timber	LG	3	2
Military/Indian conflict	MI	2	0
Mining/mineral extraction	MN	166	30
Military-general	MT	0	1
Native American	NA	8	0
Planning/development	PL	1	0
Recreation/tourism	RC	10	16
Railroad	RR	22	1
Transportation (including roads/trails)	RT	86	12
Trapping/fur trade	TR	6	2
Waterworks (dams, ditches)/reclamation	WW	11	6
Unknown	ZZ	265	4
Total		**1,092**	**116**

Note: Theme 1 count represents the primary theme listed for a site on its site recording form(s) and Theme 2 count represents the secondary heme listed for a site.

In total, 265 sites have "unknown" listed as their primary historic theme. Of these, 85 have no known cultural affiliation listed and were likely documented before the introduction of the IMACS site form in Utah. Aside from "unknown," the most common historic theme in the dataset is farming/ranching (agriculture) (41.1 percent). Next most common are mining/mineral extraction (15.2 percent), transportation (including roads/trails) (7.9 percent), railroad (2 percent), and the Civilian Conservation Corps/Works Progress Administration (CCC/WPA) (conservation in general) (1.9 percent). Overall, the five most common historic theme categories represent 68 percent of all historic and multicomponent sites in the planning area. While the recreation/tourism theme (0.9 percent) is not well represented in the existing

sample of sites, this important theme has been interwoven into the history of the MFO planning area since the designation of Arches National Monument in 1929 and will be included in the discussion below, along with the more common themes.

One theme with surprisingly few recorded sites is waterworks/reclamation. The region encompassed by the planning area receives less than 10 inches of precipitation each year, so canals, laterals, stock ponds, and other water conveyance or storage sites should be common. Why have so few of these types of sites been documented? Is this simply because previous inventories did not cover the places where these types of sites tend to occur? Is it because such sites have been documented as Civilian Conservation Corps related sites? Or have these sites been so significantly altered they are unrecognizable as waterworks/reclamation sites?

Examining the overall spatial distribution of all historic sites in the MFO planning area demonstrates the historic focus of farming, ranching, and mining across most of the area (Figure 6-7). In addition, linear sites such as trails, roads, and canals are most prevalent in the west half of the planning area. The area with the fewest previously recorded historic sites is the north and northwest portions of the planning area on the East Tavaputs Plateau. This area is primarily Uintah-Ouray Indian Reservation lands and may simply have not been surveyed as intensively as other portions of the planning area. In addition, much of this area has steep slopes that are not conducive to finding archaeological sites (Bureau of Land Management 2008). The majority of previous surveys have occurred in the western, southwestern, and southern portions of the planning area, and a larger proportion of previously documented sites accordingly occur here.

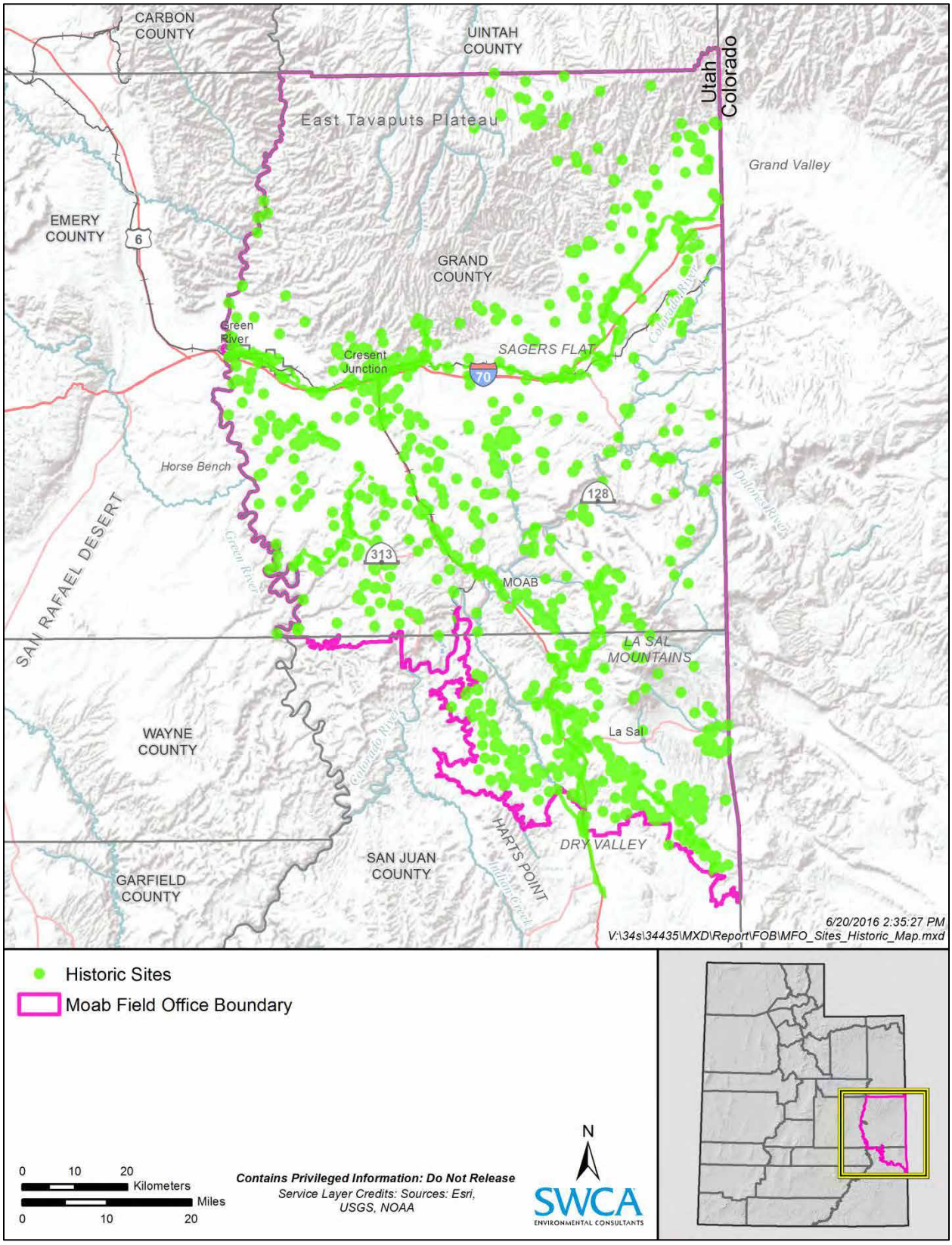


Figure 6-7. Locations of Historic period archaeological sites in the MFO planning area.

6.7.1 Farming and Ranching

The farming and ranching theme sites consist of the buildings and locations of various farming and ranching activities in the planning area, which date to as early as 1855. The establishment of productive farms and livestock herds was vital to the survival of settlers in the region. The need for fertile soils and water for irrigation guided locations chosen for farms. The region became known for fruit growing and cattle and sheep. The number of livestock grazing in the planning area negatively impacted available grazing resources by the turn of the twentieth century. The U.S. Forest Service imposed grazing regulations on the La Sal National Forest lands soon after the forest was created in 1903 (Alexander 1987:26). Although the Great Depression impacted farming and ranching in the region, its impact was delayed. With the implementation of the Taylor Grazing Act in 1934, "many small and marginal ranching outfits either quit or were forced off the land after they failed to secure permits for grazing land" (Firmage 1996:277). Many of those with grazing permits eventually fenced off their grazing lands, which helped reduce cattle rustling but also changed the character of ranching in the region forever. Figure 6-8 shows that the majority of farming and ranching sites are concentrated along major rivers and their tributaries in the western portion of the planning area. The farming and ranching sites located in the northeastern portion of the planning area are not located near obvious tributaries in many cases, and may represent dry-farming or ranching operations.

Farming and ranching sites are fairly common in the planning area and figure prominently in the settlement and development of the region. Because of this, farming and ranching sites in the planning area can provide information for a number of significant archaeological and architectural issues and questions, including the following:

- Did farms and ranches in the region begin to consolidate earlier than the 1950s? Did individuals take advantage of farms and ranches in foreclosure after the Great Depression? Did consolidation of farms and ranches occur in lesser numbers than in other regions of Utah? How was consolidation impacted by the establishment of the Taylor Grazing Act?
- With the implementation of the Taylor Grazing Act in 1934, grazing permits were issued to ranchers. The ranchers in turn began fencing off their grazing lands in the 1940s. Between 1934 and 1940, what did the grazing allotments look like? How were ranchers protecting their grazing resources during this period? How did ranchers resolve disputes if their livestock crossed onto one another's allotments?
- How did the Taylor Grazing Act change the spatial patterning of ranches and farms? Given that many smaller ranches quit or were forced out of the area, how does this alter the abandonment and reuse processes in the archaeological record? Are there specific use patterns created as a result of the act?
- Prior to the implementation of the Taylor Grazing Act, the area that is now the MFO planning area was crossed by cattle drives from Texas to California. Many of these drives followed portions of the Old Spanish Trail or traveled through the Book Cliffs Mountains (Beckstead 1991:25–27). What remains of the cattle drive trails? Are there specific short-term encampments that can be directly tied to the Texas cowboys? What differences are there, if any, in assemblages from local ranchers and sheepherder camps and out-of-state cowboy camps? Can short-term encampments be used to trace cattle drive trails? What other site types and isolated occurrences (IOs) could be related to cowboys and cattle drives?
- What were the prominent ranching and farming operations in the area? Were these operations Mormon or non-Mormon? How were these operations organized and laid out? Were there more cattle or sheep ranching operations? When did shifts in livestock types occur? When did large scale farming operations initially begin in the MFO planning area? How has farm size and crop selection change over time? How large were fruit farms at their peak? Do any fruit farms remain from the early settlement of the region?

- How did ranchers obtain their livestock? Were they brought in on cattle trails from Texas or delivered by train? Did the locations of cattle trails impact the locations where ranches were established? Did ranchers graze their livestock out of county during the winter?
- How did religious-driven settlements and the suitability of lands for agriculture in the planning area impact site choice?
- How did consumer choice among farmers in the planning area differ from residents or users other site types? How might such differences explain site assemblages and can ethnic or religious markers be identified?
- How many cooperative farming ventures versus capitalistic ventures were there in the planning area prior to the Great Depression? Were the cooperative ventures able to weather economic fluctuations and survive better than the capitalistic ventures? Are there differences between these ventures that would be distinguishable through the archaeological record, i.e., farm layout or overall farm size?

6.7.1.1 DATA NEEDS

Many of the questions raised above are dependent on a more nuanced understanding of the diversity of farming and ranching activities in the first place. Documentary sources such as assessor/tax documentation, local histories, chains of title, census records, and existing cultural resources documentation can help, but additional data from oral histories and further surveys are required. Future studies should focus on exploring potential sources of diversity in the types of farming and ranching ventures in the planning area, such as cooperative farming vs. capitalistic ventures and the role of religious and ethnic differences, as well as changes in these over time. Much of this variation may also have landscape implications such those related to the effects of the Taylor Grazing Act on resultant grazing allotments and the demise of interstate cattle drives. Geographic data from General Land Office (GLO) maps, historic topographic maps, and other sources, combined with historical and archaeological information, are needed to address these issues. Better understanding of such diversity across the planning area's historical landscape could help in answering the questions posed above as well as provide the context for some of the more site-specific issues.

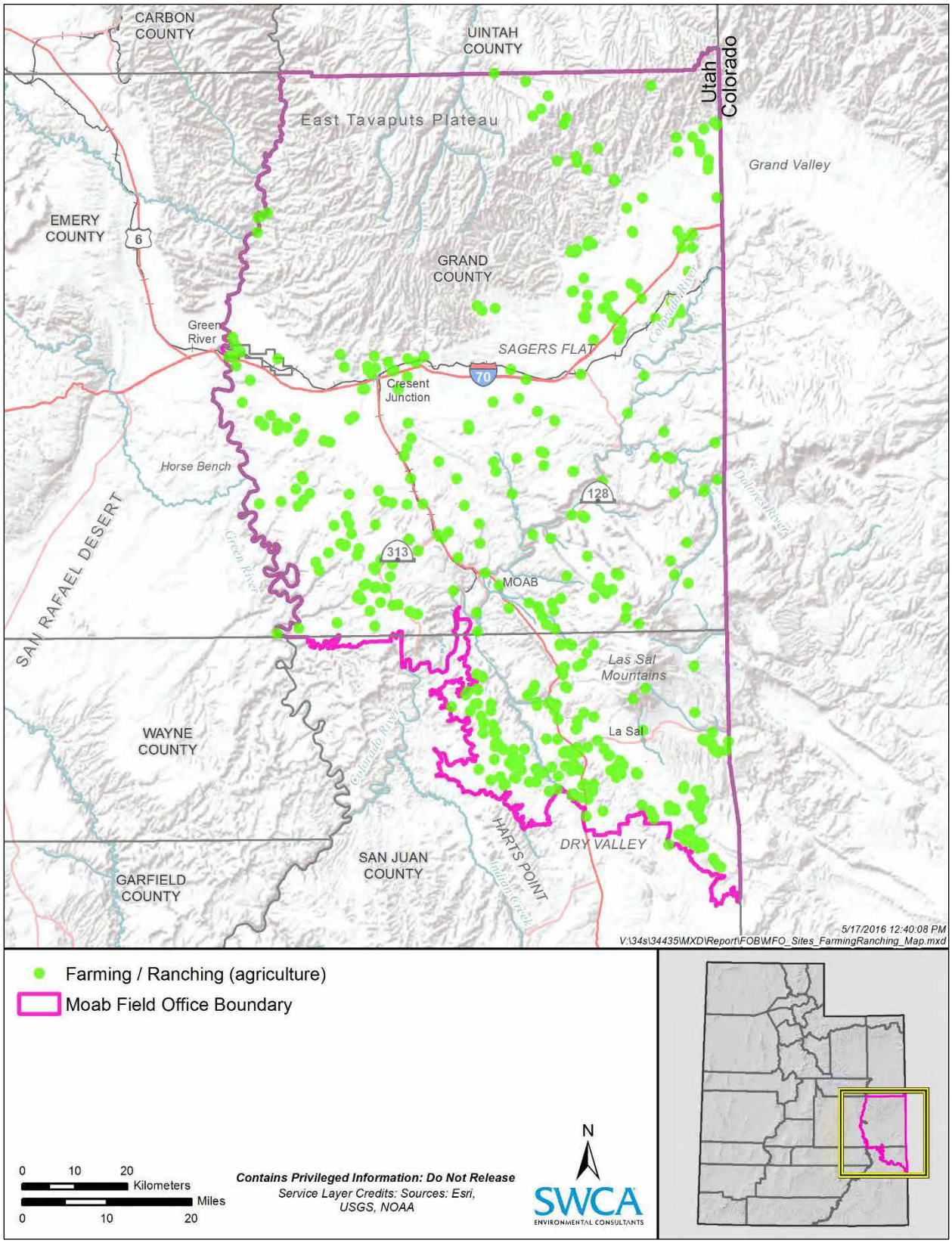


Figure 6-8. Location of farming and ranching sites in the MFO planning area.

6.7.2 Mining and Mineral Extraction

The MFO planning area has experienced boom and bust cycles over several decades from mining activities related to uranium, vanadium, potash, and coal. The various booms drew to the region operations ranging from wildcatting prospectors to large corporations, all looking to strike it rich. While the town of Sego was built to accommodate the workers at the mine there and was organized in a similar fashion to other company towns in the United States, other towns in the MFO planning area were built around the Denver & Rio Grande Western Railroad sidings and stations. Moab does not fit into either category because it was established as a postal location for cowboys and ranchers in the surrounding area and followed the typical Mormon town layout. Mrozowski and Beaudry (1990) examined the spatial arrangements and relationships at the Boott Mills complex in Lowell, Massachusetts, and "analyzed how social status was related to the size of supervisors' residences and boardinghouses for workers" (Spencer-Wood 2010:513). Hardesty notes that Western mining towns are "marked by two quite different patterns of mining technology: a nonindustrial pattern and a corporate industrial pattern" (Hardesty 1994:131). The nonindustrial pattern typically manifests as a "decentralized system of power control," has "miner-owner entrepreneurs," and has "little variation in yield, wealth, and political power," resulting from the "use of low-cost and low-power technology" (Hardesty 1994:131–132). The corporate industrial pattern results from high-cost and high-power technology with centralized power in elite groups and wage laborers (Hardesty 1994:131–132).

One or both of these patterns would be expected in the layout of mining and processing town sites in the MFO planning area. Through spatial analysis of town sites, the location of social, socioeconomic, and ethnic spaces can be identified. Town site analyses can also aid in determining the mining technology patterns that influenced the town layout and can help validate existing archival documentation about the town and its residents. Figure 6-9 presents the recorded mining and mineral extraction sites in the MFO planning area. The sites are somewhat equally spread throughout the planning area, with a large cluster of sites in the southern portion.

As early as 1942, radiation was identified as a health issue for individuals involved in vanadium and uranium mining in the United States (Ringholz 1989:36–51). It would be the 1960s, however, before health problems from exposure would result in the deaths of many of the miners, as confirmed through autopsies and multiple medical studies (Ringholz 1989:194–206). Adding mechanical ventilators to mines was recommended to circulate air and reduce radiation levels in mines as early as 1953, but most mines did not use them (Ringholz 1989:171–172). It was not until 1967 that formal safety guidelines would be produced for addressing radiation hazards in uranium mining (Federal Radiation Council 1967).

As with farming and ranching sites, mining and mineral extraction sites are fairly common in the MFO planning area and figure prominently in the settlement and development of the region. These sites can provide information on a number of significant archaeological and architectural issues and questions, including the following:

- Are there visible differences between worker and supervisor residential spaces similar to those observed by Mrozowski and Beaudry (1990) at Boott Mills? For non-company towns that experienced significant growth during booms, were areas of expansion grouped by workers and supervisors?
- Large numbers of wildcatters tested the MFO planning area in hopes of finding vanadium and uranium deposits. These small operations left many prospector pits and "doghole" mines across the landscape. What features and associated artifacts make up a typical doghole mine? How do these sites differ from large corporate mining locations? Are these smaller sites attached to larger underground workings of major mining operations? Do stone features at these smaller sites represent processing locations (i.e., sluices)? If so, is it possible to differentiate what mineral was

being mined at the site? Were these sites reused throughout multiple boom cycles with the hope that different technologies or processing would produce the desired material(s)?

- The mining activities in the MFO planning area drew many people of different ethnicities, genders, and social standing statuses to the area. Can differences in social status, socioeconomic level, and ethnicity be discerned in residences, town sites, or districts associated with mining and mineral extraction? Are there discernible differences in household consumption between the mining camps and established town site artifact assemblages? Are town site assemblages identifiable and easily located to provide a comparison to mining camp assemblages? Are mining camp and town site assemblages consistent across the MFO planning area? Are these assemblages consistent with other mining sites and town sites across the West?
- Can the phases of exploration, development, and production (per Hardesty 1994) be seen at mining locations and towns? If there are differences by resource type, what are they? Are the differences due to financial reasons? Social reasons? Availability of resources?
- Wood (2004:217–218) describes the Colorado Fuel and Iron Company's intentional distribution of members of different nationalities throughout its mining towns (e.g., Berwind, Colorado) so "no two of them shall get together and discuss their grievances," thereby reducing the chance of a strike or other work disturbance by a large group. Is there evidence in the MFO planning area of various nationalities or ethnic groups being distributed throughout mining camps and towns by the mining companies to reduce potential work disruptions by distinct ethnic blocks?
- Are the equipment and structures remaining at mining and mineral extraction sites across the MFO planning area hand-built, or are they pre-constructed kits that were assembled on-site? How frequently does hand built equipment appear at large corporate or small owner-operated mining operations? Are there instances of hand-built alterations or jury-rigging of equipment and/or structures at larger corporate mining sites, or does it only appear at small mining sites?
- Is there evidence of miners and/or mining operations observing radon-related and other radiation safety protocols at mine locations with the implementation of measures such as mechanical ventilation systems? Did smaller wildcatter operations observe these, or any, safety measures? Do mechanical ventilation systems appear with any regularity after 1967 for all mines? If so, are these systems added to older mines, or were they only built in conjunction with new mine locations? Are there pharmaceutical products that treat cancer symptoms at the sites? What products appear the most? How consistent are these treatments with the documented illnesses of the miners?

6.7.2.1 DATA NEEDS

Data needs consist of town plats, documented town layouts, assessor and tax documentation, GLO maps, historic topographic maps, oral histories, local histories, chains of title, census records, mining claim documents, mine plans, underground workings maps, mining equipment sales catalogs and information, personal documents (such as diaries, letters, etc.), existing archaeological and/or architectural documentation, and additional archaeological and/or architecture surveys.

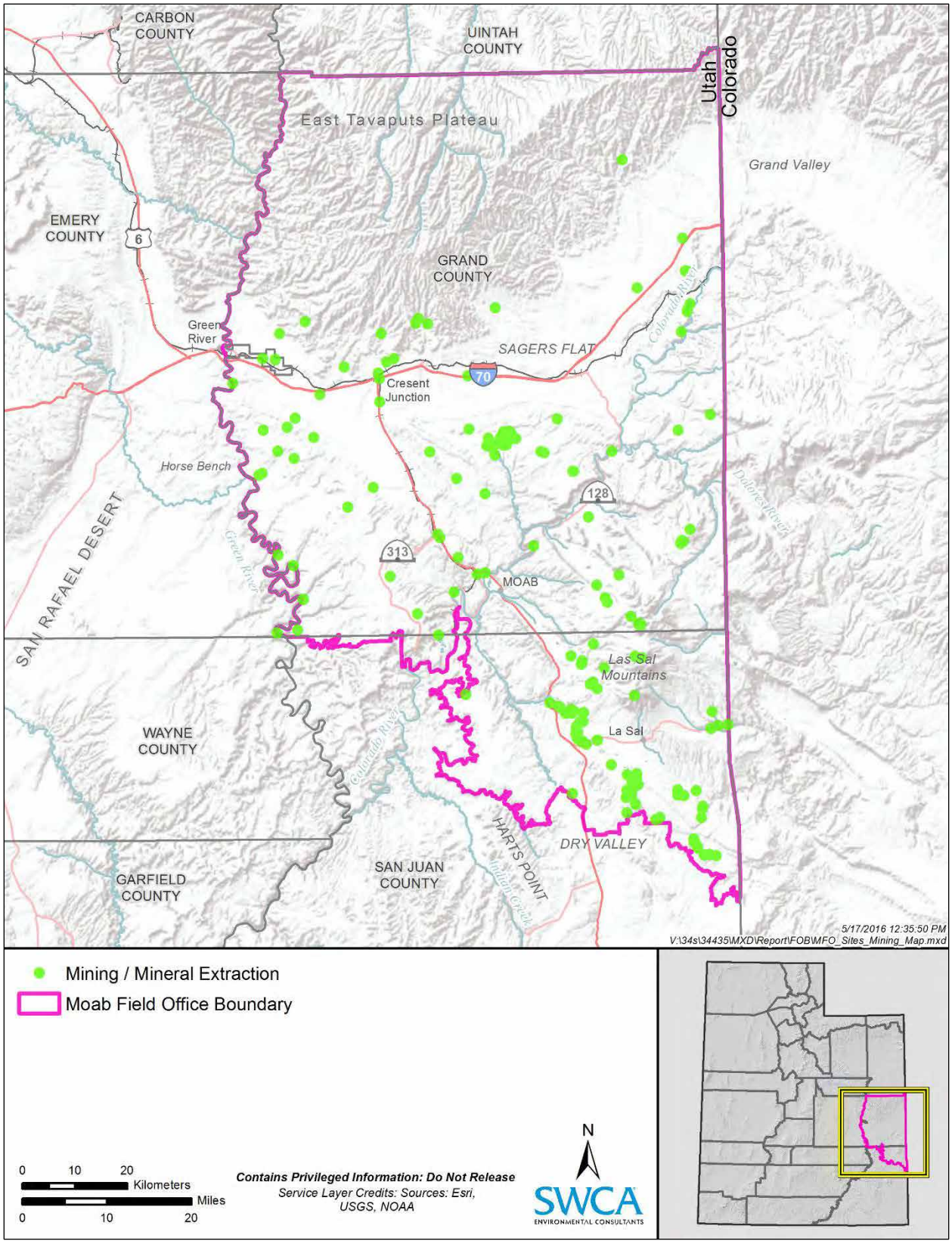


Figure 6-9. Location of mining and mineral extraction sites in the MFO planning area.

6.7.3 Transportation and Railroads

Transportation through the region encompassed by what is now the MFO planning area has been crucial since the earliest explorations through the Utah Territory in the late 1770s. Trails such as the Old Spanish Trail and the Escalante Trail provided routes for traders, trappers, and explorers. Eventually, settlers created trails and roads between settlements in the territory that allowed for regular trade routes. The region also benefited from the introduction of the railroad to Utah in the 1890s. Railroad construction involved a variety of immigrant groups, including Chinese and Japanese immigrants. Trains allowed a wider variety of goods to be transported to and from the region and to reach a broader market for goods produced in the region. Among the documented historic railroads in the planning area are the Ballard and Thompson and the Denver & Rio Grande Western (D&RGW) lines, including the D&RGW Cane Creek Branch.

Interstate (I-) 70 was built across the planning area by 1973, replacing the railroad for shipping and tourism among many other benefits. Many local roads and trails have been upgraded over time and are still in use for both every day and recreational use. Figure 6-10 shows that the majority of documented transportation-related sites in the planning area are concentrated along the U.S. Route (U.S.) 191 corridor in the west-central portion of the planning area. The few transportation sites identified in the eastern portion of the MFO planning area are located along the old U.S. 6/50 alignment or along the Colorado River and its tributaries. These sites may be associated with mining or farming and ranching operations in that area.

As with farming and ranching sites and mining sites, transportation sites are fairly common in the MFO planning area and figure prominently in the region's history. Because of this, transportation sites in the planning area can provide information for a number of significant archaeological and architectural issues and questions, including the following:

- The precise alignments of important historic trails like the Old Spanish Trail and the Escalante Trail are not known. Approximations have been posited by researchers who have made extensive use of documentary evidence coupled with observations of the regions physical geography. Does cost path GIS modeling suggest which of these alternative alignments might be more likely? If so, can archaeological and/or documentary evidence provide additional support?
- Which road and trail construction methods have best survived over time? How did construction methods change over time to accommodate different methods of transportation? Can these methods be readily identified along road and trail alignments?
- Scott (2015:384) examined the archaeological signatures (e.g., carvings, cairns, etc.) of the Buffalo Road, used for the Lewis and Clark Expedition, and noted their importance to pre-contact camps and settlements as well as European and Americans groups colonizing the West. Along the oldest trails in the MFO planning area, are there markers such as peeled trees, rock cairns, tree carvings, rock carvings, or other unique stone features that mark the trail? Are these markers the result of Native Americans, early expeditions and settlers to the area, ranchers/sheepherders, or recreationalists and tourists marking the trails, or a combination of all of the groups? How should these individual resources associated with trails and roads be incorporated into the larger linear resources?
- What types of archaeological and architectural sites can be directly associated with roads, trails, and railroads? Are these sites ephemeral and related to the construction process, or are they permanent, and did they provide services to those who used that form of transportation?

- Is there evidence of temporary encampments or dugout features along railroad alignments that are associated with the construction of the line? Can these encampments and features be positively associated with a specific ethnic group who may have built the line? What differences are there between the camps along the initial railroad building in the county and any later rail lines built for hauling mining materials?
- The MFO planning area has limited documentation on railroads, which focuses on the Ballard and Thompson and the D&RGW lines. Given the number of mining boom and bust cycles that occurred, it is possible that there may have been more railroads constructed to transport ores and processed materials and/or that other forms of transportation were used. How were ores and processed materials transported from the mines and processing facilities to market? Were they moved via truck then train? What routes were used for transporting the materials to the railroad facilities? Did these routes change after learning of the health risks associated with uranium and other radioactive materials?
- The Moab to Thompson road underwent significant efforts to maintain and improve it, but how well were other roads in the MFO planning area used for commerce and transporting goods maintained? Were there privately owned groups maintaining necessary roads? Did mining companies contribute to the construction and maintenance of roads used to transport their products? How did road conditions impact commerce within each county, with adjacent counties, and throughout Utah?

6.7.3.1 DATA NEEDS

Many sites related to transportation may be missing from current inventory data. Although railroads, all-weather roads, and heavily used wagon trails may still be visible, more ephemeral or long-abandoned routes may be more difficult to discern on the landscape. For instance, to understand the potential use of trail markers and their association with transportation routes, the analysis needs to consider resources such as cairns that may most often be recorded as IOs rather than sites. This requires archaeologists to analyze whether these IOs represent features along a linear site and ensure they conduct background research prior to the start of a field project, as suggested by the Utah Professional Archaeological Council's Linear Sites guidance document (Utah Professional Archaeological Council 2008). Historical documents such as GLO maps, historic topographic maps, historic travel and tour guides, local histories, chains of title, census records, road design documents, railroad design documents, and railroad documents (memoranda, letters, payrolls, etc.) may also assist in identifying less well-known transportation corridors, as would oral histories, existing archaeological and/or architectural documentation, and additional archaeological and/or architecture surveys.

Once identified, transportation sites can rarely be evaluated on their own and instead must be viewed—at least in part—in the context of the sites and resources they connect. Such a network approach would be especially helpful in answering some of the questions raised above, especially those related to variation in use over time, changes in the ethnic makeup of the labor force to build labor intensive networks like railroads, and scope and scale of transportation systems.

Once a transportation network is identified through historical documentary methods or discovery of any archaeological site, an additional round of fieldwork and subsequent analysis should be conducted as a part of a network-type analysis. Ad hoc trails, those that are not purposefully constructed, tend to have subtle attributes and are difficult to identify in inventories not designed to detect the physical manifestations of these networks. (Transects on block surveys are unlikely to detect subtle trail alignments.) Linear sites including trails require special methods to identify networks and nodes as they are not always readily identifiable on the ground.

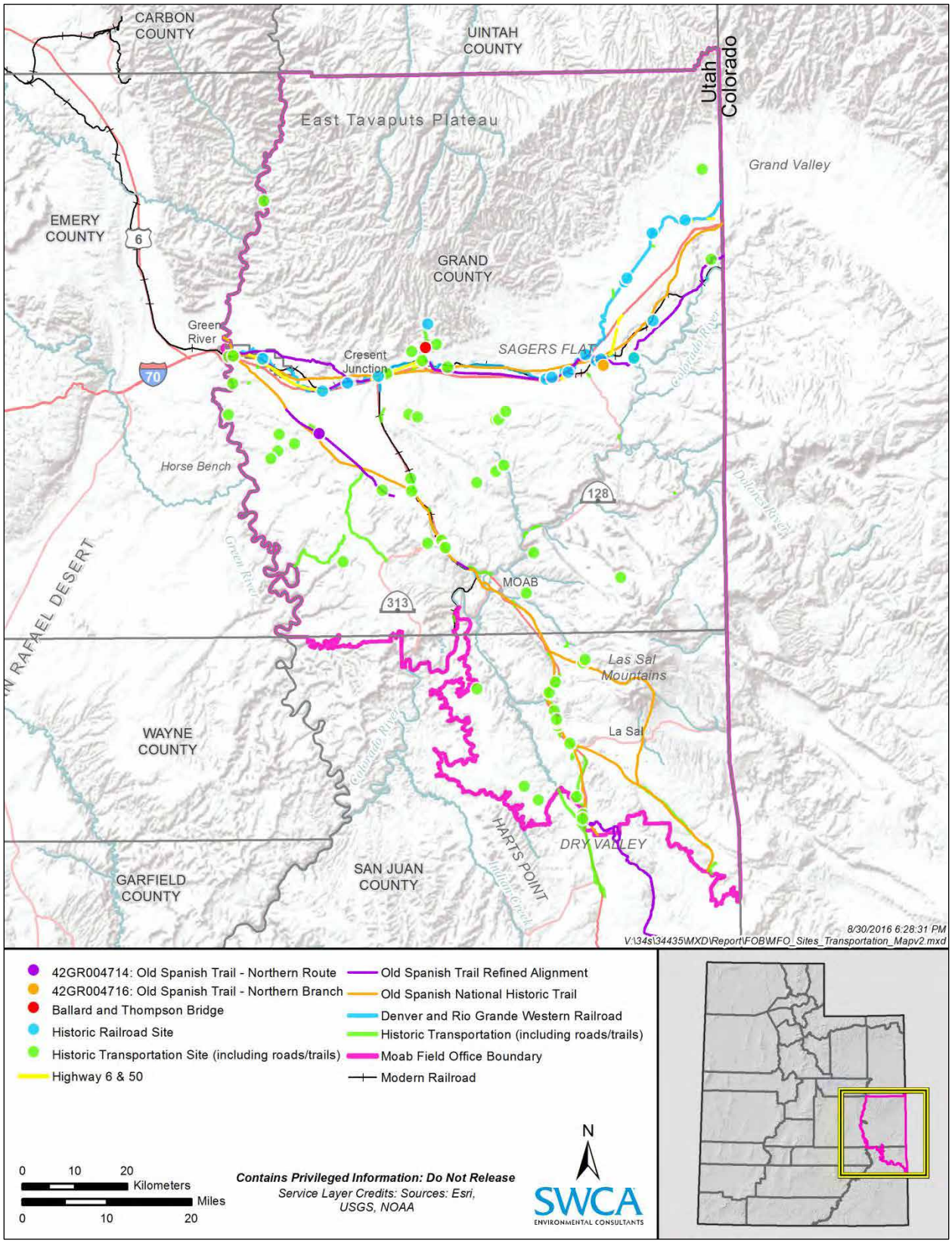


Figure 6-10. Location of transportation and railroad sites in the MFO planning area.

6.7.4 Civilian Conservation Corps and Works Progress Administration

In April 1933, the Moab *Times-Independent* announced the impending arrival of the CCC and its water, forest, and range projects (Firmage 1996:273). The first CCC camp in the area was established at Warner Lake (Camp F-20) in April 1933 (Firmage 1996:274). At least one CCC camp was active in what is now the MFO planning area at all times between 1933 and September 1941 (Firmage 1996:281). The various CCC camps completed projects for the Division of Grazing, National Park Service, U.S. Forest Service, and Soil Conservation Service by building erosion controls, flood controls, dams, roads, trails, springs, reservoirs, and fences (Firmage 1996:283). Reclamation and soil conservation work was also conducted on private lands (Firmage 1996:283). In addition to the main camps, spikes camps, or side camps, were established for short periods of time to complete "small tasks outside the parameters and boundaries of the regular camp" (Firmage 1996:284). Spike camps were established in the La Sal Mountains and near Cisco (Firmage 1996:284). The Grand County Courthouse received a grant from the Public Works Administration (PWA), while the Moab Elementary and Junior High School and water/sewer improvements received WPA grants (also called Work Projects Administration grants) funding (Firmage 1996:275, 288–289; McCormick and Carter 1985). No other projects receiving funds from the WPA or PWA are described in local or county histories.

CCC/WPA sites played an important part in generating work and funds for the region during the Depression. Because of this, CCC/WPA sites in the planning area (Figure 6-11) can provide information about a number of significant archaeological and architectural issues and questions, including the following:

- Are the WPA- and CCC-built canals, ditches, dams, and erosion controls similar in construction throughout the MFO planning area? Are they similar in construction to those built across Utah? Similar to those built throughout the United States? Are there similar modifications to improve them?
- Of the constructed features, which have survived the best with minimal upkeep or modifications? What features have required the most repairs and/or modifications? In what type of environment are the features located?
- The buildings from many of the CCC camps were dismantled or moved and sold when the camps closed. Are there any of the original CCC buildings still in use in the MFO planning area? How are they used? How have they been modified? Are they still recognizable as the original CCC buildings? If standing buildings are no longer present at a site, are there foundations or other structural remains present? What can the distribution of buildings and structural features tell us about camp organization?
- The Dalton Wells CCC camp was reused as the Moab Relocation Center during World War II. Despite the Center's short tenure at the old camp, were there distinct alterations to the camp for use as a relocation center when repairs were made? Is there evidence of the internees in the archaeological assemblage? If so, are the artifacts created from materials available at the camp?
- Are there visible remains of the CCC spike camps, such as tent pads, despite their ephemeral nature? Have spike camp locations been identified only as can or other historic artifact scatters? How do the spike camp assemblages differ from the main camp assemblages? Are spike camp assemblages similar to sheepherder camps?

- Do public buildings in the MFO planning area exhibit any style or construction influences from the WPA buildings in the area? Do any other building types in the planning area exhibit WPA style or construction influences? Do any of the buildings exhibit any styles or construction methods originating from the home region of the CCC, WPA, or PWA workers?
- Are there recreational buildings or structures related to the WPA or PWA in the MFO planning area? If so, are they related to Arches National Park, or are they small parks, swimming pools, or libraries?

6.7.4.1 DATA NEEDS

Some of the question raised above related to variation between CCC and WPA constructions of similar type, their context, and preservation over time would benefit from a regional, geospatial approach. Geographical data from GLO maps, historic topographic maps, and canal and lateral system maps can be supplemented with attribute data from, local histories, chains of title, census records, canal company documents, WPA documentation (design plans, internal documents, etc.), CCC documentation (design plans, internal documents, etc.), culinary waterline design plans, and existing archaeological and/or architectural documentation. Data informing on these questions might also be gleaned from oral histories and additional archaeological and/or architecture surveys. Better resolution of our data relevant to these resources would be helpful in addressing such themes the effects of ethnic—especially relevant in illuminating the role of prisoners of war—or regional differences between CCC camp crews in camp organization, assemblages at those camps, etc. A more robust landscape approach to such resources may also identify variation in the relationship between main and secondary camps. Further studies should be conducted examining the reuse and movement of CCC camp buildings as documentation of those buildings is lacking after their sale. In addition, complete archaeological and architectural surveys should be conducted to identify remaining CCC and WPA buildings and structures within the MFO. Condition assessments should be conducted as well to determine stabilization and/or restoration needs. Construction methods can be identified during these activities and be used for comparison with other CCC and WPA buildings and structures across Utah and the United States. If possible, identification of material sources for buildings and structures should be performed to aid in appropriate repairs.

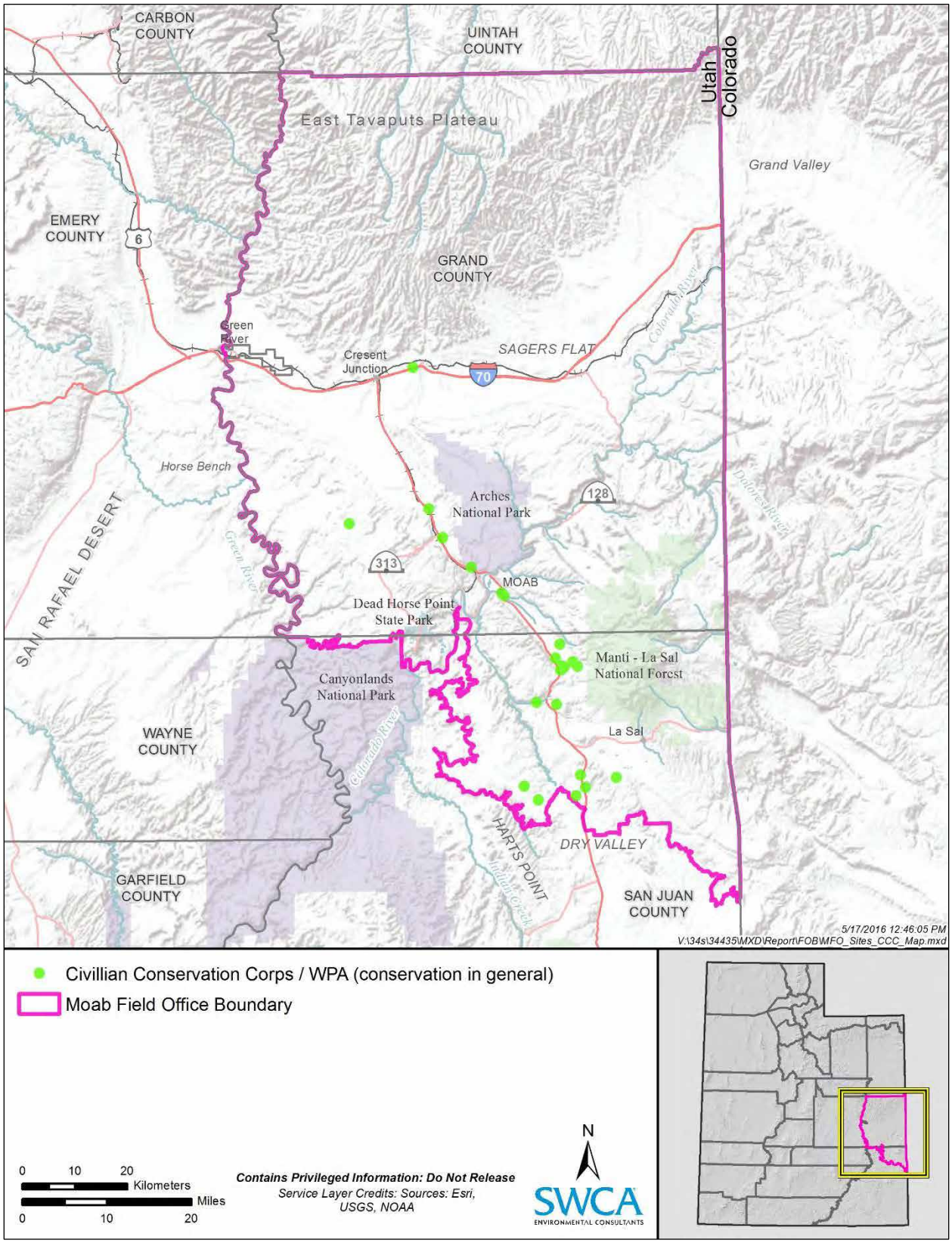


Figure 6-11. Location of CCC/WPA (conservation in general) sites in the MFO planning area.

6.7.5 Recreation and Tourism

Recreation and tourism in the United States on a large scale began in the late nineteenth century with nature tourism (Camp 2013). Early tourism by the upper classes tended to involve trains and locations that rail lines could reach. Vacationing and tourism by the middle and working classes involved activities "with minimal outlay or that saved money," as paid vacation was not offered during the early twentieth century (Aron 1999:208). As a result, "visiting relatives, fishing, and camping" were popular vacation activities and were even featured in *Ladies' Home Journal* in 1954 (Aron 1999:208; Rugh 2008:118–131). The advent of the automobile increased the number of places tourists could visit, particularly locations far from rail lines. Though relatively few sites associated with this theme have been recorded in the MFO planning area, such sites represent a largely unexplored avenue for research into the region's history. Recreation associated localities in the MFO planning area include Arches National Park (established as Arches National Monument in 1929), Sand Flats Recreation Area, Black Ridge Canyons Wilderness Area, Canyon Rims Recreation Area, Dead Horse Point State Park, Old Spanish National Historic Trail, Manti-La Sal National Forest, and the Colorado, Dolores, and Green Rivers. McInnis Canyon National Conservation Area is located along the Utah-Colorado border, with a small portion located in Utah south of the Colorado River. There are 10 Wilderness Study Areas (Behind the Rocks, Coal Canyon, Desolation Canyon, Floy Canyon, Flume Canyon, Lost Spring Canyon, Mill Creek Canyon, Negro Bill Canyon, Spruce Canyon, and Westwater Canyon) and four Areas of Critical Environmental Concern so designated due to cultural resources (Behind the Rocks, Highway 279/Shafer Basin/Long Canyon, Mill Creek Canyon, and Ten Mile Wash) located in the MFO planning area. These areas have primitive recreation restrictions in order to protect the resources these areas hold.

In addition, Canyonlands National Park was established in 1964 and is located immediately southwest of the MFO planning area in San Juan County (Firmage 1996:345). Tourism in the Moab area, including that associated with Arches National Park, had boosters as early as 1930 in the form of the local Lion's Club and was a main reason for road improvements to facilitate travel to the area (Firmage 1996:268, 271). Another important component of tourism for the region is Hollywood location filming. Local leaders realized the potential benefits and publicity that this could provide for the region and formed the Moab Film Commission in 1949 (Firmage 1996:305). A wide variety of movies and television shows have been filmed in what is now the MFO planning area since 1949.

Refining the date ranges for the documented sites should be priority so that these sites can be associated with specific events or trends in tourism and recreation. Figure 6-12 presents the recorded recreation/tourism sites in the MFO planning area. While very few sites associated with recreation and tourism have been documented, they are scattered across the planning area, with sites concentrated along the Green River, U.S. 191, and the Manti-La Sal National Forest. Only four sites associated with recreation and tourism have been documented north of I-70 and are concentrated near the northeast corner of the planning area.

Although less common in the MFO planning area, recreation and tourism related sites may provide data relevant to a number of important research issues such as the following:

- With refined date ranges, are there specific trends or events with which the sites can be associated? Are the documented artifact scatter sites associated with early vacation camping?
- Current popular recreational activities include all-terrain-vehicle trail riding, hiking, and camping. What recreational activities were popular in the MFO planning area in the early twentieth century? What type of footprint would those activities leave in the archaeological record, particularly near the popular recreation areas?

- Postcards are a popular item to purchase at modern tourism sites and typically portray a site or people associated with the site. Prior to 1920, postcards were seen as "a private memento of local people, scenes, and events," whereas later postcards were simply souvenirs for tourists (Albers and James 1984:89–90). What recreation/tourism sites in the MFO planning area are depicted on historical postcards? What places and people are portrayed on historical postcards in the MFO planning area? What undocumented potential archaeological or architectural sites are portrayed on the postcards? Do these sites still exist and have any management needs?
- How has the creation of national parks and state parks in and adjacent to the MFO planning area changed recreational and tourist activities and their locations? Have roadside attractions been constructed along the routes to major parks or attractions? Are there roadside attractions of historic age that have not been documented?
- How has the popularity of the MFO planning area as a filming location affected nearby archaeological and architectural resources? Does continued film-induced tourism, "tourist visits to the destination featured on television, video, or cinema screen," pose significant issues for site management and protection (Rewtrakunphaiboon 2009)? What measureable impacts does film-induced tourism have on the local economy?
- Without the local efforts to promote Arches National Park, the welcoming of the movie industry, and the help of the CCC to improve roads in the area, would the MFO planning area have become a popular recreation and vacation area and filming location? Would it have taken longer to achieve without the early efforts?
- Historic inscriptions and other historic rock art have been documented in the MFO planning area. How many inscriptions and rock art sites are the possibly the result of tourists or early explorers? From which era are most of the inscriptions? Can the inscriptions aid in confirming early settlement or trade stories for the region? Does the number of inscriptions decline toward the modern era? What types of historic rock art are there, and what do they depict?

6.7.5.1 DATA NEEDS

Many of the questions raised above would benefit from refined chronological placement of recreation and tourism sites in order to address trends in the popularity of places over time and the activities that occurred at them. Data from documentary sources such as GLO maps, historic topographic maps, local histories, census records, personal documents (such as diaries, letters, etc.), newspapers, historic postcards, historical travel and tour guides, and existing archaeological and/or architectural documentation, as well as new data generated from oral histories and additional archaeological and/or architecture surveys, can help refine our understanding of these diachronic changes. Historic rock and tree inscriptions of dates at sites may also be employed to further evaluate visitation and recreational visitation over time at certain locations. Historical postcards, images from historical travel guides, and even historical feature films may also be used to assist in resource discovery and management, as these sources may document as yet unrecorded cultural resources as well as their condition at the time they were photographed, allowing for assessment of general preservation and stability over time. The MFO has a high level of recreation and tourism usage, which should be studied in depth to determine its impact on archaeological resources. In addition, studies to identify which archaeological resources tourists are coming to visit and why can provide the Bureau of Land Management and other agencies with the tools to provide interpretation and protection for these resources. Further research into film-associated tourism for the region can also provide agencies with new locations that may require interpretation and protection in the future.

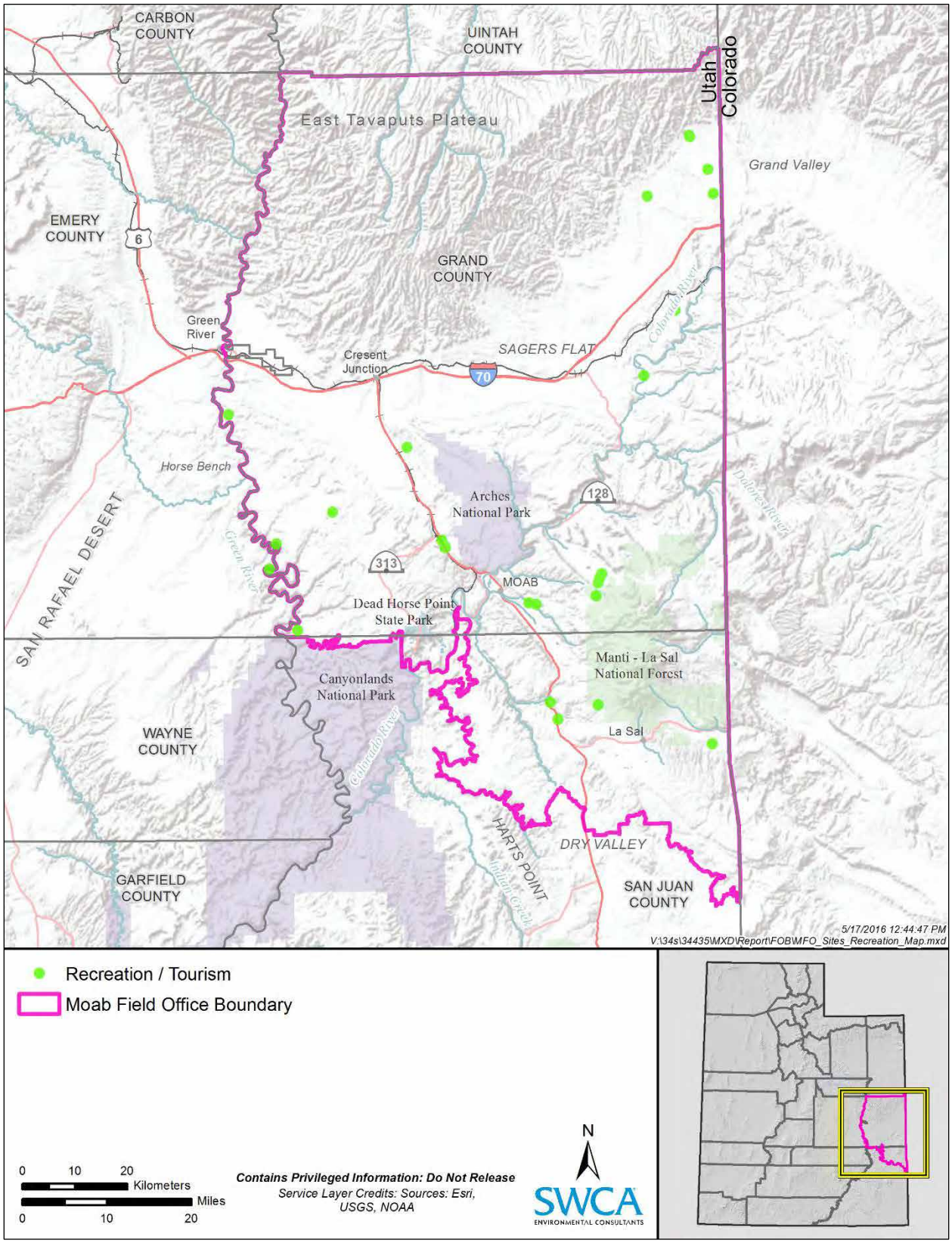


Figure 6-62. Locations of recreation and tourism sites in the MFO planning area.

6.8 Summary

Available site records for the MFO planning area indicate the presence of no fewer than 8,017 archaeological sites. These sites include evidence for the earliest human inhabitants of this part of western North America, with a number of known sites attributable to the Paleoindian period, through the remaining divisions of archaeological time, to those people who call the area home today. This rich record covering the entirety of human use of the region provides unique opportunities for research that contributes to our collective understanding of human occupation and that in turn enriches our understanding of our shared history. Many of the research issues presented in this chapter have been derived from the received wisdom of decades of research, and they have been structured largely following the culture historical traditions from which many of those observations were made. Questions regarding mobile Paleoindian foragers, broad-diet Archaic foragers, Formative period farmers and farmer/foragers, and finally Protohistoric peoples who returned to broader diets and more mobile lifeways have all been largely couched in terms of documenting and understanding spatial and temporal variation. Importantly, new questions that build upon the knowledge accumulated through answering earlier ones can now be posed. The Historic period archaeology of the MFO planning area provides evidence of use relevant to several important research themes. Specific research questions regarding farming and ranching, mining and mineral extraction, transportation, railroads, the CCC and WPA, and recreation and tourism have been outlined, with close attention paid to those questions that result in documentation and exploration of the causes for apparent temporal and spatial variation. In addition, Historic period research in the MFO planning area should focus on identifying mining and ranching site locations, particularly in the eastern portion of the planning area, as well as recreation and tourism site locations throughout the planning area. Historic period research should also examine relationships between linear sites and isolated features to see whether they exhibit predictable patterns of co-occurrence. Indeed, the richness of the MFO planning area archaeological record is matched only by the breadth of interesting and relevant research that can come from its study.

6.9 References Cited

Aikens, C. Melvin (editor)

1970 *Hogup Cave*. University of Utah Anthropological Papers No. 93. University of Utah Press, Salt Lake City.

Albers, Patricia C. and William R. James

1984 Utah's Indians and Popular Photography in the American West: A View from the Picture Post Card. *Utah Historical Quarterly* 52(2):72–91.

Alexander, Thomas G.

1987 *The Rise of Multiple-Use Management in the Intermountain West: A History of Region 4 of the Forest Service*. U.S. Department of Agriculture, Forest Service, Washington, D.C.

Ambler, J. Richard and Mark Q. Sutton

1989 The Anasazi Abandonment of the San Juan Drainage and the Numic Expansion. *North American Archaeologist* 10(1):39-53.

Antevs, Ernst

1948 Climatic Changes and Pre-White Man. *The Great Basin with Emphasis on Post-Glacial Times* 38(20):167–191.

Arakawa, Fumiyasu

2006 Lithic Raw Material and the Social Landscape in the Central Mesa Verde Region, A.D. 600-1300. Unpublished Ph.D. dissertation, Department of Anthropology, Washington State University, Pullman.

Arakawa, Fumiyasu, Scott G. Ortman, M. Steven Shackley and Andrew I. Duff

2011 Obsidian Evidence of Interaction and Migration from the Mesa Verde Region, Southwest Colorado. *American Antiquity* 76(4):773-795.

Aron, Cindy S.

1999 *Working at Play: A History of Vacations in the United States*. Oxford University Press, New York.

Bailey, Garrick and Roberta Glenn Bailey

1986 *A History of the Navajos: The Reservation Years*. School of American Research Press, Santa Fe, New Mexico.

Balenquah, Lyle

2008 Beyond Stone and Mortar: A Hopi Perspective on the Preservation of Ruins (and Culture). *Heritage Management* 1(2):145-162.

Barlow, K. Renee

2002 Predicting Maize Agriculture among the Fremont: An Economic Comparison of Farming and Foraging in the American Southwest. *American Antiquity* 67(1):65–88.

Barron, John A. and Lesleigh Anderson

2011 Enhanced Late Holocene ENSO/PDO Expression Along the Margins of the Eastern North Pacific. *Quaternary International* 235(1-2):3–12.

Beck, Charlotte and George T. Jones

1997 The Terminal Pleistocene/Early Holocene Archaeology of the Great Basin. *Journal of World Prehistory* 11:161−236.

Beckstead, James H.

1991 *Cowboying: A Tough Job in a Hard Land*. University of Utah Press, Salt Lake City.

Benson, Larry V. and Michael S. Berry

2009 Climate Change and Cultural Response in the Prehistoric American Southwest. *Kiva: The Journal of Southwestern Anthropology and History* 75(1):89-119.

Benson, Larry V., E. M. Hattori, H. E. Taylor, S. R. Poulson and E. A. Jolie

2006 Isotope Sourcing of Prehistoric Willow and Tule Textiles Recovered from Western Great Basin Rock Shelters and Caves–Proof of Concept. *Journal of Archaeological Science* 33:1588-1599.

Benson, Michael P.

1982 The Sitterud Bundle: A Prehistoric Cache from Central Utah. In *Archaeological Investigations in Utah at Fish Springs, Clay Basin, San Rafael Swell, and Southern Henry Mountains*, edited by R. E. Fike and D. B. Madsen. Bureau of Land Management, Utah State Office Salt Lake City.

Berry, Claudia F. and M. S. Berry

1986 Chronological and Conceptual Models for the Southwestern Archaic. In *Anthropology of the Desert West: Essays in Honor of Jesse D. Jennings*, edited by C. J. Condie and D. D. Fowler, pp. 255−295. University of Utah Anthropological Papers No. 110. University of Utah Press, Salt Lake City.

Betancourt, Julio L.

1984 Late Quaternary Plant Zonation and Climate in Southeastern Utah. *The Great Basin Naturalist* 44(1):1–35.

Betancourt, Julio L., Thomas R. Van Devender and Paul S. Martin

1990 *Packrat Middens: The Last 40,000 Years of Biotic Change*. University of Arizona Press, Tucson.

Broughton, Jack M., David A. Byers, Reid Bryson, William P. Eckerle and David B. Madsen

2008 Did Climatic Seasonality Control Late Quaternary Artiodactyl Densities in Western North America? *Quaternary Science Reviews* 27:1916–1937.

Bryan, Alan L.

1977 Smith Creek Cave. In *The Archaeology of Smith Creek Canyon, Eastern Nevada*, edited by Donald R. Tuohy and Doris L. Rendall. Nevada State Museum Anthropological Papers No. 17. Nevada State Museum, Carson City.

Bureau of Land Management, Moab Field Office

2008 Map 19 Steep Slopes (over 30 Percent) in Bookcliffs - Moab RMP. Available at: http://www.blm.gov/style/medialib/blm/ut/moab_fo/rmp/rod_approved_rmp/maps.Par.28561.File.dat/Maps%2019.pdf. Accessed May 17, 2016.

Byers, David A.

2012 The Dawson Site: A Paleoindian Camp in the San Rafael Desert. *Utah Archaeology* 25(1):1-14.

Byers, David A. and Jack M. Broughton

2004 Holocene Environmental Change, Artiodactyl Abundances, and Human Hunting Strategies in the Great Basin. *American Antiquity* 69:235–257.

Byers, David A. and Andrew Ugan

2005 Should We Expect Large Game Specialization in the Late Pleistocene? An Optimal Foraging Perspective. *Journal of Archaeological Science* 32(11):1624-1640.

Camp, Stacy Lynn

2013 From Nuisance to Nostalgia: the Historical Archaeology of Nature Tourism in Southern California, 1890-1940. *Historical Archaeology* 47(3):81–96.

Carlyle, Shawn W., Ryan L. Parr, M. Geoffrey Hayes and Dennis H. O'Rourke

2000 Context of Maternal Lineages in the Greater Southwest. *American Journal of Physical Anthropology* 113(1):85–101.

Coltrain, Joan B. and Steven W. Leavitt

2002 Climate and Diet in Fremont Prehistory: Economic Variability and Abandonment of Maize Agriculture in the Great Salt Lake Basin. *American Antiquity* 67(3):453–485.

Coltrain, Joan B., Joel C. Janetski and Shawn W. Carlyle

2007 The Stable- and Radio-Isotope Chemistry of Western Basketmaker Burials: Implications for Early Puebloan Diets and Origins. *American Antiquity* 72(2):301–321.

Davis, William E.

1985 The Montgomery Folsom Site. *Current Research in the Pleistocene* 2:11–12.

Eggan, Fred

1950 *Social Organization of the Western Pueblos*. University of Chicago Press, Chicago, Illinois.

Fall, Patricia L.

1997 Timberline Fluctuations and Late Quaternary Paleoclimates in the Southern Rocky Mountains, Colorado. *Geological Society of America Bulletin* 19:1306-1320.

Federal Radiation Council

1967 *Report No. 8 Revised: Guidance for the Control of Radiation Hazards in Uranium Mining*. U.S. Government Printing Office, Washington, D.C.

Firmage, Richard A.

1996 *A History of Grand County*. Utah Centennial County History Series. Utah State Historical Society, Salt Lake City.

Frison, George C.

1978 *Prehistoric Hunters of the High Plains*. New World Archaeological Record Vol. 1. Academic Press, New York.

Geib, Phil R.

1996 *Glen Canyon Revisited*. University of Utah Press Anthropological Papers No. 119, No. 119. University of Utah Press, Salt Lake City.

2011 *Foragers and Farmers of the Northern Kayenta Region: Excavations along the Navajo Mountain Road*. University of Utah Press, Salt Lake City, Utah.

Geib, Phil R. and M. M. Lyneis

1996 Sources of Igneous Temper for Fremont Ceramics. In *Glen Canyon Revisited*, edited by P. R. Geib, pp. 167–179. University of Utah Anthropological Papers No. 119. University of Utah Press, Salt Lake City.

Gilbert, M. Thomas P., Dennis L. Jenkins, Anders Götherstrom, Nuria Naveran, Juan J. Sanchez, Michael Hofreiter, Philip Francis Thomsen, Jonas Binladen, Thomas F. G. Higham, Robert M. Yohe II, Robert Parr, Linda Scott Cummings and Eske Willerslev

2008 DNA from Pre-Clovis Human Coprolites in Oregon, North America. *Science* 320(5877):786–789.

Gilpin, Dennis, Susan E. Perlman, Louise M. Senior and Lynn A. Neal

2002 *Cultural Affiliation Study for Canyons of the Ancients National Monument, Southwest Colorado*. Prepared by Two Rivers Consultants, Nashville, Tennessee, and SWCA Environmental Consultants, Flagstaff, Arizona. Copies available from the Bureau of Land Management, Canyons of the Ancients National Monument, Anasazi Heritage Center, Dolores, Colorado.

Glowacki, Donna M.

2015 *Living and Leaving: A Social History of Regional Depopulation in Thirteenth-Century Mesa Verde*. University of Arizona Press, Tucson.

Graf, Kelly E. and Dave N. Schmitt (editors)

2007 *Paleoindian or Paleoarchaic? Great Basin Human Ecology at the Pleistocene/Holocene Transition*. University of Utah Press, Salt Lake City.

Grayson, Donald K.

1993 *The Desert's Past: A Natural Prehistory of the Great Basin*. Smithsonian Institution Press, Washington, D.C.

2000 Mammalian Responses to Middle Holocene Climatic Change in the Great Basin of the Western United States. *Journal of Biogeography* 27:181–192.

2011 *The Great Basin: A Natural Prehistory*. University of California Press, Berkeley.

Hard, Robert J. and John R. Roney

1998 A Massive Terraced Village Complex in Chihuahua, Mexico, 3000 Years Before Present. *Science* 279:1661–1664.

Hardesty, Donald L.

1994 Class, Gender Strategies, and Material Culture in the Mining West. In *Those of Little Note: Gender, Race, and Class in Historical Archaeology*, edited by Elizabeth M. Scott, pp. 129–149. University of Arizona Press, Tucson.

Horn, J., A. Reed and S. M. Chandler

1994 *Grand Resource Area Class I Cultural Resource Inventory*. Prepared by Alpine Archaeological Consultants, Montrose, Colorado. Copies available from the Bureau of Land Management, Moab Field Office, Moab, Utah.

Huckell, B. B.

1996 The Archaic Prehistory of the North American Southwest. *Journal of World Prehistory* 10(3):305-373.

Hunt, Alice P.

1960 *Archeology of the Death Valley Salt Pan, California*. University of Utah Anthropological Papers No. 27. University of Utah Press, Salt Lake City.

Hurst, Winston B. and J. Willian

2011 Ute and Navajo Archaeology in the Comb Ridge Area. *Blue Mountains Shadows* 44(Fall 2011):49–57.

Janetski, Joel C.

1997 Fremont Hunting and Resource Intensification in the Eastern Great Basin. *Journal of Archaeological Science* 24:1075–1088.

Jennings, Jesse D.

1980 *Cowboy Cave*. University of Utah Anthropological Papers No. 104. University of Utah Press, Salt Lake City.

Jett, Stephen C.

1991 Split-Twig Figurines, Early Maize, and a Child Burial in East-Central Utah. *Utah Archaeology* 4:23–31.

Kohler, Timothy A., Matt Pier Glaude, Jean-Pierre Bocquet-Appel and Brian M. Kemp

2008 The Neolithic Demographic Transition in the U.S. Southwest. *American Antiquity* 73(4):645-669.

LeBlanc, Stephen A.

1999 *Prehistoric Warfare in the American Southwest*. University of Utah Press, Salt Lake City.

Louderback, Lisbeth A.

2014 The Ecology of Human Diets During the Holocene at North Creek Shelter, Utah. Unpublished Ph.D. dissertation, Department of Anthropology, University of Washington, Seattle.

Louderback, Lisbeth A. and David Rhode

2009 15,000 Years of Vegetation Change in the Bonneville Basin: The Blue Lake Pollen Record. *Quaternary Science Reviews* 28:308–326.

Madsen, David B. and Donald R. Currey

1979 Late Quaternary Glacial and Vegetation Changes, Little Cottonwood Canyon Area, Wasatch Mountains, Utah. *Quaternary Research* 12(2):254-270.

Madsen, David B. and Steven R. Simms

1998 The Fremont Complex: A Behavioral Perspective. *Journal of World Prehistory* 12(3):255–336.

Madsen, David B., Charles G. Oviatt and Dave N. Schmitt

2005 A Geomorphic, Environmental, and Cultural History of the Camels Back Cave Region. In *Camels Back Cave*, edited by Dave N. Schmitt and David B. Madsen. Anthropological Papers No. 125. University of Utah Press, Salt Lake City.

Matson, R. G.

1991 *Origins of Southwestern Agriculture*. University of Arizona Press, Tucson.

McCormick, John and Thomas Carter

1985 *National Register of Historic Places Inventory Nomination Form: Publick Works Buildings Thematic Resources*, Salt Lake City, Utah. Copies available from Utah Division of State History, Salt Lake City. Also available online: http://focus.nps.gov/nrhp.

McPherson, Robert S. and Mary Jane Yazzie

2000 Chapter Six – the White Mesa Utes. Available at: http://www.historytogo.utah.gov/people/ethnic_cultures/the_history_of_utahs_american_indians/chapter6.html. Accessed May 31, 2016.

Molenaar, Molly, Charles Easton, Louise Senior, Clint Lindsey and Jim Christensen

2005 *Ethnographic Overview and Assessment for Moab and Monticello Field Offices BLM*. Prepared by SWCA Environmental Consultants, Salt Lake City, Utah. Prepared for and copies of report available from the Bureau of Land Management, Moab Field Office and Monticello Field Office, Utah.

Montgomery, Jacki A.

2010 *Class I Existing Data Review for Utah Department of Transportation's Proposed Fiber Optic Line Along US 191 Between Moab and Crescent Jct., Grand County, Utah*. Prepared by Montgomery Archaeological Consultants, Inc., Moab, Utah. Copies available from the Utah Division of State History, Salt Lake City.

Mrozowski, Stephen A. and Mary C. Beaudry

1990 Archaeology and the Landscape of Corporate Ideology. In *Earth Patterns: Essays in Landscape Archaeology*, edited by William M. Kelso, pp. 189-208. University of Virginia Press, Charlottesville.

Reed, Paul F., (editor)

2000 *Foundations of Anasazi Culture: The Basketmaker-Pueblo Transition*. University of Utah, Salt Lake City.

Reheis, M. C., R. L. Reynolds, H. Goldstein, H. M. Roberts, J. C. Yount, Y. Axford, L. Scott-Cummings and N. Shearin

2005 Late Quaternary Eolian and Alluvial Response to Paleoclimate, Canyonlands, Southeastern Utah. *Geological Society of America Bulletin* 117:1051-1069.

Rewtrakunphaiboon, Walaiporn

2009 Film-induced Tourism: Inventing a Vacation to a Location. Available at: http://www.bu.ac.th/knowledgecenter/epaper/jan_june2009/pdf/Walaiporn.pdf. Accessed May 17, 2016.

Reynolds, Cerisa R.

2012 The Artiodactyl Index at the Origins of Agriculture in the Northern US Southwest. *Journal of Contemporary Anthropology* 3(1):39-59.

Rhode, David and David B. Madsen

1998 Pine Nut Use in the Early Holocene and Beyond: The Danger Cave Archaeological Record. *Journal of Archaeological Science* 25:1199–1210.

Ringholz, Raye C.

1989 *Uranium Frenzy: Boom and Bust on the Colorado Plateau*. University of New Mexico Press, Albuquerque, New Mexico.

Rohn, A. H.

1963 Prehistoric Soil and Water Conservation on Chapin Mesa, Southwestern Colorado. *American Antiquity* 28(4):441-455.

Rugh, Susan Sessions

2008 *Are We There Yet?: the Golden Age of American Family Vacations*. University Press of Kansas, Lawrence.

Schroedl, Alan R.

1991 Paleo-Indian Occupation in the Eastern Great Basin and Northern Colorado Plateau. *Utah Archaeology* 4:1–15.

Scott, Sara A.

2015 Indian Forts and Religious Icons: The Buffalo Road (Qoq'aalx 'Iskit) Trail Before and After the Lewis and Clark Expedition. *International Journal of Historical Archaeology* 19(2):384–415.

Seymour, Deni J.

2012 Gateways for Athabascan Migration to the American Southwest. *Plains Anthropologist* 57(222):149-161.

Simms, Steven R.

1988 Conceptualizing the Paleoindian and Archaic in the Great Basin. In *Early Human Occupation in Far Western North America: The Clovis-Archaic Interface*, edited by J. A. Willig, C. M. Aikens and J. L. Fagan, pp. 41–48. Anthropological Papers No. 21. Nevada State Museum, Carson City.

Smiley, Francis E.

1994 The Agricultural Transition in the Northern Southwest: Patterns in the Current Chronometric Data. *Kiva* 60:165–202.

Spangler, Jerry D.

1995 *Paradigms and Perspectives: A Class I Overview of Cultural Resources in the Uinta Basin and Tavaputs Plateau, Vol. 2 and 3*. Uinta Research, Salt Lake City, Utah.

Spangler, Jerry D. and Andrew Yentsch

2008 *Final Report: Baseline Site Condition and Vandalism Assessments of Archaeological Sites in Tenmile Canyon, Grand County, Utah*. Prepared by Colorado Plateau Archaeological Alliance, Ogden, Utah, Ogden, Utah. Copies available from Utah Division of State History, Salt Lake City and online at: http://suwa.org/app/uploads/10_Mile_Final_Web_Version.pdf.

Spencer-Wood, Suzanne M.

2010 A Feminist Framework for Analyzing Powered Cultural Landscapes in Historical Archaeology. *International Journal of Historical Archaeology* 14(4):498–526.

Stoffle, Richard W., Evelyn Pickering, Katherine Brooks, Kathleen Van Vlack and Christopher Sittler

2016 *Ethnographic Overview and Assessment for Arches National Park*. Final Report Draft January 2016. Copies available from the Bureau of Applied Research in Anthropology, School of Anthropology, University of Arizona, Tucson.

Sucec, Rosemary

2006 *Fulfilling Destinies, Sustaining Lives: The Landscape of Waterpocket Fold*. National Park Service and U.S. Department of the Interior, Denver, Colorado.

Thompson, R. S., C. Whitlock, P. J. Bartlein, S. P. Harrison and W. G. Spaulding

1993 Climatic Changes in the Western United States Since 18,000 yr BP. In *Global Climates Since the Last Glacial Maximum*, edited by H. E. Wright, Jr., pp. 468-513. University of Minneapolis Press, Minneapolis, Minnesota.

Utah Professional Archaeological Council

2008 *Linear Sites: Guidance for Identifying and Recording under Section 106 of the National Historic Preservation Act*. Utah Professional Archaeological Council, Salt Lake City.

Varien, Mark D.

2006 Turbulent Times in the Mesa Verde World. In *The Mesa Verde World: Explorations in Ancestral Pueblo Archaeology*, edited by D. G. Noble. School of American Research Press, Santa Fe, New Mexico.

Waters, Michael R. and C. Vance Haynes

2001 Late Quaternary Arroyo Formation and Climate Change in the American Southwest. *Geological Society of America* 29:399–402.

Wilcox, David R.

1981 The Entry of Athapaskans into the American Southwest: the Problem Today. In *The Protohistoric Period in the North American Southwest, A. D. 1450-1700*, edited by D. R. Wilcox and W. B. Masse, pp. 213-256. Anthropological Research Paper No. 24. Arizona State University, Tempe.

Williams, D. G., J. B. Coltrain, M. Lott, N. B. English and J. R Ehleringer

2005 Oxygen Isotopes in Cellulose Identify Source Water for Archaeological Maize in the American Southwest. *Journal of Archaeological Science* 32(6):931-939.

Winter, J.C.

1977 *Hovenweap 1976*. Archaeological Report No. 3. San Jose State University, San Jose, California.

Wood, Margaret C.

2004 Working-Class Households as Sites of Social Change. In *Household Chores and Household Choices: Theorizing the Domestic Sphere in Historical Archaeolog*, edited by Kerri S. Barile and Jamie C. Brandon, pp. 210–232. University of Alabama Press, Tuscaloosa.

Worley-Hood, Graham and Gavin Noyes

2013 *Academic Literature Review of Land and Resource Use of the Utah Navajo*. Prepared by Round River Conservation Studies, Salt Lake City, Utah. Copies available from Bureau of Land Management, Richfield Field Office, Richfield, Utah.

CHAPTER 7. CULTURAL RESOURCE SITE MANAGEMENT CLASSIFICATION

Mike Cannon and Kiera Westwater

Classification of cultural resource sites into types that are useful for management purposes is an important part of a Class I inventory and is required by *BLM Manual Section 8110 – Identifying and Evaluating Cultural Resources* (Bureau of Land Management 2004). This chapter presents the results of the site classification process that was used for the MFO Class I inventory. The site types developed here are intended to assist the MFO with its cultural resource management mandate; for example, the BLM may apply certain management actions categorically to sites of a given type. These site types also play a central role in the cultural resource planning model that is presented in the following chapter, where predictive models are developed individually for each of several site types, enabling a greater degree of predictive accuracy than would occur were sites of diverse functional types modeled together.

7.1 Methods

SWCA performed site classification for the MFO Class I inventory using an original methodology developed for Class I inventories undertaken previously for the Utah BLM (Beck, Cannon, Benson, et al. 2015; Beck, Cannon, Vicari, et al. 2015). This methodology allows for systematic and replicable classification of sites to types using data collected from Intermountain Antiquities Computer System (IMACS) site forms (see Chapter 2 [Study Orientation] for the data collection methods used for this project), and it is applicable to any site recorded on an IMACS site form.

The IMACS site form contains a "site type" field (referring for present purposes to Line 9 of Part A of the form), but, as is shown elsewhere (Beck, Cannon, Benson, et al. 2015; Beck, Cannon, Vicari, et al. 2015), data entered into this field tend to be so variable and inconsistent that they are of limited use for either scientific or management purposes. To classify sites in a more useful and consistent manner for the MFO planning model, SWCA employed "raw data" from other fields of the IMACS site form in an explicit and systematic classification schema. Furthermore, the inconsistencies that occur in IMACS site form "site type" entries are likely a result of the use of categories that are inferential rather than observational. For example, "campsite" is a commonly assigned archaeological site type, but archaeologists do not actually observe people camping at any site that is studied. Instead, what people did may be inferred on the basis of the material remains they left behind, and the kinds of material remains that lead one archaeologist to infer that camping occurred at a site may be quite different from those that would indicate camping to another. To minimize the problems that can result from the use of inferential site type categories and thereby provide a firmer basis for both scientific analysis and management recommendations, the classification system employed uses site type categories that are based exclusively on observable characteristics of the archaeological record (e.g., "artifact scatter with thermal features"), or, in some cases for historic sites, that are based on inferences about activities that have clear archaeological correlates (e.g., "mining," "farming/ranching," etc.).

In developing the site classification presented here, efforts were made to strike an appropriate balance between "lumping" and "splitting," a concern that arises in any classification effort. A main goal was to develop classes that contain sample sizes large enough to be useful for management and analysis purposes. It is certainly possible to "split" the classes used here into finer sub-types, and doing so may be necessary in certain cases in order to answer specific research questions. However, with the MFO dataset, this would likely result in some classes with very small sample sizes. Site types represented by very few sites may have little management utility (e.g., it may be inefficient for the BLM to develop

management actions that apply to only a handful of sites) and would not produce statistically robust results in predictive modeling or other types of analysis. At the same time, the classes used here represent an effort not to "lump" inordinately. This is done by attempting to capture major differences in site function that likely correlate with the presence or absence of major categories of archaeological features and artifacts.

The classification schema that SWCA used can be represented as a set of decision trees, which are shown in Figure 7-1 through Figure 7-3; each decision step in these trees represents a binary "yes" or "no" choice. Classification was carried out using a Visual Basic macro written for Microsoft Excel, which implements the decision trees shown in Figure 7-1 through Figure 7-3 through a series of three routines. A Microsoft Excel file containing the code for the macro will be provided to MFO with the submission of this report, should MFO or other organizations wish to use it to easily classify sites recorded in the future using the same classification system.

The main routine of the macro, IMENSITY (IMacs ENcoding SIte TYping), simply assesses whether a site contains a prehistoric and/or historic component. If a prehistoric component is present, a sub-routine specific to prehistoric materials (PSites) is called; if a historic component is present, a sub-routine specific to historic materials (HSites) is called; and if a site is multicomponent (both types of components are present), both sub-routines are called. The result is that site types are assigned independently to prehistoric and historic components (PType and HType, respectively), and multicomponent sites are assigned both a prehistoric and a historic site type.

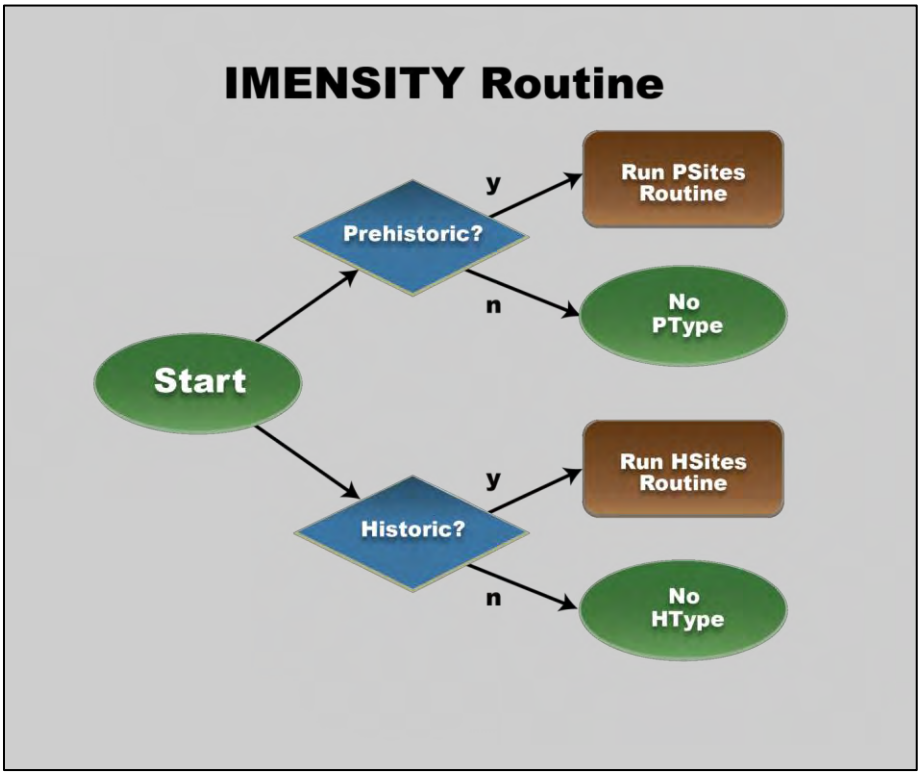


Figure 7-1. Site classification IMENSITY routine decision tree.

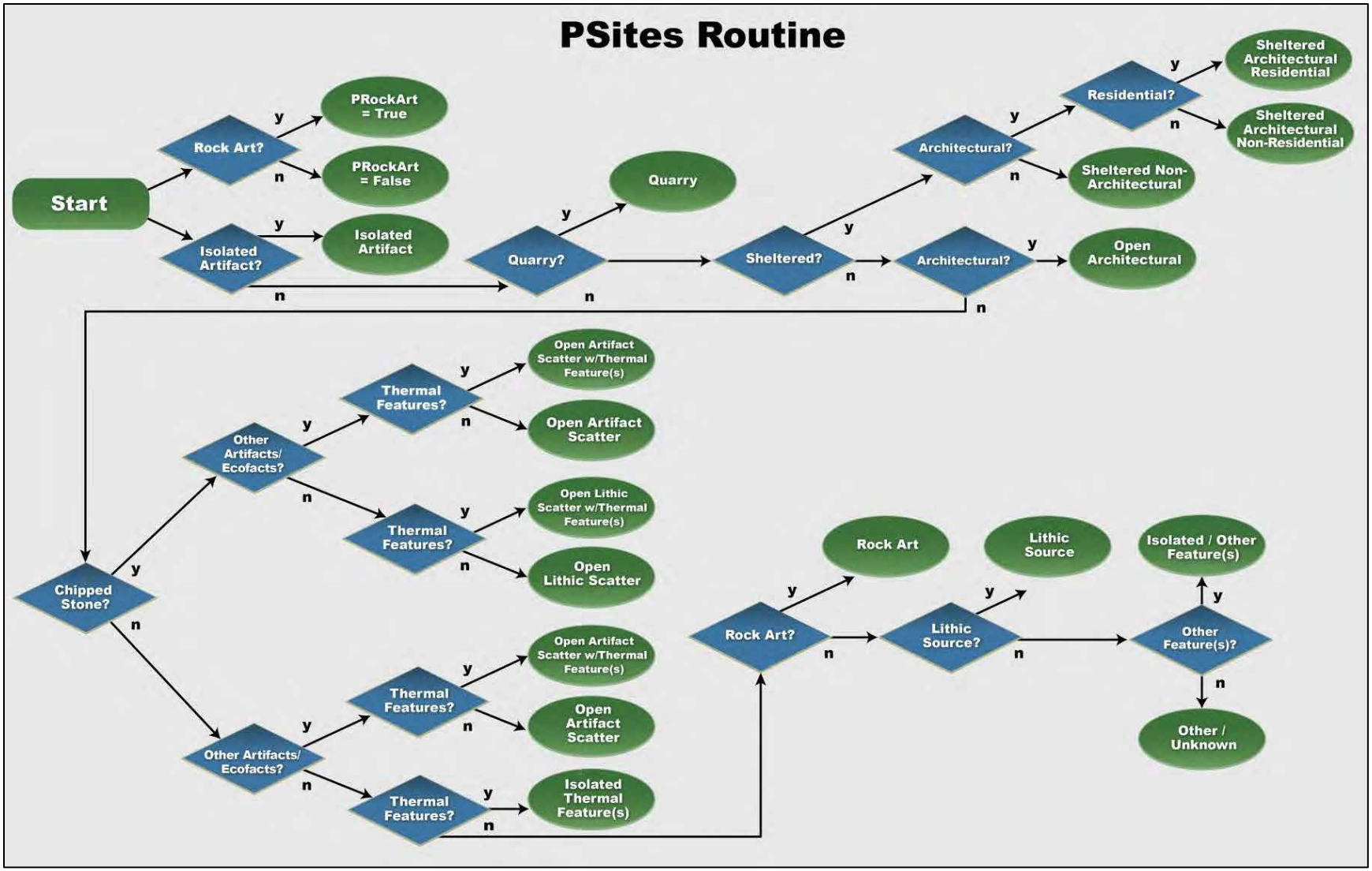


Figure 7-2. Site classification PSites routine decision tree.

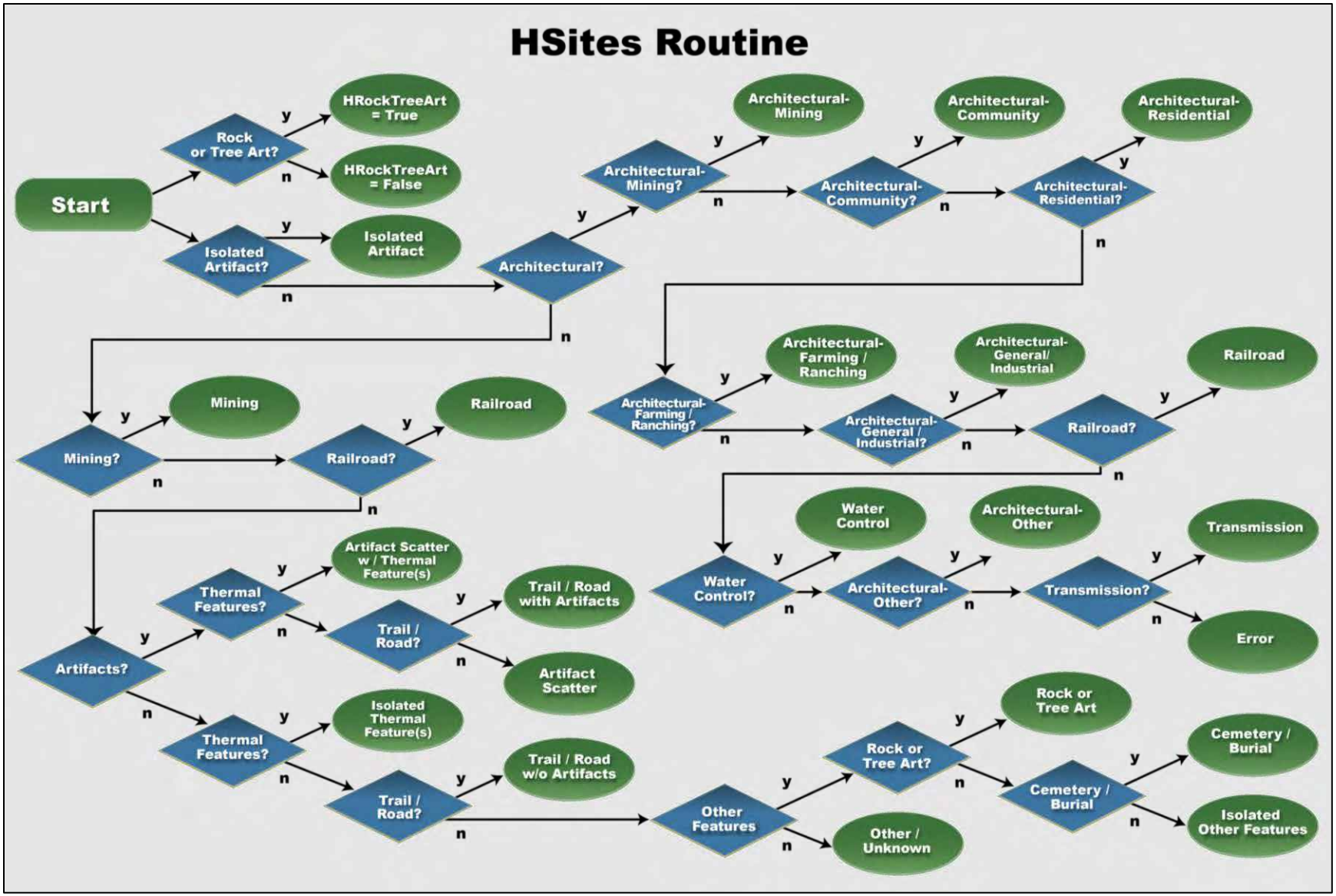


Figure 7-3. Site classification HSites routine decision tree.

The IMACS site form data fields that SWCA used in site classification are those that have to do with landform, cultural affiliation or historic theme (for prehistoric or historic components, respectively), and the types of artifacts and features recorded. The data fields used are listed in Table 7-1, which presents for each field both the field name as shown on the IMACS site form and the corresponding code that is used as a header for the field in the IMACS encoding form data obtained from the Utah Division of State History (see Chapter 2 [Study Orientation]). The IMACS site form data from these fields that SWCA used in classifying sites are provided in the electronic database that SWCA compiled to accompany this report (see Appendix A, Table A-3 "ANALYSIS: MFO Site Classification Results"), and the encoding data field codes are used as field headers in that database. SWCA ran the site typing macro on the sites being classified in a bulk manner in Microsoft Excel, and then imported the results into the project database. SWCA attempted site classification for all sites for which "additional data collection," as described in Chapter 2 (Study Orientation), was conducted—i.e., all sites located on BLM-managed lands and those located on non-BLM lands for which CURES and IMACS encoding data provided by the Utah Division of State History were complete.

Table 7-1. Intermountain Antiquities Computer System (IMACS) Encoding Data Fields Used in Site Typing

IMACS Field Name	Encoding Datasheet Field Code(s)
Part A, Line 32. Topographic Location, Secondary Landform	Topo2
Part B, Line 2. Culture, Cultural Affiliation (first entry only)	PCult1
Part B, Line 7. Summary of Artifacts and Debris	PArtif1 through PArtif6
Part B, Line 8. Lithic Tools (type only)	Tools1 through Tools6
Part B, Line 9. Lithic Debitage, Estimated Quantity	Dbqty
Part B, Line 11. Ceramic Artifacts (type only)	PCeram1 through PCeram6
Part B, Line 13. Non-Architectural Features (type only)	PFeat1 through PFeat3
Part B, Line 14. Architectural Features (type only)	PArchTyp1 through PArchTyp3
Part C, Line 2. Historic Theme(s) (first entry only)	HTheme1
Part C, Line 9. Summary of Artifacts and Debris	HArtif1 through HArtif9
Part C, Line 14. Landscape and Constructed Features (type only)	HFeat1 through HFeat3
Part C, Line 15. Buildings and Structures (type only)	HArchTyp1 through HArchTyp6

SWCA used site landform—specifically the secondary landform portion of the IMACS topographic location field—solely to classify prehistoric sites or components as either sheltered (i.e., in a rockshelter, alcove, or cave) or open. SWCA used cultural affiliation and historic theme solely to determine whether a prehistoric or historic component, respectively, is present at a site; if anything was entered in these fields, the site was assumed to have the type of component indicated (and, as described in Chapter 2 [Study Orientation], site forms were checked during data collection in cases where it appeared that encoding dataset entries for these fields were incorrect). The remaining fields relating to artifacts and features recorded were used to assign prehistoric and historic sites or components to functional classes; SWCA considered only the presence or absence of different types of artifacts and features, and not quantities, in classification.

The criteria used in classifying sites based on the IMACS encoding data are shown in detail in Table 7-2. This table lists, for each decision step shown in Figure 7-1 through Figure 7-3, the specific values of specific IMACS data fields that resulted in a decision of "yes." Data field values are given in this table using the IMACS encoding data codes that are defined in the IMACS User's Guide (IMACS 1992).

Table 7-2. IMACS Encoding Data Site Typing Classification Criteria

Routine	Decision	Yes If:
IMENSITY	Prehistoric?	PCult1 not blank
	Historic?	HTheme1 not blank
PSites	Rock Art?	PFeat1, 2, or 3 = EF, PE, or PI
	Isolated Artifact?	PArtif1 = IA and Dbqty *not* B, C, D, E, F, or Z
	Quarry?	PFeat1, 2, or 3 = QU
	Sheltered?	Topo2 = B or E
	Architectural?	PArchTyp1, 2, or 3 = AD, AE, AF, AG, AH, AP, AQ, BG, CR, CS, CU, CV, DE, or EA
	Residential?	PArchTyp1, 2, or 3 = AF, AG, AP, AQ, CR, CS, CU, CV, DE, or EA
	Chipped Stone?	PArtif1, 2, 3, 4, 5, or 6 = LS or Tools1, 2, 3, 4, 5, or 6 not blank and *not* AA, IF, IJ, IN, IO, IP, IQ, IR, IT, IY, MA, MB, MC, MD, ME, MF, MG, MI, MH, MZ, MN, NA, NB, NC, ND, or NZ or Dbqty = B, C, D, E, or F
	Other Artifacts/Ecofacts?	PArtif1, 2, 3, 4, 5, or 6 = BN, BS, BT, CA, CB, CC, CS, FG, GS, HA, IS, JA, LR, NB, PP, PN, RS, SL, SV, TB, UC, VB, VR, WD, or WB or Tools1, 2, 3, 4, 5, or 6 = IF, IJ, IN, IO, IP, IQ, IR, IT, MA, MB, MC, MD, ME, MF, MG, MI, MH, MZ, MN, NA, NB, NC, ND, or NZ or PCeram1, 2, 3, 4, 5, or 6 not blank and *not* AA
	Thermal Features?	PFeat1, 2, or 3 = FC, HE, or RP
	Lithic Source?	PArtif1, 2, 3, 4, 5, or 6 = LA, LB, LC, LF, LG, LI, LO, LP, LQ, LU, LY, or LV
	Other Features?	PFeat1, 2, or 3 = not blank and *not* FC, HE, NI, or RP
HSites	Rock or Tree Art?	HFeat1, 2, or 3 = AN, IN, PE, or PI
	Isolated Artifact?	HArtif1 = IA
	Architectural?	HArchTyp1, 2, 3, 4, 5, or 6 not blank and *not* AA or ZZ
	Architectural-Mining?	HArchTyp1, 2, 3, 4, 5, or 6 = AN, BH, BI, BK, BL, DB, or DO
	Architectural-Community?	HArchTyp1, 2, 3, 4, 5, or 6 = DL, DP, DR, or DT
	Architectural-Residential?	HArchTyp1, 2, 3, 4, 5, or 6 = AK, CC, CD, CE, CF, CG, CH, CM, CO, CQ, CR, CU, CW, DI, or DS
	Architectural-Farming/Ranching?	HArchTyp1, 2, 3, 4, 5, or 6 = AD, AJ, AV, BD, BE, CL, CN, DG, DH, or DU
	Architectural-General Industrial?	HArchTyp1, 2, 3, 4, 5, or 6 = BM, BN, BO, BP, BV, CJ, CK, DC, DN, or DQ
	Railroad?	HArchTyp1, 2, 3, 4, 5, or 6 = BU (architectural) or HArtif1, 2, 3, 4, 5, 6, 7, 8, or 9 = RR (not architectural) or HFeat1, 2, or 3 = RG (not architectural)
	Water Control?	HArchTyp1, 2, 3, 4, 5, or 6 = BQ or BR
	Architectural-Other?	HArchTyp1, 2, 3, 4, 5, or 6 = AI, AL, AM, AO, AR, AS, AU, AW, AX, AY, BA, BB, BC, BF, BG, BJ, BS, BT, BW, BY, CA, CB, CI, CP, CS, CT, CV, CX, DA, DJ, DK, DM, DV, or DX
	Transmission?	HArchTyp1, 2, 3, 4, 5, or 6 = BX
	Mining?	HArtif1, 2, 3, 4, 5, 6, 7, 8, or 9 = MN, MS, MT, or OC or HFeat1, 2, or 3 = ML, MN, MT, PH, PT, QU, or SS
	Artifacts?	HArtif1, 2, 3, 4, 5, 6, 7, 8, or 9 not blank and *not* NI
	Thermal Features?	HFeat1, 2, or 3 = HE
	Trail/Road?	HFeat1, 2, or 3 = TR
	Other Features?	HFeat1, 2, or 3 not blank and *not* NI
	Cemetery/Burial?	HFeat1, 2, or 3 = BU or CB

The prehistoric and historic classification sub-routines each first identify whether rock art has been recorded at a site and, in the case of historic sites or components, whether tree art (e.g., aspen art) has been recorded. The presence or absence of rock art (or rock or tree art, for historic sites or components) is stored in the project database in data fields separate from the site type fields to facilitate analysis and management of rock and tree art resources regardless of what other types of archaeological materials have been recorded along with them.

Each routine then works through a set of sequential decisions that result in a site type classification. The site type categories that result from the classification routines are listed in Table 7-3 for prehistoric sites or components and in Table 7-4 for historic sites or components. Both routines first determine whether what has been recorded on the site form is actually an isolated artifact, as indicated by the entry of the "IA" code in the artifact summary field. During data collection for the project, erroneous entries of isolated artifacts that should have instead been entered as sites, as indicated by use of the "IA" code along with entries of additional artifact or feature types, were corrected. For prehistoric sites, a distinction is made between sheltered and open sites. Sheltered sites are first divided into those with recorded architectural features and those without. Sheltered sites with architecture are further divided into those where at least one architectural feature of residential function is present and those where all features are non-residential. Open sites are divided into a larger number of categories. If any architectural features have been recorded at an open site, it is classified as "open architectural." Among open non-architectural sites, distinctions are made on the basis of whether only chipped stone artifacts have been recorded ("open lithic scatter") or whether other types of artifacts such as ceramic or ground stone have been recorded ("open artifact scatter"), as well as on the basis of whether thermal features such as hearths have been recorded. Remaining prehistoric site types consist of 1) ones for sites where features but no artifacts have been recorded ("isolated thermal feature[s]" and "isolated other feature[s]"; note that these do not necessarily correspond to the BLM definition of an isolated feature because any number of features may be present); 2) ones for sites at which rock art but no other features or artifacts have been recorded (this is a "rock art" site type that is distinct from the separate data field that denotes whether rock art is present regardless of any other types of materials recorded); 3) one for sites that have been recorded as quarries; and 4) one for sites where no artifacts or features have been recorded but the presence of a lithic source has been noted. Finally, sites for which no site type could be determined, which occurred only when a site form contained virtually no information about the site, are classified as "other/unknown."

Table 7-3. IMACS Encoding Data Site Types for Prehistoric Sites and Components

IMENSITY Site Type (PType)	Predictive Modeling Site Type
Sheltered Architectural Residential	Sheltered
Sheltered Architectural Non-Residential	Sheltered
Sheltered Non-Architectural	Sheltered
Open Architectural	Open with Feature(s)
Open Artifact Scatter with Thermal Feature(s)	Open with Feature(s)
Open Lithic Scatter with Thermal Feature(s)	Open with Feature(s)
Open Artifact Scatter	Open without Feature(s)
Open Lithic Scatter	Open without Feature(s)
Lithic Source	Not modeled
Quarry	Not modeled
Rock Art	Prehistoric Rock Art

Table 7-3. IMACS Encoding Data Site Types for Prehistoric Sites and Components

IMENSITY Site Type (PType)	Predictive Modeling Site Type
Isolated Thermal Feature(s)	Not modeled
Isolated Other Feature(s)	Not modeled
Isolated Artifact	Not modeled
Other/Unknown	Not modeled

Table 7-4. IMACS Encoding Data Site Types for Historic Sites and Components

IMENSITY Site Type (HType)	Predictive Modeling Site Type
Architectural-Residential	Architectural
Architectural-Farming/Ranching	Architectural
Architectural-Mining	Architectural
Architectural-General Industrial	Architectural
Architectural-Community	Architectural
Architectural-Other	Architectural
Artifact Scatter with Thermal Feature(s)	Artifact Scatter
Artifact Scatter	Artifact Scatter
Trail/Road with Artifacts	Not modeled
Trail/Road without Artifacts	Not modeled
Railroad	Not modeled
Mining	Not modeled
Transmission	Not modeled
Water Control	Not modeled
Cemetery/Burial	Not modeled
Rock or Tree Art	Not modeled
Isolated Thermal Feature(s)	Not modeled
Isolated Other Features	Not modeled
Isolated Artifact	Not modeled
Other/Unknown	Not modeled

The primary distinction among historic sites is whether architectural features have been recorded. Sites with recorded architectural features are further divided into a variety of functional categories based on the types of features recorded (e.g., residential, farming/ranching, mining, general industrial, community, railroad, water control, transmission, and other). Sites without recorded architectural features are also assigned to a few functionally specific categories (e.g., mining or railroad) if functionally diagnostic artifacts or non-architectural features have been recorded. Sites without recorded architectural features and without such functionally diagnostic artifacts or non-architectural features are distinguished on the basis of whether artifacts, thermal features, and trails or roads have been recorded. Sites where none of these things have been recorded are classified as "rock or tree art" sites if rock or tree art has been recorded (again distinct from the separate data field that denotes whether rock or tree art is present regardless of any other types of materials recorded), or as "cemetery/burial" sites or "isolated other features" if such have been recorded. Finally, as with prehistoric sites, historic sites for which no site type could be determined, again usually due to a site form lacking information, are classified as "other/unknown."

7.2 Results

As discussed further in Chapter 2 (Study Orientation), 6,900 sites located within the MFO planning area are included in the site classification dataset for this Class I inventory. Of these, 6,194 sites have prehistoric components and 1,065 have historic components. Results of the classification process, in the form of the number of sites located within the planning area that were assigned to each site type, are shown in Table 7-5 for the sites with prehistoric components and in Table 7-6 for the sites with historic components. These tables also show the percentages of the sites of each type that are eligible for the National Register of Historic Places. As might be expected, open lithic artifact–only scatters are by far the most common prehistoric site type at 60 percent of all sites with prehistoric components in the planning model dataset, followed in abundance by open scatters containing other artifact types but no features at 20 percent; in other words, open artifact scatters without any type of recorded features compose approximately 80 percent of all prehistoric sites in the planning model dataset. Artifact scatters ("lithic" or "artifact") with thermal features are relatively rare in the prehistoric site sample at 8 percent. Sheltered non-architectural sites compose approximately 5 percent of the dataset. Sites with architectural features, whether sheltered or open, make up only 2 percent of the dataset. Sheltered sites overall compose 6 percent of prehistoric sites. Approximately 3 percent of prehistoric sites are rock art–only sites, whereas 382 prehistoric sites (not shown in Table 7-5), or about 6 percent of the total, have recorded rock art with or without other recorded features or artifacts. Among sites with historic components, approximately 34 percent have architectural features (architectural-residential, architectural-farming/ranching, architectural-mining, architectural-general industrial, architectural-community, or architectural-other). Simple artifact scatters compose 44 percent of the historic site sample. Approximately 4 percent of historic sites are rock or tree art–only sites, whereas 80 historic sites (not shown in Table 7-6), or about 8 percent of the total, have recorded rock or tree art with or without other recorded features or artifacts.

Table 7-5. Counts of Prehistoric Sites and Components in the Planning Area by Type and National Register of Historic Places Eligibility Status

IMENSITY Site Type	Count	Eligible*	Not Eligible†	Undetermined/ Unknown‡	% of Determined/ Known that are Eligible
Sheltered Architectural Residential	11	8	1	2	89
Sheltered Architectural Non-Residential	38	20	6	12	80
Sheltered Non-Architectural	317	228	33	56	87
Open Architectural	89	69	7	13	91
Open Artifact Scatter with Thermal Feature(s)	390	333	44	13	88
Open Lithic Scatter with Thermal Feature(s)	126	90	24	12	79
Open Artifact Scatter	1,268	856	313	99	73
Open Lithic Scatter	3,721	1,574	1,857	290	46
Lithic Source	11	2	5	4	29
Quarry	33	16	9	8	64
Rock Art	172	148	8	16	95
Isolated Thermal Feature(s)	8	5	1	2	83
Isolated Other Feature(s)	6	4	1	1	80
Isolated Artifact	3	1	1	1	50
Other/Unknown	1	1	0	0	100
Total	**6,194**	**3,355**	**2,310**	**529**	**N/A**

* IMACS codes A, B, C, F, G, H, I, J, O.
† IMACS code D.
‡ IMACS codes E or Z.

Table 7-6. Counts of Historic Sites and Components in the Planning Area by Type and National Register of Historic Places Eligibility Status

IMENSITY Site Type	Count	Eligible*	Not Eligible†	Undetermined/ Unknown‡	% of Determined/ Known that are Eligible
Architectural-Residential	54	34	16	4	68
Architectural-Farming/Ranching	83	39	38	6	51
Architectural-Mining	63	46	15	2	75
Architectural-General Industrial	2	1	1	0	50
Architectural-Community	1	1	0	0	100
Architectural-Other	156	77	68	11	53
Artifact Scatter with Thermal Feature(s)	37	14	21	2	40
Artifact Scatter	436	138	284	14	33
Trail/Road with Artifacts	32	13	19	0	41
Trail/Road without Artifacts	44	5	39	0	11
Railroad	9	6	3	0	67
Mining	8	1	7	0	13
Transmission	6	2	4	0	33
Water Control	6	5	1	0	83
Cemetery/Burial	2	0	2	0	0
Rock or Tree Art	43	32	8	3	80
Isolated Thermal Feature(s)	3	1	2	0	34
Isolated Other Features	68	30	34	4	47
Isolated Artifact	3	2	1	0	67
Other/Unknown	9	3	6	0	33
Total	1,065	450	569	46	N/A

* IMACS codes A, B, C, F, G, H, I, J, O.

† IMACS code D.

‡ IMACS codes E or Z.

For purposes of the predictive modeling discussed in the following chapter, SWCA grouped site types resulting from the classification schema described here into higher-level categories. This was done to ensure that sample sizes per site type would be sufficiently large to ensure useful model results, and site types with very small sample sizes for which there was no meaningful higher-level grouping were not used in predictive modeling. Tables 7-3 and 7-4 show site type categories into which basic site types were grouped for the predictive modeling. In addition to these categories, all prehistoric sites with rock art (regardless of whatever else was recorded along with them) were modeled.

7.3 References Cited

Beck, R. Kelly, Mike Cannon, Lisa Benson, Stephanie Lechert, Kiera Westwater, Paul Burnett, Sarah Creer and Lindsey Kester

2015 *A Class I Cultural Resource Inventory of Lands Administered by the Bureau of Land Management, Richfield Field Office*. Draft. Prepared by SWCA Environmental Consultants, Salt Lake City, Utah. Prepared for and copies available from the Bureau of Land Management, Richfield Field Office, Richfield, Utah.

Beck, R. Kelly, Mike Cannon, Mary Ann Vicari, Lisa Benson, Stephanie Lechert, Kiera Westwater, Paul Burnett, Sarah Creer and Lindsey Kester

2015 *A Class I Cultural Resource Inventory of Lands Administered by the Bureau of Land Management, Fillmore Field Office*. Draft. Prepared by SWCA Environmental Consultants, Salt Lake City, Utah. Prepared for and copies available from the Bureau of Land Management, Fillmore Field Office, Fillmore, Utah.

Bureau of Land Management

2004 Bureau of Land Management Manual, Section 8110 – Identifying and Evaluating Cultural Resources (Public). Available at: http://www.blm.gov/style/medialib/blm/wo/Information_Resources_Management/policy/blm_manual.Par.23101.File.dat/8110.pdf. Accessed January 5, 2015.

IMACS

1992 *Intermountain Antiquities Computer System User's Guide*. Available at: http://anthro.utah.edu/labs/imacs.php. Accessed January 5, 2015.

This page intentionally blank

CHAPTER 8. MOAB FIELD OFFICE PLANNING AREA PREDICTIVE MODEL AND FUTURE INVENTORY STRATEGY

Paul Burnett, Mike Cannon, and R. Kelly Beck

This chapter presents the MFO predictive model. As discussed in Chapter 1 (Management Summary), the primary purpose of the model is to assist BLM land managers in their planning efforts by using available cultural resource site data from areas that have been inventoried for cultural resources to help predict, on the basis of observed relationships between sites and environmental variables, where sites are likely to occur in places within the planning are that have not been inventoried. Another purpose is to provide a synthetic overview of known and likely site occurrences as a part of this Class I inventory. The modeling is not intended to supplant physical inventories in advance of federal actions, as relying on modeling to exclude areas from inventory based on projected low site probability would be inappropriate (Berry 1984; BLM 2008). Nonetheless, it may help facilitate planning efforts, for example, by identifying areas of high probability that could merit special management attention.

Known cultural resource sites from previously inventoried areas are used to develop the model because they provide the best available information about where sites that have yet to be discovered are located. Provided that known sites exhibit patterned relationships with respect to environmental variables, those relationships can be used to predict with better than random chances where other sites are located. This type of modeling can be defined as *objective* modeling because it explores relationships between sites and environmental variables in a way that can be reliably measured and replicated. This approach contrasts with *intuitive* models, which rely on observer experience that cannot be completely replicated by an outside researcher (Altschul 1988:63). Observer experience has its place in the body of research into an area, but it does not contribute to the development of the statistically derived predictive models presented in the first sections of this chapter.

Because the distribution of different types of cultural resource sites is likely to be influenced by different environmental factors—e.g., people may have strategically positioned residences in relation to food and water sources, whereas they required areas with specific geological and topographic characteristics in order to create rock art—it is useful to take site types into account in any sort of planning model such as the one developed here. This represents an improvement over other models in the region that did not discriminate between various prehistoric and historic site types in their modeling efforts (e.g., the previous BLM Moab proposed resource management plan (RMP) model [BLM 2008], the Cisco Desert Project [Bradley et al. 1986], the Grand Junction Resource Area Project [Kvamme 1983)], the Seep Ridge project [Larralde and Chandler 1981], and the Tar Sands Project [Schroedl 1988]).

This chapter first presents a series of GIS-based, statistically derived predictive models, each of which is specific to a certain prehistoric or historic site type. The site type-specific models are then combined into a single composite model that takes into account the probability that a site of any given type is eligible for the National Register of Historic Places (NRHP); this composite model provides an indication of the overall probability that a significant (i.e., NRHP-eligible) cultural resource site is present at any given location within the planning area. Lastly, a few types of cultural resources that are not amenable to statistically derived predictive modeling but that are nonetheless important are added to produce a final planning model; intuitive modeling plays a role at this final stage of the modeling process.

8.1. Simple Models of a Complex World

8.1.1. Scientific Modeling

The sections that follow present an archaeological site location model developed from existing MFO planning area site data. Models are heuristic tools that work from general principles to concrete and testable illustrations of them. Among the benefits of using scientific models to understand the complexity of the archaeological record is their ability to help organize a disparate set of related observations, test our understanding of the interrelationships between those observations, and develop empirically testable predictions about those relationships. Effective models must balance three competing attributes: 1) realism, 2) generality, and 3) precision (Levins 1966). A perfectly real model will include every detail of a particular context but will do so at the expense of generality. A highly precise model will exactly describe a given situation but typically also cannot be applied effectively to other places.

Because the intent of any scientific model is to explore the relationships between selected variables and to balance the tradeoffs between realism, generality, and precision, modeling exercises are frequently accused of "reductionism" (e.g., Mayr 1988). The reductionist charge contends that scientific models are overly simplistic because they do not fully address the complexity and variety of the phenomena that they are developed to explore. Simple models, however, are not simple-minded because they do not address the complexity of a given context in its totality. Instead, simple models are intellectually powerful tools that represent phenomena of interest in a stylized but recognizable form that do not consider features of peripheral interest or secondary importance.

Simple models are not simplistic. An exchange reported by Platt (1964) aptly summarizes the utility of using simple models to understand complex systems. In this seminal paper, Platt quotes biologist Cy Levinthal who states, "Well, there are two kinds of biologists, those who are looking to see if there is one thing that can be understood, and those who keep saying it is very complicated and that nothing can be understood" (Platt 1964:349). Modeling exercises like that described below for the MFO planning area are specifically useful because they are able to make use of imperfect observations to systematically explore cause and effect relationships between relevant variables and generate empirically testable hypotheses from those modeled relationships.

8.1.2. Predictive Modeling in Archaeology

Site location modeling in archaeology has a long but uneven history that has roots with Willey's pioneering settlement pattern archaeology in the Viru Valley (Willey 1953). Predictive modeling per se did not become common in archaeological research until the mid-1980s when GIS technology became more widely available. Judge and Sebastian (1988) are often credited with producing one of the most influential works in the early days of GIS-enabled archaeological predictive modeling. Many early attempts at archaeological site location predictive modeling met with mixed results. Models were generally good at predicting where sites were, but frequently underperformed when predicting where sites were not. Kvamme (2006) provides a summary of the early challenges with modeling efforts. Although it is clear that understanding those factors that influence past land use decisions and consequent archaeological site formation would benefit both researchers and managers, development of such location models has proven difficult.

One key issue with early archaeological predictive modeling exercises is methodological. The incorporation of GIS analysis into archaeological research allowed investigators to develop maps showing the distributions of landscape characteristics favorable for archaeological site locations and then overlay those maps on one another to find areas with the greatest degree of convergence. For early iterations of

GIS-enabled modeling, the standard geospatial data model for representation of favorable landscape characteristics depicted such characteristics as simple points, lines, or polygons—a vector data model. For example, if statistical analysis indicated that known archaeological localities occur with confidence within a specific distance of an annual water source, a polygon would be drawn around all similar water sources. Significant improvements in GIS data modeling and advanced predictive modeling methods developed in landscape ecology make use of raster-based data models (e.g., Guisan and Zimmermann 2000). The key difference is that the output of a vector-based model is a polygon that shows a discrete likelihood for the presence of a site (e.g., high likelihood, moderate likelihood, low likelihood), whereas a raster-based model produces a much more refined probability surface that gives the mathematical probability for the presence of a site at any given spot on the surface. The archaeological site location model presented here is of the much-improved latter type that gives site location likelihoods as a probability surface.

8.1.3. Limitations and Promise of Archaeological Site Location Models

A complex nexus of factors influences where archaeologists are likely to find sites and where they are not, with implications for land managers and project proponents. Developing even a cursory understanding of where sites are likely to be found and where they are not likely to be found is, accordingly, a much-desired objective for archaeological research. For land managers with limited time, staff, and budgets, a well-developed and verified site location model would be invaluable in deciding where best to spend those resources to meet management goals. Project proponents and historic resources themselves both benefit when, during early project planning, a proponent can site their project away from areas with a high probability for the presence of unknown archaeological localities. Efficient allocation of limited budgets and early project planning to minimize effects to cultural resources are the two greatest potential benefits to be derived from a verified archaeological site predictive model.

The fear when using an archaeological site predictive model to help guide resource allocation or project planning decisions is that there will in fact be sites in areas designated by the model as low probability. For this reason, a predictive model is not intended to replace archaeological inventory. The model can be used to better guide where such inventory would be most effective and to inform on those inventory methods most appropriate for the area, but it does not replace the need in all cases for pedestrian surveys. Perhaps more relevant, however, is an important characteristic of scientific models in general—scientific models are not static. Scientific models are useful precisely because empirically testable expectations can be drawn from them. When expectations of a model are subject to empirical evaluation, the results of that evaluation can, and very much should, be examined in light of the model. When expectations are met, the results further validate the model. When expectations are not met, the model should be revised as appropriate. This iterative process is central to the scientific method and the archaeological site location model developed and presented here is expected to undergo such evaluation and modification.

8.2. Developing the Models

This section uses the results of the site classification procedure discussed in the previous chapter to develop predictive models intended to 1) illustrate the relationships between sites of different types and key environmental variables, and 2) show the locations within the MFO planning area where significant cultural resource sites are most likely to be found, in order to provide for better management of those sites.

8.2.1. Ecoregion Approach

SWCA is preparing Class I documents for both the MFO and the Monticello Field Office, and as a result, archaeological data from these two field offices were combined into a single dataset for predictive modeling purposes. This provides a larger sample to more thoroughly evaluate relationships between sites and environmental variables. However, due to the varied ecological settings that exist across this part of southeast Utah, the dataset was split into four groups based on broad environmental patterns. The intention of using the large dataset is to capture trends in site placement across the region, and creating separate models for different environmental types should result in a final planning tool with greater overall predictive power because it controls for the fact that the environmental variables that influenced site placement may have differed among environmental settings.

The lands in the modeled areas can be characterized generally by rugged escarpments in the north portion of the MFO planning area, transitioning to broad lowland deserts on either side of Interstate 70, dissected benches and canyons in the central and southern MFO planning area, and two areas of relatively isolated montane uplands in the south portion of the MFO planning area (US EPA 2009). These parts of the planning area correspond generally to several of Omernik's ecoregions, which denote areas of similarity in climate, physiography, geology, hydrology, and vegetation (US EPA 2009). These ecoregions form the basis for the model analysis areas; the four areas were modeled independently (Figure 8-1).

One model area encompasses Omernik's Semiarid Benchlands and Canyonlands and Arid Canyonlands ecoregions. For brevity, this region is referred to as the "Benches and Canyons" model area. This is by far the largest model area and extends from the Colorado border south of Interstate 70 to the Green and Colorado Rivers along the west side of the field offices, south to the San Juan River, which forms the south extent of the model area in the Monticello Field Office. The next model area encompasses the Shale Deserts and Sedimentary Basins and Sand Deserts ecoregions (i.e., "Deserts"), which spans the Grand Valley and Gunnison Valley, characterized by the relatively flat topography on either side of Interstate 70 in the MFO planning area. To the north is the Escarpments ecoregion, which covers the much more rugged topography to the north of the Grand and Gunnison valleys, extending to the north model boundary. The last model area covers a series of ecoregions corresponding to exposures of the Southern Rocky Mountains around Mt. Peale and the Abajo Mountains (i.e., "Forests"). This Forest ecoregion is based on Omernik's boundaries but was expanded slightly to include all surrounding lands above 2,250 m, which corresponds to the additional forest-covered areas around Omernik's designated Rocky Mountain ecoregion boundaries. After the ecoregion-specific models were constructed, they were clipped to the extent of the MFO planning area for purposes of this Class I inventory. Tribal lands were not included in the modeling effort. After the ecoregion-wide models were completed, the results from within the planning area boundary were extracted and merged into a single probability raster per site type. As a result, the planning area model is not specific only to the planning area but instead reflects the broader patterns of the surrounding landscape.

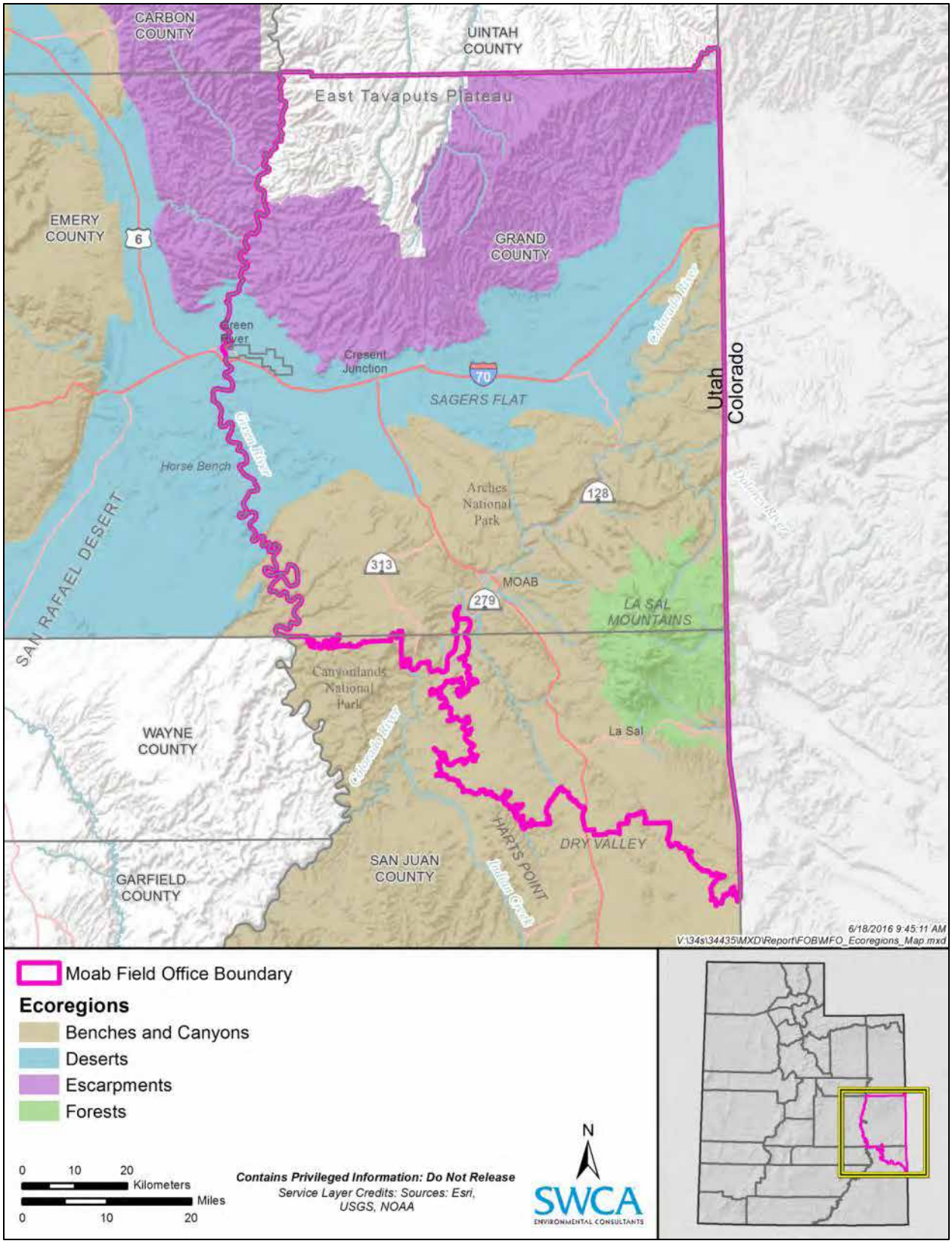


Figure 8-1. Ecoregions used in the planning area predictive models.

8.2.2. Archaeological Predictive Modeling Background

As summarized in Kvamme (2006), archaeological predictive models have their roots in the 1960s and earlier, but the modern age of GIS-based models began in the 1980s and has since fluoresced into a standard industry practice. Archaeological predictive or probability models typically use statistics to compare site locations with the surrounding environment to identify high to low probability areas for archaeological site occurrence. "Environment" is used here in its broadest sense and is not necessarily limited to components of a natural ecosystem. It could also refer to the organization of space within a culture as derived from customs, beliefs, and common practices (i.e., "cultural environment"). This could include such things as the location of roads, trails, and cities or other named geographic areas. After the relationship between sites and the environment is statistically compared, summaries or equations that describe this relationship are then used to project this comparison across larger areas. This allows the environmental settings to be used to predict the likelihood of sites across entire land surfaces, which is particularly useful in areas that have yet to be inventoried.

Human behaviors and the location of archaeological sites are influenced by cultural norms, economic orientation, heritage, spiritual practice, traditional knowledge, and other motivations. While exploring the influence of such sociocultural factors on site location in the MFO planning area would be an interesting avenue for research, spatial data pertaining to these factors are limited to nonexistent. As a result, for the models presented here, the focus is on data that are readily available, which predominantly describe factors of the environment in terms of the ecosystem but also include aspects of the cultural environment. An additional concern with attempts to employ sociocultural factors is that it would be necessary to establish some sort of contemporaneity or relevance with regard to groups of sites that were affected by any such factors (Kvamme 1992). For example, it is likely that sociocultural influences leading to the formation of 10,000-year old hunter-gatherer sites were different than those influencing 1,000 year-old agricultural sites.

The basic principles behind the predictive modeling approach are that 1) human behavior is patterned in relation to the environment, 2) these patterns are approximated by the archaeological record, 3) the discovery of archaeological sites is patterned in relation to the environment, and 4) GIS can be used to map and evaluate the relationship between archaeological sites and patterns in the environment (adapted from Kvamme 2006). Although comparing site locations with environmental parameters is the key to most models, the ability to conduct map-based calculations in GIS is critical.

The MFO planning area models focus on depicting the location of archaeological material, without reference to the behaviors that led to their deposition. Similarly to the approach recently used to develop models for the Fillmore, Kanab, and Richfield Field Offices (Beck et al. 2015a and 2015b; Lundell 2012), no attempt is made to reconstruct or interpret the behaviors that led to the archaeological material being present. Rather, the models are built upon the known presence and absence of previously identified archaeological material, whose patterns are used to project the likelihood of encountering this material across the entire landscape. These models are tailored after several previous models constructed for a variety of projects across other parts of the greater Interior West (e.g., Burnett et al. 2009).

The models were built using Esri's ArcGIS 10.3, Spatial Analyst, and ModelBuilder. Where the models temporarily depart from GIS is in the statistical analysis that defines the relationship between archaeological sites and the surrounding environment. This is currently necessary because the programming for this type of analysis in GIS is not yet at a level of sophistication desired for this modeling. SWCA used the statistical software package JMP to perform this analysis. Stepwise logistic regression is the statistical method employed here, and it is discussed in detail later in this chapter. This regression generates the equations that were entered back into GIS to map the archaeological predictive models.

The models are based on a raster data structure. In GIS, raster data represent geographic features as a grid of cells (or pixels) that have a row of data assigned to each cell. The resolution or pixel size of a predictive model is dictated by the environmental and archaeological data used in model development. As data become available at increased resolution, more detailed models become possible. Currently, typical pixel sizes for GIS-based modeling are approximately 30 × 30 m or 10 × 10 m, primarily depending on the availability of digital elevation models (DEMs). When more refined DEMs are produced, the size of these grid cells decreases, which is good for making more refined predictive models, but at the same time it becomes more taxing on computer hardware and software.

The models use rasters with a roughly 10-m cell size because it matches the best resolution of DEMs available for the study area. DEMs are three-dimensional approximations of the elevation of the earth surface represented by a grid of squares (U.S. Geological Survey 2015a). Several environmental variables rely on these DEMs, so it is useful to match the model resolution to that of the DEMs. All input datasets were converted into the same projection and datum for use in the model (Universal Transverse Mercator Zone 12, North American Datum of 1983). This was also done to further ensure that all of the raster datasets remained aligned on the same grid structure during model development.

With large models like those presented here, several hundred gigabytes of data are generated and analyzed, and this can become a significant impediment to model development using stand-alone GIS workstations. These models were produced at a resolution of 1/3 arc-second, which is approximately 10 m square (9.23 m), but if the area was significantly expanded (to the size of the state of Utah, for example), this resolution would be difficult to achieve on a typical computer. Each 10 m square is assigned environmental data, and these data are extracted according to site and nonsite locations for analysis.

8.2.3. Archaeological Data

The models are based on the sites that are located within the ecoregions and that are classifiable to one of the site types used in the predictive model (see Chapter 7 [Cultural Resource Site Management Classification], in particular Table 7-3 and 7-4). The archaeological site data used in the models were collected as part of the Class I cultural overview projects that SWCA is conducting for the MFO and the Monticello Field Office. Data collection procedures are described in Chapter 2 (Study Orientation) of this report and in the Monticello Field Office Class I report, which is in preparation. As detailed above, a larger sample of data from both field offices was used so that patterns could be observed across ecoregions. The use of the larger dataset in modeling and the development of models by ecoregion should result in final models that are more accurate than would be the case if a model were developed for the MFO planning area only.

All archaeological sites located within Moab and Monticello Field Office boundaries for which sufficient site type attribute data were available (see Chapter 2) were included for consideration in predictive modeling. This dataset includes 561 rock art sites documented by the Utah Rock Art Association (URARA) that are not in Utah Division of State History records. It should be noted that a small number of these sites could potentially be non-rock art resources due to some uncertainty in the attribute data, but it is SWCA's understanding that the vast majority are confirmed rock art locations. Winston Hurst provided additional site data from the recent Comb Ridge survey in the Monticello Field Office as well, and 482 of these sites were also incorporated into the model.

Shapefiles of archaeological site areas and areas covered by archaeological inventories or surveys were used as inputs for predictive modeling. Because the models are built using known sites and inventory areas, they are biased by the areas that have received archaeological inventory. All areas have not been equally sampled by surveys, and the models produced are a reflection of the sites and environments that

have been previously inventoried. However, the vast majority of these previous inventories are not archaeologically biased by *a priori* assumptions about where sites are most likely to be found. With a few notable exceptions (e.g., Cisco Desert surveys [Bradley et al. 1986]), most surveys were also not defined by random sampling but by being based on management needs; they provide a geographically diverse sample. As noted by Altschul (1988:67–68) and Kvamme (1988:306), because most of the data sources are not derived by probabilistic sample surveys, they contain the biases inherent in the sampled areas. As a result, the models developed are a useful "first guess" at site location and may help guide interpretations of archaeological sensitivity, but they should not be viewed as a final end product. Further, while the bias in favor of previously surveyed areas may cause some environmental settings to be poorly represented, it is important to consider the wealth of existing data that have been compiled from hundreds of surveys, the high cost of collecting only data derived from random samples, and the comparatively small sample of sites that would result from such an effort (Kvamme 1988a:302). As noted by Kvamme (1988a:303), the focus should be not so much on whether the models are based on a perfect sample but instead on how well the models perform. To limit the effects of sample bias, Kvamme advocates dividing model areas based on environmental communities or some other partition so that the unequal samples are constrained within similar environments (1988a:308–309). This is the intent of the ecoregion approach used here.

"Non-sites" are defined as areas that were inventoried that do not contain sites. These are used in the statistical analysis of environmental settings, where statistically significant differences between the environmental settings of sites and non-sites are identified. The non-site sample was generated from formally inventoried areas that have been inventoried at an intensive level (i.e., complete inventories). Due to increased survey intensity and thoroughness through time, inventories pre-dating 1985 were excluded from consideration as non-sites. The sites documented during these inventories were retained. Using only documented non-site areas undoubtedly influences the model results because all environmental settings are not equally inventoried. For example, most archaeological inventories are spurred by various aspects of infrastructure development, most of which is related to petroleum extraction in this region. This type of development tends to occur in patches within sedimentary basins capable of preserving petroleum reservoirs, which results in more archaeological inventories in these areas. In contrast, areas lacking these deposits, such as the core of the Rocky Mountains, do not typically receive a comparable level of inventory, and are therefore underrepresented in terms of known non-site areas. As discussed above, one intent of the ecoregion-based approach is to limit these sample biases by modeling these different environmental settings independently. For the data incorporated into the models, the non-site samples are generated from random samples of the inventory areas. This random sampling within specific ecoregions lessens the effect of uneven sampling but does not remove it altogether.

Site and non-site areas were randomly split into two samples for independent model development per site type. Known as "split sampling," dividing the site samples into two groups allows a model to be built with one half of the data and tested with the other half (Mosteller and Tukey 1977:38 in Kvamme 1988a:315). While the tests are useful, a downside of split sampling is that only half of the available data are used to develop each model. An advantage of this approach, however, is that two models are generated for each site type from two mutually exclusive datasets. The two models derived per site type can then be compared to determine what model more accurately predicts the sites in the opposing sample. Of the two models produced per site type, the model that performs the best is selected as the preferred model for that site type. This method allows the models to be deductively tested on set-aside data that were not used to generate each model.

The site types used are those listed as "predictive modeling site types" in Chapter 7 (Cultural Resource Site Management Classification); sites in the site classification dataset that were not assigned to one of the predictive model site types were not included in predictive modeling. The site types that are used were developed with a concern that they be not overly general, incorporating all prehistoric sites for example, since certain site types may be unique to certain environmental settings. They were also developed with a

concern not to be overly specific, as this can result in sample sizes for some site types being so low that it is not possible to derive useful statistical relationships with environmental variables. Linear sites such as trails were excluded from the models for several reasons. First, the modeling approach taken here seeks to define persistent relationships between discrete sites and the surrounding environment, and trails reflect the transportation network used to move between such discrete areas. They must cross several environmental settings as a result, which makes them ill-suited to be addressed in the same manner as discrete sites. An analysis of known and possible trail corridors would entail an entirely different approach to that which is employed here (e.g., least cost path analysis between documented segments), and as a result is not within the current scope of work. Other linear resources such as railroads and other well documented transportation routes would not benefit from this approach to predictive modeling simply because a sufficient amount of information is already available for these resources, which allows resource concerns to be better addressed with direct observations rather than modeling the likelihood of site occurrence. With these concerns in mind, six site types were selected for the models. The counts of sites or components used in predictive modeling by type and ecoregion are given in Table 8-1.

Table 8-1. Counts of Sites and Components by Predictive Modeling Site Type and Ecoregion

Site Type	Count
Benches and Canyons Ecoregion	
Historic Architectural	654
Historic Artifact Scatter	488
Prehistoric Open Artifact Scatter	8,456
Prehistoric Open with Feature(s)	5,639
Prehistoric Rock Art	1,602
Prehistoric Sheltered	1,543
Deserts Ecoregion	
Historic Architectural	74
Historic Artifact Scatter	153
Prehistoric Open Artifact Scatter	685
Prehistoric Open with Feature(s)	96
Prehistoric Rock Art	52
Prehistoric Sheltered	18
Escarpments Ecoregion	
Historic Architectural	23
Historic Artifact Scatter	32
Prehistoric Open Artifact Scatter	154
Prehistoric Open with Feature(s)	35
Prehistoric Rock Art	102
Prehistoric Sheltered	32

Table 8-1. Counts of Sites and Components by Predictive Modeling Site Type and Ecoregion

Site Type	Count
Forests Ecoregion	
Historic Architectural	44
Historic Artifact Scatter	24
Prehistoric Open Artifact Scatter	521
Prehistoric Open with Feature(s)	268
Prehistoric Rock Art	7
Prehistoric Sheltered	31

Several steps were necessary to prepare the site and survey shapefiles for use in the models. All site points and lines were buffered by 15 m prior to modeling to better represent their spatial value. Without this buffer, raster grid cells may not be extracted correctly from the original site GIS data, as the raster cells are only extracted when the site overlaps with at least half of the grid cell. Included in these initial steps was a technique for random cluster sampling to isolate sites into two groups per site type for model building and testing. This randomly selects entire sites (i.e., contiguous groups of raster grid cells) for analysis so that all cells in a site are only in either the model building or test sample, not both. Cells from the same site should not be expressed in both samples because this would exacerbate problems with spatial autocorrelation (Kvamme 1988b). Sites are comprised of all contiguous 10 by 10 m cells within the site boundary, so one site will typically be comprised of several cells. Each cell is attributed with environmental data, so the varied environmental settings within each site boundary are captured by these individual cells.

Large sites can overwhelm the archaeological signature across the study area, because every 10 m cell within a site is included in the analysis. A few large sites can contribute thousands of cells of environmental data, encompassing an area the size of dozens of smaller sites combined. Reducing the contribution of data from large sites is therefore useful in model development, so that the small sites contribute information that is not overwhelmed by the amount of information from large sites. To reduce the effect of large sites, cells within sites over 2 hectares in size were randomly sampled so that only 2 hectares of site grid were included in model development. This makes the model more representative of all sites across the landscape, rather than the model merely reflecting the pattern of the largest sites.

Non-site cell samples were derived using standard random sampling within inventoried areas lacking sites. The number of non-site grid cells used for each model was set to be two times the number of site cells (Table 8-2). Defining the number of non-site cells as two times the number of site cells allows for a large sample that captures a wide range of environmental settings without saturating the model with non-site data. To increase the contrasts between site and non-site settings, the site areas were buffered by 100 m, so that only non-site areas a minimum of 100 m from sites were included in the non-site sample. Environmental settings may not vary directly on either side of a site boundary, so adding this buffer creates more contrast between the site and non-site areas.

Table 8-2. Counts of Archaeological Site and Non-Site Grid Cells Used in Model Development

Site Type	Sample	Benches and Canyons		Deserts		Escarpments		Forests	
		Site Cells	Non-Site Cells	Site Cells	Non-Site Cells	Site Cells	Non-Site Cells	Site Cells	Non-Site Cells
Historic Architectural	1	16,492	32,984	3,821	7,642	414	828	1,289	2,578
	2	18,296	36,592	4,556	9,112	270	540	1,228	2,456
Historic Artifact Scatter	1	11,056	22,112	3,547	7,094	245	490	308	616
	2	9,426	18,852	4,321	8,642	930	1,860	770	1,540
Prehistoric Open Artifact Scatter	1	137,684	275,368	18,011	36,022	2,133	4,266	8,880	17,760
	2	140,102	280,204	19,316	38,632	2,893	5,786	10,166	20,332
Prehistoric Open with Features	1	73,415	146,830	2,825	5,650	653	1,306	3,222	6,444
	2	76,136	152,272	3,046	6,092	743	1,486	2,609	5,218
Prehistoric Rock Art	1	16,889	33,778	831	1,662	654	1,308	27	54
	2	12,917	25,834	643	1,286	973	1,946	16	32
Prehistoric Sheltered	1	15,544	31,088	612	1224	138	276	133	266
	2	15,575	31,150	584	1168	182	364	107	214

8.2.4. Environmental Variables

Human behavior is not determined by a specific, constrained set of variables, yet models must employ only a select sample of variables to predict outcomes. The selection process is guided by the availability of data, their potential applicability, and the level of detail they provide at a particular scale. For example, if a model covered the entire western United States, geographic ecoregions may be a useful variable. But if the model only involves one ecoregion, that same dataset is no longer applicable. And, there is no particular set of variables that is unanimously agreed upon as applicable to archaeological modeling. Every model will have a unique set of constraints that guides the selection process, and variables can be added or removed in each model run as information is gained. The models use publicly available datasets to represent several environmental variables thought to potentially influence archaeological site locations. Using national standard datasets ensures that the model is replicable because anyone can access the same data. Using these public datasets also increases the likelihood that the data are reliable and accurate.

As is commonly understood, the environment has not remained constant throughout the span of human occupation, and the environmental variables used in this model do not necessarily reflect the environment at the time that Native American groups occupied the area. Topography, exposed bedrock, surface geomorphology, soils, climate, precipitation, flora, and fauna have all changed throughout the human occupation, as have cultures, land use strategies, mobility, and technology. However, the intent of this modeling is to provide the BLM with an additional planning tool that identifies high to low probability areas for exposures of cultural material as observable today. The intent is not to model prehistoric and historic behaviors or the placement of sites on some ancient landscape that is no longer directly observable. As a discovery based model, the intention is to use the decades of inventory data that have been collected from the modern ground surface to interpret the patterns in observable site presence and absence. With this focus, the changing environment through time is not applicable to the modeling effort. Rather, it is the current environmental parameters that allow for the discovery of archaeological sites that is pertinent – whether or not a site is discoverable during an inventory of the modern ground surface.

8.2.4.1. VARIABLES CONSIDERED BUT NOT INCLUDED

Several variables that have previously been employed in predictive models in the Interior West were considered for use in the models developed here but rejected upon initial examination. Others, such as soils (discussed below), required further research before being excluded from model development. The intent here is not to provide an exhaustive list of every environmental variable considered for model development, but rather to provide context for the current approach. Some environmental variables employed in previous efforts are out of date and have been replaced by others using by modern GIS techniques. An example is height above water (Larralde and Chandler 1981). GIS currently allows distance to water to incorporate both vertical and horizontal distance (i.e., path distance), so there is no need to consider only height. Another example is shelter or shelter indices and view or viewspread (e.g., Kvamme 1992; Larralde and Chandler 1981). These variables have been replaced by relative elevation or height above surroundings (discussed below), which accounts for both sheltered areas and those with expansive viewsheds. Distance to certain landcover types is also not included (e.g., distance to wood [Larralde and Chandler 1981]), because there is now a layer available describing all landcover types for the region (USU 2004a).

Soils data are commonly employed in predictive models (e.g., Burnett et al. 2009; Heilen et al. 2013; Larralde and Chandler 1981) but are not incorporated into the models developed here for several reasons. The generalized soil association map (NRCS 2006) contains several large soil map units within the project area and does not have sufficient attribute data to be useful in the model. For example, there is no soil texture data in this map layer, so it is not possible to identify aeolian deposits, which are commonly

thought to correlate with areas of high archaeological site density in the region (Larralde and Chandler 1981 and references therein). Within the study area, this map layer is currently limited to large polygons depicting the names of common soil associations. Even if this map layer did contain soil texture information, it is intended for use at 1:250,000-scale analyses, and this is not sufficiently detailed for the models. The smallest map unit delineated in this data source is 1,544 acres (NRCS 2006), and this map contains large polygons that can span an area over 20 miles across within the study area. There are more detailed 1:24,000-scale Soil Survey Geographic (SSURGO) soils maps for the area with attributes regarding soil texture (among other things). This scale is appropriate for the current analysis, and SSURGO would be the ideal dataset for consideration, but unfortunately many of the soil types are not encoded with texture or other potentially relevant information. Manually assembling this information for such a large area is beyond the scope of this effort. Therefore, they cannot be employed in model development. While detailed soil data could not be included, the more general 1:100,000-scale bedrock layer discussed below does include aeolian and alluvial units, so information regarding these potentially sensitive soil types is not completely lost. Surface geology maps typically contain information regarding aeolian and alluvial units and exposed bedrock, etc., but these maps are currently unavailable in digital format for the planning area.

8.2.4.2. VARIABLES USED IN MODEL DEVELOPMENT

As described above, the modeling approach used here estimates the relationship between modern environmental variables and archaeological site location, and it maps this pattern across the study area. If the modern variables selected do influence site location, and if site location is nonrandom, then the model should be useful in allowing site locations to be predicted with a better than random chance of success. It is not necessarily important that every possible environmental condition that has been or has yet to be mapped be included in the model development; what is important is simply that the model allow site locations to be predicted. Further, modeling is not a static enterprise. It is a reflection of our current state of knowledge, our current site sample, and the tools archaeology currently has at its disposal. With this in mind, the variables employed (Table 8-3) are primarily a reflection of those employed for previous archaeological predictive models (e.g., Beck et al. 2015a and 2015b; BLM 2008; Burnett 2010, 2012, 2013, 2014; Burnett et al. 2009; Burnett et al. 2016; Heilen et al. 2013; Jochim 1976; Kvamme 1992; Larralde and Chandler 1981; Lundell 2012; Zier et al. 1981).

Table 8-3. Data Used for the Archaeological Predictive Models

Data	Data Sources
Archaeological inventory areas	As descr bed in Chapter 2 (Study Orientation)
Archaeological sites	
Elevation (meters [m])	1/3 arc-second digital elevation model (DEM) (USGS 2015a)
Slope	
Aspect (degrees from north [0-180]), degrees from east [0–180])	
Relative elevation within 500 m	
Solar radiation	
Cost surface	
Distance to streams, waterbodies, springs, and confluences	Digital elevation model (DEM) and National Hydrography Dataset (NHD), NHD Plus (Horizon Systems Corporation 2015); artificial water features were removed for the prehistoric models.

Table 8-3. Data Used for the Archaeological Predictive Models

Data	Data Sources
Distance to roads and intersections	DEM and U.S. Census Bureau, Geography Division (USDA NRCS 2014); this variable used for historic models only.
Distance to geographic place names (e.g., named arches, gaps, pillars and summits)	Geographic Names Information System (USGS 2015b)
Landcover	2004 Provisional Digital Landcover Dataset for the Southwestern United States (USU 2004a)
Landform	2004 Ten Class DEM Derived Landform for the Southwest United States. (USU 2004b)
Bedrock Type	1:100,000-scale State Geologic Map (USGS 2005)

Elevation. Elevations in the model area range from high mountains to low deserts and deep canyons. This topographic variability may have influenced both prehistoric and historic decision-making regarding landscape use and associated site placement, and previous models have demonstrated its utility as an environmental variable (Beck et al. 2015a and 2015b; Burnett et al. 2016; Kvamme 1988a:318; Schroedl 1988). High elevations can restrict movement and access for both prehistoric and historic occupations, which could lead to fewer sites at high elevations. Similarly, the lower elevations in rugged canyons may have placed restrictions on site occupation across time periods. Another consideration with regard to elevation and site placement is that seasonal land use patterns may have been driven partly by plant ripening patterns, which may have also influenced the movement and availability of faunal resources. Combined, the availability of floral and faunal resources across different elevations may have had a persistent influence on the placement of sites across various elevations. In considering the influence of elevation and site placement, raw elevation values from the DEM were incorporated into the model as one interpretation of topographic variability.

Relative Elevation. Also referred to as local elevation or height above surroundings, relative elevation may have influenced both prehistoric and historic site formation. For example, some archaeological sites may have been positioned in areas with panoramic views of the surroundings, and in contrast, others may have been placed in sheltered canyons. This varied topographic positioning influences not only visibility and shelter but also exposure to environmental conditions such as wind and extreme temperature. Jochim (1976:51, 55) notes both the importance of view and shelter as being highly important to hunter-gatherer decision making regarding site placement. Previous models have employed ranked categories describing shelter quality, degree of exposure, and viewspread (e.g., Kvamme 1980, 1988a:318; Larralde and Chandler 1981). Given current GIS technology, attributes of exposure and shelter can be approximated on a continuous (rather than ordinal) scale. For the current models, this environmental variable is expressed in meters and is defined as the raw elevation value of a grid cell (meters above sea level) minus the average elevation of the surrounding cells (meters above sea level). Relative elevations within 100-m, 500-m, and 1,000-m neighborhoods have been tested for previous models, and the 500-m relative elevations were selected for use after model testing indicated that this was the most significant in terms of influencing site placement. This variable can be further defined using a simplified example. If a small butte 10 m across stood 10 m above an expansive flat plain, the grid cell representing this butte would have a relative elevation value of 10 m. In contrast, in a narrow canyon 10 m across and 10 m deep that was also surrounded by an expansive flat plain, the bottom of the canyon would have a relative elevation value of -10 m. Broad flat plains therefore have relative elevations at or near 0.

Slope. Slope is ubiquitously employed in archaeological predictive models (Burnett 2010, 2012, 2013, 2014; Burnett et al. 2009; Burnett et al. 2016; Heilen et al. 2013; Jochim 1976; Kohler et al. 1980; Kvamme 1988a:318, 1992; Larralde and Chandler 1981; Lundell 2012; Zier et al. 1981). Slope is

typically one of the more significant factors in prehistoric and historic site placement due to the basic requirements of a stable surface for habitation and ease of movement. In contrast, some site types, such as rock art or rock shelter sites, may be correlated with very steep slopes. This modeling approach is capable of recognizing either pattern. Slope (in degrees) is derived from the DEM for use in the model.

Cost Surface. Similar to slope, the ease of movement across rugged topography is assumed to have influenced both prehistoric and historic land use and site placement due to the constraints that it places on basic human movement. Topographic roughness or "cost surface" represents both the slopes and the variability in the slopes of the surrounding terrain. Representing the relative cost of traversing a slope, high cost surfaces exhibit steep, rugged slopes, whereas low cost surfaces have gentle, smooth slopes. Following Heilen et al. (2013), this is derived from the DEM as follows: First, the mean slope within 50 m of each cell is calculated. Next, the standard deviation of slopes within 50 m is calculated. A value of 1 is added to each of these variables and the natural logarithms are calculated. These are added together to produce the cost surface, which estimates trends in both slope and surface roughness.

Aspect. Aspect is another very common environmental variable employed in predictive models (Burnett 2010, 2012, 2013, 2014; Burnett et al. 2009; Burnett et al. 2016; Heilen et al. 2013; Larralde and Chandler 1981; Kvamme 1988a:318; Schroedl 1988; Zier et al. 1981). Aspect-mediated differences in temperature, effective moisture, vegetation, and wind velocity may have influenced both prehistoric and historic land use and site placement. Aspect is derived from the DEM, and, following Kvamme (1988b:337), ArcGIS is used to calculate aspect in terms of degrees from north (0–180) and degrees from east (0–180). This produced continuous datasets rather than treating aspect as a categorical variable by segregating it into categories of north, northeast, east, etc.

Solar Radiation. The amount of solar radiation an area receives is considered a potential factor in prehistoric and historic site placement because it approximates the amount of sunlight an area receives. This has a large influence on the microclimates of habitable areas, as well as a wide range of biological and physical process such as snowmelt, evapotranspiration, soil temperature, and available light for photosynthesis—all of which affects the surrounding ecosystem. Solar radiation is calculated in ArcGIS using the DEM and the default settings of the Area Solar Radiation tool, averaging the solar radiation received over the course of a year. Due to the complexity of this calculation over a large area, it requires several days to complete. While viewed as a potentially significant variable affecting archaeological site placement, solar radiation is only recently being incorporated into archaeological predictive models (Burnett et al. 2016; Casarotto et al. 2011; Langston 2013). Because ArcGIS removes decimal places from this raster when it is combined with the other environmental rasters, the output was multiplied by 1,000 to preserve variability in the data. These values were then divided by 1,000 before conducting the stepwise logistic regression because that procedure encounters difficulty in comparing datasets with large disparities in their range of values. When entered back into the GIS during probability equation mapping, the multiplier was also divided by 1,000 so that the solar radiation layer would be multiplied correctly.

Distances to Streams, Waterbodies, Springs, and Confluences. Because streams are conduits through the landscape, their function as travel corridors may have been just as significant, if not more so, than access to water in terms of prehistoric and historic land use patterns. Distances to various water features are among the most commonly employed environmental variables in archaeological predictive models (e.g., BLM 2008; Burnett 2010, 2012, 2013, 2014; Burnett et al. 2009; Burnett et al. 2016; Heilen et al. 2013; Kohler et al. 1980; Kvamme 1988a:318; Larralde and Chandler 1981; Schroedl 1988; Zier et al. 1981). Waterbodies and springs do not benefit mobility in the same way, but proximity to these resources may also have affected site placement decisions in terms of water availability and associated unique habitats. In many areas, there is a tendency for sites to be concentrated around stream confluences, which may represent intersections in the natural transportation corridors. Additionally, confluences often offer nearly level sunny areas favorable for occupations. Distance to confluence is calculated using ArcGIS from the digitized stream data and the DEM. Both vertical and horizontal distance is incorporated into this

calculation (i.e., path distance). Artificial waterbodies, canals, etc. were removed from the dataset used for the prehistoric site models, but were retained for the historic models. These artificial water features were identified based upon the GIS attribute data (Horizon Systems Corporation 2015).

Distance to Roads and Intersections. Previous modeling of historic site locations have indicated that sites tend to be located near roads (Beck et al. 2015a and 2015b; Burnett 2014; Heilen 2013). Proximity to roads is assumed to influence historic site placement because sites should tend to be associated with the transportation network. Similarly, as road intersections represent nodes in this network, historic sites may have a tendency to be located closer to intersections rather than roads in general. The most detailed digital roads dataset known to be available for the area was employed, which is derived by the U.S. Census Bureau, Geography Division (2010) and includes roads at the street level, which in rural areas includes unimproved roads as well. Unfortunately, the construction date for these roads is not available in the dataset, so it is not possible to select only historic roads for the analysis without manually reviewing county records for every road, and this was not possible within the scope of the current project. Still, including this roads layer in an effort to model historic sites is interpreted as being more worthwhile than excluding it entirely. Path distances to roads and intersections were calculated in the same manner as distance to streams and confluences.

Distance to Geographic Place Names. Geographic datasets are available that identify named geographic features such as mountain summits, modern infrastructure (e.g., airports), streams, lakes, etc. (USGS 2015b). The layer is a points layer, even though the named place in many instances is a linear feature (e.g., stream, ridge, cliff, etc.) or an area (e.g., valley, lake, etc.). Other named features are already included for model consideration from other datasets (e.g., springs). However, 470 named features are noteworthy, and the distance to these features is included as potential environmental variables. These include named summits, arches, gaps, and pillars. To our knowledge, distance to place names as derived from this dataset has not been used in a predictive model previously.

Landcover. Landcover or vegetation type is commonly included in model development (e.g., BLM 2008; Burnett 2009, 2013, Larralde and Chandler 1981; Zier et al. 1981). Multi-season LANDSAT (ETM+) satellite imagery from 1999 to 2001 was used by the RS/GIS Laboratory of the College of Natural Resources at Utah State University to derive the landcover data that are incorporated into the model (USU 2004a). These data identify the dominant ecosystem associations for the southwestern United States. At a resolution of 30 m, these data are the most detailed of their kind currently available. The land cover raster was resampled to match the 10 m model grid.

The landcover zones mapped in the model areas include a wide variety of habitats, including modern disturbances such as agricultural fields. These are listed below in the codes for environmental variables used in the model equations. For the prehistoric models, agricultural lands were identified as inter-mountain basins big sagebrush shrubland due to the common association of these landcover types. While some of the modern agricultural areas were likely not sagebrush shrubland, nearly all of the agricultural areas are interspersed within this sagebrush landcover type, so it likely was the dominant cover prior to cultivation. Areas classified as agricultural lands were maintained for the historic models. The few areas categorized as recently logged, recently burned, and recently chained pinyon-juniper lands were recoded as Colorado Plateau pinyon-juniper woodland due to their common association. Areas encoded as invasive annual grassland, invasive perennial grassland, and invasive annual and biennial forbland were converted to inter-mountain basins semi-desert grassland for all models due to the common association.

As noted by Kvamme (1988b:333), categorizing a continuous landscape into these types of nominal values creates arbitrary in/out boundaries lacking transition, whereas continuous data such as solar radiation, relative elevation, slope etc. do not. Another concern with this dataset is that landcover type is dynamic, shifting through time with changing ecosystem state factors (e.g., climate, precipitation, relief,

etc.). Thus, the landcover present at the time of site occupation may not be reflected in the current classification. However, landcover type is commonly thought to influence site location, and therefore was considered for the current models.

An additional consideration with regard to the fact that the current vegetation communities are different from those of the past is that the model is focused on discovery of sites during modern surveys on the modern surface, and is not focused on modeling past environments. From this standpoint, while the vegetation community present during site occupation may have been a significant factor in site placement, the constraints on site discovery are also influenced by modern communities. For example, from sample surveys in the Canyonlands of the MFO planning area, Thompson (1978:137, 146) noted a tendency for sites to be located in the modern pinyon-juniper zone, with fewer in the shrublands in the Indian Creek and Castle Valley units of the MFO planning area, whereas shrublands appeared to be favored in the Dolores planning unit. While landcover may have been different at the time of site occupation, the sites documented in those inventories expressed these patterns.

Landform. While many aspects of landform are captured in the aforementioned variables derived from the DEM, the Southwest Region GAP landform dataset was included for consideration in model development. This dataset includes a 10-class landform dataset for the southwest United States (USU 2004b). These were derived from a 30-m DEM, which was resampled to 10 m for the current model. This dataset provides a unique interpretation of surface geomorphology, which may affect archaeological site placement and discovery potential. This dataset includes the following landform classifications: 1) valley flats (or water bodies); 2) toe slopes; 3) gently sloping ridges and hills; 4) nearly level plateaus or terraces; 5) very moist steep slopes; 6) moderately moist slopes; 7) moderately dry slopes; 8) very dry steep slopes; 9) cool aspect scarps, cliffs, canyons; 10) hot aspect scarps, cliffs, canyons. Similar landform attributes have been used in previous models in the region (e.g., Larralde and Chandler 1981), and Thompson (1978:145) noted a prevalence of sites on terraces, followed by broken and sloping ground in his sample surveys in the MFO planning area. As described above, the concern regarding artificial boundaries applies for this landform dataset, as well as the following Bedrock Type dataset.

Bedrock Type. Fourteen bedrock lithological classifications were included for consideration in model development (USGS 2005). These are not entirely hard rock units exposed on the surface, but also include major surface sediment types exposed on the surface. These include alluvium, conglomerate, diorite, aeolian (sediment), evaporite, fine-grained mixed clastic, glacial drift, landslide, limestone, metamorphic rock, mudstone, sandstone, shale, and water. While previous models in the region have included only a select few bedrock types (e.g., BLM 2008), the stepwise selection procedure is allowed to determine which of these are significant per site type in each ecoregion.

In discussing an error message being produced during the stepwise logistic regression in a previous model, a JMP software support statistician noted that one variable had a much larger magnitude than other variables, an issue that can cause problems in the logistic regression. This problem can be mitigated by reducing (or increasing) the magnitude of the problem variables (e.g., dividing the values by 100) so that they are more in line with the magnitude of the other variables. To ensure that the current regression proceeded smoothly, select variables were standardized by multiplying or dividing their values by a factor of 10 to bring their range of values more in line with the other variables. Slope was multiplied by 100, cost surface was multiplied by 1,000, and aspects were multiplied by 10. The original solar radiation values are very large, and were divided by 100 so that the magnitude of this variable would be more in line with the other variables.

8.3. Evaluating the Planning Area Models

The statistical methods used to evaluate the models and evaluation results are discussed here. Stepwise logistic regression is the method used to derive the model equations, and a variety of tests are employed to evaluate their predictive capacity. As will be seen, certain site types are more predictable than others, and this reflects the strength of their correlation with the selected environmental parameters.

8.3.1. Stepwise Logistic Regression

Stepwise logistic regression is one of the most widely used approaches for evaluating the statistical relationship between environmental parameters and site locations (Aldrich and Nelson 1984; Hosmer and Lemeshow 2000; Larralde and Chandler 1981; Peduzzi et al. 1980; Stopher and Meyburg 1979). The stepwise procedure systematically screens a wide variety of environmental variables for significant associations to known site presence and absence. Different site types are influenced by environmental parameters uniquely, and repeating the same procedure for all modeled site types allows the procedure to be replicated consistently. Additional advantages of this method are that it does not require the parameters to be normally distributed (i.e., parametric). Normally distributed data are represented by a symmetrical, bell-shaped frequency distribution or a series of values concentrated around an average value. Most environmental variables used in probability modeling are not normally distributed (i.e., nonparametric). For example, slope is a highly skewed dataset with a natural zero point and most areas nearer to zero than 90 degrees (vertical). Another advantage of stepwise logistic regression is that it can incorporate both continuous and categorical data. Continuous data are quantitative and have a natural ordering (e.g., slope), whereas categorical data has no greater-than/less-than rules (e.g., landcover type).

The stepwise procedure uses an algorithm with decision rules to determine the statistical importance of the variables in discriminating known site presence from site absence (Hosmer and Lemeshow 2000:125). "Importance" is determined using a statistical program (JMP 12 in this case). This is done automatically in JMP during the stepwise procedure using the Wald or Score (also known as Lagrange multiplier) chi-square tests. The probability values are derived from the chi-square values and associated degrees of freedom. After the fit of each environmental parameter as a single predictor variable is determined, the variable producing the best fit is added to the model first, and subsequent predictor variables are added or deleted in a cycle until the combination of variables producing the best fit is identified. This stepwise procedure tests the null hypothesis that the regression coefficient for each variable is equal to zero. If the null cannot be rejected, then removing the parameter would not harm the predictive fit of the model. If the null is rejected, then the parameter increases the predictive fit and is therefore retained in the prediction equation.

To determine if a variable is rejected or included in the model, JMP allows the user to set a range of "stopping rules" for the regression. These rules determine when the stepwise procedure stops selecting criteria and the optimal model is reached. Rule options include a p-value (significance) threshold, corrected Akaike's Information Criterion (AICc), and Bayesian Information Criterion (BIC). The p-value threshold uses the p-values (significance levels) to add or remove parameters. Only parameters with a p-value below a certain threshold are selected. The AICc stopping rule arranges the optimal number of parameters, with consideration given to minimizing the number of parameters while maintaining model performance. The AICc penalizes the number of parameters used, so that an optimal model is reached while minimizing the number of parameters. The BIC is similar but penalizes the models with more parameters more strongly than the AICc. These stopping rules were tested on previous models, and the p-value threshold was found to produce the best results in terms of predicting the largest number of known sites in high probability areas that cover the fewest acres. Minimizing the number of parameters is not needed for this particular modeling approach, and therefore the p-value stopping rule was employed.

Using the p-value stopping rule, the critical probability value needed to include a parameter in the model is set by the user. Selecting a very small p-value (e.g., p = 0.05) can result in a model that is too strict, excluding what could be important variables. P-values generated during stepwise selection are not p-values in the traditional sense as they relate to hypothesis testing, but instead should be viewed as signifying the relative importance of the variables being compared (Hosmer and Lemeshow 200:120). Following Hosmer and Lemeshow (2000:121), the probability to enter is set to 0.15, and the probability to leave is 0.20. As the stepwise procedure evaluates significance of parameters for inclusion in the logistic regression equation, it cycles through combinations of parameters until an optimal arrangement of environmental predictors is assembled.

The stepwise regression can be run in a forward, backward, or mixed direction in JMP. "Forward" progresses by including parameters that improve model fit if they are significant at the probability set to enter. "Backward" removes parameters with the least effects on the fit if they are not significant at the level specified in the probability to leave. "Mixed," the method by which these models were developed, alternates forward and backward steps, including the parameters that satisfy the probability to enter and removing the least significant term satisfying the probability to leave. This is done until the remaining items are significant, and it then proceeds in a forward direction. The final nominal regression is then run using the environmental parameters selected in the stepwise procedure, which generates the probability equation. The model equation defines an S-shaped logistic probability curve that ranges from a low to high likelihood of site presence. Possible values range from 0 (low site likelihood) to 1 (high site likelihood):

$$\text{Probability(site)} = 1 / (1 + \exp[\text{linear combination}]).$$

The "linear combination" in the above equation includes a constant value (or y-intercept) and multipliers for the selected environmental variables. Environmental variables that significantly correlate with site locations are uniquely weighted in the linear combination to describe the magnitude of their effect on site placement:

$$\text{linear combination} = \text{constant} + \text{value}*\text{variable}(1) + \ldots + \text{value}*\text{variable}(n).$$

To map the output from the stepwise logistic regression, the probability equation is entered into GIS, which applies the weights to each environmental variable and combines them according into the probability equation. This produces a probability map with values ranging from 0 to 1.

This type of statistical analysis was used for several reasons. In addition to being capable of incorporating a wide variety of data, it is designed to accept a large number of independent variables (i.e., environmental datasets) and exclude those that either are redundant or do not correlate significantly with the dependent variable (i.e., site presence). This is particularly useful for archaeological models, when it is not always clear *a priori* what factors may be affecting site placement. Third, the method applies unique weights to the independent variables in the optimal equation that determines the probability of site presence, and the values in this equation can be replicated in GIS.

This statistical approach is superior to high/medium/low likelihood weights applied to environmental variables in more simplistic models that rely on preconceived notions of the importance of certain environmental variables with regard to site placement (e.g., BLM 2008). One example of such a model is presented in Lock and Harris (2006) and is described as a "graphical intuitive approach" that relies on an intuitive understanding of the archaeology of a region. Importantly, the accuracy of these intuitions is often not tested. Using the stepwise selection procedure, the individual environmental variables are chosen based on statistical tests that evaluate the model improvement by including the variables. If the model is not improved by their inclusion, they are not incorporated into the model (as described above). Furthermore, the degree to which the selected environmental variables contribute to the model is

identified during this same process, when the multipliers for each environmental variables are assigned by the software. This procedure eliminates the need to assign a value describing the importance of an environmental variable based on intuition. The only contribution that intuition has in the stepwise selection procedure is at the very beginning, in the selection of environmental variables to be considered. For example, distance to water may intuitively seem like a worthy environmental variable, but it is the stepwise selection process that determines if it is in fact significantly correlated with site presence or absence. One criticism of stepwise logistic regression is that it produces results in a model that cannot be tested using conventional significance criteria. However, this problem is overcome by splitting the sample in two and building the model with half the data while testing it with the other half (Kvamme 1988b; Warren 1990); this is what was done with these models.

8.3.2. Model Tests

As will be seen, the locations of certain site types (e.g., sheltered sites) are more patterned than others (e.g., prehistoric open artifact scatters). This is expected, considering that human behavior is not uniformly patterned with regard to the environment. Sites that do not generate efficient models are either not strictly patterned or their patterns are closely not approximated by the environmental data employed in model development. Model predictive power is tested using a variety of methods. First, the number of correct and incorrect predictions based on the 10 by 10 m grid cells in the set-aside sample is established. Second, the gain statistic is calculated, which assesses the number of known sites (not cells) that were correctly predicted in comparison with the size of the high probability areas. Next, the model precision is estimated, which assesses the overall extent of high probability areas. Lastly, an estimate of model performance over random chance is calculated.

Contingency Tables. The first method compares predicted outcomes with data from the second set-aside sample using a contingency table, which is a summary table of true/false positive and true/false negative predictions (Table 8-4). These tables describe the classic Type I and Type II errors as defined by Neyman and Pearson (1933a, 1933b). Type I errors result when the null hypothesis is rejected when it is actually true. This is comparable to the model predicting a site when there actually is none (i.e., false positive). Type II errors occur when the null hypothesis is accepted when it is false, or in this case, when the model predicts a low probability area when there actually is a site present (i.e., false negative). For management reasons, Altschul (1988:62) refers to these as wasteful and gross errors. False positives are wasteful in that they cause areas to be shown to be high probability when they in fact are not, and false negatives are gross errors in that they failed to identify a site that is actually present. As described by Altschul (1988:62), models should seek to minimize both types of errors, but because they are in fact *models*, there will be wrong predictions. For management purposes however, gross errors (false negatives) are more costly than wasteful ones (false positives).

The contingency tables are built using the probability value derived from the regression equation with the actual site presence or absence data of the second sample. True positives are obtained where site cells have a probability of greater than or equal to 0.5. False positives represent a cell that is a known non-site but has a probability value of greater than or equal to 0.5. True negatives are known non-site cells that have a probability value of less than 0.5, and false negatives represent site cells that have a probability of less than 0.5. Using the data derived from a table like Table 8-4, the percentage of correct predictions can be computed using simple algebra. The percentage of correct site predictions equals the number of true positive cells divided by the sum of true positives and false negatives and multiplying this value by 100. The percentage of correct non-site predictions equals the number of true negatives divided by the sum of true negatives and false positives and multiplying this value by 100. These data from the models are detailed below. Non-site cells are always predicted more successfully than site cells. This is due to the rarity of sites compared to non-site areas, and as noted by Kvamme (1988b:393), combining the correct

non-site predictions with the correct site predictions as an evaluation of overall model performance is therefore inappropriate. Although these tests are important in comparing models, the gain statistic and model improvement over chance (described below) are given deference in selecting the best model.

Table 8-4. Format of Contingency Table Used to Determine the Percentage of Correct Model Predictions

Predicted Most Likely	Reality		
	N Rows	N(0)	N(1)
0	#	# true negatives	# false negatives
1	#	# false positives	# true positives

Contingency tables are useful in testing the accuracies of the two independent samples per site type, but these cell comparisons can also be used to test the accuracy of the map produced by the GIS that depicts the probability equation. If the equation is correctly entered in the GIS, then the number of positive and negative cells will match the positive and negative cells depicted in the GIS map. SWCA developed a custom GIS script for these models that produces true positive, false positive, true negative, and false negative shapefiles whose cells can be compared to those produced by the statistical software. These are easily compared in tabular format, and this was done to ensure that the predictive maps were correctly rendered. This step is critical to confirming that the equation generated by the statistical software is being mirrored in the GIS.

Gain. Following Kvamme (1988b:329), the gain statistic gauges model efficiency by comparing the area predicted to contain sites with the actual number of sites known in those areas using the following equation:

Gain = 1 – (% of area predicted to contain sites / % sites within the predicted site area)

A shapefile containing all areas with at least a 50 percent site probability is produced in GIS. Dividing the acreage represented by this shapefile by the total project acreage and multiplying by 100 yields the nominator in the gain equation (percentage of area predicted to contain sites).

The denominator of the gain equation (percentage of sites predicted) is also determined using GIS output. This step identifies which of the original sites are located within areas of at least 50 percent site probability. This value is divided by the total number of sites in the original gain sites shapefile and multiplied by 100, which yields the denominator (percentage of sites within the predicted site area).

The gain statistic is calculated for both samples per site type. Gain values can technically range from -1 to 1, although a negative gain value would indicate reverse predictive utility. Gain values of 0 to 1 are typical, with a value of 0 indicating no predictive utility, and a value approaching 1 indicating high predictive utility. A high gain value (approaching 1) occurs when the percentage of sites within the predicted site area outweighs the percentage of area predicted to contain sites. Conversely, gain is low when the predicted site areas are large and these areas capture a comparatively small proportion of sites. The gain statistic is one of the primary determinants in selecting the preferred model, but consideration is also given to the number of sites predicted. An example highlights this issue. Suppose that only 1 in 100 sites is predicted in a given model, yet the predicted site area covered only 0.1 percent of the total land surface. This would yield a gain of 0.90, which is a very high value. Still, this hypothetical model missed 99 percent of the sites. In contrast, a model that captured 50 percent of the sites in 10 percent of the possible area would have a gain of 0.80, which is lower than the previous example. If only the model with the highest gain was chosen, then the selected model would have missed 99 percent of the sites. For

management purposes, this would not be the ideal model. Instead, the model that captured 50 percent of the sites in 10 percent of the area would be considered a better model. Given these considerations, when interpreting the gain statistic, it is important to also consider the total number of sites predicted.

Model Precision. After the gain statistics are calculated, the base probability that a model predicts a site is calculated, which is referred to as p(M) (Kvamme 1996):

$$p(M) = (\text{high probability acreage} / \text{total study acreage})$$

This base probability describes the overall surface covered by high probability areas. If the entire surface was high probability, p(M) would equal 1. If 25 percent of the surface was high probability, p(M) would equal 0.25. These values describe the minimum percentage of sites expected to be located in high probability areas for a model with zero predictive capacity. For example, if 25 percent of the known sites were located in high probability areas, and p(M) = 0.25, the model would have no predictive utility. Building from p(M), Kvamme (2006) defines *model precision* as follows:

$$p(M') = 1 - p(M)$$

In other words, a model containing very small high probability acreages would be very *precise*. This value is useful in interpreting the overall acreage considered to be high probability. Values approaching 1 indicate a very precise model, while values approaching 0 indicate a lack of precision.

Improvement over Chance. The last evaluation of models employs elements of the previous evaluations to establish model improvement over chance:

$$\%\ \text{Model Improvement Over Chance} = (\%\ \text{sites in high probability areas}) - (p(M) \times 100)$$

Using this calculation, it is possible to evaluate model performance in terms of both precision and the number of known sites occurring in the high probability areas. For example, there would be zero improvement over chance if 25 percent of the known sites were located in high probability acreages that covered 25 percent of the modeled area. This value would approach 100 when p(M) is very small and the number of sites in the high probability areas is very large.

8.3.3. Statistical Analysis

After the environmental variables were assembled and mapped into the same 10 by 10 m grid format as the DEM, four rasters were generated that include all environmental variables for each site type per ecoregion. These consist of the 10 by 10 m cells from the two site samples and the two non-site samples, all of which were randomly generated as described above. Each raster includes an attribute table with each entry, including the environmental data for all of the site and non-site cell in each sample. These attribute tables were exported from the rasters into a database format for analysis using the JMP statistical software.

Stepwise logistic regression was used to determine the degree to which the environmental variables contribute to site presence or absence, and this was run for each of the two site/non-site samples per site type in JMP. The environmental variables were entered as independent variables, and the site column was entered as the dependent variable. The stepwise logistic regression was run, and the software selected the optimal combination of environmental variables to predict site presence or absence. The software also provided the weights for the variables to be used in the probability equation.

Using JMP, the contingency tables were produced that describe the true/false positives and true/false negatives of every 10 by 10 m cell in the site and non-site samples. These provide the first type of data useful for model evaluation. As described above, these individual cell values were replicated in GIS from the probability rasters to confirm that the equation is being correctly displayed. The results are summarized in terms of the percentage of correct site and non-site 10 by 10 m cells (Tables 8-5 to 8-8).

Gain data are then summarized per model, followed by the evaluations of model precision and model improvement over chance. While all tests of model accuracy can have a bearing on selecting the preferable model, deference was given to the gain statistic, model precision, and improvement over chance.

The probability equations were entered into ArcGIS using the Raster Calculator, which conducts the map algebra necessary to express the equation in raster format. This produced the probability maps representing each regression equation. As described above, SWCA developed a custom ArcGIS script that produces true/false positive and true/false negative shapefiles that should mirror the results of the summary tables generated in JMP. This is a necessary step to ensure that the probability equations are being correctly mapped. This custom script also isolates all areas with a probability value of 0.50 or greater and identifies sites located within these areas. These were also used to generate the other model evaluation statistics described above (see Tables 8-5 to 8-8). After identifying the preferred model per site type per ecoregion, the models were combined into a single probability map for the MFO planning area (discussed below).

Table 8-5. Benches and Canyons Model Comparisons of Correct Cell Predictions and Gain Data

Site Type	Sample	True Positive Cells	False Positive Cells	True Negative Cells	False Negative Cells	% Correct Site Cells	% Correct Non-Site Cells	% Predicted Sites Acreage	% Sites Predicted	Gain	Precision	% Improvement Over Chance
Historic Architectural	1*	3044	3271	33319	15252	16.6	91.1	7.9	34.3	0.77	0.92	26
	2	1670	1953	31029	14822	10.1	94.1	8.4	28.3	0.70	0.92	20
Historic Artifact Scatter	1*	2511	2540	16312	6915	26.6	86.5	10.2	42.8	0.76	0.90	33
	2	2526	2178	19931	8530	22.8	90.1	8.1	35.0	0.77	0.92	27
Prehistoric Open Artifact Scatter	1	36917	25135	255049	103185	26.4	91.0	10.1	36.0	0.72	0.90	26
	2*	35736	28412	246934	101936	26.0	89.7	10.8	37.8	0.71	0.89	27
Prehistoric Open with Feature(s)	1	21233	13134	139126	54903	27.9	91.4	11.0	36.9	0.70	0.89	26
	2*	19188	13437	133380	54224	26.1	90.8	9.6	41.4	0.77	0.90	32
Prehistoric Rock Art	1	8616	2216	23618	4301	66.7	91.4	22.3	59.7	0.63	0.78	37
	2*	13272	3232	30543	3617	78.6	90.4	23.1	61.0	0.62	0.77	38
Prehistoric Sheltered	1*	8885	3234	27915	6671	57.1	89.6	24.6	69.2	0.64	0.75	45
	2	8005	3074	28013	7539	51.5	90.1	22.9	66.1	0.65	0.77	43

*Preferred Model

Table 8-6. Deserts Model Comparisons of Correct Cell Predictions and Gain Data

Site Type	Sample	True Positive Cells	False Positive Cells	True Negative Cells	False Negative Cells	% Correct Site Cells	% Correct Non-Site Cells	% Predicted Sites Acreage	% Sites Predicted	Gain	Precision	% Improvement Over Chance
Historic Architectural	1	3181	906	8206	1375	69.8	90.1	8.6	51.4	0.83	0.91	43
	2*	2335	599	7043	1486	61.1	92.2	8.6	56.8	0.85	0.91	48
Historic Artifact Scatter	1	711	1104	7538	3610	16.5	87.2	12.2	44.4	0.73	0.88	32
	2*	982	926	6168	2565	27.7	86.9	12.6	49.7	0.75	0.87	37
Prehistoric Open Artifact Scatter	1*	7767	3975	34657	11549	40.2	89.7	13.3	41.2	0.68	0.87	28
	2	6108	3431	32591	11903	33.9	90.5	11.4	35.3	0.68	0.89	24
Prehistoric Open with Feature(s)	1*	664	886	5206	2382	21.8	85.5	13.3	58.3	0.77	0.87	45
	2	475	648	5002	2350	16.8	88.5	9.9	45.8	0.78	0.90	36
Prehistoric Rock Art	1*	384	69	1217	259	59.7	94.6	9.5	57.7	0.84	0.91	48
	2	428	122	1540	403	51.5	92.7	9.8	55.8	0.82	0.90	46
Prehistoric Sheltered	1	203	131	1037	381	34.8	88.8	12.8	55.6	0.77	0.87	43
	2*	379	92	1132	233	61.9	92.5	10.9	55.6	0.80	0.89	45

*Preferred Model

Table 8-7. Escarpments Model Comparisons of Correct Cell Predictions and Gain Data

Site Type	Sample	True Positive Cells	False Positive Cells	True Negative Cells	False Negative Cells	% Correct Site Cells	% Correct Non-Site Cells	% Predicted Sites Acreage	% Sites Predicted	Gain	Precision	% Improvement Over Chance
Historic Architectural	1*	19	24	516	251	7.0	95.6	3.5	60.9	0.94	0.96	57
	2	28	39	789	386	6.8	95.3	18.1	56.5	0.68	0.82	38
Historic Artifact Scatter	1*	327	185	1675	603	35.2	90.1	6.6	87.5	0.93	0.93	81
	2	119	49	441	126	48.6	90.0	25.9	59.4	0.56	0.74	33
Prehistoric Open Artifact Scatter	1*	1098	586	5200	1795	38.0	89.9	8.0	53.9	0.85	0.92	46
	2	794	540	3726	1339	37.2	87.3	10.1	52.6	0.81	0.90	42
Prehistoric Open with Feature(s)	1*	457	106	1380	286	61.5	92.9	3.6	71.4	0.95	0.96	68
	2	580	114	1192	73	88.8	91.3	5.3	71.4	0.93	0.95	66
Prehistoric Rock Art	1	596	109	1837	377	61.3	94.4	7.1	47.1	0.85	0.93	40
	2*	554	91	1217	100	84.7	93.0	6.6	49.0	0.87	0.93	42
Prehistoric Sheltered	1	141	51	313	41	77.5	86.0	35.7	93.8	0.62	0.64	58
	2*	112	28	248	26	81.2	89.9	25.6	87.5	0.71	0.74	62

*Preferred Model

Table 8-8. Forests Model Comparisons of Correct Cell Predictions and Gain Data

Site Type	Sample	True Positive Cells	False Positive Cells	True Negative Cells	False Negative Cells	% Correct Site Cells	% Correct Non-Site Cells	% Predicted Sites Acreage	% Sites Predicted	Gain	Precision	% Improvement Over Chance
Historic Architectural	1	164	168	2288	1064	13.4	93.2	8.5	38.6	0.78	0.91	30
	2*	255	250	2328	1034	19.8	90.3	10.0	77.3	0.87	0.90	67
Historic Artifact Scatter	1*	58	135	1405	712	7.5	91.2	9.6	70.8	0.86	0.90	61
	2	171	81	535	137	55.5	86.9	9.1	50.0	0.82	0.91	41
Prehistoric Open Artifact Scatter	1	5043	2449	17883	5123	49.6	88.0	14.3	63.0	0.77	0.86	49
	2*	5112	2596	15164	3768	57.6	85.4	17.0	70.4	0.76	0.83	53
Prehistoric Open with Feature(s)	1*	2029	489	4729	580	77.8	90.6	10.0	81.3	0.88	0.90	71
	2	2376	465	5979	846	73.7	92.8	9.9	78.0	0.87	0.90	68
Prehistoric Rock Art	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2*	27	0	54	0	100.0	100.0	13.6	100.0	0.86	0.86	86
Prehistoric Sheltered	1*	89	28	186	18	83.2	86.9	15.7	80.6	0.80	0.84	65
	2	80	11	255	53	60.2	95.9	14.5	74.2	0.80	0.85	60

*Preferred Model

8.4. GIS-Based Predictive Models for the Planning Area

The intent of the modeling exercise is in part to characterize archaeological site distributions across the planning area using a sample of known site types in order to estimate the archaeological sensitivity within the study area. Although commonly labeled "predictive" models, these are just as much "descriptive" in that they project the characteristics of known site (and non-site) settings across the broader landscape. Not all site types are strongly patterned in terms of their landscape position, and previous experience indicates that certain types of sites will be more amenable to location modeling than others. An overview of the results of the MFO modeling is provided here, including an evaluation of the performance of each model.

The final probability maps produced for the site types (Figures 8-2 to 8-7) represent the preferred regression equations developed for each ecoregion (Appendix B). The raw probability data derived from the modeling are represented as a continuous raster dataset with values ranging from 0 to 1 (low to high probability). These are depicted as discrete high/medium/low categories as follows: high = 0.50 to 1.00, medium = 0.25 to 0.49, and low = 0.00 to 0.24 (see Figures 8-2 to 8-7).

The values in Appendix B describe the components of the linear combination equations, which, aside from the constant, represent the multipliers of the individual environmental parameters. Due to the structure of the probability equation, negative multipliers for an environmental variable actually depict a positive correlation between the environmental variable and site presence, and vice versa. For example, the negative multiplier for "Distance to Flowlines" for the Historic Architectural sites indicates that site probability increases with increased distance to flowlines.

Historic Architectural sites are not favored near roads in the Benches and Canyons, but proximity to intersections is favored in that ecoregion. Proximity to both roads and intersections is favored for Historic Architectural sites in the Deserts and Forests ecoregions. Road distance is not interpreted as significant in the Escarpments. Additionally, these sites are consistently interpreted as being located away from streams/canals and in topographically rough areas. Proximity to waterbodies is not significant in the Benches and Canyons, but it is favored in the other three ecoregions. Proximity to named geographical locations is favored in the Benches and Canyons, Deserts, and Escarpments, but the opposite is the case in the Forests. The response to several other variables is mixed for Historic Architectural sites across the ecoregions. Large, high probability areas for Historic Architectural sites are common in the vicinity of several mines in the Yellow Cat Flat area of the central portion of the MFO planning area (see Figure 8-2). In the central and southern portion of the planning area, these high probability areas flank the dissected stream networks, at the base of canyons, mesa, and broad uplands, while broad areas of low probability are common in the flats and broad interfluvial uplands.

Historic Artifact Scatter sites tend to be located on or near high points that are also near waterbodies (except in the Forests). Areas with high solar radiation and low slopes are favored in the Deserts and Escarpments, and topographically rough areas are favored in the Benches and Canyons and Escarpments. Proximity to roads is favored in the Benches and Canyons and Deserts ecoregions. The response from the other environmental variables is mixed across ecoregions. For example, high elevations are favored in the Benches and Canyons and Deserts models, but low elevations are favored in the Escarpments and Forests. Most of the MFO planning area is characterized by a low to moderate probability for these sites. In general, the high probability areas for these sites tend to be in the southern portion of the Escarpments, in the Book Cliffs area (see Figure 8-3). The Forests are generally low probability as well, with the lower elevations having the most areas of high probability. The scattered high probability areas throughout the Benches and Canyons and Deserts ecoregions tend to be on the edges of benches and ridges overlooking dissected stream networks.

Prehistoric Open Site without Features high probability areas are fairly consistently modeled to be located in areas with a high cost surface, high relative elevation (except in the Deserts), low slope (except in the Escarpments), and south-facing slopes (except in the Deserts). Proximity to streams is favored in the Escarpments and Forests, but the opposite is the case in the Benches and Canyons and Deserts. Proximity to waterbodies is favored in the Deserts and Escarpments. High solar radiation is favored only in the Deserts and Escarpments. Proximity to named geographic features is favored in all ecoregions but the Forests, where distance to these features is favored. Pinyon-Juniper woodland is favored for this site type in all ecoregions but the Deserts, where there is no correlation with site placement. These sites are negatively correlated with moist steep slopes, except in the Benches and Canyons where there is no correlation. Except in the Forests, these sites show a tendency to be associated with Sandstone bedrock. Dunes are favored in the Benches and Canyons. The response to several other environmental variables is mixed across ecoregions for this site type. In general, high probability areas for these sites are similar to the Historic Artifact Scatter sites, being most commonly located at the edge of benches and ridges, the south flanks of the Book Cliffs, and areas overlooking dissected stream networks (see Figure 8-4). Large high probability areas are modeled to be northwest of Tenmile Canyon, west of the Green River, as well as rugged uplands across the southern portion of the MFO planning area.

High probability areas for Prehistoric Open Sites with Features are consistently near confluences across all ecoregions. High points are favored in the Benches and Canyons, as well as in the forests. South-facing slopes are favored in the Benches and Canyons and Deserts. Proximity to waterbodies and named geographic features is favored in the Escarpments and Forests. Dunes are again favored only in the Benches and Canyons. Pinyon-Juniper lands are favored only in the Benches and Canyons, as are a wide array of other landcover, landform, and rock types. In the Benches and Canyons and Escarpments ecoregions, while confluences are favored site areas, site likelihood increases with distance from streams. This focuses the high probability areas somewhat along stream networks, by depicting low probability along stretches of streams and high probability where streams intersect. Large medium to high probability areas are located in the rugged lands east of La Sal, from Hideout Mesa to the north down to the hills north of the Lower Lisbon Valley (see Figure 8-5). The Forests are predominantly low probability, with the exception of the lower flanks of that ecoregion. In the Deserts, the geological layers mapped as alluvium and eolian are favored and have a strong influence on the high probability areas in that ecoregion. In the Escarpments, gently sloping ridges and hills, along with nearly level plateaus and terraces produce a strong positive site response. These generally correlate with the Book Cliffs area.

The response of Prehistoric Rock Art to environmental variables is fairly consistent across all modeled ecoregions, although with lower sample size for these sites in the Escarpments and Forests, some variables were rejected by the stepwise procedure and those that remain return a highly positive response. This causes there to be limited areas of medium probability in these ecoregions, with large areas of low probability punctuated by small areas of very high probability. With the larger site sample in the Benches and Canyons, there are more diverse settings for these sites and the probabilities are more spread out. In general, these sites tend to be located in lower-elevation areas, away from linear stream segments but near confluences, in sheltered areas with low relative elevation and steep, rugged slopes (see Figure 8-6). Unsurprisingly, in the MFO planning area these high probability areas are depicted in the dissected lowlands, above and adjacent to the stream networks but below the broad uplands, which are characterized as large areas of low Rock Art probability.

As anticipated, Prehistoric Sheltered sites share many commonalities with Rock Art sites in terms of site placement (see Figure 8-7). The model expresses a tendency for these sites to be located in rugged areas in lower elevations, away from linear stream segments but near confluences. Southeast-facing slopes are favored in the Benches and Canyons ecoregion. Several landcover types are associated with these site types in the Benches and Canyons, and sandstone bedrock is a favored rock type in the Benches and Canyons and Escarpments ecoregions.

This page intentionally blank

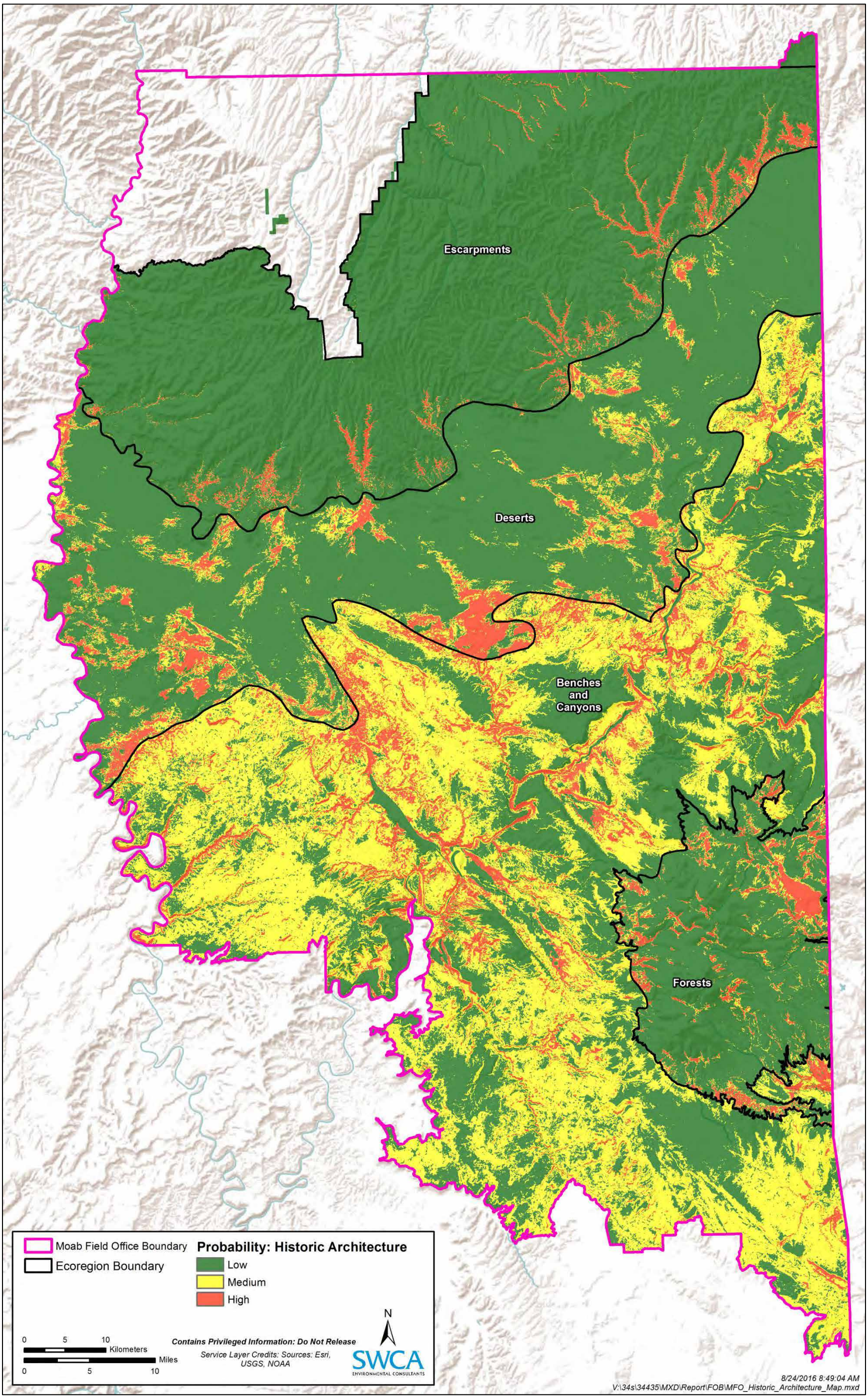


Figure 8-2. Probability map for Historic Architectural sites.

This page intentionally blank

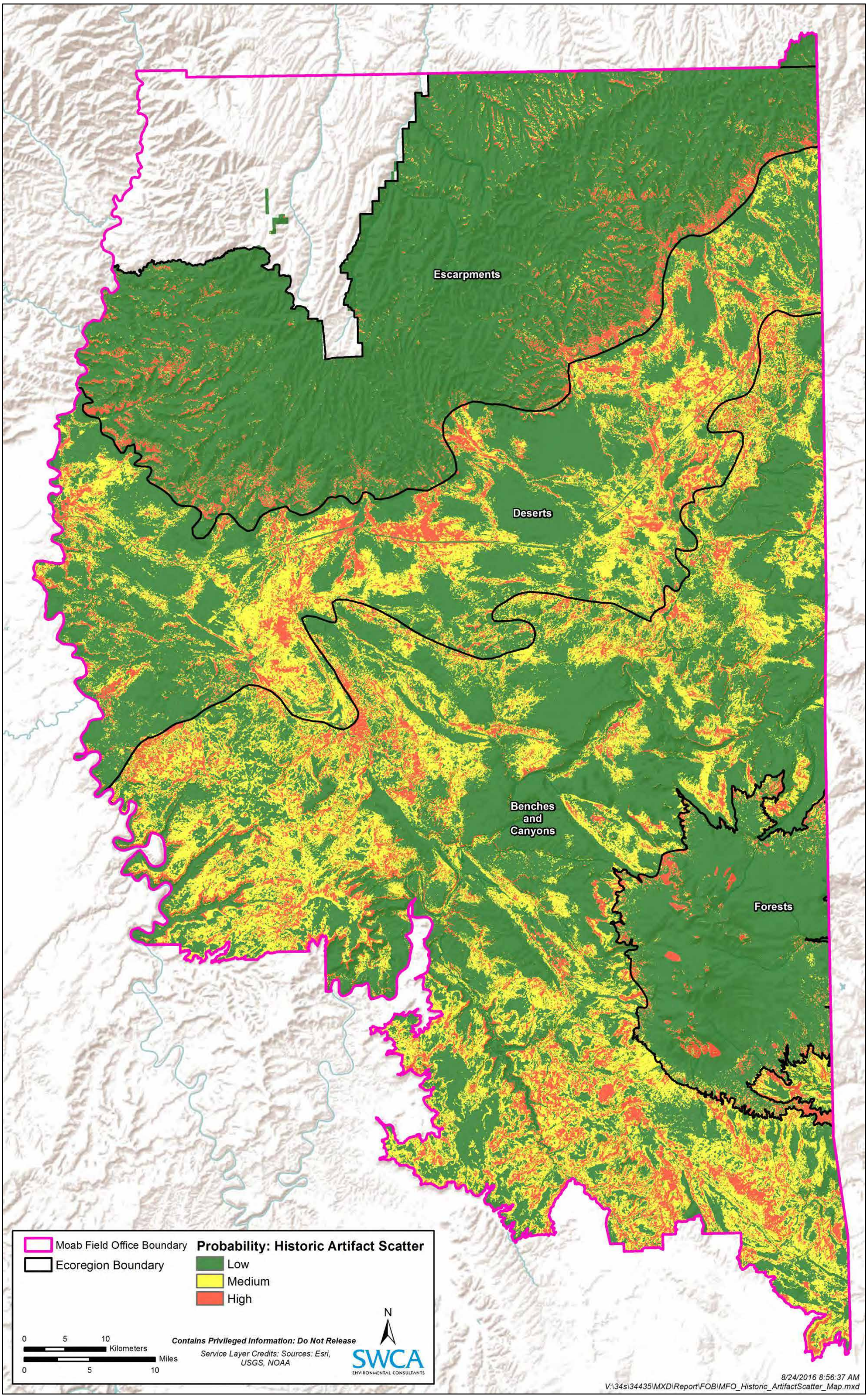


Figure 8-3. Probability map for Historic Artifact Scatter sites.

This page intentionally blank

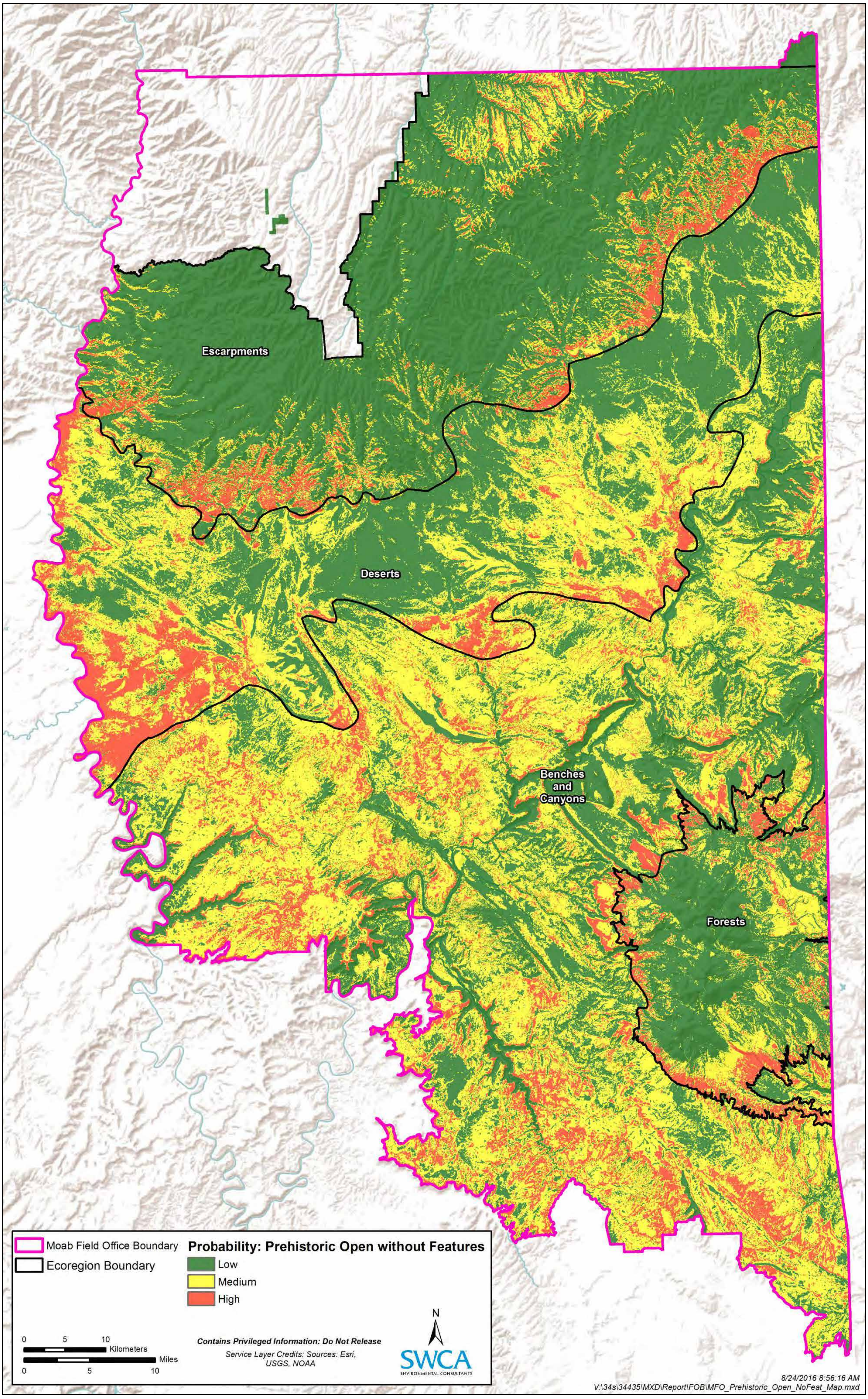


Figure 8-4. Probability map for Prehistoric Open Sites without Features.

This page intentionally blank

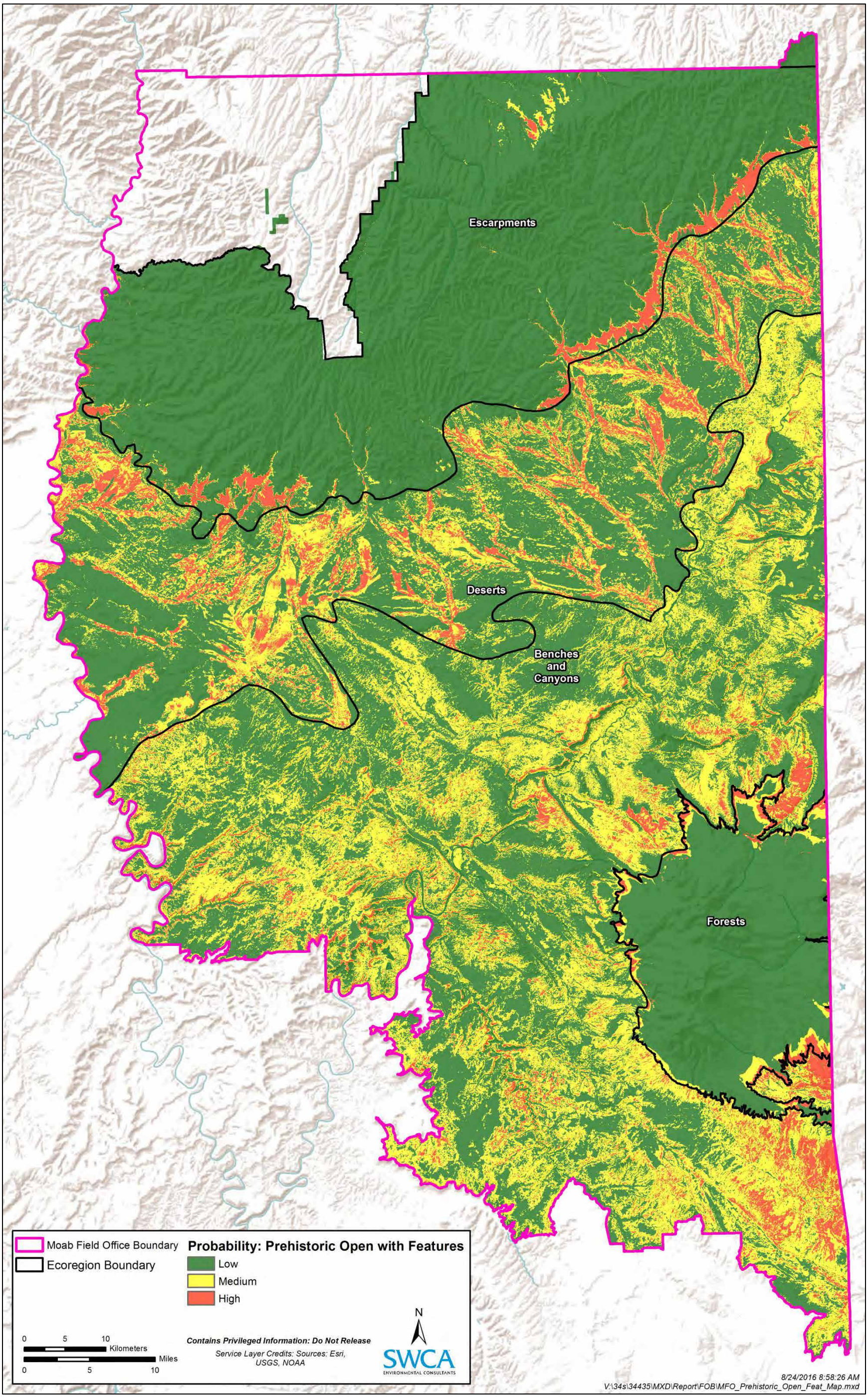


Figure 8-5. Probability map for Prehistoric Open Sites with Features.

This page intentionally blank

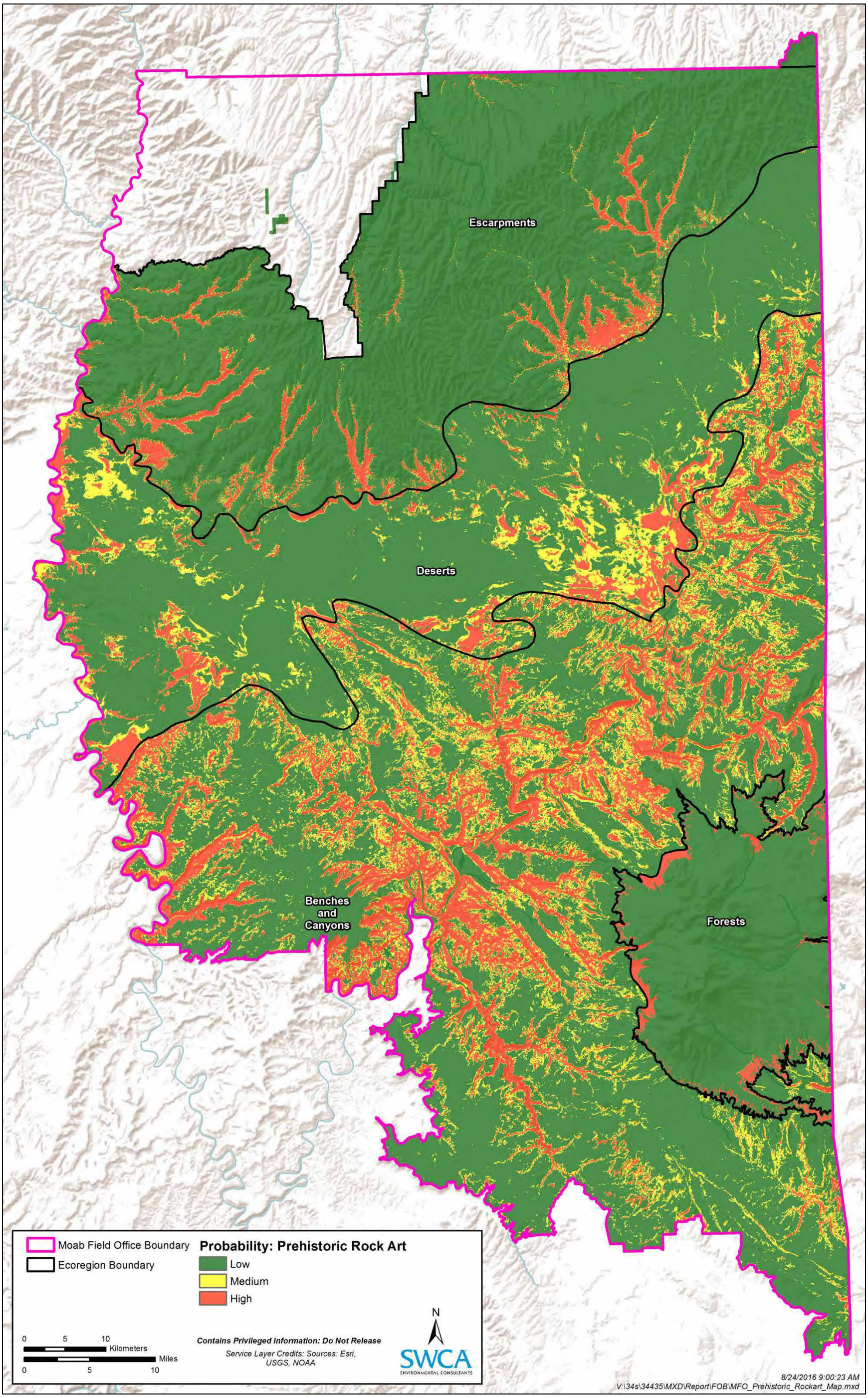


Figure 8-6. Probability map for Prehistoric Rock Art sites.

This page intentionally blank

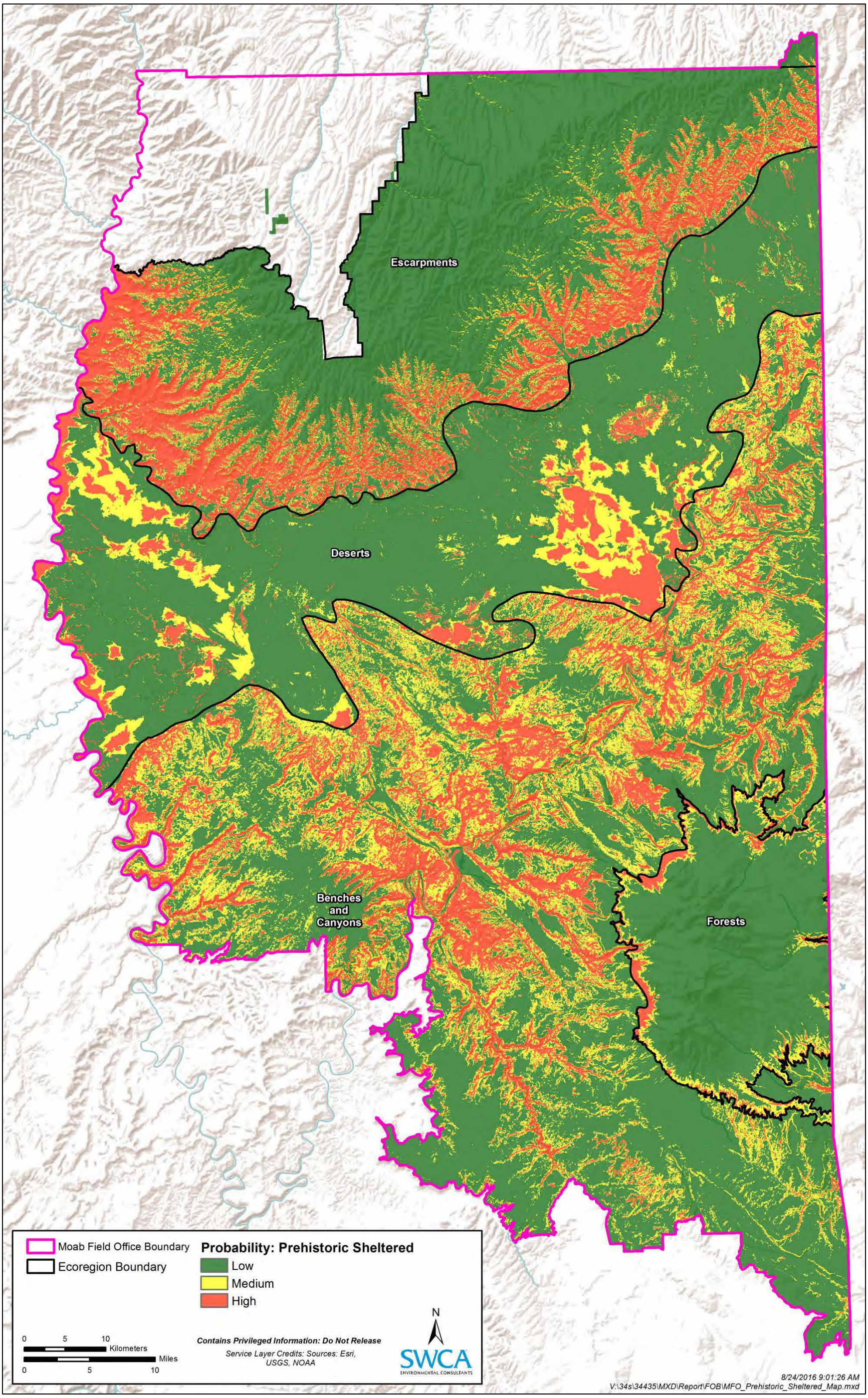


Figure 8-7. Probability map for Prehistoric Sheltered sites.

This page intentionally blank

8.4.1. GIS-Based Archaeological Sensitivity Zones

The models for each site type identify high probability areas for each type individually, but to assist in understanding overall archaeological sensitivity within the modeled ecoregions, this study goes a step beyond the site type–specific approach and addresses archaeological resources as a whole. From a resource management standpoint, archaeological sensitivity is tied to the NRHP eligibility of archaeological sites because it is the effects of undertakings on NRHP-eligible sites that federal agencies like the BLM must take into account as part of the process of complying with Section 106 of the National Historic Preservation Act. To identify areas that are sensitive from a cultural resource management perspective, then, the predictive models derived above are used for the various site types and information about the likelihood that sites of each type are eligible for the NRHP. This allows site types that are more often eligible for the NRHP to weigh more heavily in model sensitivity than those site types that are not as commonly eligible. For example, rock art sites are NRHP-eligible much more often than historic artifact scatters, so it stands to reason that the rock art sites should contribute more to the overall sensitivity of the model area than historic artifact scatters. If all site types contributed equally, the composite sensitivity model would erroneously consider historic artifact scatters to be just as important as rock art sites in terms of cultural resource management decisions. The percentage of the sites and components of each predictive modeling site type that are NRHP eligible are shown in Table 8-9 (eligibility percentages are calculated by excluding sites whose eligibility is undetermined or unknown). As is discussed in section 2.5.3 in Chapter 2 (Study Orientation), the eligibility status of a site was derived from Utah Division of State History encoding data, or in some cases from CURES data. SWCA did not review individual site forms to reevaluate eligibility recommendations or determine which recommendations were agreed upon by the agency or have concurrence from SHPO. This level of evaluation was well beyond the scope of this project.

NRHP designations are not static and may reflect shifts in management interpretations through time, as well as researcher bias. For example, many sites considered to be not eligible for NRHP nomination in the 1980s would be eligible by modern standards, and sites recorded by one group as insignificant may be found to be significant by another group. However, it is suggested that all site types have likely been influenced by similar biases and that the "error rate" in NRHP interpretations should be fairly consistent across site types. With this consistency in mind, the *averaged* NRHP eligibilities per modeled site type (i.e., eligibility percentages) should reflect the relative significance of one site type compared to another. Because the averaged NRHP eligibilities are used, the status of a single site does not weigh heavily into the results. The percentages are used to assist in evaluating the overall archaeological sensitivity of an area.

Table 8-9. Counts and Percentages of Sites and Components by Predictive Modeling Site Type and National Register of Historic Places Eligibility Status in the Four Modeled Ecoregions

Site Type	Eligible*	Not Eligible†	Eligibility Undetermined/Unknown‡	Total	% Eligible***
Benches and Canyons					
Prehistoric Rock Art	254	26	114	394	**91**
Prehistoric Sheltered	630	233	632	1,495	**73**
Prehistoric Open with Features	3,276	562	1,548	5,386	**85**
Prehistoric Open without Features	3,890	3,206	1,217	8,313	**55**
Historic Architectural	352	184	85	621	**66**
Historic Artifact Scatter	183	240	51	474	**43**
Deserts					
Prehistoric Rock Art	6	0	13	19	**100**
Prehistoric Sheltered	12	3	3	18	**80**
Prehistoric Open with Features	79	17	0	96	**82**
Prehistoric Open without Features	294	364	28	686	**45**
Historic Architectural	48	24	2	74	**67**
Historic Artifact Scatter	35	125	3	153	**23**
Escarpments					
Prehistoric Rock Art	32	2	2	36	**94**
Prehistoric Sheltered	23	4	5	32	**85**
Prehistoric Open with Features	21	12	2	35	**64**
Prehistoric Open without Features	82	59	13	154	**58**
Historic Architectural	6	15	2	23	**29**
Historic Artifact Scatter	6	26	0	32	**19**
Forests					
Prehistoric: Rock Art	0	0	0	0	**0**
Prehistoric Sheltered	10	2	19	31	**83**
Prehistoric Open with Features	74	8	190	272	**90**
Prehistoric Open without Features	200	185	136	521	**52**
Historic Architectural	25	14	5	44	**64**
Historic Artifact Scatter	12	10	2	24	**55**

* IMACS codes A, B, C, F, G, H, I, J, O.

† IMACS code D.

‡ IMACS codes E or Z.

*** % Eligible = Eligible/(Eligible + Not Eligible). Sites with unknown or undetermined eligibility are not included in calculating the percentage.

To scale the model for each site type by its tendency to be NRHP eligible, the probability values for model was multiplied by the eligibility percentage of the site type. These were combined in ArcGIS by adding the eligibility-scaled probability values of each site type together into a single raster. This raster was then set to a scale of 0 to 100 (low to high sensitivity). Finally, the 0–100 scale was divided into three discrete zones of high, medium, and low probability as follows: High = 50 to 100 (covering 8.5 percent of the model area), Medium = 25 to 49 (covering 32.7 percent of the model area), and Low = 0 to 24 (covering 58.8 percent of the model area). These three probability zones are shown in Figure 8-8. This map shows overall archaeological sensitivity, indicating the places where NRHP-eligible sites, overall, are most likely to be found.

Although the stream networks, hills, and ridges are consistently associated with highly sensitive areas, the vast expanses of low-relief flats and uplands throughout the MFO planning area tend to be associated with large areas having low to moderate archaeological sensitivity. In the north portion of the planning area, there is a pattern of highly sensitive areas along the stream networks and near streams at the base of hills and ridges – predominantly on the south-facing slopes. There is a strong pattern of high to medium sensitivity along the base of the Book Cliffs, which coincides with the south end of the Escarpments ecoregion.

The vast flats in the Deserts ecoregion tend to express low sensitivity; however pockets of sensitive areas are found near drainages. Relatively large areas with medium to high sensitivity are mapped across several miles in the area around Danish, Cisco, and Sagers Washes. Another large high probability area is in the Yellow Cat Flat vicinity, around Mine Draw. Other notable high probability areas flank the Green River along the west edge of the MFO planning area. Various sensitive areas are present immediately east of the Green River. In the large Benches and Canyons ecoregion of the central and southern portion of the planning area, high sensitivity areas are located in similar settings as areas to the north. They tend to be positioned on overlooks overlooking dissected terrain below, and at the base of ridges, broad uplands, and canyons. While the edges of broad uplands with overlooks tend to express high sensitivity, the interior portions of uplands and flats are interpreted as having comparably low sensitivity. This pattern persists across this entire ecoregion. The Forests ecoregion in the MFO planning area is limited to the La Sal Mountains southeast of Moab. Low sensitivity areas are mapped in across most of this ecoregion, with the exception of streamside settings in the lower elevations – most notably the south-facing slopes.

This page intentionally blank

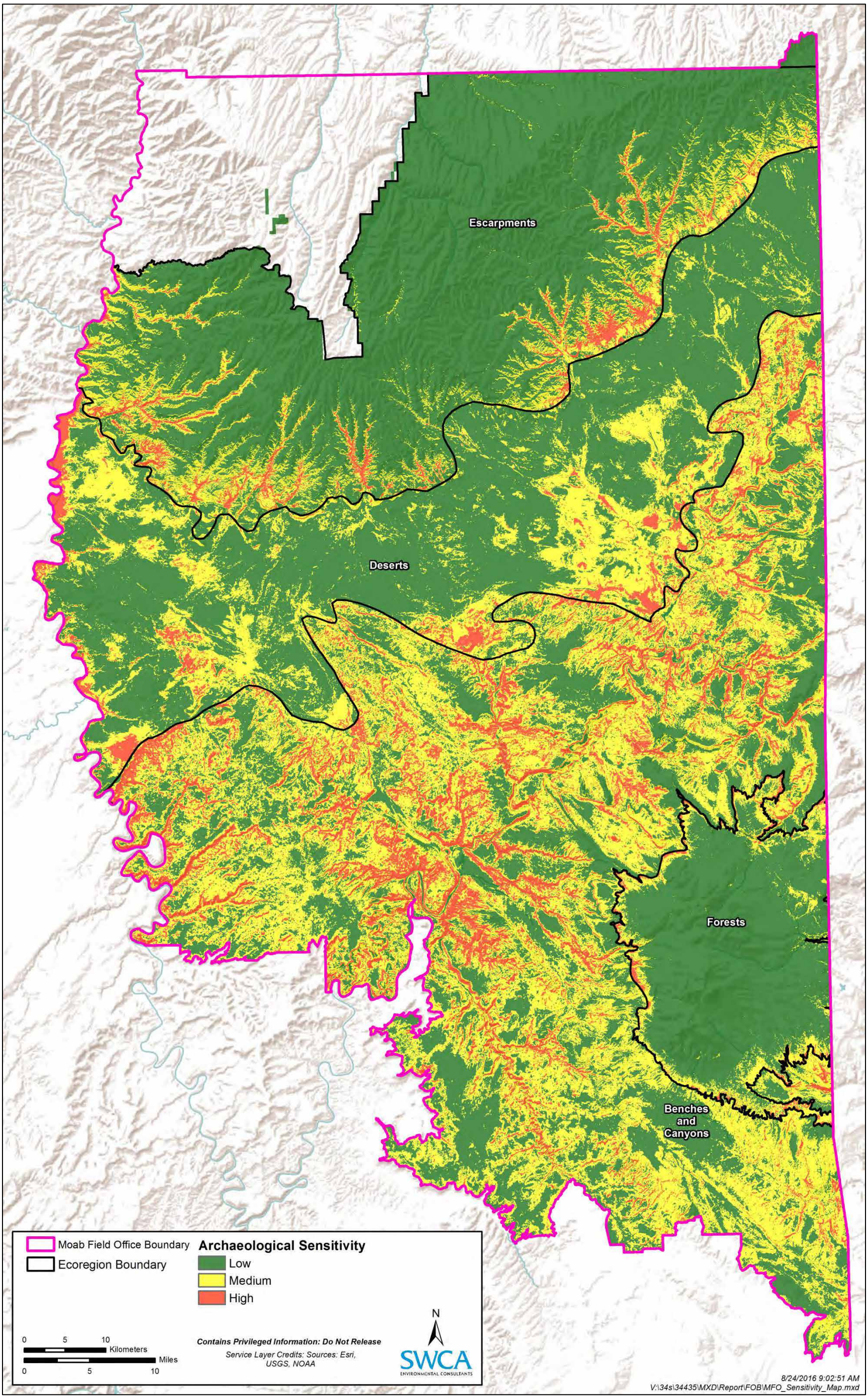


Figure 8-8. Archaeological sensitivity for the MFO planning area derived from NRHP eligibility percentages per modeled site type.

This page intentionally blank

8.5. A Composite GIS-Based and Intuitive Archaeological Sensitivity Model

The overall sensitivity model presented in the previous section indicates the probability that sites of types included in the GIS-based modeling are located in specific areas. However, some types of cultural resources are not amenable to such GIS-based modeling, and their potential occurrence is not accounted for by that model. In particular, linear resources such as roads and trails are not suitable for GIS-based modeling of the sort presented above, even though they may be highly significant. This is because, as alluded to previously, such resources cross a wide range of environmental settings, and so using environmental variables to predict the locations of linear resources that have not yet been identified would lead to the prediction that such resources could be located in a wide range of settings, which is not a particularly useful prediction. To account for the fact that such resources are known to be present in the planning area in the analysis of potential conflicts between cultural resources and land uses that is presented in the following section, a composite final planning model is developed by intuitively adding resources to the results of the sensitivity model presented in the previous section.

Specifically, the probable alignment of the Old Spanish Trail (from shapefiles of the Old Spanish National Historic Trail alignment and the Old Spanish Trail refined alignment within the planning area, as represented in BLM [2015], which the BLM provided to SWCA on a compact disc on November 16, 2015, and email shapefiles on August 22, 2016) is added, as are the alignments of historic linear sites (including two likely segments of the Old Spanish Trail) that have been recorded on IMACS forms within the MFO planning area. The historic linear sites added to the model are listed in Table 8-10; these consist of all previously recorded linear sites in the planning area that are eligible for the NRHP, plus one site (42GR002813) that is not eligible for the NRHP but that MFO requested be included. SWCA incorporated the Old Spanish Trail alignment by taking the probable trail route (based on the shapefiles noted above) and applying a 100-m buffer to it (resulting in a 200-m-wide corridor centered on the alignment). SWCA incorporated previously recorded NRHP-eligible historic linear sites by applying 50-m buffers (resulting in 100-m-wide corridors centered on road alignments; a wider corridor is used for the Old Spanish Trail than for historic roads due to the uncertainty that exists about the exact location of the former). Including these linear resources in the final planning model allows for assessment of potential impacts to them, along with assessment of potential impacts to areas with a high probability for other types of cultural resources to be present as modeled by GIS. In addition, it enables one to take into account the fact that other types of cultural resources—e.g., artifact scatters and historic architectural features—may be more likely to be present along historic transportation routes.

Table 8-10. Historic Linear Sites Intuitively Added to the Final Planning Model

Site Number	Name
42EM002605	Denver and Rio Grande Western Railroad
42GR000935	Denver and Rio Grande Western Railroad
42GR002027	Grand River Toll Road
42GR002762	Denver and Rio Grande Western Railroad
42GR002813	Historic wagon road from Thompson to Moab
42GR002923	Midland Telephone Company Thompson to Moab line
42GR003221	Associated with a famous Mormon trail called "the Jump"
42GR003429	Union Pacific Railroad "Potash Line"

Table 8-10. Historic Linear Sites Intuitively Added to the Final Planning Model

Site Number	Name
42GR004714	Old Spanish Trail Northern Route
42GR004716	Old Spanish Trail Northern Branch
42GR004973	Little Valley Road
42SA025852	Pack trail
42SA026851	Civilian Conservation Corps cattle trail
42SA027013	Civilian Conservation Corps cattle trail
N/A	Old Spanish National Historic Trail
N/A	Old Spanish Trail refined alignment

The final planning model that results from incorporating these linear resources is shown in Figure 8-9. Areas designated as high sensitivity in this final planning model comprise just over 9 percent of the total acreage of BLM-administered land in the planning area (Table 8-11).

Table 8-11. Final Planning Model Results: Acreage per Archaeological Sensitivity Level in the Planning Area

Sensitivity Level	Total Acres	Bureau of Land Management–Administered Acres
High	250,543 (9%)	180,507 (10%)
Medium	859,227 (33%)	641,824 (34%)
Low	1,547,577 (58%)	1,035,767 (56%)
Total	2,657,347	1,858,099

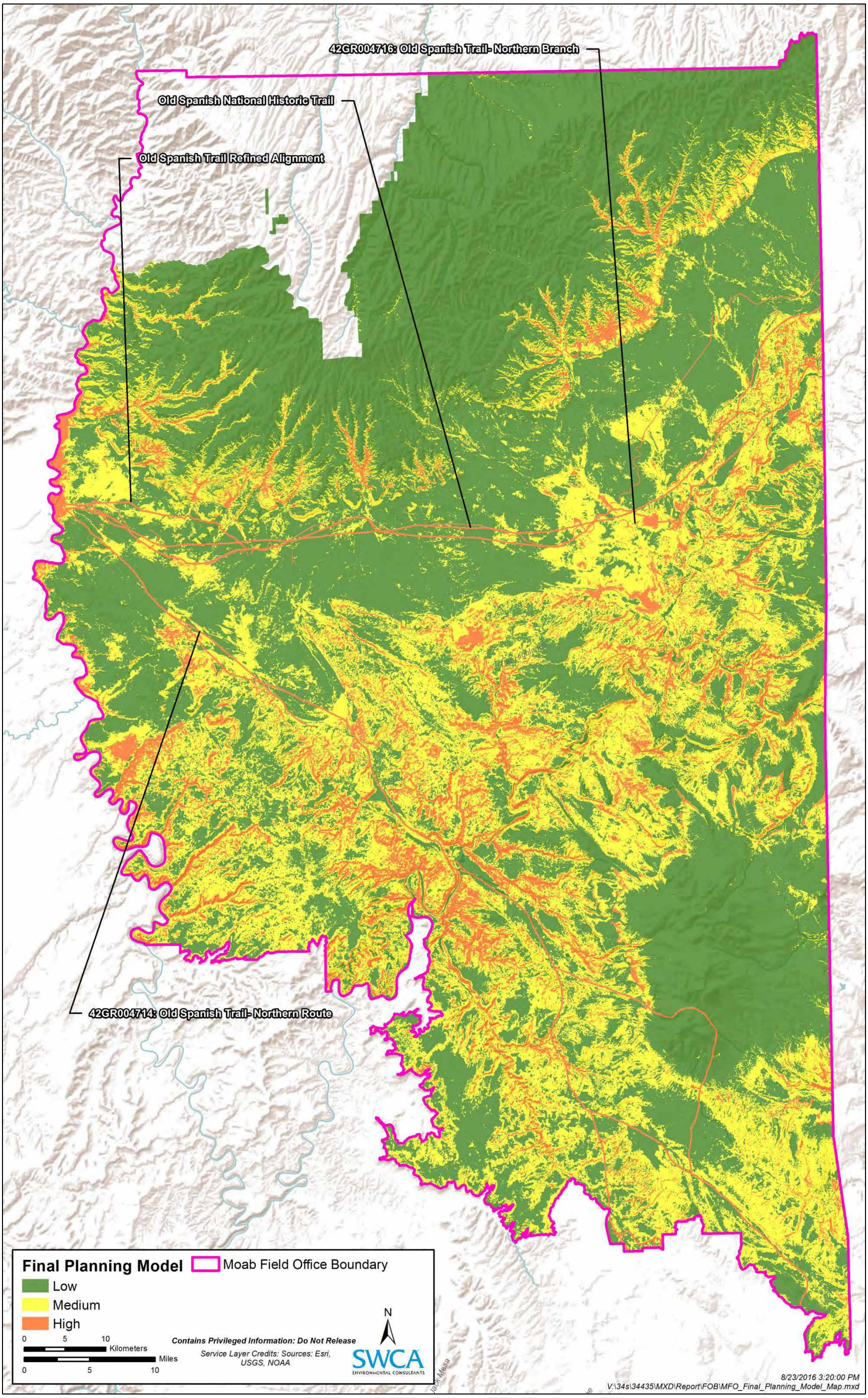


Figure 8-9. Final planning model created by intuitively adding the Old Spanish Trail and historic linear sites to the high sensitivity zone.

This page intentionally blank

8.6. Land Use and Cultural Resource Site Probabilities

This chapter next identifies areas in the MFO planning area where current and potential future land uses may either present a threat to or confer some degree of protection to significant cultural resources, and it recommends steps for accounting for the potential presence of such resources when taking future management actions. This is done through a GIS-based comparison of the final planning model just discussed with data on land use. Five datasets relevant to contemporary human land use are considered: 1) a municipalities dataset, which indicates areas of current relatively high human population density; 2) a travel routes dataset, which indicates areas easily accessible to human use; 3) a special land use designations dataset, which indicates areas that are relatively protected from intensive human use through legislation or land-management agency action; 4) oil and gas lease areas and potash lease areas; and 5) the area covered by the Cisco Desert Master Leasing Plan (MLP) for oil and gas development. These datasets are overlain on the archaeological sensitivity zones derived from the final planning model in order to identify overlaps with high-sensitivity areas (Figure 8-10 through Figure 8-12).

The municipalities dataset that is used is maintained by the Utah Automated Geographic Reference Center (AGRC) (2014a) and indicates municipal administrative boundaries. It is used here because it is likely that archaeological resources within and adjacent to the population centers that municipalities represent are at greater risk of past, present, and future impacts through land development, vandalism, and other impacts. For analysis purposes, SWCA applied a 1-mile buffer to the municipal boundaries contained in the AGRC dataset on the assumption that cultural resources either inside or within 1 mile of these boundaries are at the greatest risk from human impacts.

The travel routes dataset consists of roads, ATV routes, and trails. The roads and ATV routes datasets were provided by the BLM to SWCA on April 11, 2015, and the trails dataset is from the Utah AGRC (Utah Automated Geographic Reference Center 2014b). These datasets are used here because it is likely that archaeological resources are at greater risk of impact from human activities when they are close to travel routes. SWCA applied a 200-m buffer to the travel routes in the MFO dataset for analysis purposes on the assumption that cultural resources within this distance of a road or trail are at the greatest risk of impact from activities such as casual collecting or other forms of vandalism, as well as from construction- and development-related activities.

The special land use designations dataset that is used was compiled from four separate datasets, including two maintained by AGRC (Utah Automated Geographic Reference Center 2014b): 1) a wilderness boundaries dataset indicating federally designated wilderness on USFS lands, and 2) a dataset indicating roadless areas from the USFS roadless inventory. The dataset also includes a shapefile of BLM Wilderness Study Areas (WSAs) and a layer reflecting BLM Areas of Critical Environmental Concern (ACECs) that SWCA received from the BLM MFO on April 11, 2015. The special land use designations dataset is used because it is likely that cultural resources within such special designation areas are at a lower risk from human impacts. In particular, four of the BLM ACECs (Behind the Rocks, Highway 279/Shafer Basin/Long Canyon, Mill Creek Canyon, and Ten Mile Wash) are managed specifically to protect cultural resources (M. F. O. Bureau of Land Management 2011). No buffer was applied to the special designations area boundaries in the AGRC and BLM datasets for analysis.

The final two datasets used—one for oil and gas lease areas and potash lease areas, and one for the Cisco Desert MLP area—were provided to SWCA by the BLM on May 27, 2016. The oil and gas and potash lease area dataset represents areas currently under lease or subject to lease for minerals development. Protective stipulations, such as no surface occupancy designations, may apply to some of these lease areas, but these areas are not analyzed at that level of detail here because the data to do so are not currently available. The Cisco Desert MLP area, which overlaps with areas included in the current oil and

gas lease areas and potash lease areas dataset, is under consideration for further oil and gas leasing actions. It is SWCA's understanding that the Cisco Desert MLP process is not yet far enough along for leasing actions or stipulations to have been proposed for different areas within the Cisco Desert MLP area. For this reason, the Cisco Desert MLP area is analyzed as a single unit, just as is done with the current oil and gas lease areas and potash lease areas dataset. A recently completed report considers potential conflicts between leasing actions and cultural resources in the Moab MLP area, a separate MLP area that is also located in the MFO planning area but that is not considered here (Cannon et al. 2016). No buffer was applied to the lease area or Cisco Desert MLP area boundaries in the BLM datasets for analysis.

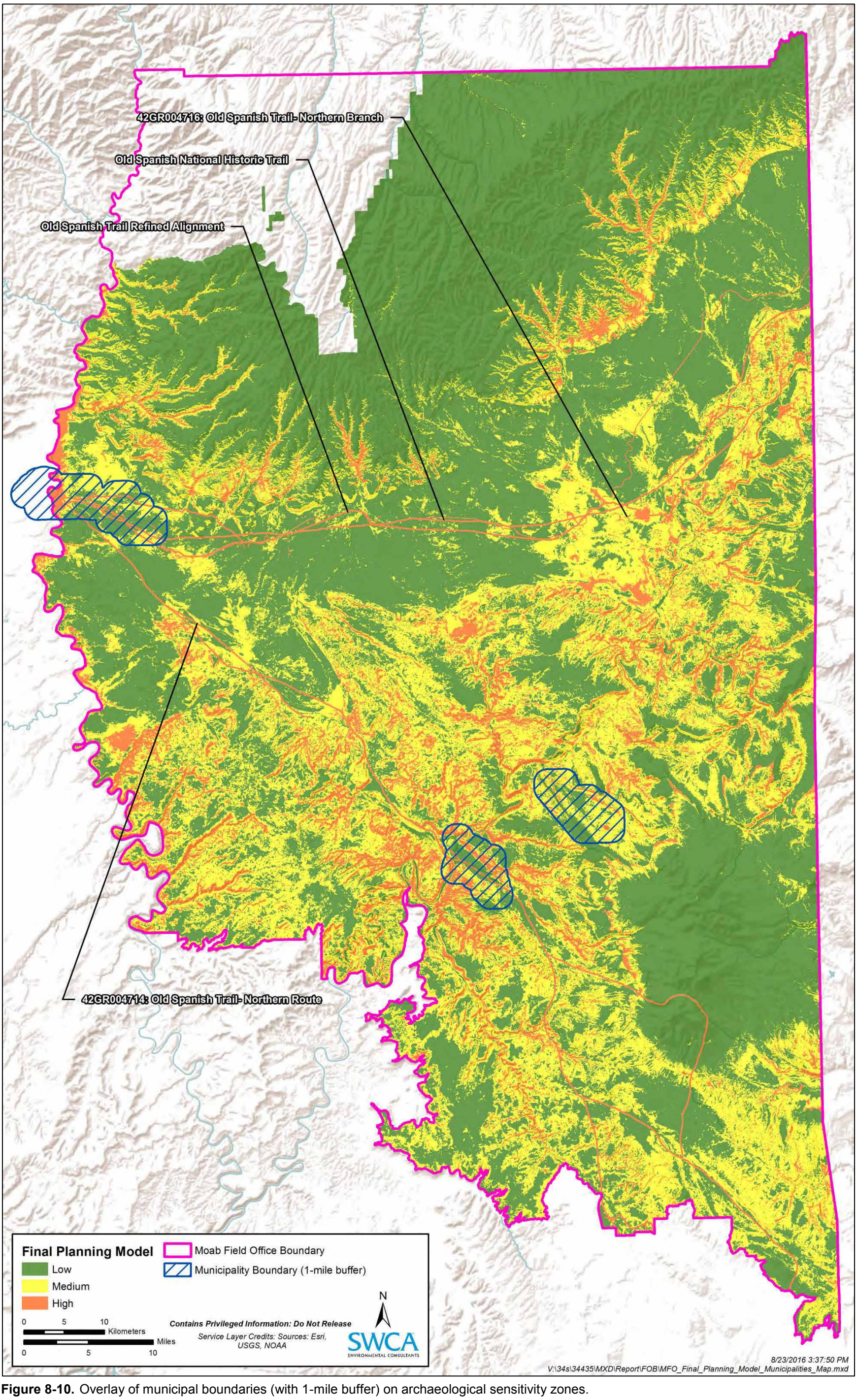


Figure 8-10. Overlay of municipal boundaries (with 1-mile buffer) on archaeological sensitivity zones.

This page intentionally blank

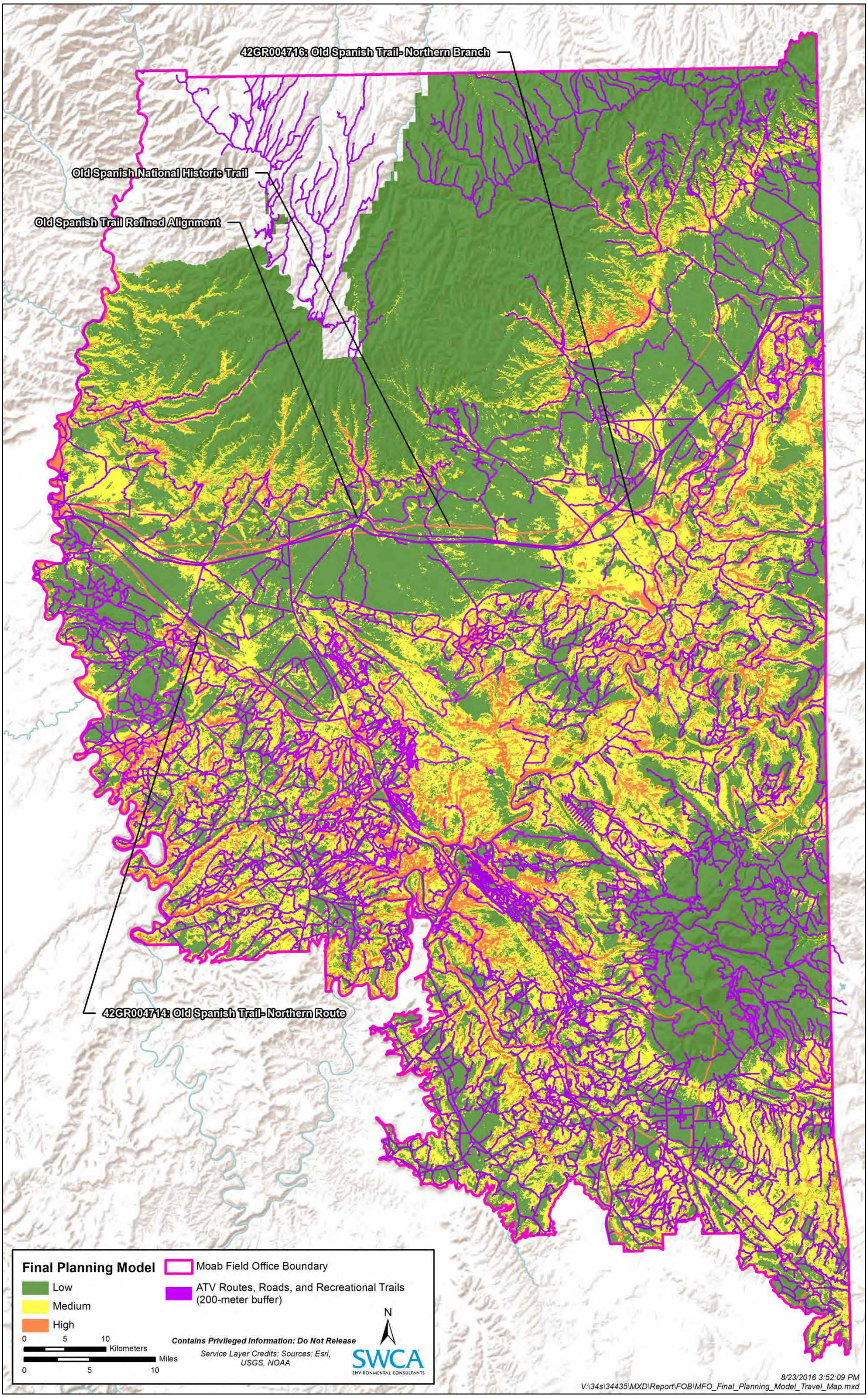


Figure 8-11. Overlay of travel routes (with 200-m buffer) on archaeological sensitivity zones.

This page intentionally blank

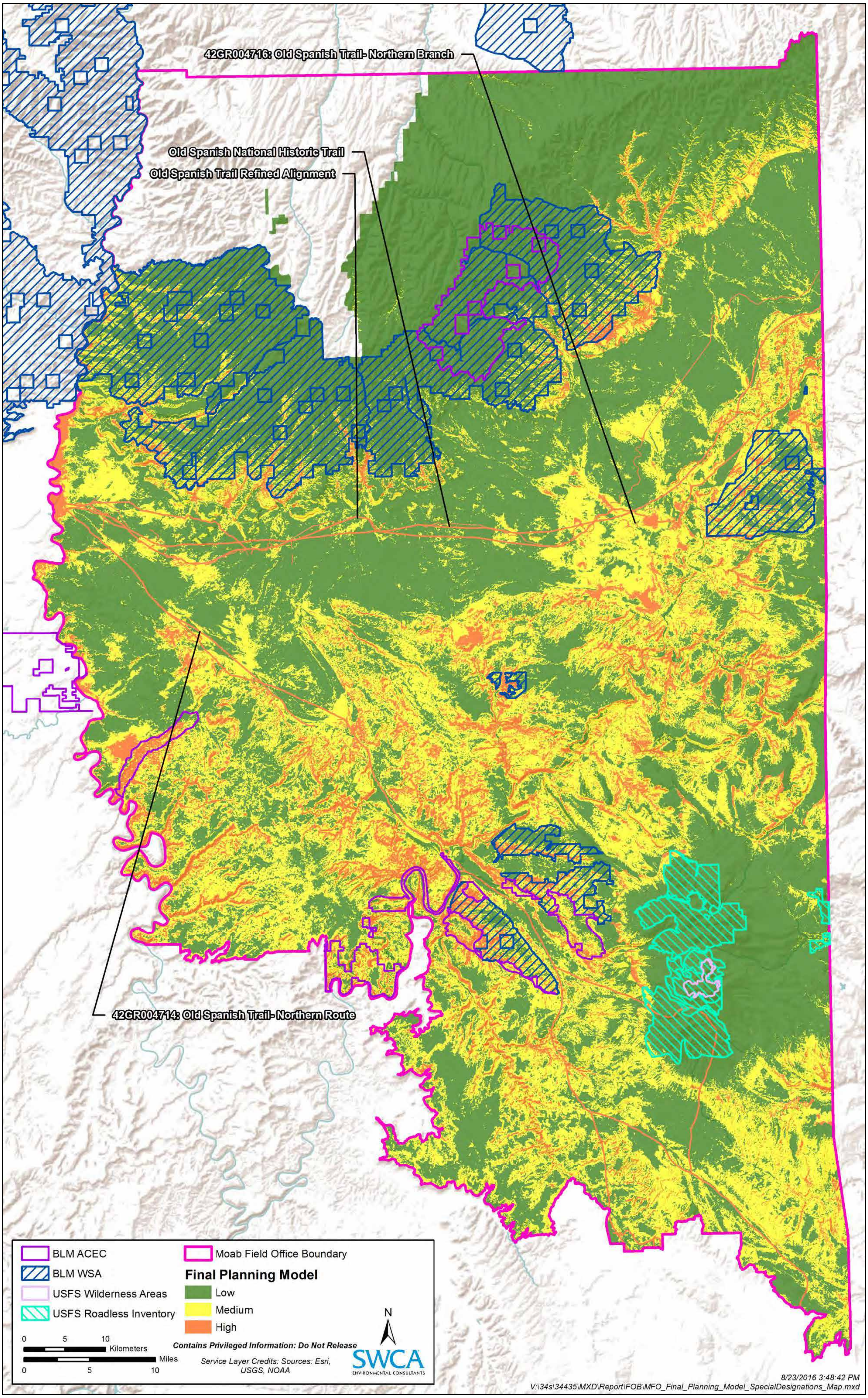


Figure 8-12. Overlay of special designation areas on archaeological sensitivity zones.

This page intentionally blank

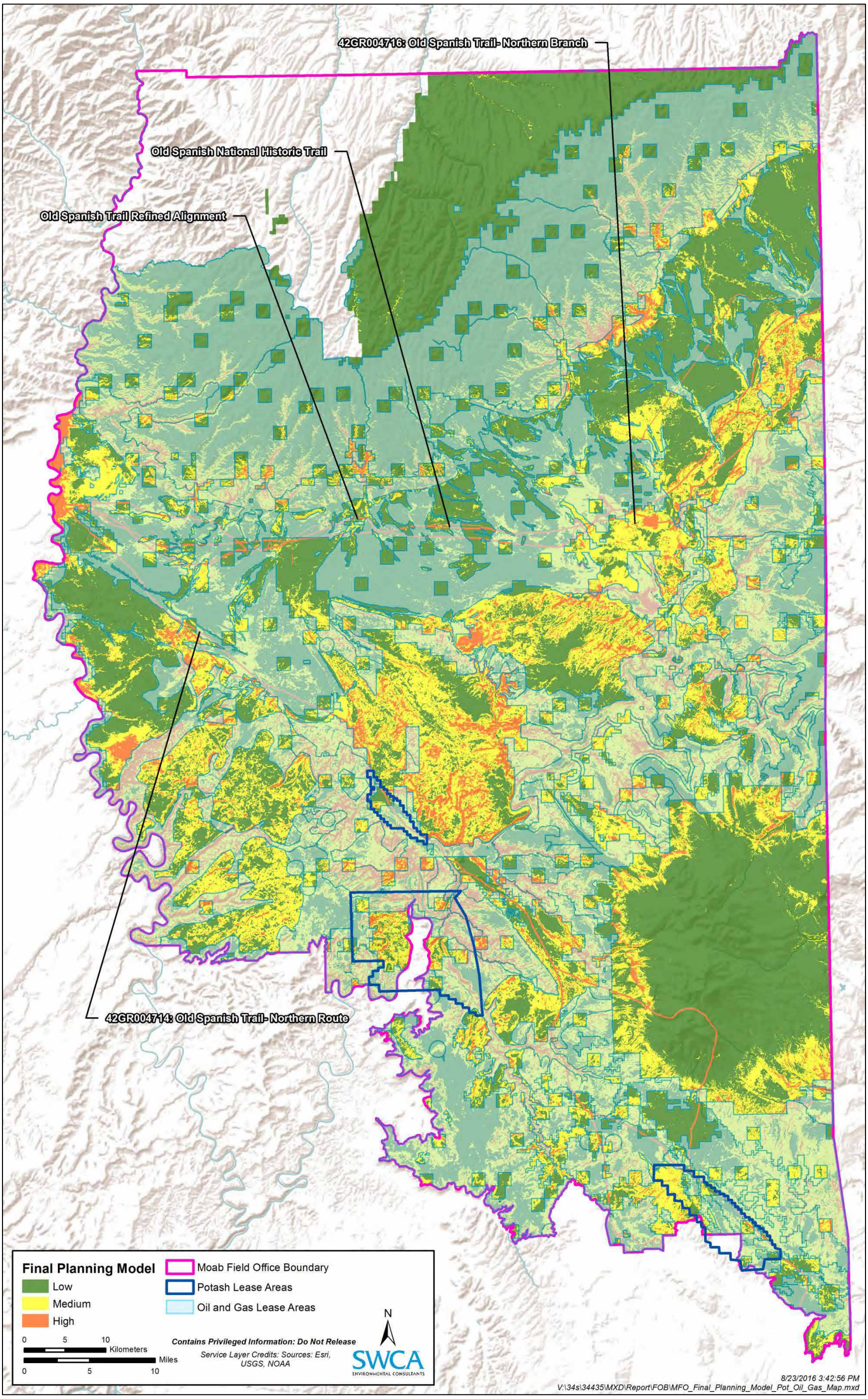


Figure 8-13. Overlay of potash lease areas and oil and gas lease areas on archaeological sensitivity zones.

This page intentionally blank

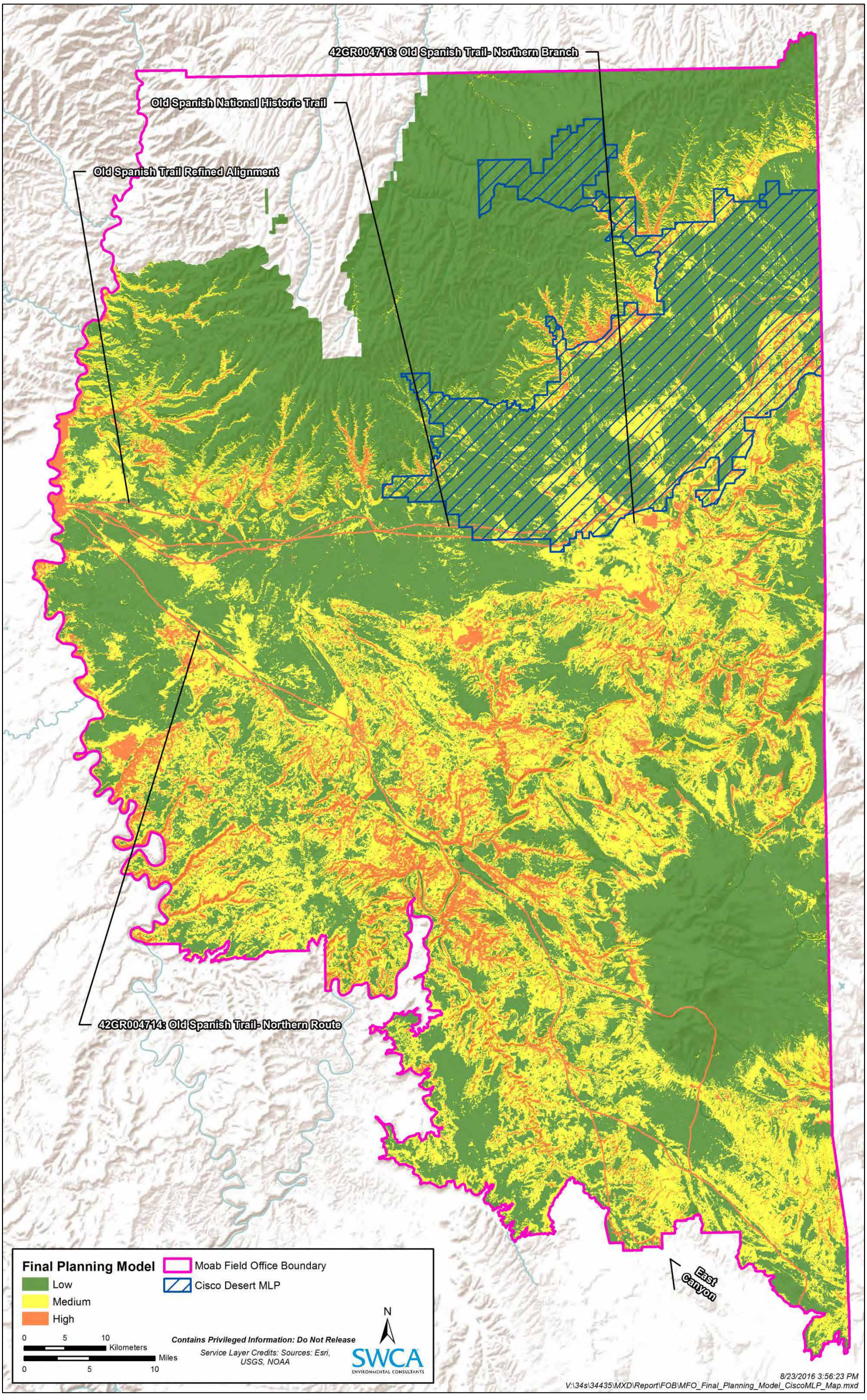


Figure 8-14. Overlay of the Cisco Desert MLP area on archaeological sensitivity zones.

This page intentionally blank

The municipal boundary data are overlain on the archaeological sensitivity data in Figure 8-10. There are 10,303 acres of high sensitivity area located inside or within 1 mile of municipal boundaries (Figure 8-15). This represents slightly less than 4 percent of the 250,543 acres of high sensitivity area within the entire MFO planning area. This is advantageous in that it indicates that most areas within the planning area where NRHP-eligible sites are likely to be located do not fall in or adjacent to current population centers. The largest expanses of high sensitivity areas in or near municipal boundaries occur in and around the town of Green River, and along the mesa tops flanking Spanish Valley around Moab. The third municipal area within the planning area, Castle Valley, has only a small amount of high sensitivity area, primarily along the northern flank of the valley.

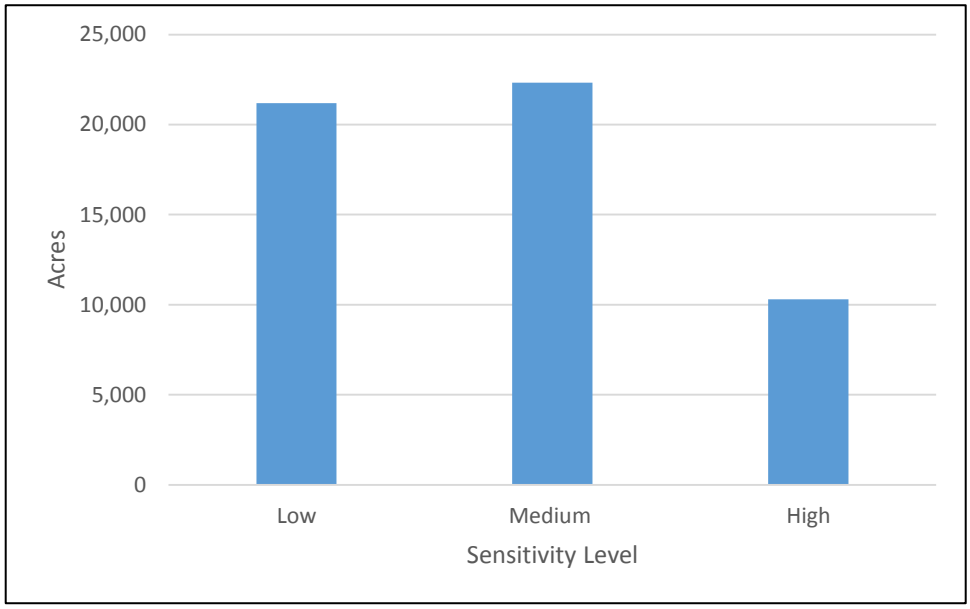


Figure 8-15. Acres of land in or within 1 mile of municipal boundaries per sensitivity level.

The travel routes data are overlain on the archaeological sensitivity data in Figure 8-11. There are 54,542 acres of high sensitivity area located within 200 m of a travel route (Figure 8-16). This represents approximately 21 percent of the 250,543 acres of high sensitivity areas within the MFO planning area. Travel routes are ubiquitous enough throughout the planning area that the risk of impacts associated with them applies to virtually all areas of high archaeological sensitivity in the study area. To help manage potential impacts to significant cultural resource sites related to their proximity to travel routes, MFO could examine the final planning model developed for this Class I inventory on a road-by-road or undertaking-by-undertaking basis and thereby identify routes or sites that might merit special attention.

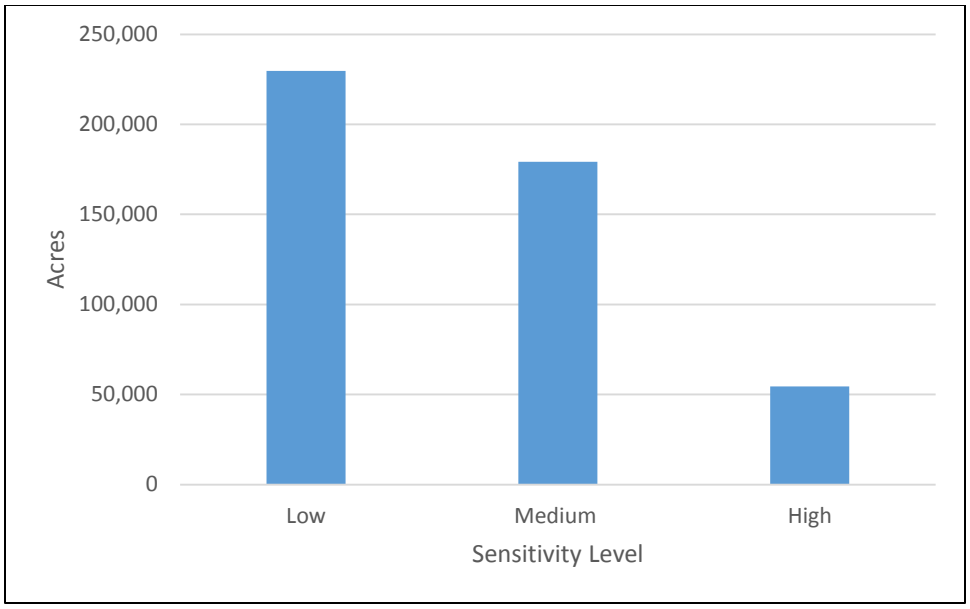


Figure 8-16. Acres of land within 200 m of a travel route per sensitivity level.

The special designation areas are overlain on the sensitivity data in Figure 8-12. There are 32,797 acres of high sensitivity area located within the special designation areas (Figure 8-17). This represents over 13 percent of the 250,543 acres of high sensitivity area within the MFO planning area. Virtually all of the high sensitivity areas that are within special designation areas are located in BLM WSAs and ACECs in the central part of the planning area. BLM WSAs contain 21,507 acres of high sensitivity area (almost 9 percent of all high sensitivity area within the planning area), and BLM ACECs contain 10,515 acres of high sensitivity area (over 4 percent of all high sensitivity area within the planning area). Only 800 acres of high sensitivity area occur within USFS roadless inventory areas, and no high sensitivity area is present within USFS wilderness area.

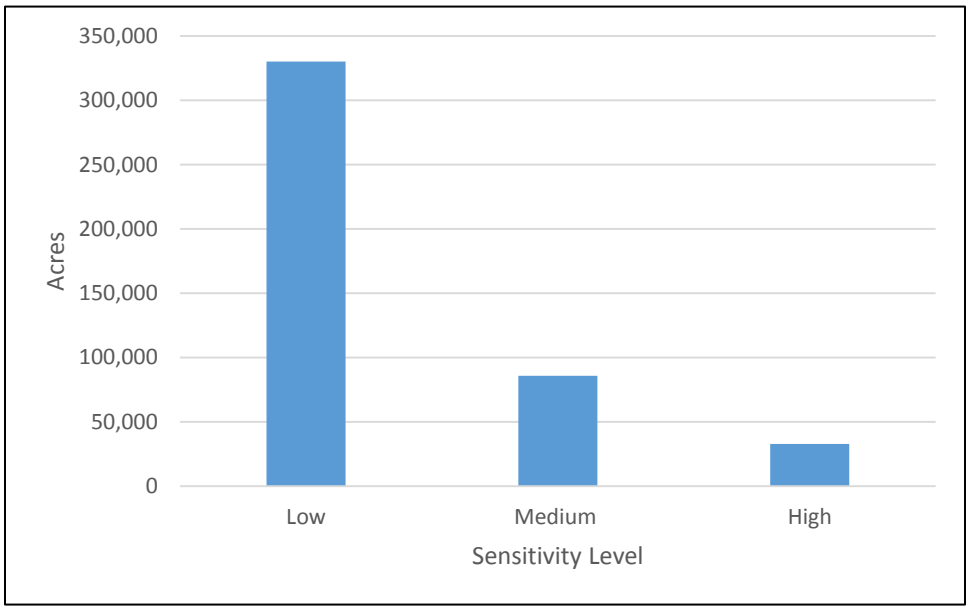


Figure 8-17. Acres of land within special designation areas per sensitivity level.

The current oil and gas lease areas and potash lease areas are overlain on the sensitivity data in Figure 8-13. There are 143,352 acres of high sensitivity area located within the oil and gas lease areas (Figure 8-18). This represents approximately 57 percent of the 250,543 acres of high sensitivity area within the MFO planning area. Potash lease areas contain 11,054 acres of high sensitivity area (Figure 8-19), or approximately 4 percent of all high sensitivity area within the planning area. As with travel routes, to help manage potential impacts to significant cultural resource sites related to their presence within lease areas, MFO could examine the final planning model derived for this Class I inventory on a case-by-case basis as minerals leasing actions or exploration and production permitting actions are planned.

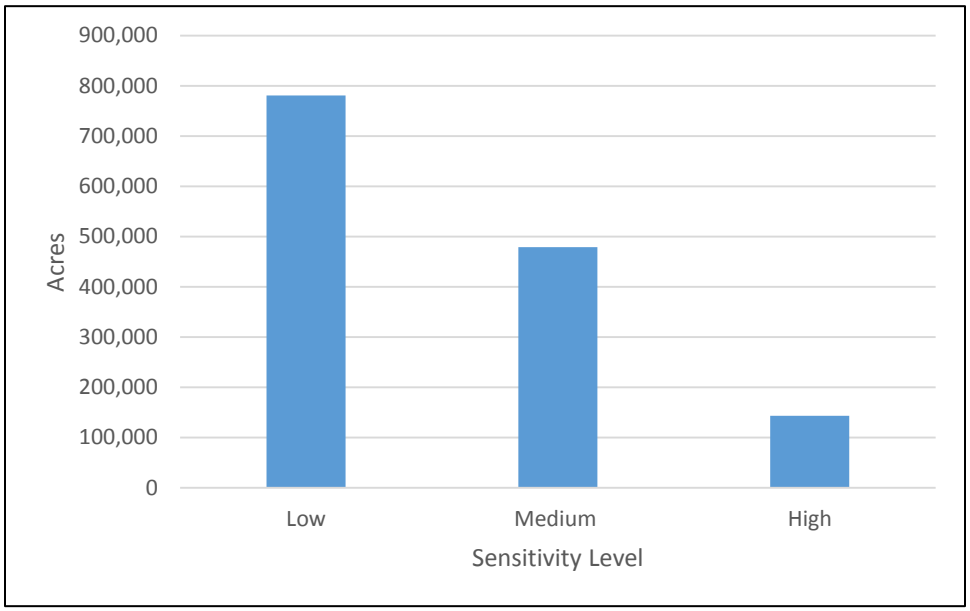


Figure 8-18. Acres of land within oil and gas lease areas per sensitivity level.

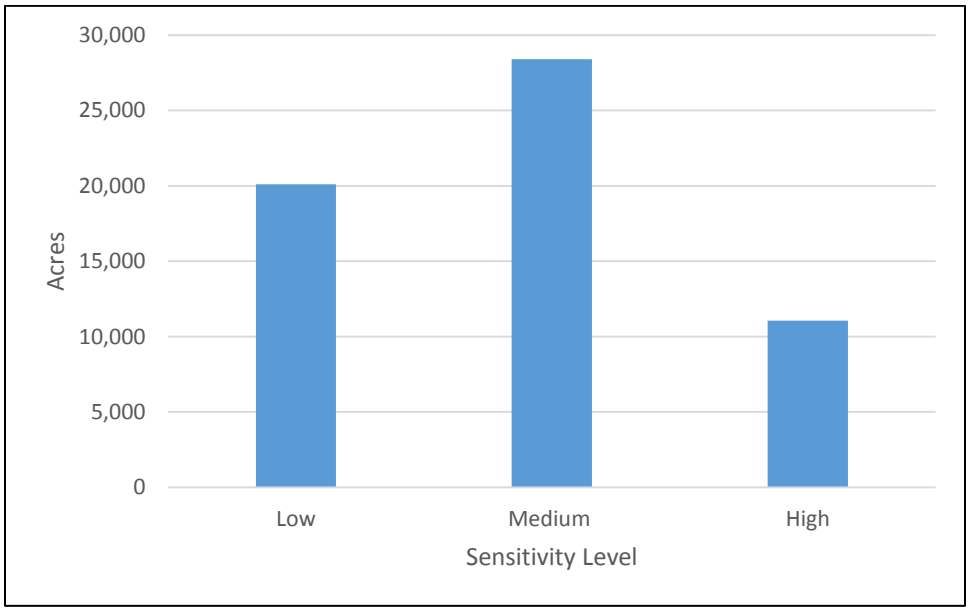


Figure 8-19. Acres of land within potash lease areas per sensitivity level.

Finally, the Cisco Desert MLP area is overlain on the sensitivity data in Figure 8-14. There are 19,005 acres of high sensitivity area located within this MLP area (Figure 8-20). This represents just over 8 percent of the 250,543 acres of high sensitivity area within the MFO planning area. The high-sensitivity areas within the Cisco Desert MLP area are located primarily along the base of the Book Cliffs in the northern part of the MLP area and to the north of the Colorado River in the southern part of the MLP area. BLM could use the planning model to identify leasing stipulations that may be appropriate for different places within the MLP area based on their potential for having significant archaeological sites.

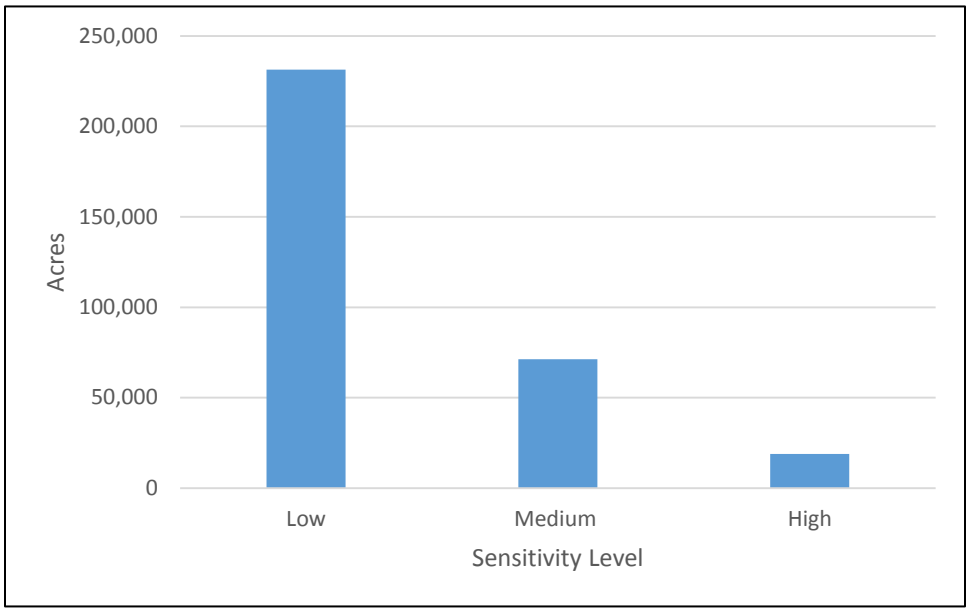


Figure 8-20. Acres of land within the Cisco Desert MLP area per sensitivity level.

To summarize the results of this analysis, it appears that most areas within the MFO planning area that have environmental characteristics associated with the presence of NRHP-eligible sites (approximately 96 percent) do not co-occur with current population centers. This would suggest that future impacts of the types associated with population centers do not pose a major risk to the remaining significant cultural resources within the MFO planning area overall. However, specific "hot spots" around individual towns may well be present, and the model presented here can help land managers plan for the potential effects of future developments around those towns. Appropriate actions might include conducting archaeological inventories targeted at generating better information about the archaeological record in areas where significant cultural resources are predicted to occur.

Impacts associated with travel routes appear to pose a somewhat greater potential threat to significant cultural resources because over 22 percent of the areas in the MFO planning area with a high probability for the presence of such resources occur close to travel routes. The precise effects of proximity to travel routes or increased visitation to significant archaeological sites as a result of increased vehicular access are not directly clear. Nonetheless, considering that the BLM administers expansive areas traversed by these travel routes, management of potential impacts associated with the use and improvement of travel routes would likely constitute one of the most effective steps that MFO could take to protect archaeological resources on lands under its jurisdiction. The planning model developed for this project coupled with targeted archaeological inventories focused on the areas of concern—in this case, travel route corridors—would again help in this effort.

It appears that only a relatively small percentage of the areas in the MFO planning area with the highest potential for the presence of NRHP-eligible sites (approximately 13 percent) are located within special designation areas that are subject to some degree of protection from development. Targeted designation of additional areas of high archaeological sensitivity for such protections would be another step that MFO could take to protect cultural resources on lands it administers, and, again, the sensitivity dataset developed for this project and targeted archaeological inventories could help in doing so.

Finally, 59 percent of the high-sensitivity areas in the planning area fall within current oil and gas lease areas, 5 percent fall within current potash lease areas, and 8 percent fall within the Cisco Desert MLP area. Cultural resources within much of these areas may be subject, either now or in the future, to leasing stipulations that confer some degree of protection to them (e.g., no surface occupancy stipulations). The planning model developed here may be useful for identifying areas that merit such stipulations in future leasing actions.

8.7. Recommendations for Future Inventory Strategies

This chapter concludes by discussing how the planning model developed here can be used to guide future cultural resource inventory strategies in the MFO planning area. As noted, the model is not intended to replace on-the-ground inventories, but it may be useful for helping to guide future inventories. As a matter of course, BLM will typically require intensive-level Class III inventories in advance of ground-disturbing undertakings under its jurisdiction, and it may also require such inventories in advance of planning-level actions that do not involve immediate direct effects on cultural resources. For planning-level actions that may not necessarily otherwise immediately undergo a Class III inventory, the BLM could examine the planning model to identify places within the area of potential effects (APE) that are modeled to have a high probability for significant archaeological sites and then direct targeted on-the-ground inventories at those areas to better understand the cultural resources within them. This would likely enable the majority of significant cultural resources within the APE to be identified at the planning stage, without incurring the expense of an intensive inventory of the entire APE. For any Class III inventory, the BLM could also tailor survey methods to sensitivity levels in order to optimize survey efficiency relative to the need to make a good faith effort to identify significant cultural resources. For example, BLM could require the use of more intensive methods in areas modeled to have high sensitivity and the use of less intensive methods in areas of low sensitivity.

The planning model also has strategic utility beyond its potential uses for on-the-ground inventories. One beneficial use of the model could be realized during the alternatives selection or siting phase of an undertaking. Areas modeled to have a high probability for significant cultural resources could be avoided to the extent possible during project design in order to minimize both impacts on cultural resources and the expense of mitigating those impacts. Such areas could also be designated for special stipulations, such as no surface occupancy, in leasing actions.

Finally, as noted, the planning model presented here is not intended to be static. Rather, models such as this one should be continually improved as new data become available. To this end, the planning model would likely best benefit by the addition of data from areas within the MFO planning area where previous survey coverage is light, particularly the northwest and east-central parts of the planning area (see Section 4.2 of this report). To the extent that it is possible to direct future inventory efforts to those areas, it should be possible both to improve the accuracy of the MFO planning model and to make more informed cultural resource management decisions for the MFO planning area overall.

8.8. Summary

This chapter presents a series of predictive models develop for the MFO planning area. Predictive models are developed using the results of the site classification procedure discussed in Chapter 7 (Cultural Resource Site Management Classification). The predictive models are intended to 1) illustrate the relationships between sites of different types and key environmental variables, and 2) show the locations within the MFO planning area where significant cultural resource sites are most likely to be found, in order to provide for better management of those sites.

The predictive models indicate that large, high probability areas for Historic Architectural sites occur in the vicinity of several mines in the Yellow Cat Flat area of the central portion of the MFO planning area. In the central and southern portion of the planning area, high probability areas for this site type flank dissected stream networks at the base of canyons, mesa, and broad uplands, while broad areas of low probability are common in the flats and interfluvial uplands. The models indicate that Historic Artifact Scatter sites have a low probability of occurrence across most of the MFO planning area. In general, high probability areas for these sites tend to occur in the Book Cliffs area in the Escarpments ecoregion, at lower elevations within the Forests ecoregion, and on the edges of benches and ridges overlooking dissected stream networks in the Benches and Canyons and Deserts ecoregions.

High probability areas for Prehistoric Open Artifact Scatter sites are similar to those for Historic Artifact Scatter sites, with these sites most commonly located at the edge of benches and ridges, along the south flanks of the Book Cliffs, and in areas overlooking dissected stream networks. Large high probability areas for Prehistoric Open Artifact Scatter sites are modeled to occur northwest of Tenmile Canyon, west of the Green River, and in rugged uplands across the southern portion of the MFO planning area. High probability areas for the Prehistoric Open with Features site type consistently occur near confluences. Large medium to high probability areas for this site type are located in the rugged lands east of La Sal, from Hideout Mesa to the north down to the hills north of the Lower Lisbon Valley. The Forests ecoregion generally has a low probability for this site type, with the exception of the lower flanks of this ecoregion. In the Deserts ecoregion, geological layers mapped as alluvial and aeolian tend to have a high probability. In the Escarpments ecoregion, high probability areas tend to occur on gently sloping ridges and hills and on nearly level plateaus and terraces, areas that generally correlate with the Book Cliffs area.

Prehistoric Rock Art sites tend to be located in lower-elevation areas, away from linear stream segments but near confluences, in sheltered areas with low relative elevation and steep, rugged slopes. Unsurprisingly, in the MFO planning area these high probability areas occur in the dissected lowlands, above and adjacent to stream networks but below the broad uplands, which are characterized as large areas of low Rock Art probability. Prehistoric Sheltered sites share many commonalities with Rock Art sites in terms of site placement. These sites to be located in rugged areas at lower elevations, away from linear stream segments but near confluences.

In addition to developing predictive models for the various site types that identify high probability areas for each type individually, an overall archaeological sensitivity model is developed to assist with land use planning and resource management. This is done by scaling the predictive model for each site type by the tendency of that site type to be NRHP eligible; specifically, the probability values for each environmental variable in the model for a given site type are multiplied by the eligibility percentage of that site type. The eligibility-scaled probability values for each site type with then combined into a single GIS raster file that is set to a scale of 0-100 (low to high sensitivity), which is then divided into three discrete zones of high, medium, and low probability as follows: High = 50 to 100, Medium = 25 to 49, and Low = 0 to 24.

In the overall sensitivity model, stream networks, hills, and ridges are consistently modeled to be high-sensitivity, whereas the vast expanses of low-relief flats and uplands that occur throughout the MFO planning area tend to have low to moderate archaeological sensitivity. In the Escarpments ecoregion in the north portion of the planning area, there is a pattern of highly sensitive areas along stream networks and near streams at the base of hills and ridges, predominantly on the south-facing slopes, and there is a strong pattern of high to medium sensitivity along the base of the Book Cliffs. The vast flats in the Deserts ecoregion tend to express low sensitivity, but pockets of sensitive areas occur near drainages. Relatively large areas of medium to high sensitivity are modeled in the area around Danish, Cisco, and Sagers Washes. Another large high probability area occurs in the Yellow Cat Flat vicinity, around Mine Draw. Other notable high probability areas flank the Green River along the west edge of the MFO planning area, and various sensitive areas are present immediately east of the Green River. In the large Benches and Canyons ecoregion of the central and southern portion of the planning area, high sensitivity areas are located in similar settings as in areas to the north. They tend to be positioned on overlooks above dissected terrain and at the base of ridges, broad uplands, and canyons. The Forests ecoregion, which is limited to the La Sal Mountains within the MFO planning area, is largely a low sensitivity area, with the exception of streamside settings in the lower elevations, most notably the south-facing slopes.

After developing the overall archaeological sensitivity model, SWCA produced a final planning model by adding to it locational data for cultural resource sites that are not amenable to GIS-based predictive modeling. Specifically, the probable alignment of the Old Spanish Trail and the known alignments of several historic linear sites that have been recorded on IMACS forms were added. Even though such linear resources may be highly significant, they are not suitable for GIS-based predictive modeling because they cross a wide range of environmental settings.

The last analysis presented in this chapter uses the final planning model just described to identify areas in the MFO planning area where current and potential future land uses may either present a threat to or confer some degree of protection to significant cultural resources. This is done through a GIS-based comparison of the final planning model with data on land use. This analysis indicates that most areas within the MFO planning area that have environmental characteristics associated with the presence of NRHP-eligible sites (approximately 96 percent) do not co-occur with current population centers. This would suggest that future impacts of the types associated with population centers do not pose a major risk to the remaining significant cultural resources within the MFO planning area overall, even though important "hot spots" around individual towns may well be present. Impacts associated with travel routes appear to pose a somewhat greater potential threat to significant cultural resources because more than 22 percent of the areas in the MFO planning area with a high probability for the presence of such resources occur close to travel routes. However, the precise effects of proximity to travel routes or increased visitation to significant archaeological sites as a result of increased vehicular access are not directly clear. It appears that only a relatively small percentage of the areas in the MFO planning area with the highest potential for the presence of NRHP-eligible sites (approximately 13 percent) are located within special designation areas, such as WSAs or ACECs, that are subject to some degree of protection from development. More than half (59 percent) of the high-sensitivity areas in the planning area fall within oil and gas lease areas, 5 percent fall within potash lease areas, and 8 percent fall within the Cisco Desert MLP area, though it is noted that cultural resources within much of these areas may be subject to leasing stipulations that confer some degree of protection to them.

Finally, this chapter makes recommendations regarding how the planning model developed here can be used to guide future cultural resource inventory strategies in the MFO planning area. For planning-level actions, the BLM could examine the planning model to identify places within an APE that are modeled to have a high probability for significant archaeological sites and then direct targeted on-the-ground inventories at those areas to better understand the cultural resources within them. This would likely enable

the majority of significant cultural resources within the APE to be identified at the planning stage, without incurring the expense of an intensive inventory of the entire APE. The BLM could also tailor the survey methods for on-the-ground inventories to sensitivity levels in order to optimize survey efficiency while maintaining a good faith effort to identify significant cultural resources: e.g., by requiring the use of more intensive methods in areas modeled to have high sensitivity and the use of less intensive methods in areas of low sensitivity. Beyond on-the-ground inventories, the BLM or project proponents could use the planning model to assist during the alternatives selection or siting phase of an undertaking, and areas modeled to have a high probability for significant cultural resources could be avoided during project design in order to minimize both impacts on cultural resources and the expense of mitigating those impacts. Efforts should also be made, to the extent that it is possible to do so, to direct future inventories towards areas where previous survey coverage is light. This should make it possible to improve the planning model presented here, which is not intended to be static, and to improve the knowledge base that the BLM has available to it from which to make cultural resource management decisions.

8.9. References Cited

Aldrich, John H., and Forrest D. Nelson

1984 *Linear Probability, Logit, and Probit Models.* Sage University Papers on Quantitative Applications in the Social Sciences No. 07-045. Sage Press, Beverly Hills, California.

Altschul, Jeffrey H.

1988 Models and the Modeling Process. In *Quantifying the Present and Predicting the Past: Theory, Method, and Application of Archaeological Predictive Modeling*, edited by W. J. Judge and Lynne Sebastian, pp. 61–96. U.S. Government Printing Office, Washington, D.C.

Beck, R. Kelly, Mike Cannon, Lisa Benson, Stephanie Lechert, Kiera Westwater, Paul Burnett, Sarah Creer, and Lindsey Kester

2015a A Class I Cultural Resource Inventory of Lands Administered by the Bureau of Land Management, Richfield Field Office. Part 1: Regional Overview. Prepared by SWCA Environmental Consultants. Prepared for Bureau of Land Management, Richfield Field Office. Copies available by Bureau of Land Management, Richfield Field Office, Richfield, Utah.

Beck, R. Kelly, Mike Cannon, Mary Ann Vicari, Lisa Benson, Stephanie Lechert, Kiera Westwater, Paul Burnett, Sarah Creer, and Lindsey Kester

2015b A Class I Cultural Resource Inventory of Lands Administered by the Bureau of Land Management, Fillmore Field Office. Part 1: Regional Overview. Prepared by SWCA Environmental Consultants. Prepared for Bureau of Land Management, Fillmore Field Office. Copies available by Bureau of Land Management, Fillmore Field Office, Fillmore, Utah.

Berry, Michael S.

1984 Sampling and Predictive Modeling on Federal Lands in the West. *American Antiquity* 49:842–853.

Bradley, John E., William R. Killam, George R. Burnes, and Marilyn A. Martorano.

1986 *An Archaeological Survey and Predictive Model of Selected Areas of Utah's Cisco Desert, Grand County, Utah*. Bureau of Land Management Cultural Resource Series No. 18.

Bureau of Land Management

2008 *National Historic Preservation Act SHPO 106 Consultation for the BLM Moab Proposed RMP.* Bureau of Land Management, Moab Field Office.

2012 *Scoping Report for the Canyon County District Office. Moab Master Leasing Plan and Draft Environmental Impact Statement.* Available at: http://www.blm.gov/style/medialib/blm/ut/moab_fo/mlp0.Par.46877.File.dat/01_MoabMLP_Scoping-Report_5-6-2013_web.pdf. Accessed January 2016.

2015 *Moab Master Leasing Plan and Draft Resource Management Plan Amendments / Draft Environmental Impact Statement for the Moab and Monticello Field Offices.* Available at: http://www.blm.gov/ut/st/en/fo/moab/MLP/deis.html. Accessed January 2016.

Burnett, Paul

2010 Archaeological Sensitivity Model for the Willow Central Geophysical Exploration Project, Chambers, Galveston, Jefferson, and Liberty Counties, Texas. *Unpublished report prepared for Samson Lone Star, LLC.*

2012 Minimizing Impacts to Archaeological Sites on Private Land. Poster presented at the 70th Plains Anthropological Conference, Saskatoon, Saskatchewan.

2013 Disaster Plan: Probability Modeling in Northwest Colorado. Poster presented at the 78th Annual Society for American Archaeology Meeting, Honolulu, Hawaii.

2014 Adaptive Management in the Niobrara Oil Play: Probability Modeling for Cultural Resources. Poster presented at the 79th Annual Society for American Archaeology Meeting, Austin, Texas.

Burnett, Paul, John Kennedy, Lee Brannon, Darcee Killpack, Chris Millington, Guy Hepp, Courtney Higgins, and James Brechtel

2009 *Archaeological Sensitivity Model and Class III Inventory for the Cedar Ridge Area, Fremont and Natrona Counties, Wyoming.* Prepared by SWCA Environmental Consultants, Denver, Colorado. Copies available from Wyoming State Historic Preservation Office, Laramie.

Burnett, Paul, Lawrence Todd, Zane Eggett, and Erik Otárola-Castillo

2016 Improving Discovery-Based Probability Models for the Shoshone National Forest, Wyoming. Poster presented at the 81st Annual Society for American Archaeology Meeting, Orlando, Florida.

Cannon, Mike, Paul Burnett, Christine Michalczuk, Kiera Westwater and Rob D'Andrea

2016 A Cultural Resource Planning Model for the Moab Master Leasing Plan. Prepared by SWCA Environmental Consultants, Salt Lake City. Copies available from the Bureau of Land Management, Moab Field Office, Moab, Utah.

Casarotto, Anita, Armando De Guio, Francesco Ferrarese, and Giovanni Leonardi

2011 A GIS-Based Archaeological Predictive Model for the Study of Protohistoric Location-Allocation Strategies (Eastern Lessinia, VR/VI). *IpoTESI di Preistoria* 4:1–24.

Heilen, Michael, Phillip O. Leckman, Adam Byrd, Jeffrey A. Homburg, and Robert A. Heckman.

2013 *Archaeological Sensitivity Modeling in Southern New Mexico*. Copies available from U.S. Bureau of Land Management, Denver Federal Center.

Horizon Systems Corporation

2015 NHD Plus. Available at: http://www.horizon-systems.com/NHDPlus/index.php. Accessed January 8, 2015.

Hosmer, David W., and Stanley Lemeshow

2000 *Applied Logistic Regression*. Second ed. John Wiley, New York.

IMACS

1992 *Intermountain Antiquities Computer System User's Guide*. Available at: http://anthro.utah.edu/labs/imacs.php. Accessed November 5, 2015.

Jochim, Michael A.

1976 *Hunter-Gatherer Subsistence and Settlement: A Predictive Model.* Academic Press, New York.

Kohler, Timothy A., Thomas P. des Geans, Carl Feiss, and Don E. Thompson

1980 *An Archaeological Survey of Selected Areas of the Fort Benning Military Reservation, Alabama and Georgia.* Remote Sensing Analysts. Submitted to the Heritage Conservation and Recreatgion Service. Copies available from Interagency Archaeological Services, Atlanta.

Kvamme, Kenneth, L.

1980 Predictive Model of Site Location in the Glenwood Springs Resource Area. In *Class II Cultural Resource Inventory of the Glenwood Springs Resource Area, Grand Junction District, Colorado.* Unpublished manuscript on file at the Bureau of Land Management, Grand Junction Field Office.

1983 A Manual for Predictive Site Location Models. Examples from the Grand Junction District, Colorado. Report submitted to the Bureau of Land Management, Grand Junction District.

1988a Using Existing Archaeological Survey Data for Model Building. . In *Quantifying the Present and Predicting the Past: Theory, Method, and Application of Archaeological Predictive Modeling*, edited by W. J. Judge and Lynne Sebastian, pp. 301–324. U.S. Government Printing Office, Washington, D.C.

1988b Development and Testing of Quantitative Models. In *Quantifying the Present and Predicting the Past: Theory, Method, and Application of Archaeological Predictive Modeling*, edited by W. J. Judge and Lynne Sebastian, pp. 325–428. U.S. Government Printing Office, Washington, D.C.

1992 A Predictive Site Location Model on the High Plains: An Example with an Independent Test. *Plains Anthropologist* 37:19–40.

2006 There and Back Again: Revisiting Archaeological Locational Modeling. In *GIS and Archaeological Site Location Modeling*, edited by Mark. W. Mehrer and Konnie L. Wescott, pp. 41–62. Taylor and Francis, New York.

Langston, Lucinda M.

2013 Site Location Modeling and Prehistoric Rock Shelter Selection on the Upper Cumberland Plateau of Tennessee. *Electronic Theses and Dissertations.* Paper 1157. Available at: http://dc.etsu.edu/etd/1157. Accessed May 31, 2016.

Larralde, Signa L. and Susan M. Chandler

1981 *Archaeological Inventory in the Seep Ridge Cultural Study Tract, Uintah County, Northeastern Utah.* Bureau of Land Management Cultural Resource Series No. 11.

Lee, Kang-In, and John J. Koval

1997 Determination of the Best Significance Level in Forward Stepwise Logistic Regression. *Communications in Statistics – Simulation and Computation* 26:559–575.

Lock, Gary, and Trevor Harris

2006 Enhancing Predictive Archaeological Modeling: Integrating Location, Landscape, and Culture. In *GIS and Archaeological Site Location Modeling*, edited by Mark. W. Mehrer and Konnie L. Wescott, pp. 41–62. Taylor and Francis, New York.

Lundell, Michael J.

2012 The Road Ahead: Creating a Cultural Resource Inventory Plan for the Kanab Field Office Routes, Unpublished M.A. Thesis, Department of Anthropology, Northern Arizona University, Flagstaff. Also available online from ProQuest at http://gradworks.umi.com/15/18/1518030.html.

Mosteller, F., and J. W. Tukey

1977 *Data Analysis and Regression.* Addison-Wesley, Reading, Massachusetts.

Natural Resources Conservation Service (NRCS)

2006 Digital General Soil Map of U.S. U.S. Department of Agriculture, Natural Resources Conservation Service, Fort Worth, Texas. Available at: http://websoilsurvey.nrcs.usda.gov. Accessed May 24, 2016.

Neyman, Jerzy, and Egon S. Pearson

1933a On the Problem of the Most Efficient Tests of Statistical Hypotheses. *Philosophical Transactions of the Royal Society* 231:281–337.

1933b The Testing of Statistical Hypotheses in Relation to Probabilities A Priori. *Proceedings of the Cambridge Phuilopsophical Society* 24:492–510.

Peduzzi, Peter N., Robert J. Hardy, and Theodore R. Holford

1980 A Stepwise Variable Selection Procedure for Nonlinear Regression Models. *Biometrics* 36:511–516.

Schroedl, Alan R.

1988 Site Location and Predictive Modelling. In *The Tar Sands Project: An Inventory and Predictive Model for Central and Southern Utah,* edited by Betsy L. Tipps. Bureau of Land Management Cultural Resource Series No. 22.

Stopher, Peter R., and Arnim H. Meyburg

1979 Survey Sampling and Multivariate Analysis for Social Scientists and Engineers. Lexington Books, Lexington, Massachusetts.

U.S. Census Bureau, Geography Division

2010 Processed TIGER 2010 Streets. Available at: https://gdg.sc.egov.usda.gov/. Accessed January 2016.

U.S. Department of Agriculture and Natural Resources Conservation Service

2011 2011 National Land Cover Dataset. Available at: https://gdg.sc.egov.usda.gov/. Accessed January 2016.

U.S. Environmental Protection Agency (US EPA)

2009 Level IV Ecoregions of the Coterminous United States. Western Ecology Division, Corvallis, Oregon. Available at: ftp://ftp.epa.gov/wed/ecoregions/us/Eco_Level_IV_US.zip. Accessed January 2016.

U.S. Geological Survey

2005 State Geologic Maps. Available at: https://gdg.sc.egov.usda.gov/. Accessed May 19, 2016.

2015a National Elevation Dataset. Available at: http://ned.usgs.gov. Accessed January 2016.

2015b Geographic Names Information System, Non-Populated Places. Available at: https://gdg.sc.egov.usda.gov/. Accessed May 19, 2016.

Utah State University (USU)

2004a Provisional Digital Landcover Dataset for the Southwestern United States. RS/GIS Laboratory, College of Natural Resources, Utah State University. Available at: http://earth.gis.usu.edu/swgap/. Accessed May 20, 2016.

2004b Ten Class DEM Derived Landform for the Southwest United States. RS/GIS Laboratory, College of Natural Resources, Utah State University. Available at: http://earth.gis.usu.edu/swgap/. Accessed May 20, 2016.

Utah Automated Geographic Reference Center

2014 City, County, and State Boundaries GIS Data Layer. Available at: http://gis.utah.gov/data/boundaries/citycountystate/. Accessed October 5, 2015.

Warren, Robert E.

1990 Predictive Modeling in Archaeology: A Primer. In *Interpreting Space: GIS and Archaeology*, edited by Kathleen M. Allen, Stanton W. Green, and Ezra B. W. Zubrow, pp. 90–111. Taylor & Francis, London.

Zier, Christian J., William M. Loker, Denise P. Fallon, and John Bradley

1981 Prehistoric Settlement Factors in the Medicine Bow Area of Wyoming. *Wyoming Archaeologist* 84:86–112

This page intentionally blank

CHAPTER 9. SUGGESTED CULTURAL RESOURCE USE ALLOCATIONS AND MANAGEMENT OPTIONS

R. Kelly Beck, Mike Cannon, and Ralph Burrillo

The principal goal of the Class I effort presented in the previous chapters has been to summarize and synthesize available cultural resources information for the MFO planning area to provide direction for future research in the region and to help the BLM make important and difficult management decisions with the benefit of the most current information available. This final chapter brings these goals together by presenting discussions of the BLM's cultural resource use allocation protocol outlined in *BLM Manual Section 8110 – Identifying and Evaluating Cultural Resources* (Bureau of Land Management 2004) and suggesting which site types, as classified by the IMENSITY routine described in Chapter 7 (Cultural Resource Site Management Classification), may best match each use category. The chapter concludes with a discussion of a few key conflicts between anticipated land use and cultural resources, and outlines some options for managing those conflicts.

9.1 Cultural Resource Use Allocations

The BLM Manual Section 8110 (Bureau of Land Management 2004) describes six different use categories to which cultural resource localities are to be assigned: 1) scientific use, 2) conservation for future use, 3) traditional use, 4) public use, 5) experimental use, and 6) discharged from management. The manual also provides guidance for preparing statements in support of use allocations (Bureau of Land Management 2002:9–11). Management decisions to assign sites to a specific use category can be made on a site-by-site basis, or can be made by reference to classes of site types. Using the cultural resource site classification described in Chapter 7 (Cultural Resource Site Management Classification), this section briefly summarizes each cultural resource use category and then discusses the site types that are likely to be included in each use category.

9.1.1 Cultural Resource Site Classification

The larger objectives of the MFO Class I inventory necessitate that cultural resource sites be classified into categories that are useful for analytical and management purposes. This was done using an original classification methodology that SWCA has developed specifically for Utah BLM Class I inventories, as fully described in Chapter 7 (Cultural Resource Site Management Classification). The methodology allows for systematic and replicable classification of sites to types using data collected from Intermountain Antiquities Computer System (IMACS) site forms. The IMACS site form contains a field for "site type," but data entered into this field are so variable and inconsistent that they are of limited use for either scientific or management purposes. To classify sites in a more useful and consistent manner for the MFO Class I inventory, "raw data" from other fields of the IMACS site form were used in an explicit and systematic classification schema implemented by a Microsoft Excel macro that SWCA calls IMENSITY (IMacs ENcoding SIte TYping). IMACS data were used by IMENSITY to assign each site to a specific site type listed in Table 9-1.

Table 9-1. IMENSITY Site Types for Prehistoric and Historic Sites/Components

IMENSITY Site Type (PType)	Site Class
Sheltered Architectural Residential	Prehistoric
Sheltered Architectural Non-residential	Prehistoric
Sheltered Non-architectural	Prehistoric
Open Architectural	Prehistoric
Open Artifact Scatter with Thermal Feature(s)	Prehistoric
Open Lithic Scatter with Thermal Feature(s)	Prehistoric
Open Artifact Scatter	Prehistoric
Open Lithic Scatter	Prehistoric
Lithic Source	Prehistoric
Quarry	Prehistoric
Rock Art	Prehistoric
Isolated Thermal Feature(s)	Prehistoric
Isolated Other Feature(s)	Prehistoric
Isolated Artifact	Prehistoric
Other/Unknown	Prehistoric
Architectural-Residential	Historic
Architectural-Farming/Ranching	Historic
Architectural-Mining	Historic
Architectural-General Industrial	Historic
Architectural-Community	Historic
Architectural-Other	Historic
Artifact Scatter with Thermal Feature(s)	Historic
Artifact Scatter	Historic
Trail/Road with Artifacts	Historic
Trail/Road without Artifacts	Historic
Railroad	Historic
Mining	Historic
Transmission	Historic
Water Control	Historic
Cemetery/Burial	Historic
Rock or Tree Art	Historic
Isolated Thermal Feature(s)	Historic
Isolated Other Features	Historic
Isolated Artifact	Historic
Other/Unknown	Historic

9.1.2 Scientific Use

Sites allocated for scientific use are suitable for additional study using current analytical methods to address scientifically relevant research objectives provided by individual researchers or from background sources such as agency planning documents or historic context studies (Bureau of Land Management 2002:10). For this reason, these sites typically are those that contain or are likely to contain those data necessary to address one or more relevant research questions. These sites often have intact archaeological deposits, though it is not necessary for such deposits to be present for relevant research data to be available. Often, these sites have large and varied artifact assemblages with characteristics that are readily classifiable using current analytical methods. Sites that may be allocated for scientific use are frequently considered eligible for the National Register of Historic Places (NRHP) under Criterion D, but they may be considered eligible for other NRHP criteria as well.

Chapter 6 (Cultural Resource Synthesis and Future Research Directions) summarizes a number of key research themes for both prehistoric and historic archaeological sites found in the MFO planning area. These major research themes follow closely with ongoing and emergent research themes common in the broader archaeological, anthropological, and historical research communities. Sites found in the MFO planning area that could yield relevant data for one or more of these research themes could be allocated for scientific use. Sites discussed in Chapter 5 (Cultural Resource Overview) and Chapter 6 (Cultural Resource Synthesis and Future Research Directions) have the potential to address these research issues. Nearly any of the IMENSITY site types could yield such data, and for this reason—with the exception of isolated artifacts or isolated features—site type alone is not a useful determinant for deciding whether a given site should be allocated for research use or not.

9.1.3 Conservation for Future Use

Sites allocated to conservation for future use are those that are singularly rare or have unique characteristics that cannot be readily or adequately studied with current analytical methods. Sites in this use category could include those of particular historical, architectural, or cultural significance and "should be based on future long-term goals and information needs as discussed in Bureau planning documents, Class I Regional Overviews, historic context studies, and other background documents" (Bureau of Land Management 2002:10). Sites in the MFO planning area that could be allocated to conservation for future use include numerous rock art sites for which limited modern technology is incapable of establishing confident chronologies, including the iconic pictograph panels of Courthouse Wash and Sego Canyon; any of the known historic water control sites, such as 42GR3063; or cattle camps and associated trails. Allocation of a site for conservation for future use is not exclusive with allocation to other uses, because singularly unique or particularly important localities could also be allocated for traditional use (as could be a likely scenario for certain traditional cultural places [TCPs]), or allocated for public use (as could be the case for particularly well known and highly visible rock art localities). IMENSITY site types to which such unique sites could be assigned may include sheltered or open prehistoric architectural sites, prehistoric rock art sites, any historic architectural site, historic sites directly and clearly associated with any one of the region's major historical themes (e.g., mining, agriculture, and trails), or historic cemeteries.

9.1.4 Traditional Use

Sites allocated for traditional use are those that are considered culturally or socially important by a specific social, ethnic, or cultural group (Bureau of Land Management 2002:10). Such sites may have been designated as a TCP, but such designation is not necessary for allocation as traditional use. In the MFO planning area, the rock art and material archaeology of Arches National Park make it a culturally important location to the Hopi, Zuni, Ute, and Southern Paiute (Stoffle et al. 2016), and specific sites within or near the park could be allocated for traditional use. Culturally important sites allocated for traditional use should be managed so as to maintain, unimpaired, those characteristics of the locality that

contribute to its significance. Because sites allocated for traditional use are those that achieve importance principally through their social and/or cultural context, differentiating between IMENSITY site types that may or may not have sites appropriate for allocation as traditional use is challenging and, indeed, is likely not a useful exercise.

9.1.5 Public Use

Sites allocated for public use are those with characteristics that make them particularly suited for on-site interpretation, education, or recreational use. Recreation specialists should be involved when sites are being considered for this use category (Bureau of Land Management 2002:10). Examples of sites that could be allocated for public use include the Thompson Wash Rock Art District, the rock art panels of Potash and Kane Creek Roads, and the Old Spanish Trail. In the MFO planning area, several potential site types are present that are particularly amenable to public use; these include rock art localities, standing historical features that are associated with important themes, and even prehistoric village or habitation sites. IMENSITY site types that may be conducive for public use sites are quite similar to those that may be allocated for conservation for future use; these include sheltered or open prehistoric architectural sites, prehistoric rock art sites, any historic architectural sites, and historic sites directly and clearly associated with any one of the region's major historical themes.

9.1.6 Experimental Use

This use category is assigned to sites that are suited for well-designed and well-controlled experimental study (Bureau of Land Management 2002:10–11). Whereas the primary intent of allocation for scientific study is to address important archaeological or historical research questions, allocation for experimental use is intended to be used at those sites where scientific experimentation and study can provide important information regarding management of localities as cultural resources. Such experimental investigations might include study of erosional geomorphological processes and their effect on surface artifact movement, recreational site visitation characteristics, or site access modalities (e.g., pedestrian access, motorized access, or horseback access). A particularly striking example of such a study (though unpublished) comes from former BLM Richfield Field Office archaeologist Craig Harmon's study of site erosion at sites avoided during a post-fire rehabilitation and revegetation project in the mid-1990s (Harmon 2011). Because all cultural resource types require some management by the BLM, experimental study at any one of the IMENSITY site types could provide useful management direction to the agency. For this reason, sites classified to any IMENSITY site type could be allocated for experimental use.

9.1.7 Discharged from Management

The final use allocation category is reserved for those localities for which no further conceivable use is apparent (Bureau of Land Management 2002:11). Sites discharged from management may include those that do not maintain characteristics consistent with NRHP eligibility or those for which investigation and documentation have completely and fully exhausted the site's information potential. In practical terms, sites that are determined by the BLM to be non-significant and therefore not NRHP eligible are effectively allocated to the discharged from management use category. Such sites are often (though not necessarily by default) small prehistoric or historic artifact scatters, open surface sites of any age, and isolated features or artifacts that are not formally documented as archaeological sites. It is important to note that discharge of a site from management simply removes a locality from active management consideration but does not eliminate that site from BLM concern. Allocating a site for discharge from management is not equivalent to the site being no longer of archaeological interest as outlined in the Archaeological Resources Protection Act (ARPA). Sites that have been discharged from management are still BLM properties subject to ARPA protection from looting and vandalism.

9.2 Suggested Management Options

The BLM MFO actively manages 1.8 million acres of the larger 2.9-million-acre MFO planning area for multiple-use as directed by the Federal Land Policy and Management Act of 1976 (Public Law 94-579). The MFO's land management decisions must additionally comply with several planning documents that also require the application of multiple-use principles. Planning documents that are currently in effect for the MFO or that may be in the future include a resource management plan and master leasing plans (MLPs) for minerals development. Two MLPs are in preparation: the Moab MLP and the Cisco Desert MLP. Under its multiple-use mandate, the BLM must consider a disparate range of potential uses such as economic development (e.g., oil and gas development, ranching, and mining), recreation, and preservation (e.g., Wilderness Study Areas and Areas of Critical Environmental Concern), among many others. As these potential uses intersect, MFO managers are faced with the challenges of considering the effects of those uses on cultural resources, as required by statute and by agency policy. Although there are many uses of MFO-managed land that could pose conflicts with cultural resources, the MFO faces two significant challenges, in particular, as it works to 1) manage minerals development and 2) manage recreation, including backcountry access on the area's many four-wheel-drive roads and trails and other travel routes.

Management of potential conflicts between cultural resources and minerals development is likely to be a major challenge that the MFO will face in the coming years. In the planning area, the main forms of minerals development that currently occur and that can be anticipated in the future are exploration and production activities for oil and gas and for potash. The scale of the management challenge posed by these activities is illustrated by observing that over 1.4 million acres of BLM-administered land within the MFO planning area are currently under lease or subject to lease for oil and gas extraction, while almost 60,000 acres are under lease or subject to lease for potash mining. The BLM's role in minerals development is to conduct minerals leasing actions for specific parcels and then to conduct permitting actions for exploration and production activities that developers may choose to pursue on leased parcels. Both leasing actions and permitting actions are subject to review under applicable environmental laws such as the National Environmental Policy Act (NEPA) and Section 106 of the National Historic Preservation Act (NHPA). The MLPs currently being prepared by the MFO are intended in large part to manage conflicts between leasing and permitting actions and a variety of other resources and uses, including cultural resources. The MLPs are themselves also subject to review under NEPA and the NHPA.

The archaeological planning model developed in Chapter 8 (Moab Field Office Planning Area Predictive Model and Future Inventory Strategy) provides some insight into potential conflicts between minerals development and cultural resources. (A separate analysis not discussed here does the same for the Moab MLP (Cannon et al. 2016).) The planning model suggests that 138,995 acres of land that is highly sensitive (i.e., has a high probability for the occurrence of NRHP-eligible cultural resource sites) fall within areas that are currently under or subject to lease for oil and gas development. This represents approximately 57 percent of the 243,261 acres of high sensitivity area within the MFO planning area. Current potash lease areas contain 11,054 acres of high sensitivity area, or approximately 5 percent of all high sensitivity area within the planning area. The Cisco Desert MLP area, which overlaps with current oil and gas lease areas, contains 17,669 acres of high sensitivity area, or just over 7 percent of all high sensitivity area within the planning area. Importantly, cultural resources within much of these current and potential future lease areas may be subject to leasing stipulations that confer some degree of protection to them (e.g., no surface occupancy stipulations). The planning model developed here may be useful for identifying areas that have a high potential for the presence of significant cultural resources and that accordingly may merit such stipulations in future leasing actions.

Another major challenge for management of cultural resources in the MFO planning area is the effect of increased public contact with sensitive localities as a result of increased access. Ease of access is afforded by the area's many travel routes, and the effects of this access are greatly enhanced by the region's attractiveness for recreational use. The Moab area has positioned itself as a destination for tourism since the early twentieth century (see Chapter 5 [Cultural Resource Overview]), and this has famously intensified in recent decades as outdoor recreation has become a cornerstone of the area's economy. Along with the economic benefits that may come with recreational activities—which largely revolve around four-wheel-drive travel and non-motorized travel in the MFO planning area—come significant conflicts with cultural resources. According to a recent *Federal Register* report, the BLM has noted greatly increasing visitation and resulting pressures in recreational areas that have a high density of archaeological sites (Bureau of Land Management 2016a). The number of incidents of vandalism as a result of recreational access and use of areas with sensitive archaeological sites appears to be steadily growing as a consequence, especially at the numerous rock art sites that lie within easy access from Moab. In 2001, vandals completely destroyed the Blue Buffalo rock art panel near Mill Canyon (Blake 2001). In 2011, BLM archaeologists reported vandalism at the Moab Owl rock art site and at rock art sites in Moonflower Canyon, Courthouse Wash, and Sego Canyon (Church 2011).

The archaeological planning model presented in this report provides further insight into the challenges related to conflicts between recreational access and cultural resources in the MFO planning area. This model suggests that there are 50,739 acres of high sensitivity area located within 200 meters of a travel route, representing approximately 21 percent of all high sensitivity areas in the planning area. To help manage potential impacts to significant cultural resource sites related to their proximity to travel routes, the MFO could examine the final planning model developed for this Class I inventory on a road-by-road or undertaking-by-undertaking basis in order to identify routes or sites that might merit special attention.

The planning model could also be used in the planning of Special Recreation Management Areas (SRMAs), which the BLM has designated to better manage visitation. The MFO has designated six SRMAs: Canyon Rims, Colorado Riverway, Dolores River Canyons, Indian Creek, Labyrinth Rims/Gemini Bridges, and South Moab. In many of these SRMAs, management plans include limiting use of off-highway vehicles (OHVs) to existing trails, and, in some cases, also include constructing recreational facilities that would likely direct use away from known cultural resources. As the BLM considers the design of recreational facilities and selects specific trails for OHV use, the planning model can provide an educated guess about the potential for conflict with cultural resources. Using the model as a guide, the BLM could design facilities and designate trails to avoid, as much as practical, areas of expected high archaeological sensitivity. For SRMAs as a whole, the planning model could be used to identify high-priority areas for more-intensive cultural resources investigations with either probabilistic sampling surveys or intensive-level surveys for cultural resources.

The BLM has recently implemented a program called "Respect and Protect" in collaboration with an organization called "Tread Lightly!" to bring more public attention to cultural resources (Bureau of Land Management 2016b). Working together through the Respect and Protect program, these groups seek to engage the public in the protection of our nation's shared cultural heritage. A number of specific initiatives are proposed for the Respect and Protect program including communicating key public awareness issues through partnerships to construct and maintain trailhead kiosks and interpretive sites at targeted localities. The MFO area contains an abundance of cultural resource sites that could make excellent public interpretive sites. Specifically, well-known resources such as the Old Spanish National Historic Trail, the Antoine Robidoux inscription, Sego Canyon/Thompson Springs rock art, Kane Creek rock art, the Denver and Rio Grande Western Railroad, and the region's major transportation corridors along Highway 6 and Highway 50.

Finally on the subject of management options, Chapter 8 (Moab Field Office Planning Area Predictive Model and Future Inventory Strategy) presents recommendations to guide future cultural resource inventory strategies and project planning strategies in the MFO planning area. These recommendations are summarized here and apply to any management decisions that the BLM must make—whether related to challenges from minerals development or recreation or whether related to other land and resource uses. For planning-level actions, the BLM could examine the planning model presented in this report to identify areas that are modeled to have a high probability for significant archaeological sites and then direct targeted, on-the-ground inventories at those areas to better understand the cultural resources within them. This would likely enable the majority of significant cultural resources within the area to be identified at the planning stage, without incurring the expense of an intensive inventory of the entire area. The BLM or project proponents could also use the planning model during the alternatives selection or siting phases of an undertaking, and areas modeled to have a high probability for significant cultural resources could be avoided during project design in order to minimize impacts on cultural resources and the expense of mitigating those impacts. Efforts should also be made, to the extent possible, to direct future inventories toward areas where previous survey coverage is light, particularly the northwest and east-central parts of the planning area (see section 4.2 in Chapter 4 [Prior Cultural Resource Investigations]). Inventories in lightly studied areas should result in improvements to the planning model, which is not intended to be static, and, more importantly, to the knowledge base the BLM has available for making cultural resource management decisions.

9.3 References Cited

Blake, Catherine S.

2001 Blue Buffalo Art Destroyed. Available at: http://www.deseretnews.com/article/865273/Blue-Buffalo-art-destroyed.html?pg=all. Accessed June 29, 2016.

Bureau of Land Management

2002 *Bureau of Land Management Guidelines for Identifying Cultural Resources, Handbook H-8110*. Bureau of Land Management, Salt Lake City, Utah.

2004 Bureau of Land Management Manual, Section 8110 – Identifying and Evaluating Cultural Resources (Public). Available at: http://www.blm.gov/style/medialib/blm/wo/Information_Resources_Management/policy/blm_manual.Par.23101.File.dat/8110.pdf. Accessed January 5, 2015.

2016a Final Supplementary Rules for Public Lands Managed by the Moab and Monticello Field Offices in Grand and San Juan Counties, UT. *Federal Register* 81(37):9499-9505.

2016b Respect and Protect: A Public Awareness Campaign to Eliminate the Looting and Vandalism of Archaeological, Paleontological, and Natural Resources in Utah, Communications Plan. Available at: https://www.treadlightly.org/wp-content/uploads/2016/05/Respect-and-Protect-Comm-Plan-5-4-16.pdf. Accessed August 24, 2016.

Cannon, Mike, Paul Burnett, Christine Michalczuk, Kiera Westwater and Rob D'Andrea

2016 *A Cultural Resource Planning Model for the Moab Master Leasing Plan*. Prepared by SWCA Environmental Consultants, Salt Lake City. Copies available from the Bureau of Land Management, Moab Field Office, Moab, Utah.

Church, Lisa J.

2011 BLM Investigating Vandalism at Moab Rock Art Site. Available at: http://www.moabtimes.com/view/full_story/16931298/article-BLM-investigating-vandalism-at-Moab-rock-art-site. Accessed June 29, 2016.

Harmon, Craig B.

2011 The Effect of Range Fires on Surface Artifact Scatters in Western Utah. In *Archaeology in 3D: Deciphering Buried Sites in the Western U.S.*, edited by M. T. Seddon, H. Roberts and R. V. N. Ahlstom, pp. 85–98. Society for American Archaeology Press, Washington, D.C.

Stoffle, Richard W., Evelyn Pickering, Katherine Brooks, Kathleen Van Vlack and Christopher Sittler

2016 *Ethnographic Overview and Assessment for Arches National Park*. Final Report Draft January 2016. Copies available from the Bureau of Applied Research in Anthropology, School of Anthropology, University of Arizona, Tucson.

A Class I Cultural Resource Inventory of Lands Administered by the Bureau of Land Management, Moab Field Office

Part 1: Regional Overview

APPENDIX A

Project Database Overview

Table A-1. Content of Access Database Table "FINAL: MFO Sites"

Field	Example	Description
SiteNumber_Long	42EM000866	*Standard Smithsonian trinomial; leading zeros added by SWCA*
SiteNumber_Short	42EM866	*Standard Smithsonian trinomial; no leading zeros*
Landownership	USFS	*Primary landownership of the site*
Comments	Site same as 42EM000800	*Any comments about the site that would impact data collection and analysis.*
Site _Classified	Yes/No	*Indicates whether or not the site was classified. If the site was not classified then data was not available.*
Predictive_Model	Yes/No	*Indicates whether or not the site was included in the modeling.*
Year_Recorded	1981	*The year the site was recorded*
Organization	UH	*The recording organization*
Eligibility	D	*NRHP Eligibility*
Class	Prehistoric	*Site Class (derived from IMENSITY macro output)*
Northing	4204372	*Northing (Center)*
Easting	566044	*Easting (Center)*

Table A-2. Content of Access Database Table "FINAL: MFO Projects"

Field Name	Example	Description
State_Project	U00A10570	*Standard State of Utah project number issued by the Antiquities Section of UDSH*
Project_Title	White Wash OHV Study	*A shortened version of the full report title*
Survey_Method	Complete Inventory	*The survey method type*
Organization	Alpine Archaeological Consultants	*The name of the reporting organization*
Predictive_Model	Yes/No	*Indicates whether or not the project was included in the modeling.*

Table A-3. Content of Access Database Table "ANALYSIS: MFO Site Classification Results"

Field	Description
SiteNumber_Long	*Standard Smithsonian trinomial; leading zeros added by SWCA*
Prehistoric	*Prehistoric component present; Yes No*
Historic	*Historic component present; Yes No*
PRockArt	*Prehistoric rock art present; Yes No*
HRockTreeArt	*Historic rock or tree art present; Yes No*
PType	*Prehistoric site type*
HType	*Historic site type*
PSheltered	*Site Type = Prehistoric Sheltered; Yes No*
POpenFeatures	*Site Type = Prehistoric Open Feature; Yes No*
POpenNoFeatures	*Site Type = Prehistoric Open No Features; Yes No*
HArchitectural	*Site Type = Historic Architectural-Residential/Farming/Ranching; Yes No*
HArtScatter	*Site Type = Historic Artifact Scatter; Yes No*

Table A-4. Content of Access Database Table "ANALYSIS: MFO Site Classification Data"

Field	Description
SiteNumber_Long	*Standard Smithsonian trinomial; leading zeros added by SWCA*
Cond	
Impcts1	
Impcts2	
Impcts3	
Topo2	
PCult1	
PDatMeth1 (not used in site typing)	
PCult2 (not used in site typing)	
PDatMeth2 (not used in site typing)	
PArtif1	
PArtif2	
PArtif3	
PArtif4	
PArtif5	
PArtif6	
Tools1	
Tools2	
Tools3	
Tools4	
Tools5	
Tools6	
Dbqty	
PCeram1	
PCeram2	
PCeram3	
PCeram4	
PCeram5	
PCeram6	
PFeat1	
PFeat2	
PFeat3	
PArchTyp1	
PArchTyp2	
PArchTyp3	

Table A-4. Content of Access Database Table "ANALYSIS: MFO Site Classification Data"

Field	Description
HTheme1	
HTheme2 (not used in site typing)	
HCult1 (not used in site typing)	
HDatMeth1 (not used in site typing)	
HCult2 (not used in site typing)	
HDatMeth2 (not used in site typing)	
HArtif1	
HArtif2	
HArtif3	
HArtif4	
HArtif5	
HArtif6	
HArtif7	
HArtif8	
HArtif9	
HFeat1	
HFeat2	
HFeat3	
HArchTyp1	
HArchTyp2	
HArchTyp3	
HArchTyp4	
HArchTyp5	
HArchTyp6	

Table A-5. Attribute Fields in CURES View Data for Sites

Field Name	Description	Field Entry Options
SmithTri*	*Standard Smithsonian trinomial - no leading zeros*	N/A
NR_SHPO_Opinion_Code*	*NRHP Eligibility IMACS code from site form*	See NRHP eligibility codes in IMACS Guide
NR_SHPO_JUSTIFICATION	*The justification statement (?)*	N/A
DATE_ENTERED	*The date the data were created.*	N/A
DATE_FINALIZED	*The date the data were finalized/uploaded.*	N/A
SDELoad	*The date the data were finalized/uploaded into the SDE database.*	N/A

Table A-5. Attribute Fields in CURES View Data for Sites

Field Name	Description	Field Entry Options
HposAcc	*How accurate are the data? Sub-meter, meter? Default is set to "Unknown High." If the level of accuracy is known, select the appropriate value from the drop down)*	<1m
		<10m
		<20m
		<100m
		UnknownLow
		UnknownHigh
		UnknownUnknown
HposSrc	*How were the data generated? GPS, 24k map plot, 100k map plot? default is set to "USGS Map Scale 24K." If the source of the data is otherwise (e.g. 100k georeferenced map, or GPS) select the appropriate value from the drop down.*	GPS
		Survey Instrument
		USGS Map Scale 24,000
		USGS Map Scale 62,500
		USGS Map Scale 100,000
		Aliquot
		Asserted
		Other
		Unknown
OrgCode*	*The two character IMACS code used for the reporting organization*	See organization codes in IMACS Guide
State_Project_Number*	*The associated standard State of Utah project number issued by the Antiquities Section of UDSH*	N/A
site_admin_notes	*Notes from SHPO*	N/A

**Used for RFO Class I project data population and analysis.*

Table A-6. Attribute Fields from Encoding Data Used for Data Population and Analysis

Field Name	Description	Field Entry Options
SmithTri	*Standard Smithsonian trinomial*	N/A
NR	*NRHP Eligibility*	See NRHP elig bility codes in IMACS Guide
Organ	*The recording organization*	See organization codes in IMACS Guide
Survdate	*The date the site was recorded*	N/A

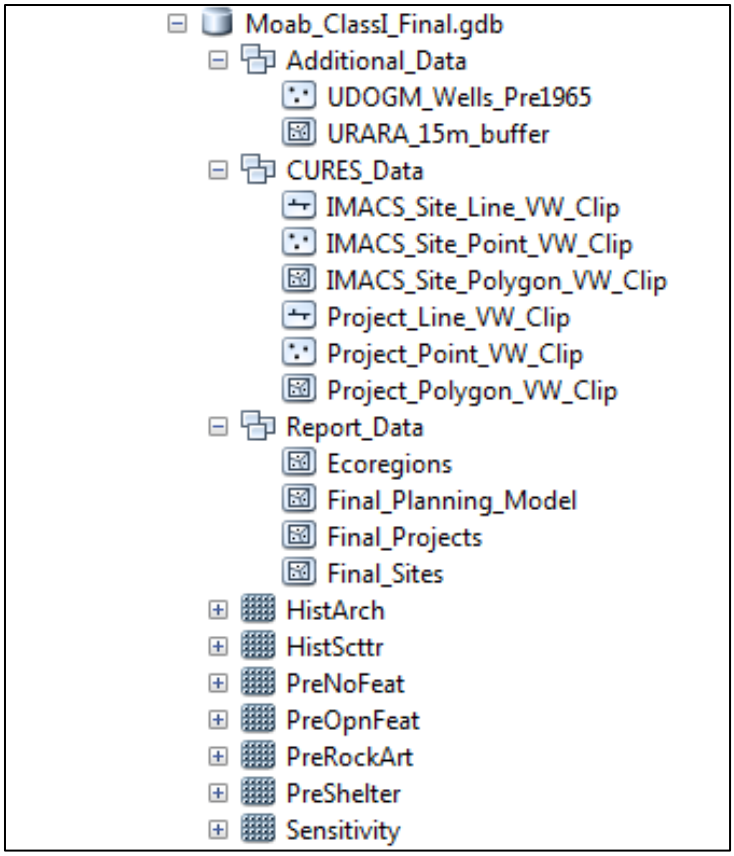


Figure A-1. Structure of MFO Class I project geodatabase.

Table A-7. Content of Attribute Table for Geodatabase "Final_Sites" Feature Class

Field Name	Example	Description
ObjectID	1	*Number automatically generated by the database*
Shape	Polygon	*Type of shapefile*
SmithTri	42GA001444	*Smithsonian Trinomial*
Shape_Length	94.128233	*Length of shape, but may not reflect the actual project area length (in meters)*
Shape_Area	703.27558	*Area of shape (in square meters)*

Table A-8. Content of Attribute Table for Geodatabase "Final_Projects" Feature Class

Field Name	Example	Description
ObjectID	1	*Number automatically generated by the database*
Shape	Polygon	*Type of shapefile*
State_Project_Number	U00AS0411	*Utah State Antiquities Project Number*
Shape_Length	13732.74225	*Length of shape, but may not reflect the actual project area length (in meters)*
Shape_Area	215225.2102	*Area of shape (in square meters)*

Table A-9. Content of Attribute Table for Geodatabase "Final_Planning_Model" Feature Class

Field Name	Example	Description
ObjectID	1	*Number automatically generated by the database*
Shape	Polygon	*Type of shapefile*
gridcode	1	*The archaeological sensitivity level: 1 – Low, 2 – Medium, 3 – High.*
Shape_Length	94.128233	*Length of shape, but may not reflect the actual project area length (in meters)*
Shape_Area	703.27558	*Area of shape (in square meters)*

A Class I Cultural Resource Inventory of Lands Administered by the Bureau of Land Management, Moab Field Office

Part 1: Regional Overview

APPENDIX B

Environmental Variable Abbreviations and Probability Model Equations

Appendix B-1. Continuous Variable Abbreviations used in model equations.

Abbreviation	Variable Description
dem	raw elevation
r500	relative elevation within 500 m
sol100	solar radiation (x 100)
slp100	slope (x 100)
n100	degrees from north (x 100)
e100	degrees from east (x 100)
stream	path distance to natural streams
flow	path distance to all flowlines (including artificial - historic models only)
cost1000	cost surface (x 1000)
spg	path distance to springs
conf	path distance to stream confluences
wtrbdy_nat	path distance to natural waterbodies
wtrbdy_all	path distance to all waterbodies (including artificial - historic models only)
names	path distance to named geographic features
road	path distance to roads (historic models only)
int	path distance to road intersections (historic models only)

Appendix B-2. Categorical Variables Abbreviations used in model equations.

Abbreviation	Variable Description
lc(x)_1	Presence of land cover type (x)
lc(x)_0	Absence of land cover type (x)
lc2	Rocky Mountain Alpine Bedrock and Scree
lc5	Rocky Mountain Cliff and Canyon
lc9	Colorado Plateau Mixed Bedrock Canyon and Tableland
lc10	Inter-Mountain Basins Shale Badland
lc11	Inter-Mountain Basins Active and Stabilized Dune
lc22	Rocky Mountain Aspen Forest and Woodland
lc26	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland
lc28	Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland
lc30	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland
lc32	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland
lc34	Rocky Mountain Ponderosa Pine Woodland
lc36	Colorado Plateau Pinyon-Juniper Woodland
lc38	Inter-Mountain West Aspen-Mixed Conifer Forest and Woodland Complex

Appendix B-2. Categorical Variables Abbreviations used in model equations.

Abbreviation	Variable Description
lc40	Inter-Mountain Basins Mat Saltbush Shrubland
lc41	Rocky Mountain Gambel Oak-Mixed Montane Shrubland
lc42	Rocky Mountain Lower Montane-Foothill Shrubland
lc46	Colorado Plateau Pinyon-Juniper Shrubland
lc48	Inter-Mountain Basins Big Sagebrush Shrubland
lc50	Colorado Plateau Mixed Low Sagebrush Shrubland
lc53	Colorado Plateau Blackbrush-Mormon-tea Shrubland
lc58	Inter-Mountain Basins Mixed Salt Desert Scrub
lc62	Inter-Mountain Basins Montane Sagebrush Steppe
lc67	Inter-Mountain Basins Semi-Desert Shrub Steppe
lc70	Rocky Mountain Subalpine Mesic Meadow
lc71	Southern Rocky Mountain Montane-Subalpine Grassland
lc76	Inter-Mountain Basins Semi-Desert Grassland
lc77	Rocky Mountain Subalpine-Montane Riparian Shrubland
lc79	Rocky Mountain Lower Montane Riparian Woodland and Shrubland
lc82	Inter-Mountain Basins Greasewood Flat
lc83	North American Warm Desert Riparian Woodland and Shrubland
lc85	North American Arid West Emergent Marsh
lc86	Rocky Mountain Alpine-Montane Wet Meadow
lc104	Wyoming Basins Low Sagebrush Shrubland
lc108	Southern Colorado Plateau Sand Shrubland
lc110	Open Water
lc113	Barren lands
lc114	Agriculture
lc115	Disturbed
lc117	Mined or Quarried
lc118	Invasive Southwest Riparian Woodland and Shrubland
pre_lc48	Inter-Mountain Basins Big Sagebrush Shrubland and Agriculture land (prehistoric models only)
lf(x)_1	Presence of landform (x)
lf(x)_0	Absence of landform (x)
lf1	valley flats (or water bodies)
lf2	toe slopes, bottoms, and swales
lf3	gently sloping ridges and hills
lf4	nearly level plateaus or terrace
lf5	very moist steep slopes
lf6	moderately moist steep slopes
lf7	moderately dry slopes

Appendix B-2. Categorical Variables Abbreviations used in model equations.

Abbreviation	Variable Description
lf8	very dry steep slopes
lf9	cool aspect scarps, cliffs, canyons
lf10	hot aspect scarps, cliffs, canyons
r(x)_1	Presence of rock type (x)
r(x)_0	Absence of rock type (x)
r1	alluvium
r2	conglomerate
r3	diorite
r4	eolian
r5	evaporite
r6	fine-grained mixed clastic
r7	glacial drift
r8	landslide
r9	limestone
r10	metamorphic rock
r11	mudstone
r12	sandstone
r13	shale
r14	water

Appendix B-3. Equations for the Preferred Archaeological Predictive Models (Probability = 1 / (1 + Exp[Linear Combination])

Site Type	Model	Linear Combination
Historic Architectural	Benches and Canyons	8.50218047221863 + -0.0137791157151931 * "flow" + -0.00595493275235936 * "road" + 0.000724202199067747 * "dem" + 0.00432943936863903 * "r500" + -0.000097423628178359 * "solar100" + -0.0001725322971313 29 * "cost1000" + 0.0113358244795327 * "int" + -0.0011016408752941 * "spg" + 0.00836144190959621 * "conf" + 0.0000557832544854017 * "names" + -0.208466265025809 * "r4_0" + 0.208466265025809 * "r4_1" + 0.22863584944905 * "r8_0" + -0.22863584944905 * "r8_1" + -1.08656053696401 * "r9_0" + 1.08656053696401 * "r9_1" + -1.22773094258448 * "r10_0" + 1.22773094258448 * "r10_1" + -0.12045048564139 * "r12_0" + 0.12045048564139 * "r12_1" + -0.955265200316109 * "r14_0" + 0.955265200316109 * "r14_1" + -0.163891979374788 * "lf1_0" + 0.163891979374788 * "lf1_1" + 0.102902224191771 * "lf4_0" + -0.102902224191771 * "lf4_1" + -0.364555150830879 * "lf5_0" + 0.364555150830879 * "lf5_1" + -0.650500774049595 * "lf9_0" + 0.650500774049595 * "lf9_1" + 0.221255098514262 * "lc9_0" + -0.221255098514262 * "lc9_1" + 0.560504633741538 * "lc40_0" + -0.560504633741538 * "lc40_1" + -1.08204845964984 * "lc41_0" + 1.08204845964984 * "lc41_1" + -0.088622254355546 * "lc48_0" + 0.088622254355546 * "lc48_1" + 0.146193491647288 * "lc58_0" + -0.146193491647288 * "lc58_1" + -0.705416689265845 * "lc67_0" + 0.705416689265845 * "lc67_1" + 0.211476819157137 * "lc76_0" + -0.211476819157137 * "lc76_1" + 0.23863491726978 * "lc79_0" + -0.23863491726978 * "lc79_1" + 0.286227709789318 * "lc82_0" + -0.286227709789318 * "lc82_1" + -1.03303517532173 * "lc108_0" + 1.03303517532173 * "lc108_1" + -0.451514927357702 * "lc114_0" + 0.451514927357702 * "lc114_1" + -1.49645352051752 * "lc115_0" + 1.49645352051752 * "lc115_1"
	Deserts	4.77476124086495 + -0.0961409289991303 * "flow" + 0.128863161088244 * "road" + -0.00203987274288328 * "dem" + -0.000881915508765266 * "slp100" + 0.00107117900213088 * "n100" + -0.000306626304162178 * "cost1000" + 0.133404976655759 * "int" + 0.0171158392109184 * "spg" + 0.00941536479304943 * "wtrbdy_all" + -0.0253250102675861 * "conf" + 0.000156100434906697 * "names" + -0.417214841102463 * "r1_0" + 0.417214841102463 * "r1_1" + -0.485939039320254 * "r4_0" + 0.485939039320254 * "r4_1" + -0.265259255028827 * "lf4_0" + 0.265259255028827 * "lf4_1" + -1.09855935331711 * "lc9_0" + 1.09855935331711 * "lc9_1" + -0.460244805720987 * "lc10_0" + 0.460244805720987 * "lc10_1" + -1.81594760304815 * "lc11_0" + 1.81594760304815 * "lc11_1" + -0.539457592723164 * "lc40_0" + 0.539457592723164 * "lc40_1" + -0.43019712931526 * "lc53_0" + 0.43019712931526 * "lc53_1"
	Escarpments	13.0263455018358 + -0.0757311471680596 * "flow" + -0.000722483581140758 * "solar100" + -0.00103935466424893 * "n100" + -0.00145951769042148 * "cost1000" + 0.0458770011370845 * "int" + 0.0254527963550318 * "wtrbdy_all" + 0.0731391279436146 * "conf" + 0.000092732881769 7479 * "names" + 2.12994155744602 * "r12_0" + -2.12994155744602 * "r12_1" + -1.11100357972797 * "lf3_0" + 1.11100357972797 * "lf3_1" + -2.00137718760142 * "lc9_0" + 2.00137718760142 * "lc9_1" + 2.77776469065456 * "lc36_0" + -2.77776469065456 * "lc36_1" + 2.18388511940147 * "lc46_0" + -2.18388511940147 * "lc46_1"
	Forests	-3.37275611988688 + -0.0293421579453803 * "flow" + 0.110125866944918 * "road" + 0.0677257165127391 * "r500" + -0.00129267618412697 * "n100" + -0.000595620307783449 * "cost1000" + 0.0291597665824227 * "int" + 0.00653469370725558 * "spg" + 0.0108873032593592 * "wtrbdy_all" + -0.0253904684881579 * "conf" + -0.00032001746402177 * "names" + 0.987990678743483 * "r11_0" + -0.987990678743483 * "r11_1" + 1.03273260718386 * "r12_0" + -1.03273260718386 * "r12_1" + 0.890975254665953 * "r13_0" + -0.890975254665953 * "r13_1" + 0.60841162642206 * "lf2_0" + -0.60841162642206 * "lf2_1" + 0.736880578881195 * "lf7_0" + -0.736880578881195 * "lf7_1" + 1.84891191101851 * "lc2_0" + -1.84891191101851 * "lc2_1" + 2.60645388157823 * "lc5_0" + -2.60645388157823 * "lc5_1" + -0.966848368132861 * "lc34_0" + 0.966848368132861 * "lc34_1" + 1.18808786412169 * "lc36_0" + -1.18808786412169 * "lc36_1" + 1.31447375827583 * "lc114_0" + -1.31447375827583 * "lc114_1"

Appendix B-3. Equations for the Preferred Archaeological Predictive Models (Probability = 1 / (1 + Exp[Linear Combination])

Site Type	Model	Linear Combination
Historic Artifact Scatter	Benches and Canyons	-0.545618085343127 + 0.0220661809489371 * "road" + -0.0119482741158001 * "r500" + 0.000281169817763261 * "slp100" + 0.000256739600048096 * "e100" + -0.000204990815133898 * "cost1000" + 0.0143216924666059 * "conf" + 0.68232175411403 * "r8_0" + -0.68232175411403 * "r8_1" + -1.48213420765138 * "r9_0" + 1.48213420765138 * "r9_1" + -1.5612739497544 * "r11_0" + 1.5612739497544 * "r11_1" + 0.272195729586941 * "r12_0" + -0.272195729586941 * "r12_1" + -0.443720822235865 * "lf1_0" + 0.443720822235865 * "lf1_1" + 0.30299569628859 * "lf3_0" + -0.30299569628859 * "lf3_1" + 1.93879291525551 * "lf10_0" + -1.93879291525551 * "lf10_1" + 0.515934759290603 * "lc9_0" + -0.515934759290603 * "lc9_1" + 0.31540259036236 * "lc36_0" + -0.31540259036236 * "lc36_1" + 0.559802077751693 * "lc40_0" + -0.559802077751693 * "lc40_1" + 0.663783029366746 * "lc41_0" + -0.663783029366746 * "lc41_1" + -0.249365260515765 * "lc58_0" + 0.249365260515765 * "lc58_1" + 0.771306026378824 * "lc82_0" + -0.771306026378824 * "lc82_1" + -0.698006521333777 * "lc114_0" + 0.698006521333777 * "lc114_1"
	Deserts	8.16167592397476 + -0.0303390492867593 * "flow" + 0.15613106976174 * "road" + -0.00298073969064617 * "dem" + -0.0903792708768665 * "r500" + -0.00049923663366089 * "solar100" + 0.000689545166868509 * "slp100" + -0.000281347171555 * "n100" + -0.000511926863141303 * "cost1000" + -0.0129553225796925 * "int" + 0.00367953023166047 * "spg" + 0.00455852644700006 * "wtrbdy_all" + 0.0271487721328549 * "conf" + -0.000110892559080062 * "names" + 0.129255752590208 * "r4_0" + -0.129255752590208 * "r4_1" + -0.280406824901776 * "lf1_0" + 0.280406824901776 * "lf1_1" + 0.2375009717609 * "lf2_0" + -0.2375009717609 * "lf2_1" + -0.318053566646908 * "lf4_0" + 0.318053566646908 * "lf4_1" + 1.42326102916008 * "lc11_0" + -1.42326102916008 * "lc11_1" + 0.476149128539518 * "lc40_0" + -0.476149128539518 * "lc40_1" + 0.861227018706866 * "lc46_0" + -0.861227018706866 * "lc46_1" + 0.685595796099974 * "lc48_0" + -0.685595796099974 * "lc48_1" + 1.03336445068023 * "lc58_0" + -1.03336445068023 * "lc58_1" + 0.326675687637416 * "lc76_0" + -0.326675687637416 * "lc76_1" + 0.801432017665929 * "lc82_0" + -0.801432017665929 * "lc82_1" + 1.07390702237747 * "lc108_0" + -1.07390702237747 * "lc108_1" + -0.801505931471872 * "lc115_0" + 0.801505931471872 * "lc115_1"
	Escarpments	59.4032312123958 + 0.0553257667748043 * "flow" + 0.0127251612855361 * "dem" + -0.0757168645850304 * "r500" + -0.00557110576860074 * "solar100" + 0.00399857534263902 * "slp100" + 0.0169655656323433 * "conf" + -1.11408548528689 * "r13_0" + 1.11408548528689 * "r13_1" + -1.16007616313191 * "lf4_0" + 1.16007616313191 * "lf4_1" + -3.12495582153314 * "lf6_0" + 3.12495582153314 * "lf6_1" + 1.65140752962148 * "lc46_0" + -1.65140752962148 * "lc46_1" + 1.45403111251603 * "lc53_0" + -1.45403111251603 * "lc53_1" + 2.1458593337636 * "lc62_0" + -2.1458593337636 * "lc62_1"
	Forests	-53.4377656375328 + -0.0636944898547464 * "flow" + 0.0174534110340882 * "dem" + 0.00359844072243744 * "slp100" + 7.9653920827105 * "r3_0" + -7.9653920827105 * "r3_1" + 0.288608273939354 * "lf4_0" + -0.288608273939354 * "lf4_1" + 2.15914186553821 * "lf6_0" + -2.15914186553821 * "lf6_1" + 1.52760524710911 * "lc32_0" + -1.52760524710911 * "lc32_1" + 1.30403086735506 * "lc36_0" + -1.30403086735506 * "lc36_1" + 1.98528317026153 * "lc62_0" + -1.98528317026153 * "lc62_1"

Appendix B-3. Equations for the Preferred Archaeological Predictive Models (Probability = 1 / (1 + Exp[Linear Combination])

Site Type	Model	Linear Combination
Prehistoric Open Artifact Scatter	Benches and Canyons	0.512346429225333 + -0.000766396353472178 * "dem" + -0.0146831046623058 * "r500" + 0.000164721267127654 * "solar100" + 0.000377526511880058 * "slp100" + -0.00021468453555848 * "n100" + 0.0000798708946669452 * "e100" + -0.00297415072956356 * "stream" + -0.000122704332487957 * "cost1000" + 0.000240888476332491 * "spg" + 0.00759389901708273 * "conf" + 0.000437409001891736 * "wtrbdy_nat" + 0.0000580170890361534 * "names" + 0.281441921494084 * "lc9_0" + -0.281441921494084 * "lc9_1" + 0.11253560240207 * "lc10_0" + -0.11253560240207 * "lc10_1" + 0.776174494240365 * "lc11_0" + -0.776174494240365 * "lc11_1" + -0.967353025835977 * "lc34_0" + 0.967353025835977 * "lc34_1" + 0.305152643198431 * "lc36_0" + -0.305152643198431 * "lc36_1" + 0.361491401697336 * "lc40_0" + -0.361491401697336 * "lc40_1" + -0.328566812015798 * "lc41_0" + 0.328566812015798 * "lc41_1" + -0.0744728259964799 * "pre_lc48_0" + 0.0744728259964799 * "pre_lc48_1" + 0.163880380681909 * "lc53_0" + -0.163880380681909 * "lc53_1" + 0.0776680491235808 * "lc58_0" + -0.0776680491235808 * "lc58_1" + -1.3421963861647 * "lc62_0" + 1.3421963861647 * "lc62_1" + -0.153676719814431 * "lc67_0" + 0.153676719814431 * "lc67_1" + 0.291674055945887 * "lc76_0" + -0.291674055945887 * "lc76_1" + -0.360147868063452 * "lc79_0" + 0.360147868063452 * "lc79_1" + 0.0496495239634059 * "lc82_0" + -0.0496495239634059 * "lc82_1" + -0.417762944021819 * "lc110_0" + 0.417762944021819 * "lc110_1" + -0.491110428166495 * "lc115_0" + 0.491110428166495 * "lc115_1" + -1.33010986396786 * "lc117_0" + 1.33010986396786 * "lc117_1" + 0.313635715404263 * "lf2_0" + -0.313635715404263 * "lf2_1" + 0.386529838334835 * "lf3_0" + -0.386529838334835 * "lf3_1" + 0.171203824058516 * "lf4_0" + -0.171203824058516 * "lf4_1" + -0.060286417096949 * "lf5_0" + 0.060286417096949 * "lf5_1" + 0.104978533560002 * "lf7_0" + -0.104978533560002 * "lf7_1" + 0.456792033832183 * "lf8_0" + -0.456792033832183 * "lf8_1" + -0.328699814282818 * "lf9_0" + 0.328699814282818 * "lf9_1" + 0.385027355850099 * "lf10_0" + -0.385027355850099 * "lf10_1" + 1.36293150542627 * "r2_0" + -1.36293150542627 * "r2_1" + 0.325832868573322 * "r4_0" + -0.325832868573322 * "r4_1" + 0.288960927539461 * "r5_0" + -0.288960927539461 * "r5_1" + 0.0712357317203477 * "r8_0" + -0.0712357317203477 * "r8_1" + -0.394102541376119 * "r10_0" + 0.394102541376119 * "r10_1" + -0.299995908699075 * "r11_0" + 0.299995908699075 * "r11_1" + 0.406579749868013 * "r12_0" + -0.406579749868013 * "r12_1" + 0.0877269766112717 * "r13_0" + -0.0877269766112717 * "r13_1" + -0.189898104617424 * "r14_0" + 0.189898104617424 * "r14_1"
	Deserts	-4.64137899771344 + 0.00703395407661617 * "dem" + 0.0116694884732845 * "r500" + -0.00030017907457244 * "solar100" + 0.00027000374287693 * "slp100" + 0.000397581566871744 * "n100" + 0.000219623488475197 * "e100" + -0.0568178974460115 * "stream" + -0.000254948676271653 * "cost1000" + 0.0182340561041679 * "wtrbdy_nat" + 0.0000751205405723376 * "names" + -0.26241667598736 * "lc9_0" + 0.26241667598736 * "lc9_1" + -0.299441591897684 * "lc40_0" + 0.299441591897684 * "lc40_1" + 0.820094194294105 * "lc46_0" + -0.820094194294105 * "lc46_1" + -1.40802092130782 * "lc67_0" + 1.40802092130782 * "lc67_1" + 0.432341811475281 * "lc118_0" + -0.432341811475281 * "lc118_1" + -0.211786720152939 * "lf2_0" + 0.211786720152939 * "lf2_1" + -0.127194090529941 * "lf4_0" + 0.127194090529941 * "lf4_1" + -0.722201702105934 * "lf6_0" + 0.722201702105934 * "lf6_1" + 0.522639184966532 * "r4_0" + -0.522639184966532 * "r4_1" + 0.117702227077389 * "r12_0" + -0.117702227077389 * "r12_1"
	Escarpments	4.55301791158068 + -0.0134781318830457 * "r500" + -0.000359634614839291 * "solar100" + -0.000446344682990457 * "n100" + 0.0214577682199778 * "stream" + -0.000198734556645569 * "cost1000" + 0.00414933129045087 * "wtrbdy_nat" + 0.000156612767643086 * "names" + 0.495045323095113 * "lc36_0" + -0.495045323095113 * "lc36_1" + -0.813659246328454 * "pre_lc48_0" + 0.813659246328454 * "pre_lc48_1" + 1.42992652758232 * "lc76_0" + -1.42992652758232 * "lc76_1" + 0.352341087805576 * "lf4_0" + -0.352341087805576 * "lf4_1" + -0.406876347854895 * "lf6_0" + 0.406876347854895 * "lf6_1" + 0.983661072202442 * "r12_0" + -0.983661072202442 * "r12_1"
	Forests	-1.33323794251754 + -0.00716610693170722 * "r500" + 0.00102964965124857 * "slp100" + -0.000324012269340398 * "n100" + -0.000340552281540254 * "e100" + 0.0221651916354479 * "stream" + -0.000311717632223616 * "cost1000" + -0.0000668338268008986 * "names" + -0.182323261934624 * "lc34_0" + 0.182323261934624 * "lc34_1" + 0.78004309643748 * "lc36_0" + -0.78004309643748 * "lc36_1" + 0.879647168168501 * "lc46_0" + -0.879647168168501 * "lc46_1" + 0.606062417683285 * "pre_lc48_0" + -0.606062417683285 * "pre_lc48_1" + 0.603979940921998 * "lc62_0" + -0.603979940921998 * "lc62_1" + -0.830244257904093 * "lf6_0" + 0.830244257904093 * "lf6_1" + 0.986368569916381 * "lf10_0" + -0.986368569916381 * "lf10_1" + 0.506547103805957 * "r8_0" + -0.506547103805957 * "r8_1"

Appendix B-3. Equations for the Preferred Archaeological Predictive Models (Probability = 1 / (1 + Exp[Linear Combination])

Site Type	Model	Linear Combination
Prehistoric Open with Features	Benches and Canyons	-19.2250847251765 + 0.00139878666239825 * "dem" + -0.00857058161237051 * "r500" + -0.000127000441344123 * "solar100" + -0.000164249573661464 * "n100" + 0.000209599200064483 * "e100" + -0.0051128687039178 * "stream" + -0.000152342171759873 * "cost1000" + -0.00245136597608766 * "spg" + 0.0123131148397271 * "conf" + 0.00061851969554413 * "wtrbdy_nat" + 1.53029384934074 * "lc5_0" + -1.53029384934074 * "lc5_1" + 1.33691192438363 * "lc9_0" + -1.33691192438363 * "lc9_1" + 0.709803340436704 * "lc10_0" + -0.709803340436704 * "lc10_1" + 1.49300847734207 * "lc11_0" + -1.49300847734207 * "lc11_1" + 0.889619870155195 * "lc34_0" + -0.889619870155195 * "lc34_1" + 1.60352327048476 * "lc36_0" + -1.60352327048476 * "lc36_1" + 0.906629142740856 * "lc40_0" + -0.906629142740856 * "lc40_1" + 1.7414533815181 * "lc41_0" + -1.7414533815181 * "lc41_1" + 1.25096419520999 * "lc46_0" + -1.25096419520999 * "lc46_1" + 1.24333809246469 * "pre_lc48_0" + -1.24333809246469 * "pre_lc48_1" + 0.944926268262428 * "lc53_0" + -0.944926268262428 * "lc53_1" + 0.881405747886509 * "lc58_0" + -0.881405747886509 * "lc58_1" + 1.15486318835515 * "lc67_0" + -1.15486318835515 * "lc67_1" + 1.08985362816568 * "lc76_0" + -1.08985362816568 * "lc76_1" + 1.1963046830226 * "lc79_0" + -1.1963046830226 * "lc79_1" + 1.0484882248449 * "lc82_0" + -1.0484882248449 * "lc82_1" + 2.57500112508815 * "lc83_0" + -2.57500112508815 * "lc83_1" + 1.2343896234573 * "lc108_0" + -1.2343896234573 * "lc108_1" + 0.582714342132356 * "lc110_0" + -0.582714342132356 * "lc110_1" + 1.09816769622981 * "lc118_0" + -1.09816769622981 * "lc118_1" + -0.0399080413895077 * "lf1_0" + 0.0399080413895077 * "lf1_1" + 0.115014894115536 * "lf2_0" + -0.115014894115536 * "lf2_1" + 0.280965291704569 * "lf3_0" + -0.280965291704569 * "lf3_1" + 0.234364274600411 * "lf4_0" + -0.234364274600411 * "lf4_1" + -0.25688775439716 * "lf5_0" + 0.25688775439716 * "lf5_1" + 0.278213088204265 * "lf9_0" + -0.278213088204265 * "lf9_1" + 0.465332726490023 * "lf10_0" + -0.465332726490023 * "lf10_1" + -0.114779173600991 * "r4_0" + 0.114779173600991 * "r4_1" + -0.36410897485213 * "r5_0" + 0.36410897485213 * "r5_1" + -0.163106775657483 * "r8_0" + 0.163106775657483 * "r8_1" + -1.94022811916282 * "r10_0" + 1.94022811916282 * "r10_1" + -0.13439041690658 * "r13_0" + 0.13439041690658 * "r13_1"
	Deserts	0.819283914257628 + -0.000870133370805372 * "n100" + 0.0314940909060742 * "conf" + 0.440520495976435 * "lc58_0" + -0.440520495976435 * "lc58_1" + 0.888485436193389 * "lf2_0" + -0.888485436193389 * "lf2_1" + 0.617833250292393 * "lf3_0" + -0.617833250292393 * "lf3_1" + 0.844697433590969 * "r1_0" + -0.844697433590969 * "r1_1" + 0.720732155629503 * "r4_0" + -0.720732155629503 * "r4_1" + -1.59519572081289 * "r12_0" + 1.59519572081289 * "r12_1"
	Escarpments	-8.58548704293257 + 0.000787825161783676 * "cost1000" + 0.0321500636523158 * "conf" + 0.0254085234217976 * "wtrbdy_nat" + 0.000239951560513081 * "names" + 2.62571476330891 * "lf10_0" + -2.62571476330891 * "lf10_1" + 1.21719721070478 * "r12_0" + -1.21719721070478 * "r12_1"
	Forests	-45.6267983981886 + 0.0189992028884675 * "dem" + -0.0425000176783186 * "r500" + -0.00341127975614054 * "spg" + 0.0105515466528387 * "conf" + 0.00918030458021886 * "wtrbdy_nat" + 0.000232374645519065 * "names" + 2.24592649675128 * "lc5_0" + -2.24592649675128 * "lc5_1" + -1.68848419808411 * "r4_0" + 1.68848419808411 * "r4_1" + 1.23768333956427 * "r11_0" + -1.23768333956427 * "r11_1"

Appendix B-3. Equations for the Preferred Archaeological Predictive Models (Probability = 1 / (1 + Exp[Linear Combination])

Site Type	Model	Linear Combination
Prehistoric Rock Art	Benches and Canyons	1.03630563834382 + 0.00274030803073494 * "dem" + 0.00618652916984204 * "r500" + -0.000515225409477208 * "n100" + -0.0277958541847771 * "stream" + -0.000716860394694059 * "cost1000" + -0.00184104957442654 * "spg" + 0.0200836159104587 * "conf" + -0.000059453742143791 * "names" + 0.290365982234945 * "lc9_0" + -0.290365982234945 * "lc9_1" + 0.450842550312747 * "lc76_0" + -0.450842550312747 * "lc76_1" + -0.441558952537638 * "lf1_0" + 0.441558952537638 * "lf1_1" + -0.675771317917255 * "lf4_0" + 0.675771317917255 * "lf4_1" + -0.50858445471687 * "lf5_0" + 0.50858445471687 * "lf5_1" + -0.62420348210477 * "r13_0" + 0.62420348210477 * "r13_1"
	Deserts	-16.7627739712498 + 0.0132128823724022 * "dem" + 0.218676608003159 * "r500" + -0.00161431168744576 * "slp100" + -0.218350723881262 * "stream" + 0.11190369773511 * "wtrbdy_nat"
	Escarpments	6.53203718343713 + -0.0377216670882736 * "r500" + -0.000289420481147925 * "solar100" + -0.00106445952907083 * "n100" + 0.00115698977573662 * "e100" + -0.000790487537390703 * "cost1000" + 0.0184499695224055 * "spg" + 0.0655257418618587 * "conf" + 0.00302296438145663 * "wtrbdy_nat" + -0.000596148123998505 * "names" + 2.66837747518116 * "lc9_0" + -2.66837747518116 * "lc9_1" + 1.90482351294849 * "lc36_0" + -1.90482351294849 * "lc36_1" + 2.24724343912677 * "lc46_0" + -2.24724343912677 * "lc46_1" + 1.73599022658952 * "pre_lc48_0" + -1.73599022658952 * "pre_lc48_1" + 1.2274798359854 * "lc53_0" + -1.2274798359854 * "lc53_1" + 1.57779232918936 * "lc58_0" + -1.57779232918936 * "lc58_1" + 1.13421604775157 * "lc82_0" + -1.13421604775157 * "lc82_1" + 0.82452736608712 * "lf2_0" + -0.82452736608712 * "lf2_1" + 0.546484609359208 * "lf6_0" + -0.546484609359208 * "lf6_1" + -11.4076243433197 * "lf9_0" + 11.4076243433197 * "lf9_1" + 0.684748955816431 * "lf10_0" + -0.684748955816431 * "lf10_1" + 1.18649722777449 * "r1_0" + -1.18649722777449 * "r1_1" + 1.74075072167224 * "r12_0" + -1.74075072167224 * "r12_1" + -0.450894083976134 * "r13_0" + 0.450894083976134 * "r13_1"
	Forests	-2913.84584689769 + 1.27520168627772 * "dem" + -43.2298655617561 * "lf3_0" + 43.2298655617561 * "lf3_1"
Prehistoric Sheltered	Benches and Canyons	-2.14846935045965 + 0.00167413748907601 * "dem" + -0.00019890225445949 * "slp100" + -0.000281353065791019 * "n100" + 0.000297041754641564 * "e100" + -0.00964215625189126 * "stream" + -0.000567014454607028 * "cost1000" + 0.0163214667196882 * "conf" + -0.00363977092707082 * "wtrbdy_nat" + -0.0000381838451598725 * "names" + 0.296122204103196 * "lc9_0" + -0.296122204103196 * "lc9_1" + 0.591916951503846 * "lc40_0" + -0.591916951503846 * "lc40_1" + 0.217993447723195 * "lc53_0" + -0.217993447723195 * "lc53_1" + 0.476318735770804 * "lc67_0" + -0.476318735770804 * "lc67_1" + 0.736844410675526 * "lc76_0" + -0.736844410675526 * "lc76_1" + 0.369311631150395 * "lc79_0" + -0.369311631150395 * "lc79_1" + -0.468803503670757 * "lf5_0" + 0.468803503670757 * "lf5_1" + -0.193110263915289 * "lf6_0" + 0.193110263915289 * "lf6_1" + -0.522268522390174 * "r9_0" + 0.522268522390174 * "r9_1" + -0.470259211114686 * "r11_0" + 0.470259211114686 * "r11_1" + 0.256340070327164 * "r12_0" + -0.256340070327164 * "r12_1" + 1.36929367174069 * "r14_0" + -1.36929367174069 * "r14_1"
	Deserts	-48.4473353830219 + 0.0256764536291461 * "dem" + 0.105955806427717 * "wtrbdy_nat" + 0.000256911632343059 * "names" + 5.60742431943011 * "lc46_0" + -5.60742431943011 * "lc46_1" + 1.18742015225714 * "lc76_0" + -1.18742015225714 * "lc76_1" + 4.3118243295449 * "lf7_0" + -4.3118243295449 * "lf7_1"
	Escarpments	2.62934545152849 + 0.00755908880031831 * "dem" + -0.000593038477896733 * "solar100" + -0.0015353294584023 * "cost1000" + 1.09936462219545 * "r12_0" + -1.09936462219545 * "r12_1"
	Forests	-35.8637047343242 + 0.0168234387580402 * "dem" + -0.0369813275734574 * "r500" + -0.000707731604254319 * "cost1000"

From: Howard, Stephanie
Subject: Monument Butte EIS Record of Decision is now available
Date: Friday, September 30, 2016 2:35:20 PM
Attachments: MBROD 20160930 Final.pdf
Attachment 8 Form 1842-001.pdf

Hi,

You are receiving this message because you have commented on the Monument Butte Final EIS. The BLM has just signed our Record of Decision for this project. You can access the ROD on the project's BLM NEPA register web page at the following address. For your convenience I have also attached it to this email. Thank you for your interest in your public lands.

http://go.usa.gov/xqjTJ

Stephanie Howard
NEPA Coordinator

Bureau of Land Management
Vernal Field Office
170 S 500 E
Vernal, UT 84078
phone (435) 781-4469
fax (435) 781-4410

RECORD OF DECISION

for

Newfield Exploration Company
Monument Butte Oil and Gas Development Project

in Uintah and Duchesne Counties, Utah

UT-G010-2009-0217

DOI-BLM-UT-G010-2016-0065

U.S. Department of Interior
Bureau of Land Management
Vernal Field Office

170 South 500 East

Vernal, Utah 84078

2016

This Page Intentionally Left Blank

Contents

Newfield Exploration Company Monument Butte Oil and Gas Development Project 1
1. Approval 1
2.0 Summary 3
3.0 The Decision 5
3.1 What the Decision Includes 5
3.1.1 The Selected Alternative 5
3.1.2 Big Wash Lands with Wilderness Characteristics Submission 7
3.2 What the Decision Does Not Include 7
3.2.1 Decisions on Lands or Minerals other than BLM-Administered 8
3.2.2 Site-Specific Permits 8
3.2.3 Acquired Land in the Pariette ACEC 8
3.2.5 FEIS Mitigation Measures Not Carried Forward as ROD COAs 8
4.0 Management Considerations 11
4.1 Purpose and Need 11
4.2 Conformance with BLM Land Use Plans, Laws, and Policy 11
4.3 Consistency with Other Plans, Statutes, and Objectives 12
4.4 Alternatives 13
4.4.1 Alternative A: Proposed Action 13
4.4.2 Alternative B: No Action (Environmentally Preferable Alternative) 14
4.4.3 Alternative C: Field-Wide Electrification 14
4.4.4 DEIS Alternative D: Original Resource Protection (Agency Preferred Alternative) 15
4.4.5 FEIS Alternative D: Resource Protection (Agency Preferred Alternative) 16
4.5 Consultation and Coordination 17
4.5.1 Cooperating Agencies 17
4.5.2 Air Resource Coordination 18
4.5.3 NHPA Section 106 Consultation and Government to Government Consultation 18
4.5.4 ESA Section 7 Consultation 19
4.6 Public Involvement 20
4.6.1 Public Scoping 20
4.6.2 Draft EIS 21

4.6.3 Final EIS 22
5.0 Appeal Process 25
6.0 Literature Cited 27
Attachment 1: Maps and Figures 29
Attachment 2: Data Collection and Reporting Requirements and Conditions of Approval 37
Attachment 3: Air Mitigation Strategy – Applicant Committed Environmental Protection Measures 89
Attachment 4: Final Cactus Conservation and Mitigation Strategy 95
Attachment 5: Biological Opinion 117
Attachment 6: Comment Responses 131
Attachment 7: Errata 159
Attachment 8: Appeals Form 1842-1 167

1. Approval

I approve the Monument Butte Oil and Gas Development Project as described in the Decision section of this document (Section 3) and the maps and figures in Attachment 1, subject to the Data Collection and Reporting Requirements and Conditions of Approval contained in Attachment 2, which are formed from the FEIS, the Air Quality Strategy (Attachment 3), the Final Cactus Strategy (Attachment 4), and the Biological Opinion (Attachment 5).

Approved By:

SEP 3 0 2016

Jenna Whitlock
Acting State Director

Date

This Page Intentionally Left Blank

2.0 Summary

Pursuant to Section 102(2)(C) of the National Environmental Policy Act of 1969, the United States (U.S.) Bureau of Land Management (BLM) Vernal Field Office has prepared a Final Environmental Impact Statement on the impacts of proposed oil and natural gas development within the Greater Monument Butte Project Area (MBPA) (Attachment 1). The MBPA is located in southeastern Duchesne County and southwestern Uintah County. The MBPA consists of approximately 119,743 acres of Federal, State, and private lands. The Bureau of Land Management Utah State Director is the Authorized Officer for this decision. Implementation of the Decision has been delegated to the Vernal Field Office and/or the Green River District.

Newfield Exploration Company (Newfield) notified the BLM Vernal Field Office on January 14, 2009 of its need and plan to expand their ongoing oil and natural gas development within the MBPA. This Record of Decision (ROD) documents the BLM's final decision regarding Newfield's plan (Section 3) as well as the BLM's management considerations (Section 4) in making the decision including: purpose and need of the project, conformance of the project with existing Land Use Plans, the potential impacts of the proposed oil and natural gas development under the four alternatives as documented in the Final Environmental Impact Statement (FEIS), outcomes of the consultations undertaken for the project, and responses to public comments on the FEIS (Attachment 6) and the resulting FEIS errata (Attachment 7). The form to be completed by any party adversely affected by and wishing to appeal the Decision is included as Attachment 8.

This Page Intentionally Left Blank

3.0 The Decision

BLM has determined that the analysis contained in the FEIS is adequate for the purposes of reaching an informed decision regarding implementation of Newfield's plan on BLM-administered lands or minerals. However, all components of the selected alternative as described below are subject to further site-specific permitting and NEPA requirements. Newfield must obtain federal, state, and local permits, along with right-of-way (ROW)[1] grants, licenses, easement agreements, and other authorizing actions to proceed with all project-related development.

3.1 What the Decision Includes

The decision is hereby made to allow oil and natural gas drilling on leased federal lands as described in the FEIS Section 2.6 Alternative D – Agency Preferred Alternative subject to the attached Conditions of Approval (hereafter referred to as the Selected Alternative). The Selected Alternative is programmatically depicted in Map 2-4 included in Attachment 1 of this ROD. The Conditions of Approval are listed in Attachment 2: Data Collection and Reporting Requirements and Conditions of Approval, and formed from the FEIS, the Air Quality Strategy in Attachment 3, the Final Cactus Strategy in Attachment 4, and the Biological Opinion in Attachment 5.

3.1.1 The Selected Alternative

The Selected Alternative includes the following primary components.

1) Wells and facility development and construction in the project area as described in FEIS Section 2.6 including:

    a. Development of up to 750 new Green River vertical oil wells to be drilled from a combination of new, small and large well pads, all of which would eventually be converted into waterflood injection wells;

    b. Development of up to 2,500 new deep gas wells that would be vertically or directionally drilled from a combination of new and existing, large well pads;

    c. Development of up to 2,500 new 20-acre downhole spacing Green River oil production wells to be directionally drilled from a combination of new or existing, small and large well pads;

    d. Construction of up to 226 miles of new 100-foot-wide ROWs that would be used for new road construction (40-foot width) and pipeline installation (60-foot width).

    e. Construction of ROWs up to 70-foot-width adjacent to approximately 318 miles of existing roads ROWs for road upgrade (10-foot width) and pipeline installation (60-

[1] Throughout this document, the term ROW is used to generically indicate infrastructure corridors, for example pipelines and roads that may or may not require an actual ROW grant.

foot width);

f. Construction of 20 new compressor stations for deep gas well development;

g. Expansion of three existing Green River oil well compressor stations and construction of one new compressor station for gas associated with Green River oil well development;

h. Construction of up to one 50-MMscf/d centralized Green River oil well gas processing plant;

i. Construction of up to 13 gas driven water treatment and injection facilities for management, distribution, and injection of produced water;

j. Construction of up to 12 Gas Oil Separation Plants (GOSP) for oil and produced water collection;

k. Development of one fresh water collector well for waterflood operations;

l. Construction of six water pump stations, and

m. Applicant Committed Measures as carried forward into the Conditions of Approval.

2) New development in the project area outside the Pariette Wetlands ACEC and threatened cactus core conservation areas based on existing well density (See Attachment 1 Map 2.6-1):

a. High-density development areas are those areas that already have from six to 16 well pads per 640-acre section (i.e., one well pad per 40 to 106 acres). Within high-density development areas, four large, existing well pads per section could be expanded by about 0.2 to 0.8 acres per new well (anticipated to be up to six wells per existing pad consisting of: one existing vertical 40-ac water injection well, one new directional 20-ac oil well, one new vertical deep gas well, and three new directional deep gas wells). Additionally, within high-density development areas, 12 small well pads per section could be expanded by about 0.2 acres per well to accommodate one new directional 20-ac oil well (i.e., each existing well pad is anticipated to contain up to two wells, consisting of one existing vertical 40-ac oil/injection and one new directional 20-ac oil).

b. Low-density development areas are defined as those areas that have had no development at all or contain up to five well pads per section. For low-density development areas with zero to five existing well pads per section, the proposed surface density would be no more than four large, new well pads per 640-acre section (i.e., one large well pad per 160 acres) and twelve small, new well pads per 640-acre section (i.e., three small well pads per 160 acres). See Figures 2.6-2 (Attachment 1) for a graphical representation of this alternative as compared to the Proposed Action. There would be no restriction on the number of wells that could be drilled from those well pads, provided that the wells conform to downhole spacing requirements.

3) Pariette Wetlands Area of Critical Environmental Concern (ACEC) development guidelines and restrictions to protect the Relevant and Important Values:

    a. Development restrictions for 100-year Floodplains, Riparian Areas, Water Resources, and Special Status Species habitats as described in the attached Conditions of Approval.

    b. In the remainder of the ACEC, new or expanded well pads could be built following the low density development guidance described in 2b (above) so long as surface disturbance is minimized to the extent possible and no impacts occur to the relevant and important values.

4) Project area development restrictions for Sclerocactus suitable habitat and core conservation areas as described in the attached Conditions of Approval and Attachment 4.

5) Project area development restrictions for 100-year Floodplains, Riparian Areas, and other Water Resources as described in the attached Conditions of Approval.

6) Biological Opinion reporting requirements and development restrictions to protect threatened and endangered species and their habitats (see Attachment 5).

7) Unprecedented applicant committed measures for the project area to protect air quality (detailed in Attachments 2 and 3) including: "no net increase emissions" development restrictions to be documented annually on an emissions balance sheet, a Directed Inspection and Maintenance (DI&M) program, and an Ozone Action Mitigation Plan.

3.1.2 Big Wash Lands with Wilderness Characteristics Submission

There currently are no lands with wilderness characteristics identified within the project area. BLM has previously documented the absence of wilderness characteristics within the project area. In late 2014, information was submitted to the BLM which identified potential lands with wilderness characteristics in the Big Wash area. Due to staffing issues and other priorities, BLM's review of this submission has not yet been completed. Approximately 100 acres of the Big Wash submission overlaps the MBPA (see the following Big Wash Wilderness Characteristics map). Because the review has not been completed it is unknown if BLM considers the area to contain wilderness characteristics or not. The conceptual impacts of facility development in this area have been analyzed in the FEIS for all resources except wilderness characteristics. The BLM therefore commits to conduct a review of the Big Wash Wilderness Characteristics submission as a part of, or prior to as priorities allow (whichever is first), the review process of any site-specific surface use applications. If the BLM determines wilderness characteristics are present in the area, then the site-specific NEPA for any surface use applications in that 100 acre-area will disclose and mitigate as appropriate the impacts to any affected resources.

3.2 What the Decision Does Not Include

3.2.1 Decisions on Lands or Minerals other than BLM-Administered

Decisions contained within this ROD do not apply to lands or minerals administered by agencies or individuals other than the BLM. However, other agencies or individuals may, at their discretion, use the analysis in the FEIS to inform their own decisions on their lands or minerals.

3.2.2 Site-Specific Permits

This ROD does not directly authorize any site-specific permits or the construction of any particular facility on BLM-administered lands or minerals. Rather, the proponent or affiliate are required to submit applications for permit to drill, sundry notices, right of way, or other applications for approval of wells, well pads, pipelines, roads, or other ancillary facilities associated with project development. Those applications will be subject to an appropriate level of site-specific NEPA review before construction may be authorized.

3.2.3 Acquired Land in the Pariette ACEC

In March 2014, the BLM acquired 160 acres of private lands and minerals in the Pariette Wetlands Area of Critical Environmental Concern. The affected lands are in Township 9 South, Range 19 East, Section 8, E2NW, NESW, NWSE. Transfer of the minerals required ratification by the lease holder. Newfield elected to continue their lease with the BLM under the terms of the original Easement, Right-of-Way and Surface Use Agreement dated November 11, 2008. Decisions in this ROD will not supersede that agreement, which is a valid, pre-existing right.

3.2.5 FEIS Mitigation Measures Not Carried Forward as ROD COAs

3.2.5.1 Project Design Mitigation

The following cactus mitigation measures identified in the FEIS have been superseded by more specific requirements in the Biological Opinion, and were therefore not carried forward as conditions of approval in the ROD.

FEIS Page 4-166 Lines 21-45:

- Design project infrastructure to minimize impacts within potential habitat:
    - Reduce well pad size to the minimum needed, without compromising safety;
    - Limit new access routes created by the project;
    - Roads and utilities should share common ROWs where possible;
    - Reduce width of ROWs and minimize the depth of excavation needed for the road bed or use the natural ground surface for the road within habitat where feasible;
    - Place signing to limit off-road travel in sensitive areas; and
    - Stay on designated routes and other cleared/approved areas, and
    - All disturbed areas will be re-vegetated with native species comprised of species indigenous to the area and non-native species that are not likely to invade other areas.

- Within occupied habitat, project infrastructure will be designed to avoid direct disturbance and minimize indirect impacts to populations and to individual plants:
    - Follow the above recommendations for project design within potential habitats;
    - Before and during construction, areas for avoidance should be visually identifiable in the field, e.g., flagging, temporary fencing, rebar, etc.;
    - Where technically and economically feasible, use directional drilling or multiple wells from the same pad;
    - Designs will avoid concentrating water flows or sediments into occupied habitat;
    - Place produced oil, water, or condensate tanks in centralized locations, away from occupied habitat;
    - Minimize the disturbed area of producing well locations through interim and final reclamation. Reclaim well pads following drilling to the smallest area possible;

3.2.5.2 Cactus Survey Protocols

The following mitigation measures identified in the FEIS are older survey protocols. During the ESA Section 7 consultation, the BLM committed to comply with the USFWS's latest survey protocols. Therefore, recitation of the older protocols in the BLM's decision document is not necessary.

FEIS Page 4-165 Lines 7-19

- Sclerocactus surveys for access roads, buried pipelines, well pads, and other facilities requiring removal of vegetation (e.g., compressor stations) will include the project area and/or right-of-way (ROW), and 300 feet from the edges of the project disturbance and/or ROW.
- Sclerocactus surveys for surface pipelines placed within an existing road ROW, and within 10 feet from the edge of the disturbed surface of the road, will include the ROW and 50 feet from the edge of the ROW on the pipeline side of the road.
- Sclerocactus surveys for cross-country surface pipelines (pipelines over 10 feet from a road), where the pipeline will be laid by hand with minimal disturbance and no vehicle use, will include the ROW and 50 feet from the edges of both sides of the ROW.
- Surveys for all other cross-country surface pipelines (vehicles or equipment used, not laid out by hand) will include the ROW and 300 feet from the edges of both sides of the ROW.
- Sclerocactus surveys will not be necessary when pipelines are buried in existing roads.

3.2.5.3 Closed Loop Drilling in Sensitive Floodplains

The following applicant committed measure is superseded by the ESA Section 7 consultation requirements that: 1) no well pad related activities would be allowed within active floodplains; and 2) a 200 foot setback be implemented for all tributaries that drain

directly to Pariette Draw or the Green River. Since this measure as worded is specific to well drilling in floodplains and named drainages, it was excluded from the COAs to prevent future confusion. However, a condensed version of it was inserted into the general COA section which states: "Newfield would use closed-loop drilling techniques for all proposed wells located near sensitive areas as determined necessary during the onsite process".

FEIS Page 2-36 Lines 25-28

- Newfield would use closed-loop drilling techniques for all proposed wells located in sensitive areas, such as the 100-year floodplain of Pariette Draw, and in all U.S. Geological Survey (USGS) named drainages within 3 miles of the Green River. Additional locations where closed-loop drilling may be merited would be determined during the onsite process.

3.2.5.4 Annual Raptor Surveys Duplicate Measures

The following measures are duplicative of other raptor survey and buffer measures, and as such have been removed for simplification purposes.

FEIS Page 2-37 Line 37:

- Annual raptor surveys within the MBPA would be conducted by a BLM-qualified biologist.

FEIS Page 4-161 Lines 31-36

- Project-related development in areas directly associated with raptor nest and roost areas would be guided by the use of Best Management Practices for Raptors and Their Associated Habitats in Utah (found in Appendix A of the Vernal RMP [BLM 2008b]) and the USFWS Utah Field Office's Guidelines for Raptors Protection from Human and Land Use Disturbances (Romin and Muck 2002) that use seasonal and spatial buffers as well as mitigation to maintain and enhance raptor nesting and foraging habitat, while allowing for other resource uses.

3.2.5.5 Unclear Active Drainage Measure

The following measure is poorly worded and its meaning is unclear, so it was not carried forward as a COA. Other measures were included which accomplish the intent of this measure.

FEIS Page 4-203 Lines 43-44

- Well pads would not be located in active drainages.

3.2.5.6 Conflicting ACEC mitigation

FEIS Page 4-50 Line 22

- Directional drilling would be used to reduce or avoid impacts to the ACEC relevant values where feasible (all relevant and important values of ACECs and ORVs of proposed WSR).

4.0 Management Considerations

My Decision to approve this project was made after consideration of the relevant factors discussed below.

4.1 Purpose and Need

The purpose of the Monument Butte FEIS is to facilitate the BLM decision-making process as to whether to approve, approve with modifications, or disapprove Newfield's proposed project and project components based on an evaluation of the expected impacts. The BLM's purpose is to minimize or avoid environmental impacts to the extent possible, while allowing Newfield to exercise its valid lease rights.

The need for a BLM action is to respond to this proposal. The Federal Land Policy and Management Act of 1976, or FLPMA (Public Law 94-579, 43 United States Code [U.S.C.] 1701 et seq.), recognizes oil and gas development as one of the "principal" uses of the public lands. Federal mineral leasing statutes, including the Mineral Leasing Act of 1920, 30 U.S.C. 181 et seq., and the implementing regulations by which they are enforced recognize the statutory right of lease holders to develop federal mineral resources to meet continuing national needs and economic demands, subject to lease stipulations and reasonable measures that BLM may require to minimize adverse impacts.

It has been determined that the Selected Alternative meets this purpose and need because environmental restrictions, such as high density and low density pad placement and sensitive area avoidance or other restrictions, have been incorporated that have reduced surface disturbance by about 40% in comparison to the proposed action. In addition, the applicant has committed to, and the Selected Alternative incorporates, extensive air quality mitigation measures beyond those required by regulation to minimize the emissions to the environment from the proposed development.

4.2 Conformance with BLM Land Use Plans, Laws, and Policy

Management objectives for lands under the authority of the VFO are contained within the Vernal ROD and approved Resource Management Plan (RMP) (BLM 2008b), as amended. The RMP allows for the exploration and development of oil and gas resources while protecting or mitigating impacts to other resource values.

The goals and objectives of the Minerals and Energy Resources management decisions of the Approved RMP are as follows:

- Meet local and national non-renewable and renewable energy and other public mineral needs.
- Support a viable long-term mineral industry related to energy development while providing reasonable and necessary protections to other resources.
- The following principles will be applied:

- Encourage and facilitate the development by private industry of public land mineral resources in a manner that satisfies national and local needs and provides for economical and environmentally sound exploration, extraction and reclamation practices.
- Process applications, permits, operating plans, mineral exchanges, leases, and other use authorizations for public lands in accordance with policy and guidance.
- Monitor salable and leasable mineral operations to ensure proper resource recovery and evaluation, production verification, diligence, and inspection and enforcement of contract sales, common use areas, community pits, free use permits, leases and prospecting permits.

- This RMP will recognize and be consistent with the National Energy Policy by:
  - Recognizing the need for diversity in obtaining energy supplies
  - Conserving sensitive resource values
  - Improving energy distribution opportunities (BLM 2008b).

Most of the subject leases in the project area were issued prior to the completion of the Vernal ROD and Approved RMP with stipulations that were standard at that time. The Approved RMP does not affect valid existing rights and does not affect terms of existing leases (BLM 2008b page 21).

The Selected Alternative is deemed in conformance with management decisions made in the Vernal ROD and Approved RMP because it meets the goals and objectives of the Minerals and Energy Resources management decisions as listed above. The Selected Alternative allows for the development of valid existing rights, and it does not affect the terms of the existing leases, although it does provide for protection of the various sensitive resources found throughout the project area.

4.3 Consistency with Other Plans, Statutes, and Objectives

The Selected Alternative would be in compliance with the Federal Land Policy and Management Act of 1976, or FLPMA (Public Law 94-579, 43 United States Code [U.S.C.] 1701 et seq.), which recognizes oil and gas development as one of the "principal" uses of the public lands. Federal mineral leasing statutes, including the Mineral Leasing Act of 1920, 30 U.S.C. 181 et. seq., and the implementing regulations by which they are enforced recognize the statutory right of lease holders to develop federal mineral resources to meet continuing national needs and economic demands, subject to lease stipulations and reasonable measures that BLM may require to minimize adverse impacts.

The Selected Alternative would be in compliance with other Federal, State, and local laws and regulations. Increased development of oil and gas resources on public lands is consistent with Federal Onshore Oil and Gas Leasing Reform Act of 1987 (FOOGLRA), Comprehensive National Energy Strategy announced by the U.S. Department of Energy in April 2008, the Energy Policy and Conservation Act (42 U.S.C. 6201), and the Energy Policy Act of 2005.

Utah Code Section 63J-8-105.5 established the Uintah Basin Energy Zone, which includes the

MBPA. The highest management priority for these lands is responsible development of energy resources. SITLA has leased all of the state lands within the MBPA and permits on-going oil and gas production. These actions are consistent with SITLA's primary objective to fund the state school system. The Selected Alternative would allow for oil and gas production on federal leases and would be consistent with the objectives of the Uintah Basin Energy Zone.

The Selected Alternative would be in compliance with the Duchesne County General Plan, as amended (Duchesne County 2005, 2007, 2012, 2013). This General Plan supports responsible natural resource use and development and emphasizes the need to keep public lands open for oil and gas exploration and development under multiple-use and sustained yield principles.

The Selected Alternative would be in compliance with the Uintah County General Plan 2005, as amended (Uintah County 2005, 2012). This General Plan supports oil and gas development, emphasizes responsible multiple-use of public lands, and optimizes utilization of public resources.

4.4 Alternatives

The range of alternatives that were available to the agency was constrained given that leases had previously been issued and are valid existing rights. Four alternatives were identified and considered in detail in the Final EIS. The total number of wells drilled under each alternative would depend largely on outside factors such as production success, engineering technology, reservoir characteristics, economic factors, commodity prices, rig availability, and lease stipulations. The anticipated life of an individual well under each alternative is 20 to 30 years, and the anticipated time it would take for field abandonment and final reclamation is an estimated 5 years. For a complete description of these alternatives, refer to FEIS Sections 2.2 through 2.7. The BLM considered the environmental impacts anticipated under each of these alternatives, including climate change impacts. For a summary of the environmental impacts, please refer to FEIS Table ES-2. The following subsections highlight the major components of these alternatives, and the relevant factors that BLM considered when preparing this decision.

4.4.1 Alternative A: Proposed Action

Under the Proposed Action Alternative, Newfield plans to drill up to 5,750 wells and associated facilities at an average rate of 360 wells per year until the resource base is fully developed. Construction, drilling, and completion would occur for approximately 16 years. The anticipated life of project (LOP) under the Proposed Action would be from 41 to 51 years. Additionally this alternative includes the construction of approximately 243 miles of new roads and pipelines, 363 miles of new pipeline adjacent to existing roads, 21 new and 3 expanded compressor stations, one gas processing plant, seven new and six expanded water treatment and injection facilities, 12 gas and oil separation plants, six water pump stations, as well as the drilling of one freshwater collector well. Total new surface disturbance under the Proposed Action would be approximately 16,129 acres, which would be reduced to 7,808 acres through interim reclamation.

The Proposed Action Alternative meets the BLM's Need for the project in that it allows for development of the valid existing leases. It also conforms to federal, state, and local laws and policies and the BLM's land use plan. It is anticipated to create 32,743 jobs in Duchesne and Uintah Counties, and directly employ about 478 people per day during construction (16 years)

and 46 people per day during production (20 to 30 years). It is estimated to generate about $3.6 billion in personal income in Uintah and Duchesne Counties, $73.6 million in taxes for Uintah and Duchesne Counties, and about $138.7 million in taxes for the State. However, upon review of the FEIS, it was determined that additional measures could be taken to further reduce impacts including disturbance to sensitive surface resources in accordance with the BLM's Purpose for the project. Therefore, the BLM did not carry this alternative forward as the selected alternative.

4.4.2 Alternative B: No Action (Environmentally Preferable Alternative)

The No Action Alternative evaluates development, production, and maintenance of the remaining approximately 241 wells approved under the August 2005 ROD for the Castle Peak and Eight Mile Flat Oil and Gas Expansion EIS on BLM-administered lands, as well as an additional approximately 547 oil and gas wells estimated to be developed on State and private lands or minerals.

Under the No Action Alternative, up to 788 wells would be developed on BLM, State, and private lands at an average rate of up to 360 wells per year. Construction, drilling, and completion of all wells would occur over an approximately 2.2-year period. The anticipated LOP under the No Action Alternative would be approximately 28 to 38 years. Additionally this alternative includes the construction of approximately 23.5 miles of new roads and pipelines, 45 miles of new pipeline adjacent to existing roads, 2 new compressor stations, one gas processing plant, one new water treatment and injection facility, one gas and oil separation plant, and one water pump stations. Total new surface disturbance under the No Action Alternative would be 870 acres of new disturbance, which would be reduced to 659 acres through interim reclamation.

NEPA implementing regulation 40 CFR 1505.2(a) requires the identification of the alternative or alternatives which are considered to be environmentally preferable. For the Monument Butte FEIS, the environmentally preferable alternative is Alternative B: No Action because it proposes acres of disturbance and the fewest emissions due to the low number of new wells and other facilities.

The No Action Alternative nearly eliminated impacts including surface disturbance to sensitive surface resources in accordance with the BLM's Purpose for the project. In addition, the development that would occur under this alternative conforms to federal, state, and local laws and policies and the BLM's land use plan. It is anticipated to create 4,487 jobs in Duchesne and Uintah Counties, and directly employ about 468 people per day during construction (2 years) and 24 people per day during production (20 to 30 years). It is estimated to generate about $496 million in personal income in Uintah and Duchesne Counties, $10.1 million in taxes for Uintah and Duchesne Counties, and about $19 million in taxes for the State. However, upon final review it was determined that this alternative does not meet the BLM's Need to allow for the development of the valid existing Federal leases in conformance with FLPMA and the lease terms. Therefore, the BLM did not carry this alternative forward as the selected alternative.

4.4.3 Alternative C: Field-Wide Electrification

The Field-Wide Electrification Alternative was developed in response to air quality issues raised during the public and agency scoping process. The principal component of this alternative entails a phased field-wide electrification system that would be integrated in the MBPA over an estimated 7-year period. This alternative would incorporate the same construction and

operational components described in Section 2.2 of the Final EIS (Development Activities Common to all Alternatives), except that gas-driven motors would be converted to electric motors as field electrification is phased into the MBPA.

Under the Field-Wide Electrification Alternative, up to 5,750 wells would be developed on BLM, State, and private lands at an average rate of up to 360 wells per year. Construction, drilling, and completion of all 5,750 wells would occur for approximately 16 years. The anticipated LOP under Alternative C would be 41 to 51 years. The phased field-wide electrification component consists of construction of 35 miles of overhead cross-country 69kV transmission lines, 156 miles of distribution lines, and 11 substations. Additionally this alternative includes the construction of approximately 243 miles of new roads and pipelines, 363 miles of new pipeline adjacent to existing roads, 21 new compressor stations, three expanded compressor stations, one gas processing plant, seven new and six expanded water treatment and injection facilities, 12 gas and oil separation plants, six water pump stations, as well as the drilling of one freshwater collector well. Total new surface disturbance under this alternative would be approximately 20,112 acres, which would be reduced to 10,173 acres through interim reclamation.

The Field Wide Electrification Alternative meets the BLM's Need for the project in that it allows for development of the valid existing leases. It also conforms to federal, state, and local laws and policies and the BLM's land use plan. It is anticipated to create 32,743 jobs in Duchesne and Uintah Counties, and directly employ about 486 people per day during construction (16 years) and 46 people per day during production (20 to 30 years). It is estimated to generate about $3.6 billion in personal income in Uintah and Duchesne Counties, $73.6 million in taxes for Uintah and Duchesne Counties, and about $138.7 million in taxes for the State. However, upon review of the FEIS, it was determined that additional measures could be taken to further reduce impacts including disturbance to sensitive surface resources in accordance with the BLM's Purpose for the project. Also, electrification of the field in general is not technically feasible. The power demands of the field for this electrification alternative would exceed the current capacity of the Bonanza Coal Fired Power Plant. In addition, Newfield assessed the Alternative and determined that it would be completely cost prohibitive. Newfield estimated the lifetime cost of self-generation at $600 million each for 11 generation stations, including distribution systems but excluding on-drill pad electrification costs and fuel value. The aggregate costs would exceed $1.4 million per well, which is more than the current development cost per well. Therefore, the BLM did not carry this alternative forward as the selected alternative.

4.4.4 DEIS Alternative D: Original Resource Protection (Agency Preferred Alternative)

The DEIS agency preferred alternative focused on reducing the number of new well pads, and preventing new surface disturbance in the Pariette Wetlands ACEC. The development scenario called for four (4) surface well pad locations (160 surface pad spacing) per one square mile. Each surface well pad location would be a high well density installation, with six or more wells on each well pad, each targeting either the formation containing the shallow oil (depth between 4,500 and 7,000 ft) or the formation(s) containing the deep gas (depth between 13,000 and 18,000 ft). With the alternative D program setup, about fifty percent of the wells on the surface pad location would be directional wells, with a vertical section displacement of around 2,000 ft

(inclination angle 20 degrees). The alternative also contained an aggressive reclamation program for the waterflood injection well pads.

The BLM revised the Agency Preferred Alternative between draft and final based on public comment which pointed out the technical infeasibility of the alternative as relates to: 1) inefficient waterflood sweep, 2) directional well downhole equipment failure, 3) potential well bore collision, and 4) insufficient injection well pad size for safe operations. BLM engineers reviewed the comment and determined the technical points of the comment were correct. These technical issues affected the proponent's ability to diligently and efficiently develop oil and gas resources as required by regulation and the terms of their leases. Therefore the BLM determined adjustments to the agency preferred alternative were necessary to bring the alternative into conformance with the purpose and need of this EIS, so the alternative as presented in the DEIS was not carried forward as the selected alternative. Please note that the Agency Preferred Alternative revisions were wholly within the range of alternatives considered in the DEIS, therefore the BLM determined that a Supplement to the draft was not warranted.

4.4.5 FEIS Alternative D: Resource Protection (Agency Preferred Alternative)

The primary objective of the Resource Protection Alternative is to meet the purpose and need for the Project while 1) protecting the relevant and important values of the Pariette Wetlands Area of Critical Environmental Concern (ACEC); 2) minimizing the amount of new surface disturbance and habitat fragmentation within and around USFWS proposed Level 1 and 2 Core Conservation Areas (for two federally-listed plant species: the Uinta Basin hookless and the Pariette cactus); 3) precluding new well pads (with the exception of Newfield's proposed water collector well) and minimizing new surface disturbance (roads or pipelines) within 100-year floodplains; 4) precluding new well pads, pipelines, or roads within riparian habitats; and 5) minimizing overall impacts from the proposed oil and gas development through the use of directional drilling technology.

Under the Resource Protection Alternative, up to 5,750 wells would be developed on BLM, State, and private lands at an average rate of up to 360 wells per year. Construction, drilling, and completion of all 5,750 wells would occur for approximately 16 years. The anticipated LOP under Alternative D would be 41 to 51 years. Additionally this alternative includes the construction of approximately 226 miles of new roads and pipelines, 318 miles of new pipeline adjacent to existing roads, 21 new and 3 expanded compressor stations, one gas processing plant, seven new and six expanded water treatment and injection facilities, 12 gas and oil separation plants, six water pump stations, as well as the drilling of one freshwater collector well. Total new surface disturbance under the Agency Preferred Alternative would be approximately 10,122 acres, which would be reduced to 4,978 acres through interim reclamation.

The Resource Protection Alternative meets the BLM's Purpose and Need for the project in that it minimizes the impacts to surface resources while allowing for development of the valid existing leases. It also conforms to federal, state, and local laws and policies and the BLM's land use plan. It is anticipated to create 32,743 jobs in Duchesne and Uintah Counties, and directly employ about 478 people per day during construction (16 years) and 46 people per day during production (20 to 30 years). It is estimated to generate about $3.6 billion in personal income in Uintah and Duchesne Counties, $73.6 million in taxes for Uintah and Duchesne Counties, and

about $138.7 million in taxes for the State. The Resource Protection Alternative, as modified by the Conditions of Approval, was therefore carried forward as the selected alternative.

4.5 Consultation and Coordination

4.5.1 Cooperating Agencies

The following entities were invited to be Cooperating Agencies:

- U.S. Environmental Protection Agency (EPA);
- State of Utah, (via the Governor's Public Lands Policy and Coordination Office (PLPCO));
- Duchesne County;
- Uintah County;
- Bureau of Indian Affairs (BIA)-Uintah and Ouray Agency, and
- The Ute Indian Tribe.

The EPA, PLPCO, Duchesne County, and Uintah County agreed to participate as Cooperating Agencies and signed related memorandums of understanding (MOUs).

The U.S. Fish and Wildlife Service (USFWS) and the U.S. Army Corps of Engineers (USACE) have been on-going Cooperating Agencies under the BLM Energy Pilot Office program authorized by the Energy Policy Act of 2005. Major reviews conducted by the Cooperating Agencies during development of alternatives and preparation of the DEIS were conducted as follows:

- August 24, 2009, Uintah County MOU signed
- August 31, 2009, Duchesne County MOU signed
- September 30, 2011, Utah PLPCO MOU signed
- February 8, 2012, EPA MOU signed
- September-October 2012 Chapters 1 and 2 review
- September 26, 2012 Cooperators meeting held
- November-December 2012 revised alternatives review
- January 23, 2013 meeting to provide status updates and discuss alternatives
- February-March 2013 Chapters 1 and 2 review
- July-August 2013 PDEIS review
- October 2013 revised PDEIS review
- June 2014 revised alternative update to cooperators
- July 2014 COE discussed cooperating agency status

- October 2014 PFEIS cooperator review

4.5.2 Air Resource Coordination

There was extensive coordination with the BLM Utah Air Resource Technical Advisory Group (RTAG) throughout the preparation and finalization of the air quality analysis for the FEIS, in conformance with the *NEPA Air Quality MOU for Federal Oil and Gas Decisions* (signed June 23, 2011). The main participants in the RTAG are the EPA, National Park Service, US Forest Service, US Fish and Wildlife Service, and Utah Department of Environmental Quality. The major RTAG and other air quality reviews occurred as follows. All reviews were by the RTAG unless otherwise indicated:

- May 2012 BLM applicant committed measures preliminary review
- September-October 2012 BLM/EPA early coordination regarding applicant committed measures, "net zero" and pollutant "trading"
- December 2012-January 2013 Air modeling protocol review
- February-March 2013 BLM/EPA Emission Inventory report review
- April-October 2013 BLM/EPA/Newfield worked on a draft net zero/adaptive management approach
- July-September 2014 development of proposed ARMS model protocol
- September-October 2014 BLM/EPA adaptive management plan review
- October-November 2014 ARMS model protocol review
- February-April 1, 2015 ARMS model report review
- May-August 2015 controls and mitigation review
- June 2015-July 2016 BLM/EPA/Newfield discussion regarding feasible mitigation measures and existing ozone situation
- July 2016 final air measures agreed to by BLM, EPA, and Newfield

4.5.3 NHPA Section 106 Consultation and Government to Government Consultation

Section 106 consultation and Tribal consultation milestones are summarized below:

- December 22, 2010: The BLM sent an initiation of consultation letter which summarized the proposed project to the thirteen tribes with ties to the Basin.
- June 4, 2012: A BLM letter initiated the Section 106 process and proposed consulting parties.
- August 1, 2012: Utah State Historic Preservation office confirmed the proposed consulting parties list.
- September 20, 2012: The BLM sent a letter announcing the October 11 meeting, and inviting the proposed consulting parties to participate.

- September 27, 2012: The Laguna Pueblo Tribe response indicated that the "undertaking will not have a significant impact at this time".
- September 27, 2012: A response letter was received from Duchesne County asking for an invitation to participate.
- October 1, 2012: The Hopi Tribe response requested continued consultation.
- October 11, 2012: The consulting parties defined the Area of Potential Effect as the project area, and determined that a Programmatic Agreement was not needed.
- December 1, 2014: A conclusion of consultation letter was sent by the BLM.
- December 4, 2014: Section 106 consultation with Utah SHPO and any potentially affected Native American Tribes was finalized with the receipt of Utah SHPO's concurrence letter.
- December 14, 2014: Tribal consultation concluded due to lack of responses from any of the consulted Tribes.

4.5.4 ESA Section 7 Consultation

Formal Section 7 consultation under the authority of the ESA was initiated in October 2014 and finalized on September 4, 2015. Extensive coordination between Newfield, the BLM, and the FWS occurred to ensure impacts to listed species are minimized or compensated to the extent possible. A chronology of Consultation Events is included below:

- October 22, 2014-April 8, 2015: Meetings and correspondence held among USFWS, BLM and Newfield to discuss Sclerocactus Strategy.
- June 2, 2015: USFWS received the BA and letter requesting formal consultation.
- June 15, 2015: USFWS received edited acreage calculations for the amount of disturbance associated with this project in Sclerocactus habitat.
- July 9, 2015: Meeting was held between USFWS, BLM, and Newfield to discuss conservation measures and request accurate information regarding water depletions. USFWS also received follow-up emails with corrected water right and depletion information from BLM.
- July 17, 2015: USFWS received a letter from BLM stating that they have changed their determination from adversely modify critical habitat to may affect likely to adversely affect critical habitat for listed Colorado River fish. USFWS also received an email from BLM with updated conservation measures for all listed species.
- July 18, 2015: USFWS received updated conservation measures with additional questions from BLM. USFWS had a phone conversation with BLM to clarify conservation measures.
- August 6, 2015: USFWS received updated applicant-committed conservation measures from BLM and Newfield in an email.
- August 10, 2015: USFWS had a phone conversation with BLM to discuss conservation

measures for Ute ladies' -tresses and Western yellow-billed cuckoo.

- August 27, 2015: USFWS received an email from BLM stating that they would implement the final conservation measures in the proposed action and ROD.
- September 2, 2015: USFWS received a signed copy of the final conservation measures.
- September 3, 2015: USFWS received an email from BLM changing their determination for Colorado River fish critical habitat from may affect likely to adversely affect to may affect not likely to adversely affect the critical habitat.
- September 4, 2015: Biological Opinion was signed.

In the Biological Opinion, the USFWS determined that the effects of the action on Western yellow-billed cuckoo, Ute ladies'-tresses, razorback sucker, and Colorado pikeminnow are expected to be insignificant. The USFWS indicated they may reconsider the determination for Western yellow-billed cuckoo, Ute ladies'-tresses, razorback sucker, and Colorado pikeminnow if project action changes or additional information about the distribution of the listed species becomes available.

In the Biological Opinion, the USFWS determined that the project is not likely to jeopardize the continued existence of Pariette cactus and Uinta Basin hookless cactus. Approximately 4,295 acres of surface disturbance will occur within the Sclerocactus Habitat Polygon, which represents approximately 1 percent of habitat within the Sclerocactus Habitat Polygon. Surface disturbance within Level 1 CCAs represents approximately 0.3 percent of habitat within Level 1 CCAs. Surface disturbance within Level 2 CCAs represents approximately 0.9 percent of habitat within Level 2 CCAs. The USFWS reached this conclusion based upon the applicant committed conservation measures to avoid and minimize impacts within the range of the species as well as the minimal scope of disturbance within Sclerocactus habitat.

The Biological Opinion included Reporting Requirements and Conservation Recommendations which have been incorporated into the Selected Alternative as Conditions of Approval.

4.6 Public Involvement

4.6.1 Public Scoping

The public scoping process was initiated on August 25, 2010, with the publication of a Notice of Intent (NOI) in the Federal Register. The BLM prepared a scoping information notice and provided copies to the public, other government agencies, and Tribes. These announcements included information on two open house public scoping meetings, which were held at the County Commissioner's Office in Duchesne, Utah, on September 13, 2010, and at the Western Park Convention Center in Vernal, Utah, on September 20, 2010. The scoping meetings included participants from the BLM, Ashley National Forest, Uintah County Public Lands, Newfield, El Paso County, consultants, as well as local landowners. The official scoping period ended October 9, 2010.

Public response to the NOI and meetings included seven letters: two from federal agencies; one from a state agency; one from a county agency; and three from industry or private individuals. The following concerns were identified in the letters:

- Comprehensive air-quality analyses and region-wide air-quality modeling;
- Direct and indirect effects of water injection and hydrogen sulfide on gilsonite mining operations;
- Incorporation of operational flexibility into the Record of Decision and Final EIS;
- Recognition of valid existing lease rights within the Project Area by BLM;
- Explanation of the positive air quality impacts and reduction in emissions that would result from electrification;
- Limited BLM statutory or regulatory authority to regulate air quality or enforce air quality laws;
- Economic benefits to the local and state economies and SITLA;
- Conformance of the proposed project to the Vernal RMP;
- Direct, indirect, and cumulative impacts to Waters of the U.S.;
- Direct, indirect, and cumulative air quality impacts with an emphasis on fine particulate matter ($PM_{2.5}$), nitrogen dioxide (NO_2), volatile organic compounds (VOC), and ozone;
- Protection of wetland, stream, and riparian resources;
- Alternatives for water treatment and produced water management;
- Protection of groundwater, drinking water, and irrigation water;
- Impacts of fugitive dust from construction and travel on unpaved roads;
- Impacts of noise from central facilities located near residences and wildlife in the MBPA;
- Analysis of proposed project development on water quality within Pariette Draw; and
- Potential introduction and expansion of noxious weeds in the MBPA.

These concerns were considered during or incorporated into the development of alternatives and analysis in the EIS.

4.6.2 Draft EIS

The Notification of Availability for the Draft EIS was published on December 20, 2013. The Draft EIS was made available for a 45-day public comment period, which was subsequently extended by an additional 30 days at the request of the State of Utah. Three public meetings were held; one on January 21, 2014 in Salt Lake City, Utah, one on January 22, 2014 in Roosevelt, Utah, and one on January 23, 2014 in Vernal, Utah. A total of 22 unique comment letters or emails were received during the official comment period, and one letter was received after the comment period ended. The 23 comment letters or emails included one from a federal agency, one from the House of Representatives, one from a state agency, two from County governments, one from the proponent (Newfield), nine from other oil and gas industry representatives or trade groups, one from the proponent's outside legal counsel, one from a non-governmental organization, and six from private individuals. There were also 1,780 form letters received from members of the environmental community that expressed concern regarding ozone impacts, and 161 form letters received from Newfield Employees that expressed concern over impacts to their livelihoods from the Agency Preferred Alternative. A detailed list of substantive comments received and BLM's response to those comments is included in the FEIS Attachment 2. However, comments largely focused on the following:

- Comments stating that the Agency Preferred Alternative was technically flawed and would not meet the purpose and need for the project;

- Comments asking the BLM to adopt the No Action Alternative;
- Comments asking the BLM to adopt the Proposed Action Alternative;
- Direct, indirect, and cumulative impacts to Waters of the U.S.;
- Direct, indirect, and cumulative air quality impacts with an emphasis on fine particulate matter ($PM_{2.5}$), nitrogen dioxide (NO_2), volatile organic compounds (VOC), and ozone;
- Limited BLM statutory or regulatory authority to regulate air quality or enforce air quality laws;
- Economic benefits to the local and state economies and SITLA;
- Protection of wetland, stream, and riparian resources;
- Alternatives for water treatment and produced water management;
- Protection of groundwater, drinking water, and irrigation water;
- Analysis of proposed project development on water quality within Pariette Draw; and
- Surface restrictions in the Pariette Wetlands ACEC and *Sclerocactus* core conservation areas.

4.6.3 Final EIS

The Notification of Availability for the Final EIS was published on June 24, 2016. The Final EIS was made available for a 45-day availability period. The longer than usual availability period was offered in response to a suggestion of the EPA due to the changes to the agency preferred alternative that occurred between Draft and Final EISsto address technical issues with the DEIS alternative. During this availability period the BLM received the following letters:

- 10 letters from the public against the project;
- 1 letter from Western Energy Alliance in favor of the project;
- 1 letter from Uintah County in favor of the proposed action;
- 26,250 for letters from the public against the project received during the availability period; and
- 1,962 form letters from the public against the project received after the close of the availability period.
- 1 petition with 20 Utah residents signatures against the project received after the close of the availability period

In addition, the BLM received seven letters that contained potentially substantive comments. These were received from: the Environmental Protection Agency Region 8; Western Environmental Law Center on the behalf of Wild Earth Guardians, Southern Utah Wilderness Alliance, Center for Biological Diversity, Sierra Club, and Utah Native Plants Society; Utah Native Plant Society; Wild Earth Guardians; Utah Physicians for a Healthy Environment; and Beatty & Wozniak on behalf of Newfield Exploration Company (two letters – an initial and a supplemental).

The BLM reviewed the comments submitted and determined that no significant new circumstances or information were contained in them. However, several comments were determined to warrant clarification to improve public and decision maker understanding, so responses to those comments are included in Attachment 6, and any errata that occurred as a

result of comment responses are documented in Attachment 7.

This page intentionally left blank.

5.0 Appeal Process

This decision is effective upon the date it is signed by the authorized officer. The decision is subject to appeal. This decision may be appealed to the Interior Board of Land Appeals (IBLA), Office of Hearings and Appeals, U.S. Department of the Interior, 801 North Quincy Street, Suite 300, Arlington Virginia 22203, in accordance with the regulations contained in 43 Code of Federal Regulation (CFR) Part 4. Appeal and stay procedures are outlined on Form 1842-1, which is attached to this ROD as Attachment 8.

Notice of Appeal: Within 30 days of the posting of this decision ("date of service"), a Notice of Appeal must be filed in writing to the office that issued this decision (43 CFR 4.411 and 4.413:

State Director
BLM Utah State Office
440 West 200 South, Suite 500
Salt Lake City, Utah 84101-1345

At the same time, a copy of the Notice of Appeal must also be sent to:

Regional Solicitor
U.S. Department of the Interior
6201 Federal Building
1235 South State Street
Salt Lake City, Utah 84138-1180

Statement of Reasons: Within 30 days after filing the Notice of Appeal, you must also file a complete statement of the reasons why you are appealing. This must be filed with:

U.S. Department of the Interior
Office of Hearings and Appeals
Interior Board of Land Appeals
801 N. Quincy Street, Suite 300
Arlington, Virginia 22203

If you fully stated your reasons for appealing when filing the Notice of Appeal, no additional statement is necessary (43 CFR 4.412 and 4.413).

Within 15 days after each document is filed, each adverse party named in the decision and the Regional Solicitor must be served a copy of the document.

At the end of any document that is filed in an appeal, the party filing the document must certify that service has been or will be made in accordance with the applicable rules, and specify the date and manner of service (43 CFR 4.401(c)). Unless the procedures set forth herein are followed, an appeal will be subject to dismissal (43 CFR 4.402).

Petition for a Stay: This decision becomes effective upon the expiration of the time allowed for the filing of an appeal unless a petition for a stay is timely filed with a Notice of Appeal (43 CFR 4.21). If you wish to file a petition for a stay of the effectiveness of this decision during the time that your appeal is being reviewed by the IBLA, the petition for a stay must accompany your Notice of Appeal (43 CF 4.21). Except as otherwise provided by law, or applicable regulation, guideline, or policy, a petition for a stay of a decision pending appeal must show sufficient

justification based on the following standards:

(1) The relative harm to the parties if the stay is granted or denied;
(2) The likelihood of the appellant's success on the merits;
(3) The likelihood of irreparable harm to the appellant or resources if the stay is not granted; and,
(4) Whether the public interest favors granting the stay.

A petition for stay of this decision must be filed in the office of the Authorized Officer, which in this case is the BLM Utah State Office.

6.0 Literature Cited

Please also refer to Ch.7 References of the Final EIS for the Monument Butte Oil & Gas Development Project

Bureau of Land Management (BLM) 1988. 1613 Areas of Critical Environmental Concern.

BLM 2012. Colorado Plateau Rapid Ecoregional Assessment Report. May 2015.

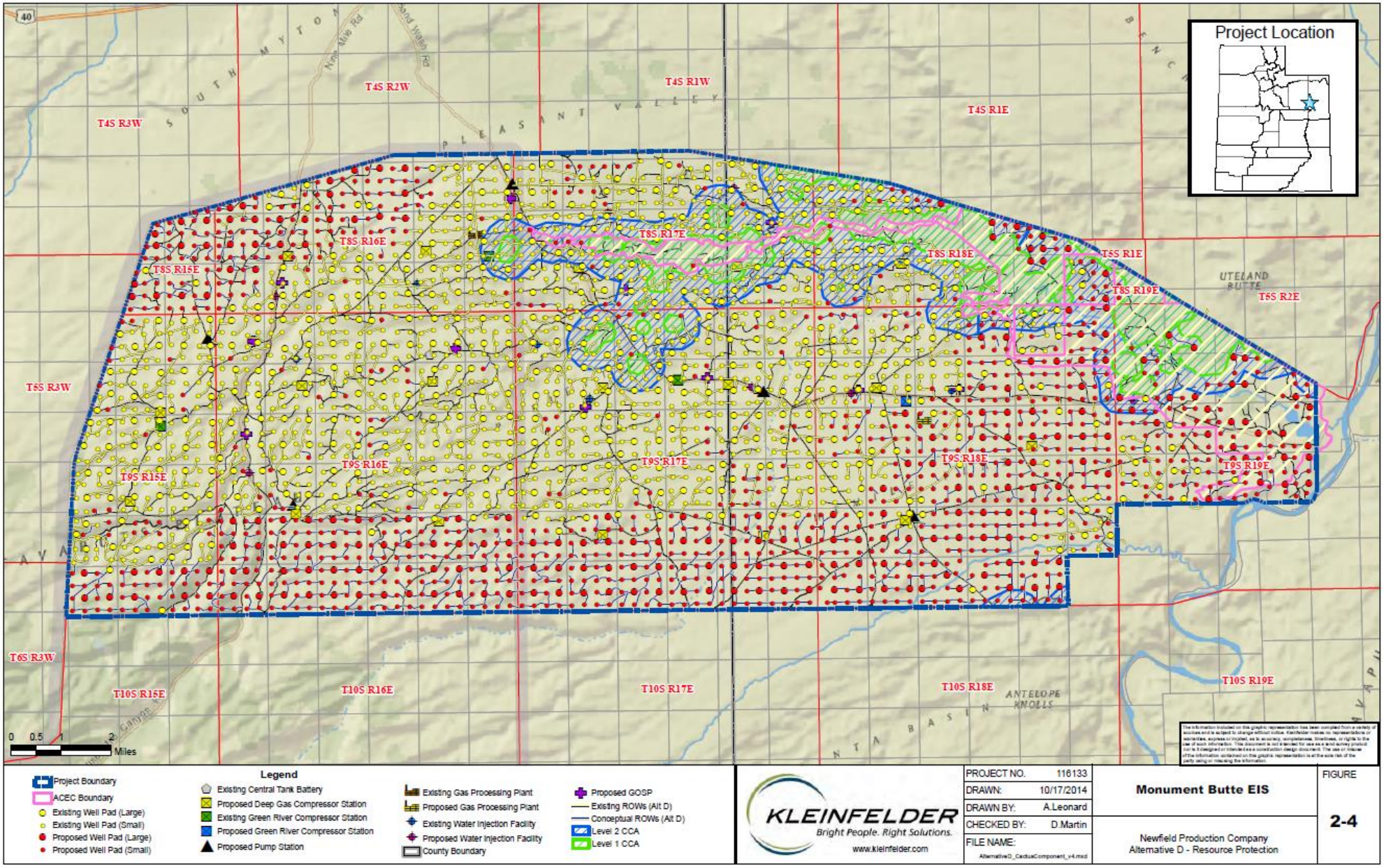
Environmental Protection Agency 2016. Oil and Natural Gas Sector: Emission Standards for New, Reconstructed, and Modified Sources. 81 FR 35823, dated June 3, 2016.

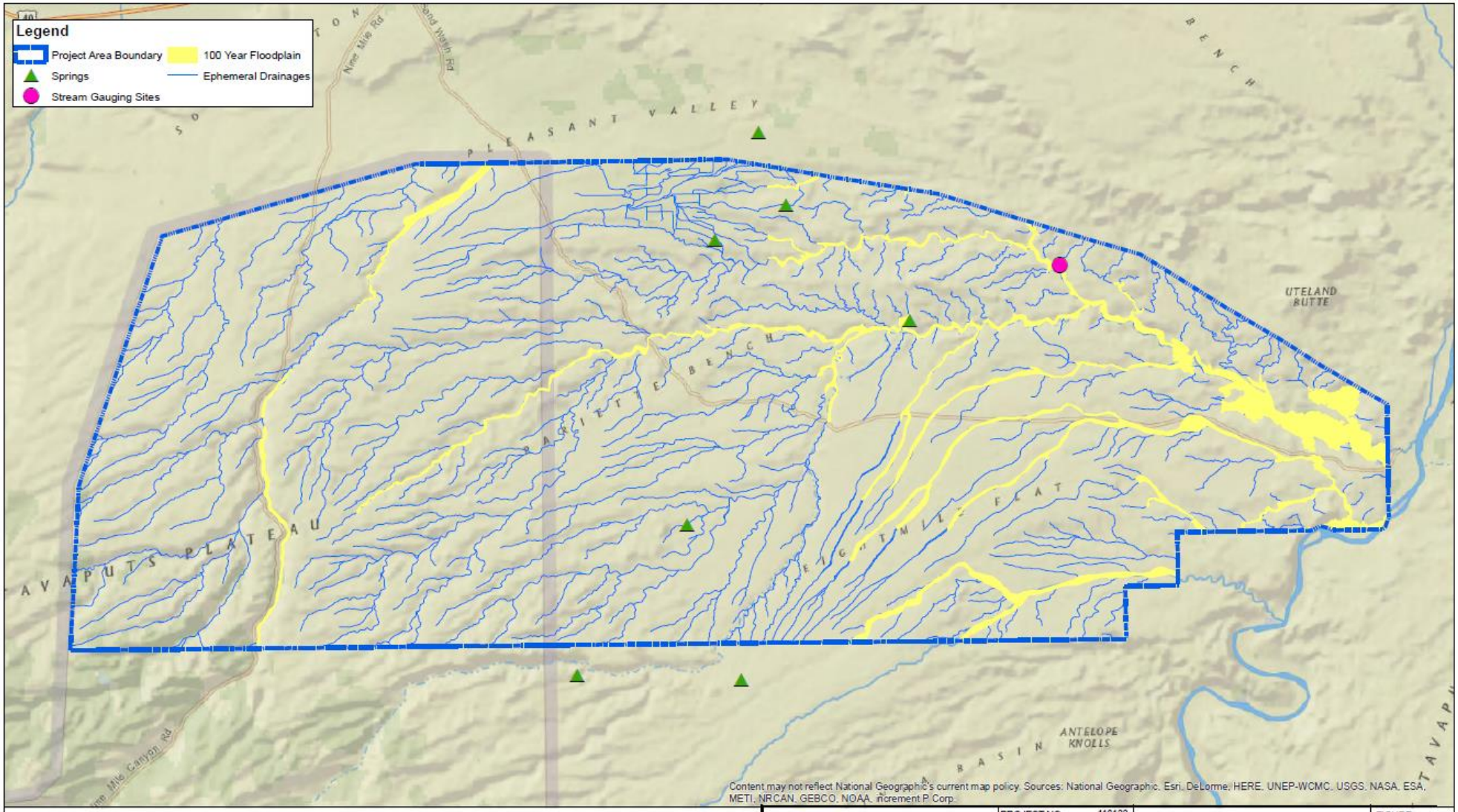
Utah Division of Air Quality 2014. Approval Order: General Approval Order for a Crude Oil and Natural Gas Well Site and/or Tank Battery. DAQE-AN149250001-14 dated June 5, 2014.

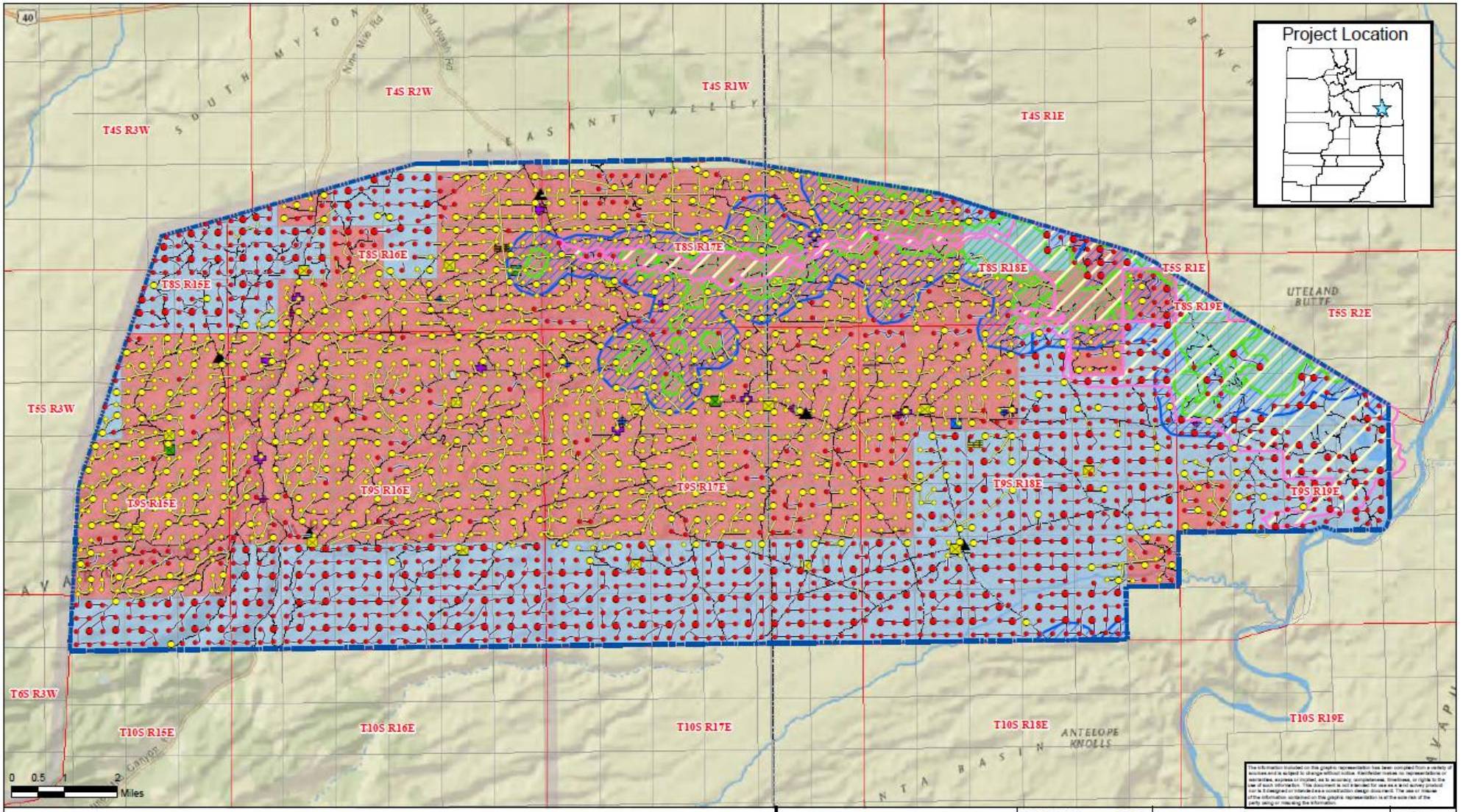
This Page Intentionally Left Blank

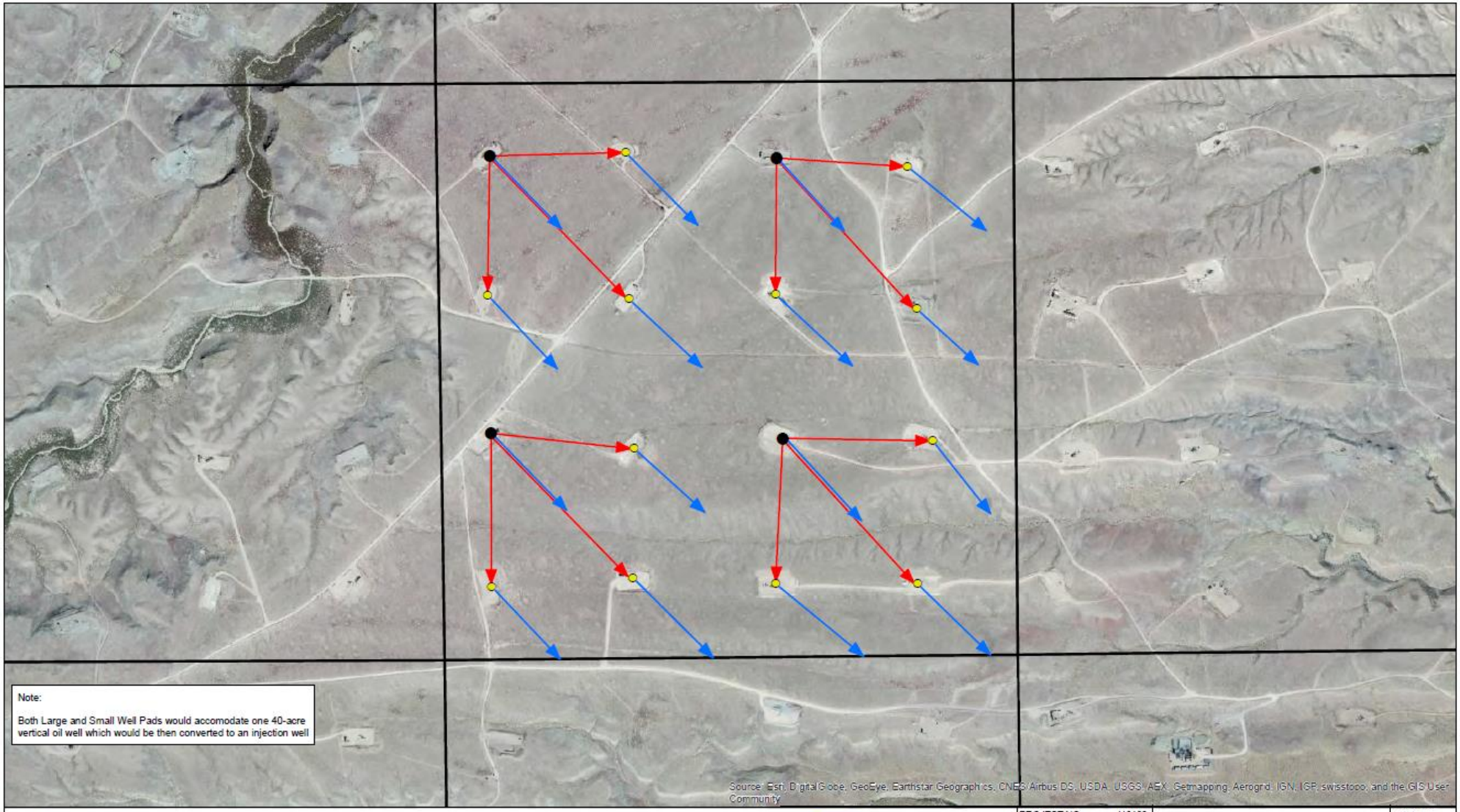
Attachment 1: Maps and Figures

This Page Intentionally Left Blank


Project Location
T4S R3W
T4S R2W
T4S R1W
T4S R1E
T8S R16E
T8S R15E
T8S R17E
T8S R18E
T8S R19E
T5S R1E
T5S R2E
T5S R3W
T9S R16E
T9S R15E
T9S R17E
T9S R18E
T9S R19E
T6S R3W
T10S R15E
T10S R16E
T10S R17E
T10S R18E
T10S R19E
PLEASANT VALLEY
SOUTH MYTON
UTELAND BUTTE
ANTELOPE KNOLLS
0 0.5 1 2
Miles
Legend
Project Boundary
ACEC Boundary
Existing Well Pad (Large)
Existing Well Pad (Small)
Proposed Well Pad (Large)
Proposed Well Pad (Small)
Existing Central Tank Battery
Proposed Deep Gas Compressor Station
Existing Green River Compressor Station
Proposed Green River Compressor Station
Proposed Pump Station
Existing Gas Processing Plant
Proposed Gas Processing Plant
Existing Water Injection Facility
Proposed Water Injection Facility
County Boundary
Proposed GOSP
Existing ROWs (Alt D)
Conceptual ROWs (Alt D)
Level 2 CCA
Level 1 CCA
KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com
PROJECT NO. 116133
DRAWN: 10/17/2014
DRAWN BY: A.Leonard
CHECKED BY: D.Martin
FILE NAME: AlternativeD_CactusComponent_v4.mxd
Monument Butte EIS
Newfield Production Company
Alternative D - Resource Protection
FIGURE
2-4


Legend
Project Area Boundary
100 Year Floodplain
Springs
Ephemeral Drainages
Stream Gauging Sites
PLEASANT VALLEY
BENCH
UTELAND BUTTE
BASIN
ANTELOPE KNOLLS
Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, DeLorme, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.
0 1.25 2.5 5 Miles
Base Map: ESRI Online Map
Floodplain Data: Utah SGID ArcSDE Database (1995)
Stream Data: Utah SGID ArcSDE Database (2011)
Stream Guage Data: USGS (2004)
Springs Data: Utah SGID ArcSDE Database (2011)
N
W
E
S
KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com
PROJECT NO. 116133
DRAWN: 3/27/2015
DRAWN BY: A.Leonard
CHECKED BY: D.Martin
FILE NAME: Floodplain.mxd
Newfield Exploration Company
Monument Butte EIS
Surface Water and Floodplains
Uintah & Duchesne Counties, Utah
FIGURE
3.6.3.2-1


Project Location
T4S R3W
T4S R2W
T4S R1W
T4S R1E
T8S R16E
T8S R17E
T8S R18E
T8S R15E
T8S R19E
T5S R1E
T5S R2E
T5S R3W
T9S R16E
T9S R17E
T9S R18E
T9S R15E
T9S R19E
T6S R3W
T10S R15E
T10S R16E
T10S R17E
T10S R18E
T10S R19E
UTELAND BUTTE
ANTELOPE KNOLLS
PLEASANT VALLEY
SOUTH MYTON
0 0.5 1 2 Miles
Legend
Project Boundary
ACEC Boundary
Existing Well Pad (Large)
Existing Well Pad (Small)
Proposed Well Pad (Large)
Proposed Well Pad (Small)
Existing Central Tank Battery
Proposed Deep Gas Compressor Station
Existing Green River Compressor Station
Proposed Green River Compressor Station
Proposed Pump Station
Existing Gas Processing Plant
Proposed Gas Processing Plant
Existing Water Injection Facility
Proposed Water Injection Facility
County Boundary
Proposed GOSP
Existing ROWs (Alt D)
Conceptual ROWs (Alt D)
High Well Density Area
Low Well Density Area
KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com
PROJECT NO. 116133
DRAWN: 10/17/2014
DRAWN BY: A.Leonard
CHECKED BY: D.Martin
FILE NAME:
Fig 2.6-1_v2.mxd
Monument Butte EIS
Newfield Production Company
High- and Low-Density Development Areas
Under Alternative D
FIGURE
2.6-1


Note:
Both Large and Small Well Pads would accomodate one 40-acre vertical oil well which would be then converted to an injection well
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
0 250 500 1,000 Feet
Legend
Large Well Pad
Small Well Pad
20-ac Directional Oil Well
Directional Deep Gas Well
Section
KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com
PROJECT NO. 116133
DRAWN: 3/30/2015
DRAWN BY: A.Leonard
CHECKED BY: D.Martin
FILE NAME: Figure 2.6-2.mxd
Monument Butte EIS
Newfield Production Company
Low-Density Development
Scenario for Alternative D
FIGURE
2.6-2

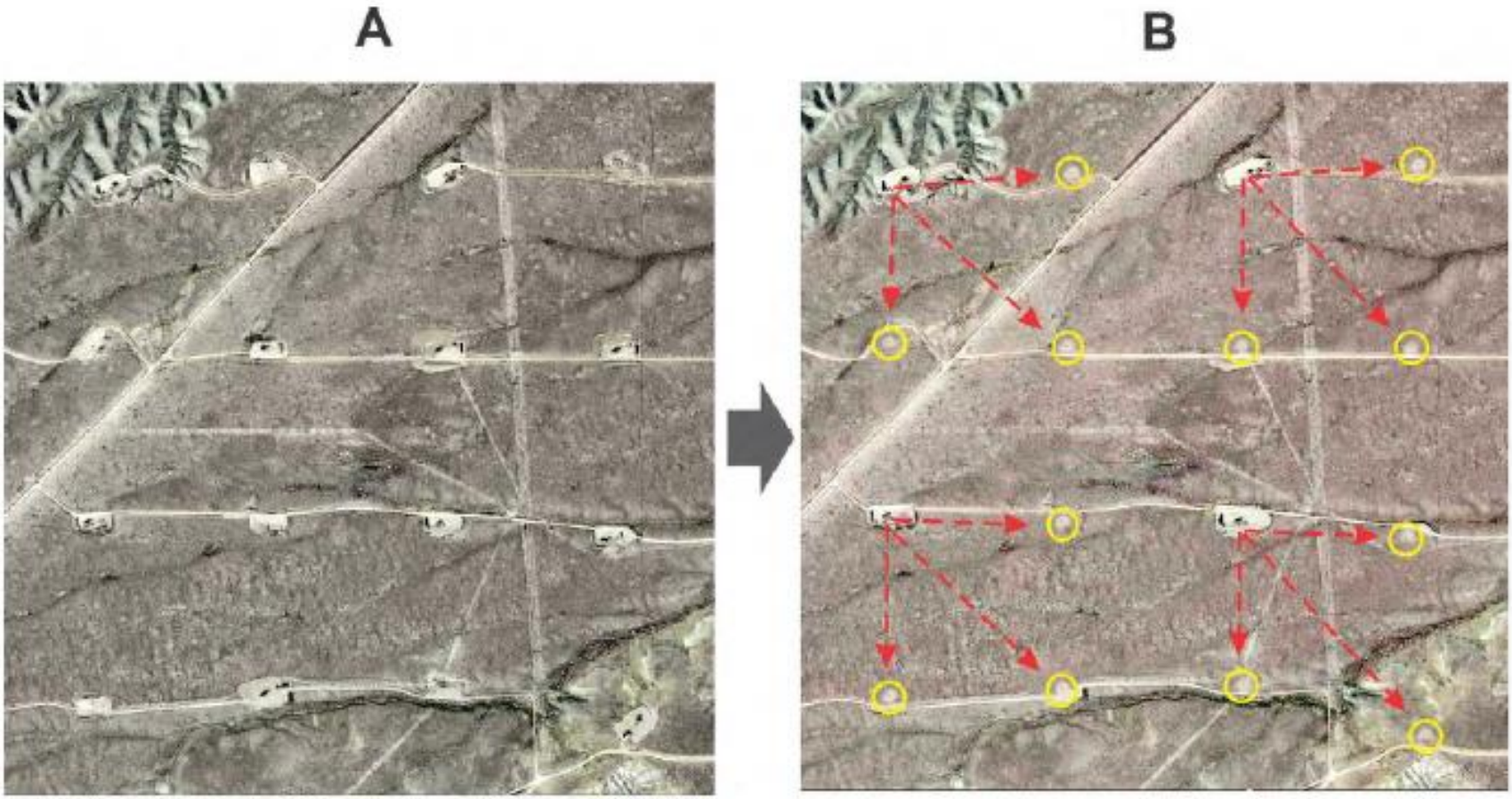


Figure 2.6-2. Comparison of a Typical 640-acre Section Drilled at a 40-acre Surface Spacing (16 Well Pads) (A), with Simulations of Four of the Well Pads Expanded for Directional Drilling, and the Conversion of the Remaining 12 Well Pads Into Water-flood Injection Wells as Shown in Yellow (B).

This Page Intentionally Left Blank

Attachment 2: Data Collection and Reporting Requirements and Conditions of Approval

Table 1 summarizes the data collection and reporting requirements and responsibilities of the Selected Alterative. For a full description of the collection and reporting requirements, refer to the source document. Table 2 lists the Conditions of Approval included in the Selected Alternative.

Table 1: Data Collection and Reporting Requirements[2]

BLM	Newfield	Source	Requirement
X		Biological Opinion	Reporting Requirements for Colorado River Fishes: In order to comply with the Colorado River Recovery Program and ensure exemption from prohibitions of section 9 of the Act, the BLM is required to submit to our office an annual report of water depletions associated with oil and gas development, including the following information: i. Project name and/or applicant name ii. Permit number and/or special use authorization iii. General location and legal description iv. Depletion amount in acre-feet v. Timing of depletion vi. Identify if new or historic depletion vii. Sub-total water depletion (acre-feet) for each applicant viii. Total depletion for the entire year in acre-feet ix. Total number of APDs approved x. Total number of wells spudded Reports shall be due on a yearly basis by October 31.

[2] The BLM highly recommends that Newfield submit an annual report documenting their compliance with these data collection and reporting requirements, and other COAs as appropriate, in an annual comprehensive report. The BLM AO is willing to coordinate with Newfield on the formatting and/or elements of this report.

BLM	Newfield	Source	Requirement
X	X	Biological Opinion	Any annual Sclerocactus monitoring reports associated with the proposed actions must be submitted to USFWS by January 31 each year following monitoring. • Any fish impinged on the intake screen or entrained into irrigation canals would be reported to the USFWS (801-975-3330) or to the UDWR Northeastern Region, located at 318 North Vernal Avenue, Vernal, UT 84078 (435-781-9453). • Biological reports of the spot check survey will be submitted to the BLM AO, and the authorizing official will provide written approval to the operator to proceed with the project. • Spot check biological reports will also be submitted to the Service so that the Service may evaluate the efficacy of these survey methods. • If a spill occurs within the Sclerocactus T&E potential, critical, or core habitats polygon, Newfield would provide a copy of the official spill report to USFWS within the same timeframe required by the regulatory agency.
	X	Biological Opinion	If listed plants are crushed or injured during Project activities, or upon locating dead, injured; or sick listed species, immediate notification must be made to USFWS Salt Lake City Field Office at (801) 975-3330 and Division of Law Enforcement, Ogden, Utah, at (801) 625-5570, and to the BLM AO (435) 781-4400. Pertinent information including the date, time, location, and possible cause of injury or mortality of each species shall be recorded and provided to the Service.
X		Biological Opinion	As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action was retained (or is authorized by law) and if: (1) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (2) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (3) a new species is listed or critical habitat designated that may be affected by the action. If the Project changes or it is later determined that the Project affects listed species differently than identified above; it may become necessary to reinitiate section 7 consultation.
	X	Applicant	• In an effort to ensure that project activities do not increase the existence of invasive or noxious

BLM	Newfield	Source	Requirement
		Committed Measures FEIS Section 2.2.12, FEIS Section 4.7.2, and BA Section 2.3.14	weeds in the MBPA, Newfield would prepare a Weed Control Plan. Specific components of the plan would include ○ Conducting individual noxious weed inventories on a well-by-well basis prior to construction activities. The inventories would include examination of all proposed surface disturbance (i.e., roads, pipelines, and well pads) associated with each well. The results of these inventories would include Global Positioning System (GPS) locations indicating the type and size of each infestation. This data would be formulated into a report and submitted with the APD. ○ Preparation of a Pesticide Use Proposal (PUP). ○ Following the construction phase and drilling phase for each well, all disturbed surface would be monitored annually for the presence of noxious weeds. If monitoring shows the presence of noxious weeds, Newfield would be responsible for treating these areas. Noxious plant control measures (mechanical, cultural, chemical) would be conducted annually prior to seed set. Monitoring and treatment would be conducted annually until reclamation and weed eradication is deemed successful by the AO of the appropriate SMA. ○ All herbicide chemical control will be in conformance with national and local guidance, including approved chemicals, rates, and appropriate BMPs. ○ To prevent further spread of noxious weeds, all vehicles and equipment would be power washed at designated washing locations to remove seed and plant materials before entering the MBPA from outside of the Uinta Basin.
	X	Applicant Committed Measures FEIS 2.2.12, FEIS Section 4.9, and BA Section 2.3.14	• All wildlife law violations would be reported to the UDWR.

BLM	Newfield	Source	Requirement
	X	Applicant Committed Measures FEIS 2.2.12 expanded to contain the original wording from the Mitigation Strategy – Applicant Committed Environmental Protection Measures. See ROD Attachment 3	Mitigation Strategy – Applicant Committed Environmental Protection Measures The purpose of the mitigation strategy outlined here, as incorporated into the Final EIS and ROD, is to ensure that implementation of the Greater Monument Butte Project will not result in net emission increases of volatile organic compounds (VOC) from stationary sources located within the exterior boundaries of the Project area beyond VOC emissions levels for the 2012 operating year. To demonstrate the effectiveness of this "no net increase" strategy, both additions and reductions in VOC would be documented annually on an emissions balance sheet. This documentation along with the additional components of the mitigation strategy -- a Directed Inspection and Maintenance (DI&M) program, an Ozone Action Mitigation Plan, and the Applicant Committed Environmental Protection Measures -- shall be deemed to provide reasonable assurance that project activities analyzed in the GMBU FEIS do not cause or contribute to a Clean Air Act ozone NAAQS violation. Strategy Principles: • Be protective: Provide reasonable assurance that the Project will not cause or contribute to ozone violations in the Basin. • Be accountable and transparent: Allow BLM and Newfield to publically document the project's VOC emissions. • Be adjustable to changing regulatory environment: o Emission reductions of VOC resulting from actions taken by Newfield or natural production decline (defined in the Technical Support Document) shall be used to create headroom for project activities that result in new sources of VOC emissions. In the event of a non-attainment designation on lands including the Project Area, the documented emissions reductions shall be considered by BLM in determining Newfield's compliance with applicable ozone conformity requirements to the extent possible. o Upon the implementation of any new regulation applying to activities within the Project area, such requirement(s) shall replace any comparable component of this mitigation strategy if BLM determines, according to the process outlined below, that compliance with the new requirement(s) commits Newfield to measures that will reduce VOC

BLM	Newfield	Source	Requirement
			emissions. ▪ Provide a process for internal review and assessment conducted by BLM, in consultation with Newfield, to assess whether components of the mitigation strategy can be removed for being equivalent in effect or duplicative of new state or federal air quality regulatory requirements, and whether it is necessary for BLM to continue to require the annual emissions balance sheet and subsequent annual reviews. o In the event of an ozone nonattainment designation and subsequent implementation of an ozone attainment FIP/SIP/TIP (or General Conformity or comparable provisions if the area is classified as marginal), the new requirements shall replace this mitigation strategy. • Flexible: Newfield determines how to accomplish the no-net increase strategy. • Be Cost Effective: Implementation of the components of this mitigation strategy should not impose significant increased operational costs on Newfield beyond those of the Applicant Committed Measures specified in the DEIS in the absence of promulgation and issuance of a new regulation or a SIP/FIP/TIP. Adaptive Management - Annual Emissions Balance Sheet[3] Newfield will ensure that new stationary sources authorized by the ROD will not result in net increases of volatile organic compounds (VOC) emissions. This will be accomplished by achieving reductions of VOC emissions from existing stationary sources prior to operating new sources, balanced on a calendar year annual basis. Newfield will document such reductions in VOC, as well as additions in VOC, from stationary sources in an Annual Emissions Balance Sheet that will have sufficient information for BLM to verify the Operator's actions. The Project Area shall be defined as the area analyzed in the GMBU FEIS (this shall be the "geographic area" as referenced elsewhere in this document). Stationary sources include, but are not limited to, engines, heaters, glycol dehydrators, oil and produced water storage tanks, truck loading, pneumatic controls, pneumatic pumps, and fugitive leaks.

[3]The Annual Emissions Balance Sheet will be submitted to the BLM AO.

BLM	Newfield	Source	Requirement
			Newfield will develop and use the Initial Emissions Balance Sheet as follows: 1. The reporting tool for the Initial Emissions Balance Sheet will be the emissions inventory workbook created by UDAQ and EPA for the Uinta Basin 2014 inventory (2014 emissions inventory workbook), which provides facility-by-facility and source-by-source emissions detail. 2. Newfield will use the emissions quantification methods used in the 2014 emissions inventory workbook to calculate VOC emissions for the 2012 operating year. This calculation of VOC emissions for the 2012 operating year will serve as the initial inventory against which subsequent increases or decreases in VOC emissions will be calculated and documented. 3. Technical corrections and revised calculation methodologies may be applied to the 2014 emissions inventory workbook following consultation between UDAQ, EPA, BLM and Newfield. For subsequent year Annual Emissions Balance Sheets, the above-referenced 2012 emissions inventory calculated by using the 2014 emissions inventory workbook shall continue to serve as the template from which further emissions reductions and additions are calculated and documented. A separate 2015 or 2016 inventory of VOC emissions, as appropriate based upon the timing for the issuance of the ROD, will subsequently be prepared for comparison with the calculations of VOC emissions for the 2012 operating year to determine the net change in VOC emissions and available VOC headroom for project activities that result in new sources of VOC emissions. VOC emissions reductions including, but not limited to, actions taken in response to voluntary actions, the implementation of applicant committed environmental protection measures, natural production decline (defined in the Technical Support Document), existing or new regulations, and/or ozone attainment and maintenance plans can be used to create headroom for project activities that result in new sources of VOC emissions. Annually, or upon request by Newfield, the BLM AO will conduct an internal review and assessment and confer with Newfield to consider new state and federal regulatory requirements and evaluate if portions of this mitigation strategy are no longer necessary. Upon review and Newfield consultation, BLM may remove components of the mitigation strategy that are determined to be equivalent in effect or duplicative of state or federal regulatory requirements or otherwise create contradictory or overlapping requirements. The review will also evaluate the impact of new regulations upon project VOC emissions

BLM	Newfield	Source	Requirement
			and the need to continue the annual emissions balance sheet requirement. The implementation of General Conformity requirements following an ozone non-attainment designation shall be considered equivalent to the annual emissions balance sheet provisions of this strategy, and the annual emissions balance sheet requirements may be terminated at Newfield's option. Upon adoption of a nonattainment FIP/SIP/TIP (or comparable provisions if the area is classified as marginal), this mitigation strategy in its entirety shall be replaced by the FIP/SIP/TIP.
	X	Applicant Committed Measures FEIS 2.2.12 and the Mitigation Strategy – Applicant Committed Environmental Protection Measures. See ROD Attachment 3	Newfield will conduct Audio-Visual-Olfactory (AVO) leak inspections on all existing and new facilities within the Project Area on an annual basis and repair observed leaks. Newfield will utilize IR Camera observations in place of AVO inspections for 10% of facility inspections. If future regulations are implemented to address leak detection and repair requirements, the regulatory program will replace the voluntary inspection program. • Newfield will develop, and submit for BLM approval, ○ a corrective action plan for the Project Area that would include appropriate timeframes to complete necessary repairs that may be identified in the future through the Monitoring Program. ○ an annual report listing the facilities where leaks were observed, the date the leak was observed, the cause of the leak, and the date corrective actions were completed at such facilities.
	X	Applicant Committed Measures FEIS 2.2.12	• Notice of any reportable spill or leakage, as defined in BLM NTL 3A or subsequent revisions, would be reported by Newfield to the AO of the appropriate SMA as required by law. Oral notice would be given as soon as possible, but within no more than 24 hours, and those oral notices would be confirmed in writing within 72 hours of any such occurrence.
	X	FEIS Section 4.8.2	• Project activities would be coordinated to minimize conflicts with ranching operations. This would include conducting an annual meeting with the BLM and livestock operators to discuss the upcoming year's development activities, to identify potential issues, and to determine potential corrective actions by either the livestock permittee and/or proponent; establishing effective and

BLM	Newfield	Source	Requirement
			frequent communication with affected permittees during the year; and scheduling project activities to minimize potential disturbance of livestock activities. • Damage to livestock and livestock facilities would be reported as quickly as possible to the BLM and to affected livestock operators.
X		Hopi Consultation Reply Letter October 1, 2012	• Continue consultation on this proposal including being provided with copies of the cultural resource survey reports as they are generated and any proposed treatment plans for review and comment.
X		Pueblo of the Laguna Consultation Reply Letter September 27, 2012	• In the event that any new archaeological sites are discovered and any new artifacts are removed, notify the tribe and provide the discovery results including photographs to the Tribe for review and comment.
	X	Water Quality Monitoring Plan FEIS Appendix H	• Develop a comprehensive quality assurance project plan (QAPP), including a comprehensive sampling analysis plan (SAP). The QAPP would be prepared prior to any sampling collection, including baseline sampling, prior to commencement of the project.
	X	Water Quality Monitoring Plan FEIS Appendix H	• Prior to commencement of the Greater Monument Butte project, baseline data would be collected in accordance with the QAPP and SAP for all parameters listed in FEIS Appendix H Tables H-2, H-4, and H-6 for surface water, springs, and groundwater, respectively. Data would be collected from appropriate monitoring sites, as described in Sections H.3.1, H.3.2, and H.3.3.
	X	Water Quality Monitoring Plan FEIS Appendix H	• Quarterly water monitoring results would be entered into a database and summarized into a report quarterly. • The annual water monitoring report would contain a description of the monitoring results that identifies by location, observed trends in water quality, any identified potential impacts to water quality, flow conditions, changes in depth to groundwater, recommendations for changes in the long-term monitoring program, and recommendations for mitigation measures to reduce any impacts observed

BLM	Newfield	Source	Requirement
			• In addition to the annual reports, a cumulative assessment of the previous five years of monitoring results would be compiled every five years • A final report would also be completed at the conclusion of the project, which would summarize the entire monitoring program and include a final assessment of all sites monitored throughout the LOP. • All monitoring reports would be submitted to the BLM, EPA, UDWQ, and UDOGM, and they would be made available to the public upon request.
X		Water Quality Monitoring Plan FEIS Appendix H	• The BLM would review the monitoring plan every two years to determine 1) if the plan needs to be changed to adapt to data results; 2) the locations of active project construction; and 3) other project variables.

This page intentionally left blank.

Table 2: Conditions of Approval[4]

Source	Resource	Conditions of Approval
Selected Alternative Description FEIS Section 2.6.3	General	• Within high-density development areas[5], four large, existing well pads per section could be expanded by about 0.2 to 0.8 acres per new well (anticipated to be up to six wells per existing pad, consisting of one existing vertical 40-ac oil/injection one new directional 20-ac oil one new vertical deep gas; and three new directional deep gas). Additionally, within high-density development areas, 12 small well pads per section could be expanded by about 0.2 acres per well to accommodate one new directional 20-ac oil well (i.e., each existing well pad is anticipated to contain up to two wells, consisting of one existing vertical 40-ac oil/injection and one new directional 20-ac oil). • For low-density development areas[6], the proposed surface density would be no more than four large, new well pads per 640-acre section (i.e., one large well pad per 160 acres) and twelve small, new well pads per 640-acre section (i.e., three small well pads per 160 acres). See Figures 2.6-2 (Attachment 1) for a graphical representation of this alternative as compared to the Proposed Action. There would be no restriction on the number of wells that could be drilled from those well pads, provided that the wells conform to downhole spacing requirements. • Newfield would use closed-loop drilling techniques for all proposed wells located near sensitive areas as determined necessary during the onsite process.
Applicant Committed Measures FEIS 2.2.12 and the Mitigation	Air Quality	General • Newfield would use water or other BLM-approved dust suppressants as needed during drilling, completion, and high traffic production operations for dust abatement. • Newfield employees would comply with posted speed limits on unpaved county roads used for

[4] These Conditions of Approval were pulled from the Applicant Committed Measures, the Agency Preferred Alternative components, the FEIS mitigation measures, the Biological Assessment and the Biological Opinion. Duplicate measures between these sources were removed or consolidated to the extent possible without losing or altering intent. If any Applicant Committed Measures, Agency Preferred Alternative components, FEIS mitigation measures, or Biological Assessment measures conflicted with the Biological Opinion requirements, the Biological Opinion requirements were left in and the conflicting measures were removed.

[5] High-density development areas are those areas that already have from six to 16 well pads per 640-acre section (i.e., one well pad per 40 to 106 acres).

[6] Low-density development areas are defined as those areas that have had no development at all or contain up to five well pads per section.

Source	Resource	Conditions of Approval
Strategy – Applicant Committed Environmental Protection Measures. See ROD Attachment 3		access and would use safe vehicle speeds on other unpaved access roads. Newfield would instruct contractors to comply with posted speed limits. • The use of carpooling would be encouraged to minimize vehicle traffic and related emissions and Newfield would implement a vehicle policy to minimize idling while also recognizing safety concerns. • Newfield would conduct a pilot test to evaluate the feasibility for converting fleet vehicles to cleaner-burning compressed natural gas (CNG) or liquefied natural gas (LNG) fuels. The results of this pilot test would be submitted to the AO. Drilling / Completion Operations • Newfield would use Tier II diesel drill rig engines or equivalent, with the phase-in of Tier IV engines or equivalent emission reduction technology by 2018. • Newfield would employ reduced-emission completion practices, including: using the recovered gas as fuel for another useful purpose when feasible; routing all saleable quality gas to a flow line as soon as practicable; and safely maximizing resource recovery and minimizing potential VOC emissions from hydraulically fractured, high-pressure gas well flowback operations (not including low-pressure oil wells). If high-pressure gas well flowback emissions cannot be routed to a flow line, they will be captured and routed to a completion combustion device, unless such device will result in a fire or explosion hazard. Production Operations • Newfield would utilize for new construction low- or intermittent-bleed pneumatic devices to minimize VOC emissions. High-bleed devices may be allowed for critical safety and/or process purposes. • High-bleed pneumatic devices at existing Newfield facilities would be replaced/retrofitted with low- or intermittent-bleed devices when repair or replacement is warranted, and no later than 6 months after the ROD is signed. High-bleed devices may be allowed to remain in service for critical safety and/or process purposes. • Newfield would employ for new construction glycol dehydrator still vent emission controls with

Source	Resource	Conditions of Approval
		a control efficiency of 95 percent or greater. • Newfield would conduct a study to evaluate the feasibility for the implementation of "low emission" glycol dehydrators. The results of this study would be submitted to the AO. o Newfield would install emission controls with an efficiency of 95 percent on tanks that have been constructed, modified or re-constructed after August 23, 2011, with the potential to emit greater than 6 tons per year (tpy) VOC. • Newfield would implement a telemetry monitoring system where feasible to provide for the effective management of production exceptions, while reducing the number of vehicle trips and miles traveled. Central Facilities • Newfield would install electric motor driven compression where feasible. Where electrification is not feasible, Newfield would utilize lean-burn natural gas fired compressor engines or equivalent rich-burn engines with catalysts. Lean-burn engines would be fitted with oxidation catalysts to minimize carbon monoxide and VOC emissions. • Newfield would maximize the use of central compression, thereby reducing the need for smaller and less efficient (higher emission) well site compressor units. • Newfield would periodically replace rod packing systems on reciprocating compressors and when feasible use dry seals on centrifugal compressors to minimize the loss of VOC. • Newfield would employ for new construction glycol dehydrator still vent emission controls with a control efficiency of 95 percent or greater. • Newfield would install for new construction emission controls with an efficiency of 95 percent or greater on stock tanks that have the potential to emit VOC greater than 6 tpy. GOSP Implementation • Where feasible, Newfield would implement Green River oil gathering systems and construct GOSPs. With GOSP implementation, the majority of the stock tanks, produced water tanks, and related tank heaters at affected existing well sites would be removed from service. New wells

Source	Resource	Conditions of Approval
		served by a GOSP would be constructed without tank batteries, thereby eliminating tank battery and related tanker truck emissions. • The GOSP facilities would be specifically designed to minimize the emission of VOC. Storage tank emissions would be captured and reused within the facility process or sold as product. Vapors from truck loading operations would be controlled by 95 percent. Cooperative Efforts and Outreach • Newfield would encourage and lend technical support to scientific research efforts focused on improving the understanding of ozone formation chemistry within the Uinta Basin, emission inventory enhancements, source apportionment studies, ozone precursor transport studies, precursor sensitivity studies, and evaluations of cost effective control strategies. • Newfield would incorporate ozone awareness and specific actions for reducing ozone precursor emissions into the current employee training program. Ozone Training for Operations Personnel • Newfield will develop an Ozone Action Mitigation Plan which includes an operator training component as well as a list of Project activities that could be delayed or minimized during ozone episodes. o For the purposes of the Ozone Actions Mitigation Plan, an ozone episode would be any next day that the UDAQ air quality forecast is Unhealthy for Sensitive Groups (Code Orange – minimum ozone concentration of 0.071) or higher as published on the UDAQ website (current link is: http://air.utah.gov/forecast.php?id=v4). • Newfield will develop and submit for BLM approval an Ozone Action Mitigation Plan which includes the following components: o Newfield will incorporate in its current employee training program ozone awareness and specific actions for reducing ozone precursor emissions. o To the extent practical, Newfield will halt, defer and/or otherwise schedule activities that may contribute to ozone formation to periods outside of ozone episodes.

Source	Resource	Conditions of Approval
		• Operations personnel shall receive training prior to ozone season. Training programs shall cover the following: o Ozone – what it is and how it impacts air quality and human health. o Ozone formation ingredients – NOx, VOCs, and weather conditions. o Ozone attainment status in the Uinta Basin. o Review of applicable regulations. o What can be done to prevent and/or reduce emissions of ozone precursor gases – such as limiting driving, maintaining equipment, delaying optional activities (e.g. equipment and well blowdowns, well completions, etc.). o The importance of proper maintenance of tank hatches, vapor capture and combustor systems, and other equipment that reduces emissions. Work Practices • Newfield will remain fully compliant with applicable UDEQ-DAQ rules at all times, including permitting for new and existing sources, and specifically found in Utah Administrative Code Title R307 501 through 504. • Newfield will comply with Utah Division of Air Quality (UDAQ) Rule 307-502 requiring effective December 1, 2015, all existing pneumatic controllers in Duchesne County or Uintah County meet the standards established for pneumatic controller affected facilities that are constructed, modified or reconstructed on or after October 15, 2013, as specified in 40 CFR 60, Subpart OOOO Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution to minimize VOC emissions. High-bleed devices may be allowed for critical safety and/or process purposes. • When technically and/or economically feasible, Newfield will consider non-gas driven (no bleed) pneumatics and potential opportunities for power supply for such devices through renewable resources for both existing and new development. • Newfield would comply with the applicable requirements of UDAQ Rule 307-401-8a as they

Source	Resource	Conditions of Approval
		apply to the installation of Best Available Control Technology (BACT) compliant emission controls on glycol dehydrator still vents which requires the degree of pollution control for emissions, to be at least best available control technology. When determining best available control technology for a new or modified source in an ozone nonattainment or maintenance area that will emit volatile organic compounds or nitrogen oxides, best available control technology shall be at least as stringent as any Control Technique Guidance document that has been published by EPA that is applicable to the source. The control efficiency shall be at least 95 percent or greater. • Newfield would comply with the applicable requirements of UDAQ Rule 307-401-8a as they apply to the installation of Best Available Control Technology (BACT) compliant emission controls on tanks which requires the degree of pollution control for emissions to be at least best available control technology. When determining best available control technology for a new or modified source in an ozone nonattainment or maintenance area that will emit volatile organic compounds or nitrogen oxides, best available control technology shall be at least as stringent as any Control Technique Guidance document that has been published by EPA that is applicable to the source. • When technically and/or economically feasible, Newfield would route salable gas from oil/water/gas separators to a gas gathering pipeline or otherwise control emissions via a vapor combustor or equivalent methodology. • Wells that utilize plunger lift systems (or otherwise automated systems) shall be operated so as to minimize fugitive emission from well pressure fluctuation and liquid accumulation within the well. • The GOSP facilities would be specifically designed to minimize the emission of VOC. Storage tank emissions would be captured and reused within the facility process or sold as product. Vapors from truck loading operations would be controlled through a vapor capture system utilizing Best Available Control Technology (BACT) compliant with UDAQ Rule 307-401-8(a) which requires the degree of pollution control for emissions to be at least best available control technology. When determining best available control technology for a new or modified source in an ozone nonattainment or maintenance area that will emit volatile organic compounds or

Source	Resource	Conditions of Approval
		nitrogen oxides, best available control technology shall be at least as stringent as any Control Technique Guidance document that has been published by EPA that is applicable to the source. • Evaporation Ponds: Newfield would not own or operate evaporation ponds for the storage or disposal of liquids. • Dehydrators: Optimize dehydrator recirculation rates for the prevailing conditions • Venting Blow Downs: Defer and/or minimize blow down of wells, pipelines, and pressure vessels during ozone events • Pneumatic Pumps: Adjust and optimize pneumatic heat trace pump rates for the prevailing conditions • General Episodic Practices: To the extent practical, defer and/or otherwise schedule activities that may contribute to ozone formation to periods outside of ozone events • Limit Vehicle Idle Time: Limit vehicle idle time to the extent practical
Applicant Committed Measures FEIS 2.2.12	Cultural Resources	• A Class III inventory would be conducted in all areas within Federal lands proposed for surface disturbance. These surveys would be conducted on a site-specific basis prior to the initiation of construction activities. • Whenever feasible, prehistoric and historic sites documented during the Class III inventory as eligible for listing on the National Register of Historic Places (NRHP), as well as areas identified as having a high probability of subsurface materials, would be avoided by development. Specifically, well pad locations and access/gas and water line routes would be altered or rerouted as necessary to avoid impacting NRHP-eligible sites. • If avoidance is not feasible or does not provide the required protection, adverse effects would be mitigated (e.g., data recovery through excavation). • Newfield would inform their employees, contractors, and subcontractors about relevant Federal regulations intended to protect archaeological and cultural resources. All personnel would be informed that collecting artifacts is a violation of Federal law and that employees engaged in this

Source	Resource	Conditions of Approval
		activity would be subject to disciplinary action. • If cultural resources are uncovered during surface-disturbing activities, Newfield would suspend operations at the site and immediately contact the appropriate AO, who would arrange for a determination of eligibility in consultation with the Utah State Historic Preservation Office (SHPO) and if necessary, would recommend a recovery or avoidance plan.
Applicant Committed Measures FEIS 2.2.12, FEIS Section 4.9, and BA Section 2.3.14	Fish and Wildlife[7]	• As required by BLM's Gold Book, Newfield would remove any visible accumulation of oil from the reserve pit immediately upon release of drilling rig to prevent exposure of wildlife to petroleum products. • To minimize wildlife mortality due to vehicle collisions, Newfield would advise project personnel regarding appropriate speed limits in the Monument Butte Project Area. • Employees and contractors would be educated about anti-poaching laws. • If wildlife law violations are discovered, the offending employee would be subject to disciplinary action by Newfield. All wildlife law violations would be reported to the UDWR. • To reduce potential stress from facility construction to antelope, Newfield would install two antelope guzzlers per year for five years within the MBPA. These new facilities would not be subject to setbacks. • Proposed wells and roads located within pinyon-juniper woodland-dominated habitat would be sited, whenever possible, to reduce the amount of disturbance to mule deer foraging habitat. • All proposed roads and well pads would be sited as far from permanent water sources as possible. • All open exhaust stacks would be capped with screen cones to exclude their use by birds and bats. • All open pits or tanks containing liquids would be covered or netted to exclude their use by birds, bats, and other wildlife.

[7] Measures for special status species from section 2.2.12 and the BA have been moved to the special status species section of this table.

Source	Resource	Conditions of Approval
		• All applicable surface stipulations from Appendix K, subject to valid existing rights, and Fluid Minerals BMPs from Appendix R of the Vernal RMP (BLM 2008b) would be implemented. • Exploration, drilling, and other development activity would not be conducted within crucial elk calving and deer habitat from May 15 to June 30. • A Worker Environmental Awareness Program would be implemented for construction and drilling crews prior to the commencement of the project activities. Training materials and briefings would include, but would not be limited to, discussion of the Federal ESA, the consequences of noncompliance with this Act, identification and values of wildlife and natural plant communities, threatened and endangered species within the MBPA, hazardous substance spill prevention and containment measures, and review of all required and recommended mitigation measures.
FES Section 4.3.2	Geology and Minerals	All applicable Fluid Minerals BMPs from Appendix R of the Vernal RMP (BLM 2008b) would be incorporated as needed to avoid resource conflicts or impacts to mineral resources. These include: • Interim reclamation of the well and access road will begin as soon as practicable after a well is placed in production. Facilities will be grouped on the pads to allow for maximum interim reclamation. Interim reclamation will include road cuts and fills and will extend to within close proximity of the wellhead and production facilities. • All above ground facilities including power boxes, building doors, roofs, and any visible equipment will be painted a color selected from the latest national color charts that best allows the facility to blend into the background. • All new roads will be designed and constructed to a safe and appropriate standard, "no higher than necessary" to accommodate intended vehicular use. Roads will follow the contour of the land where practical. Existing oil and gas roads that are in eroded condition or contribute to other resource concerns will be brought to BLM standards within a reasonable period of time. • Final reclamation of all oil and gas disturbance will involve recontouring of all disturbed areas, including access roads, to the original contour or a contour that blends with the surrounding topography and revegetating all disturbed areas.

Source	Resource	Conditions of Approval
		• Raptor perch avoidance devices will be installed on all new powerlines and existing lines that present a potential hazard to raptors. • All powerlines to individual well locations (excluding major power source lines to the operating oil or gas field) and all flow lines will be buried in or immediately adjacent to the access roads where feasible. • In developing oil and gas fields, all production facilities may be centralized to avoid tanks and associated facilities on each well pad where necessary to address resource issues. • Multiple wells will be drilled from a single well pad wherever feasible. • Noise reduction techniques and designs will be used to reduce noise from compressors or other motorized equipment. • Seasonal restrictions on public vehicular access will be evaluated where there are wildlife conflict or road damage/maintenance issues. • Monitoring of wildlife to evaluate the effects of oil and gas development • Avoiding placement of production facilities on hilltops and ridgelines; • Screening facilities from view; • Bioremediating oil field wastes and spills; and • Using common utility or Right-of-Way corridors containing roads, powerlines, and pipelines.
Applicant Committed Measures FEIS 2.2.12 and BA Section 2.3.14	Health and Safety and Hazardous Materials	• Newfield would institute a Hazard Communication Program (HCP) for its employees and require the subcontractor to operate in accordance with Occupational Safety and Health Administration (OSHA) (29 CFR 1910.1200). • As required by OSHA, Newfield would place warning signs near hazardous areas and along access roads. • In accordance with 29 CFR 1910.1200, a Material Safety Data Sheet (MSDS) for every chemical or hazardous material brought on-site would be kept on file in Newfield's field office.

Source	Resource	Conditions of Approval
		• Newfield would transport and/or dispose of any hazardous wastes, as defined by the Resource Conservation and Recovery Act of 1976 (RCRA), as amended, in accordance with all applicable Federal, State, and local regulations. • All storage tanks that contain produced water, or other fluids which may constitute a hazard to public health or safety, would be surrounded by a secondary means of containment for the entire contents of the tank plus freeboard for precipitation, or 110 percent of the capacity of the largest tank. Production facilities that have the potential to leak produced water, or other fluids which may constitute a hazard to public health or safety, would be placed within an appropriate containment and/or diversionary structure to prevent spilled or leaking fluid from reaching groundwater or surface waters. • Newfield would provide portable sanitation facilities at drill sites, would 1 place trash cage at each construction site to collect and store garbage and refuse, and would ensure that all garbage and refuse is transported to a State-approved sanitary landfill for disposal.
FEIS Section 4.12	Land Use and Transportation	• Newfield employees and contractors would comply with posted speed limits while driving roads within the MBPA and would adhere to speed limits outside the MBPA. • Additional permanent and temporary signage would be placed along roadsides to alert motorists of upcoming construction vehicles to lower the probability of accidents. • Newfield would coordinate with the appropriate AO when constructing, maintaining, or reclaiming roads. • Cooperative road management plans would be developed among Newfield, Duchesne County, Uintah County, the State of Utah, and private landowners to address maintenance requirements and responsibilities, and to ensure that roads used by project vehicles are not degraded. • Whenever practicable, heavy and/or slow-moving equipment would be moved at night or during non-peak driving times to minimize delays to other users. Flaggers and/or flag cars would be used to alert non-project traffic to upcoming project equipment. • Gas and water pipelines would be buried at road crossings. Newfield would bury all pipelines crossing County roads to a minimum depth of 5 feet to ensure the safety of road maintenance

Source	Resource	Conditions of Approval
		workers and activities. • Signs would be installed in areas of heavy equipment and truck traffic to warn other users. • Passing areas would be constructed as directed by the AO so other users can safely pass project related vehicles. • Newfield would use centralized tank locations for water and condensate tanks to reduce vehicle trips whenever possible. The feasibility of centralizing tank facilities would be determined on a site-specific basis. • All applicable Fluid Minerals BMPs from Appendix R of the Vernal RMP (BLM 2008b) would be implemented.
Applicant Committed Measures FEIS 2.2.12 and FEIS Section 4.8	Livestock Grazing and Range Resources	• Newfield would repair or replace any fences, cattle guards, gates, drift fences, and natural barriers that are damaged as a result of the Proposed Action. Cattle guards or gates would be installed for livestock control on roads when fences are crossed, and these structures would be maintained by Newfield for the life of the road. • During the APD permitting process, surveys would be conducted to identify active range improvements, including livestock and wildlife water sources/systems, sheep lambing areas, and shearing areas in coordination with the BLM and the livestock operators. Based on the results of these surveys, no roads, well pads, construction/production facilities, or linear facilities would be placed within 200 meters of range improvements, including livestock and wildlife water sources/systems (not to include antelope guzzlers as proposed by Newfield in Section 2.2.12.7). If avoidance is not feasible, features would be relocated to an alternate location per the SMA or AO guidance. Alternate locations would be approved by the BLM on BLM-administered lands, and by appropriate SMA on all other lands. • • Operators would develop and employ prevention measures to avoid damaging fences, gates, and cattle guards, including upgrading cattle guard gate widths and load-bearing requirements. • Speed limits would be followed and signs would be erected in active lambing/calving areas,

Source	Resource	Conditions of Approval
		shipping pastures, or adjacent to working corrals to warn vehicle operators. • Project activities would adhere to the Utah BLM Rangeland Health Standards, as required by the Vernal RMP (BLM 2008b).
Applicant Committed Measures FEIS 2.2.12	Paleontological Resources	• Paleontological surveys would be conducted by an SMA-approved paleontologist prior to any surface disturbance on State and Federal surface. • If fossils are encountered during the survey, the paleontologist would assess and document the discovery, and either collect the fossils or recommend the area be avoided so as not to destroy the resource. • The AO of the SMA would determine the need for further monitoring of the area or mitigation of the site during ground-disturbing activities. • If paleontological resources are encountered during excavation, construction would be suspended, and the AO of the SMA would be notified. Construction would not resume until the paleontological resources are assessed by the AO of the SMA, and appropriate mitigation measures are developed and implemented.
Applicant Committed Measures FEIS 2.2.12, FEIS Section 4.13, and FEIS Section 4.14	Recreation and Visual Resources	• To reduce visual impacts to recreationists using the Green River, low-profile tanks would be used at all well pads located within 0.5 mile or within line of sight (whichever is less) of the Green River. • Low-profile tanks would be used to reduce visual impacts to recreationists in visually sensitive areas at the direction of the AO. • Newfield would use offsite tanks or centralized tank batteries at production locations to reduce visual impacts to recreationists whenever possible. The feasibility of using offsite tanks or centralized tank batteries would be determined on a site-specific basis. • Newfield and the AO would perform the following actions during APD processing when feasible: o Jointly determine the use of topographic features to serve as visual screens

Source	Resource	Conditions of Approval
		○ Place facilities away from highly visible points such as ridgelines ○ Use low-profile tanks to reduce visibility where taller tanks would be more visible ○ Use noise-reducing technology to reduce noise levels experienced by river recreationists to "quiet" levels ○ Avoid excessive side-casting of earth materials from ridgelines and steep slopes • No wells, roads, or other surface disturbance would be allowed on the Pariette Wetlands trail or parking lot. • Except for the proposed water collector well, no surface-disturbing activities would occur within 0.5 miles or line of sight of the river. • The proposed water collector well would be screened from the viewshed of the river as much as possible. • Camouflage coloring, facility design, low-profile structures, proper placement, edge feathering along access roads and vegetation/road boundaries, and/or topographic screening would be used to reduce or eliminate the observable effects of well pads, roads, and infrastructure. Topographic screening and proper placement could include hiding the facilities behind ridge lines, in natural depressions, behind vegetation, or behind rock outcrops. • Surface disturbances would be minimized by sharing ROWs, off-site directional drilling, and off site placement of storage tanks. • Pipelines would be buried in the road when feasible • In VRM Class II areas, night-lighting and light pollution sky glow impacts would be reduced (as feasible) by using only the minimal lighting required for safety and security, installing lights at the minimal heights required, and installing hoods on lights to reduce light diffusion. • Newfield would use centralized tank locations for water and condensate tanks to reduce visual impacts whenever possible. The feasibility of centralizing tank facilities would be determined on a site-specific basis.

Source	Resource	Conditions of Approval
		• Unless no other alternative exists, surface disturbances would be avoided in VRM Class II areas.
Applicant Committed Measures FEIS 2.2.12, and 4.5.2, and BA Section 2.3.14	Soil Resources	• During project construction, surface disturbance and placement of gas and water lines would be limited to the approved location and access routes. • No oil, lubricants, or toxic substances would be drained onto the ground surface. • All areas used for soil storage would be stripped of topsoil before soil placement. • Where directed by the appropriate SMA, Newfield would construct erosion control devices (e.g., riprap, bales, and heavy vegetation) at culvert outlets. All construction activities would be performed to retain natural water flows to the greatest extent possible. • In areas with unstable soils where seeding alone may not adequately control erosion, grading would be used to minimize slopes and water bars would be installed on disturbed slopes. • Erosion control efforts would be monitored by Newfield, and modifications would be made to control erosion if necessary. • Erosion protection and silt retention would be provided by the construction of silt catchment dams where needed and as feasible. • No surface disturbance would occur on slopes between 40 percent and 60 percent. If it is not feasible to avoid these slopes, then the applicant would provide the AO with an erosion control plan, a road maintenance plan, and an engineered drawing of the proposed road. Approval from the AO would be required for all proposed roads traversing slopes between 40 percent and 60 percent. • Surface disturbance would be minimized on slopes between 21 and 40 percent. • The presence of biological soil crusts would be assessed on a site-specific basis during well pad and road development and siting. Areas with crusts would be avoided as feasible, and any unavoidable disturbance would be mitigated as necessary. • Erosion and sedimentation would be reduced through the use of BMPs, including but not limited to berms, sediment control structures, grading, mulching, revegetation, and interim reclamation.

Source	Resource	Conditions of Approval
		• Reclamation would be performed in accordance with the Green River District Reclamation Guidelines for Reclamation Plans (BLM 2011a). Additional measures to ensure successful reclamation would be implemented, as determined by the AO. They would consist of, but would not be limited to, hydro mulching, supplemental mycorrhizal applications, erosion blankets, spray-on fiber matrices, tackifiers, etc.
FEIS Section 4.15	Special Designations	• Newfield and the AO would perform the following actions during APD processing when feasible: o Jointly determine the use of topographic features to serve as visual screens; o Place facilities away from highly visible points such as ridgelines; o Use low-profile tanks to reduce visibility where taller tanks would be more visible; and o Avoid excessive side-casting of earth materials from ridgelines and steep slopes (Scenic value in Lower Green River ACEC, recreational value in Lower Green River proposed WSR). • Placement of tanks and drilling pads would be considered, and off-site tanks may be used to minimize visual impacts (Scenic value in Lower Green River ACEC, recreational value in Lower Green River proposed WSR). • Newfield would use offsite tanks or centralized tank batteries at production locations to reduce visual impacts whenever possible. The feasibility of using offsite tanks or centralized tank batteries would be determined on a site-specific basis (Scenic value in Lower Green River ACEC, recreational value in Lower Green River proposed WSR). •
BA Attachment G, BO Section IX Conservation Recommendations FEIS Section 4.10.5 and	Special Status Species Habitat	• Special Status Plants: 1) Within suitable habitat, site-specific inventories will be conducted to determine occupancy. The inventories will be conducted for lands within 300 feet of proposed surface disturbance; 2) In suitable habitat, the project infrastructure will be designed to minimize impacts; and 3) Within occupied habitat, the project infrastructure will be designed to avoid direct disturbance and to minimize indirect impacts to populations and individual plants. The nearest proposed surface disturbance to a plant will be at least 300 feet away.

Source	Resource	Conditions of Approval
Appendix J. See Volume 3 PDF Page 1050		• As required by the Endangered Species Act (ESA) of 1973, as amended, no activities would be permitted that would jeopardize the continued existence of threatened or endangered plant species. • Interim reclamation of the well and access road will begin as soon as practicable after a well is placed in production. Facilities will be grouped on the pads to allow for maximum interim reclamation. Interim reclamation will include road cuts and fills and will extend to within close proximity of the wellhead and production facilities. • While construction in the 100-year floodplain or wetlands is occurring, heavy equipment working on wet soils shall be placed on mats. Work should be conducted primarily while the ground is frozen or soils are dry. • Silt fence shall be properly installed in 100-year floodplains and wetlands where project disturbance may erode into waters during a precipitation event. All applicable surface stipulations from Appendix K, subject to valid existing rights, and Fluid Minerals BMPs from Appendix R of the Vernal RMP (BLM 2008b) would be implemented. These include: • Interim reclamation of the well and access road will begin as soon as practicable after a well is placed in production. Facilities will be grouped on the pads to allow for maximum interim reclamation. Interim reclamation will include road cuts and fills and will extend to within close proximity of the wellhead and production facilities. • All above ground facilities including power boxes, building doors, roofs, and any visible equipment will be painted a color selected from the latest national color charts that best allows the facility to blend into the background. • All new roads will be designed and constructed to a safe and appropriate standard, "no higher than necessary" to accommodate intended vehicular use. Roads will follow the contour of the land where practical. Existing oil and gas roads that are in eroded condition or contribute to other resource concerns will be brought to BLM standards within a reasonable period of time. • Final reclamation of all oil and gas disturbance will involve recontouring of all disturbed areas, including access roads, to the original contour or a contour that blends with the surrounding topography and revegetating all disturbed areas.

Source	Resource	Conditions of Approval
		• Raptor perch avoidance devices will be installed on all new powerlines and existing lines that present a potential hazard to raptors. • All powerlines to individual well locations (excluding major power source lines to the operating oil or gas field) and all flow lines will be buried in or immediately adjacent to the access roads where feasible. • In developing oil and gas fields, all production facilities may be centralized to avoid tanks and associated facilities on each well pad where necessary to address resource issues. • Multiple wells will be drilled from a single well pad wherever feasible. • Noise reduction techniques and designs will be used to reduce noise from compressors or other motorized equipment. • Seasonal restrictions on public vehicular access will be evaluated where there are wildlife conflict or road damage/maintenance issues. • Monitoring of wildlife to evaluate the effects of oil and gas development • Avoiding placement of production facilities on hilltops and ridgelines; • Screening facilities from view; • Bioremediating oil field wastes and spills; and • Using common utility or Right-of-Way corridors containing roads, powerlines, and pipelines.
FEIS Section 4.10.5 and Biological Assessment Attachment G Section 7 Applicant Committed	Special Status Species – Fish *(See also the Water Resources Including 100-year Floodplains, Wetlands/Riparian, Springs section of*	• Newfield and its contractors would locate, handle, and store hazardous substances in locations that would prevent accidental spill or delivery to the Green River or its tributaries. • Natural gas-condensate pipelines that cross mapped 100-year floodplain, mapped riparian, or wetland areas would be routinely pigged (as technically feasible) and would have emergency shutoff valves located immediately outside the floodplain. • Natural gas pipelines that cross perennial, intermittent, and ephemeral stream channels would be buried below the predicted scour depth for an equivalent flood event. The construction

Source	Resource	Conditions of Approval
Measures and FEIS Appendix J. See Volume 3 PDF Pages 1357 - 1360	*these COAs)*	requirements for each type of crossing would be determined on a site-specific basis and would consider the technical guidance of the document entitled, "Hydraulic Considerations for Pipeline Crossings of Stream Crossings," which is found in Appendix B of the Vernal RMP (BLM 2008b). • Natural gas pipelines that cross perennial, intermittent, and ephemeral stream channels would have automatic shutoff valves directly beyond the area at risk of flooding to reduce the magnitude of contamination in the event of an accidental pipeline break. • Natural gas pipelines that cross perennial, intermittent, and ephemeral stream channels would be buried at least 5 feet below the channel bottom. • With the exception of the water collector well, wells proposed within the Green River's 100-year floodplain would be relocated to non-floodplain areas or drilled directionally from beyond the floodplain. • Wells proposed in all 100-year floodplains within 3 miles of the Green River would use measures including the use of closed-loop drilling methods, berming, and secondary containment of all tanks and pits, as well as drilling during non-flood prone seasons. • All applicable BLM-committed Conservation Measures for Colorado River fishes, as described in Appendix L of the Vernal RMP (BLM 2008b), would be used as needed to mitigate potential impacts to endangered and sensitive fishes and their habitat. • To avoid entrainment, water would be pumped from an off-channel location - one that does not connect to the river during high spring flows. An infiltration gallery constructed in a location approved by USFWS would be used. • If the pump head is located in the river channel, the following stipulations would apply: o The pump would not be situated in a low-flow or no-flow area, because these habitats tend to concentrate larval fishes. o The amount of pumping would be limited, to the greatest extent possible, during that period of the year when larval fish may be present (April 1- August 31). The amount of pumping would be limited, to the greatest extent possible, during the 2 midnight hours (10

Source	Resource	Conditions of Approval
		PM to 2 AM), because larval drift studies indicate that this is the period of greatest daily activity. Dusk is the preferred pumping time, because larval drift abundance is lowest during this time. o All pump intakes would be screened with 3/32-inch mesh material. o Approach velocities for intake structures would follow the National Marine Fisheries and USFWS document "Fish Screening Criteria for Anadromous Salmonids." For projects with an in-stream intake that operate in stream reaches where larval fish may be present, the approach velocity would not exceed 0.33 feet per second. o Any fish impinged on the intake screen or entrained into irrigation canals would be reported to the USFWS (801-975-3330) or to the UDWR Northeastern Region, located at 318 North Vernal Avenue, Vernal, UT 84078 (435-781-9453). • For all tributaries that drain directly to Pariette Draw or directly to the Green River, roads and well pads would be set back a minimum of 300 feet from the active stream channel (average 3-feet wide or greater without an associated riparian zone), unless site specific analysis demonstrates that 1) the proposed well or road could be placed on higher terrain above the 100-year floodplain, 2) the 100-year floodplain can be demonstrated to be narrower than 200 feet in the area proposed for well location; or 3) the well pad or road can be increased in height to avoid a predicted over-topping 50-year flood. In these situations, the well pad or road would not be placed closer than 100 feet from the stream channel. • All new stream crossings would be kept to a minimum. In the case of an unavoidable stream crossing, culverts would be designed and constructed to allow fish passage. All stream crossings would be designed and constructed to keep impacts to riparian and aquatic habitat to a minimum. • Appropriate BMPs needed to mitigate water impacts anticipated to occur from surface-disturbing activities would be identified during the onsite process and may include, but would not be limited to, proper culvert design, installation of energy dissipation devices, proper site selection (avoidance of steep slopes, riparian areas, wetlands, areas subject to severe soil movement, and areas of shallow groundwater and natural watercourses), and using closed-loop drilling. • Water production will be managed to ensure maintenance or enhancement of riparian habitat.

Source	Resource	Conditions of Approval
		• Avoid loss or disturbance of riparian habitats. • Where technically and economically feasible, use directional drilling or multiple wells from the same pad to reduce surface disturbance and eliminate drilling in suitable riparian habitat. Ensure that such directional drilling does not intercept or degrade alluvial aquifers. • Implement the Utah Oil and Gas Pipeline Crossing Guidance (from BLM National Science and Technology Center). • Oil or gas drilling will not occur within 100-year floodplains of rivers or tributaries to rivers that contain listed fish species or critical habitat. • In areas adjacent to 100-year flood plains, particularly in systems prone to flash floods, analyze the risk for flash floods to impact facilities, and use closed loop drilling, and pipeline burial or suspension according to the Utah Oil and Gas Pipeline Crossing Guidance, to minimize the potential for equipment damage and resulting leaks or spills. • Construction activities in the 100-year floodplain of the Green River will be timed to reduce impacts to seasonal fish movements, spawning activity, and rearing activity by avoiding construction from April 1 through August 31. • No work will occur directly in the Green River or other rivers that are considered to be critical habitat for listed Colorado River fish. • Best Management Practices (BMPs) would be used to minimize sedimentation, temporary erosion of stream banks, and needless damage or alteration to the Green River streambed. BMPs should also ensure construction related byproducts do not enter the riverine ecosystem that will cause negative impacts to aquatic organisms. • Construction activities in designated critical habitat of the listed Colorado River fish will not occur during active flooding events (when the water level rises more than 6 inches above the normal wetted channel). If construction materials are displaced by high flow the applicant will contact our office as soon as possible to coordinate the least intrusive retrieval methods. • No more than 1 acre of ground disturbance will occur within the critical habitat of listed

Source	Resource	Conditions of Approval
		Colorado River fish. • Temporary and permanent construction-related impacts to Colorado pikeminnnow and razorback sucker critical habitat will be addressed by revegetation of construction affected areas. • Imported and site source materials will be stored in the staging area away from the 100-year floodplains of the Green River. For chemicals being used on-site, the contractor or responsible representative shall provide watertight tanks or barrels for the storage and disposal of chemical pollutants, including those that are produced as byproducts of the construction activities, such as drained lubricating or transmission fluids, grease, or soaps. Upon completion of construction work, these containers will be removed from the action area and their contents disposed of at a designated disposal location. • Machinery will be fueled offsite or in a confined, designated area to prevent spillage into any surface water. Refueling will not occur within the 100-year floodplain of the Green River. • Contaminant control measures will be installed to prevent contaminants release into the Green River channel. • Sediment control measures will be implemented to prevent project-related sediment from entering the critical habitat of the flowing stream channel. • Materials should not be stockpiled in the 100-year floodplain or wetlands. • Mitigation for permanent impacts to designated critical habitat of the Colorado River Fish will be achieved through completion of a riparian restoration project implemented at a ratio of 3:1 for all permanent disturbed areas. Temporary impacts will be mitigated at a 2:1 ratio for all disturbed areas. For every 1 acre of temporary disturbance 2 acres will be restored. For every 1 acre of permanent disturbance, 3 acres will be restored. • Disturbed areas in Colorado River Fish Critical Habitat will be restored to natural grade, tilled if necessary to loosen compacted soils, and planted with a combination of native, certified weed-free riparian trees, shrubs, and other vegetation. The applicant will work with the U.S. Fish and Wildlife Service Utah Ecological Services Field Office (USFWS) to complete a restoration plan. This plan will include planting willows, cottonwoods, or other native vegetation, removal of

Source	Resource	Conditions of Approval
		noxious weeds, and other measures to be determined on a site-specific basis. The planting success criteria and monitoring will be coordinated with the USFWS Utah Ecological Services Field Office. • The mitigation restoration project will occur within one year post-construction.
FEIS Section 4.10	Special Status Species – Raptors and Migratory Birds	• For any surface-disturbing activities proposed between January 1 and September 31, a BLM-approved biologist would survey proposed development sites for the presence of raptor nests. The survey area would be determined on a site-specific basis by the AO of the appropriate SMA. On BLM lands, if occupied/active raptor nests are found, construction would not occur during the nesting season for that species within the species-specific buffer described in "Best Management Practices for Raptors and Their Associated Habitats in Utah." As specified in the Raptor BMPs, modifications of these spatial and seasonal buffers for BLM-authorized actions would be permitted, so long as protection of nesting raptors was ensured (see Appendix A of the Vernal ROD and Approved RMP) (BLM 2008b). Fee and SITLA lands would be excluded from this measure. • All applicable surface stipulations from Appendix K, subject to valid existing rights, and Fluid Minerals BMPs from Appendix R of the Vernal RMP (BLM 2008b) would be implemented. • Electric distribution and transmission structures would be designed according to criteria presented in Suggested Practices for Raptor Protection on Power Lines: the State of the Art in 2006 (APLIC 2006). In addition, strategies for minimizing collision risk with power lines would follow criteria presented in Reducing Avian Collisions with Power Lines: the State of the Art in 2012 (APLIC 2012). • Between March 1 and August 31, new construction or surface-disturbing activities would not occur within 0.25 miles of active burrowing owl and short-eared owl nests. • Between May 1 and June 15, new construction or surface-disturbing activities would not occur in mountain plover habitat to protect the species during the breeding and nesting season. • As required by BLM's Gold Book, Newfield would remove any visible accumulation of oil from the reserve pit immediately upon release of drilling rig to prevent exposure of migratory birds to

Source	Resource	Conditions of Approval
		petroleum products.
FEIS Section 2.6.1.2 and 4.10.5 as modified by BO and its Section 7 Applicant Committed Measures. See FEIS Appendix J-Attachment 1-Appendix A Volume 3 PDF pages 1311-1316 and 1350 - 1353	Special Status Species – Sclerocactus	• The Conservation, Restoration, and Mitigation Strategy for the Pariette and Uinta Basin Hookless Cactus for the Newfield Greater Monument Butte Project (ROD Attachment 4) developed by USFWS and Newfield will be implemented under this Alternative. • Surveys will be completed in accordance with the latest conservation measures and USFWS protocols and Memorandums of Understanding. The BLM's current understanding of these protocols is as follows: Sclerocactus Surveys • Pre-project habitat assessments will be completed across 100% of the project disturbance area within potential habitat prior to any ground-disturbing activities to determine if suitable Sclerocactus habitat is present. • Pre-construction Sclerocactus surveys will occur following the pre-project habitat assessments that identified any potential habitat within the project area. These pre-construction surveys must follow U.S. Fish and Wildlife Service (USFWS) Utah Field Office Guidelines for Conducting and Reporting Botanical Inventories and Monitoring of Federally Listed, Proposed, and Candidate Plants. Surveys will be conducted in suitable habitat prior to initiation of project activities, at a time when the plant can be detected, and during appropriate flowering periods: • Sclerocactus brevispinus surveys must be conducted between March 15th and June 30th, unless an extension is provided in writing by the USFWS, • Sclerocactus wetlandicus surveys can be done any time of the year provided there is no snow cover. • Sclerocactus surveys will be conducted by a qualified botanist. Qualifications are defined in the USFWS Utah Field Office Guidelines for Conducting and Reporting Botanical Inventories and Monitoring of Federally Listed, Proposed and Candidate Plants, http://www.fws.gov/utahfieldoffice/SurveyorInfo.html. Qualified botanists must also attend the USFWS Uinta Basin Rare Plant Workshop,

Source	Resource	Conditions of Approval
		http://www.fws.gov/utahfieldoffice/UBRarePlants.html. • Surveys will be valid per the FWS Survey Methods and Protocol for *Sclerocactus brevispinus* and *Sclerocactus wetlandicus.* • Sclerocactus spot check surveys will be conducted on an annual basis by a qualified botanist, and reviewed by the Bureau of Land Management (BLM) and our office for all planned disturbance areas if the project has not been completed within the year following pre-construction plant surveys. Review of spot checks may result in additional pre-construction plant surveys as directed the BLM and our office. If the proposed action has not occurred within four years of the original survey, additional coordination with the BLM and our office must occur and a new clearance survey may be necessary prior to ground disturbing activities. • Sclerocactus surveys for access roads, buried pipelines, well pads, and other facilities requiring removal of vegetation (e.g., compressor stations) will include the project area and/or right-of-way (ROW), and 300 feet (ft.) from the edges of the project disturbance and/or ROW. • Sclerocactus surveys for surface pipelines placed within an existing road ROW, and within 10 ft. from the edge of the disturbed surface of the road, will include the ROW and 50 ft. from the edge of the ROW on the pipeline side of the road. • Sclerocactus surveys for cross-country surface pipelines (pipelines over 10 ft. from a road), where the pipeline will be laid by hand with minimal disturbance and no vehicle use will include the ROW and 50 ft. from the edges of both sides of the ROW. • Surveys for all other cross-country surface pipelines (vehicles or equipment used, not laid out by hand) will include the ROW and 300 ft. from the edges of both sides of the ROW. • *Sclerocactus* surveys will not be necessary when pipelines are buried in existing roads. • Sclerocactus brevispinus and S. wetlandicus Survey Methods and Protocol: o Initial pre-disturbance 100% clearance surveys will be conducted following standard methodology and will be valid for a period of 4 years. ▪ If more than 4 years pass between the original surveys and construction, a new 100% clearance survey will be required. ▪ If construction is to occur within the 4 year window, an additional, reduced-effort "spot check" survey will be conducted following the below methodology in the

Source	Resource	Conditions of Approval

		year of project construction.
		• Sclerocactus Spot Check Survey Methods:
		  ○ Spot checks will be conducted by qualified individuals according to BLM and Service standards for plant surveyors (i.e. attendance at Uinta Basin Rare Plant Workshop, qualifying education and experience).
		  ○ Spot check surveys will occur during the year of construction.
		  ○ Timing limitations for spot check surveys will follow existing protocols for regular surveys:
		  ▪ S. brevispinus: March 15 through June 30 unless extended by prior written approval by the Service;
		  ▪ S. wetlandicus: During any time of year with no snow cover.
		• Within 30 feet (10 meters) of the perimeter of the previous survey, spot check surveys will occur at a moderate intensity (survey lines spaced 10 feet or so apart at a moderately slow speed; this can be done via a meander survey method) except in the following locations:
		  ○ Original survey areas that are within 300 feet and downslope of known plant locations, where seeds are likely to disperse during rain events. Locations meeting these criteria will require 100% clearance surveys.
		  ○ Areas immediately adjacent to ant mounds/colonies that fall within the original 100% clearance survey boundary. Another known mechanism for Sclerocactus seed dispersal is harvester ants, so the area immediately adjacent to active and inactive ant mounds (approximate 10 foot diameter) should be surveyed following standard survey protocols for new germinants of Sclerocactus.
		• Surveys will be completed prior to any ground disturbing activities. Operators may not proceed on the basis of a preliminary negative spot check survey.
		• Biological reports of the spot check survey will be submitted to the BLM AO, and the authorizing official will provide written approval to the operator to proceed with the project.

Source	Resource	Conditions of Approval
		• Spot check biological reports will also be submitted to the Service so that the Service may evaluate the efficacy of these survey methods. PROJECTS PROPOSED WITHIN SCLEROCACTUS HABITAT General Measures • The BLM's priority will be to locate any new surface disturbance more than 300 feet from Sclerocactus populations or individuals, except for surface pipelines, which is 50 feet. • Access roads, buried pipelines, well pads, and other facilities requiring removal of vegetation (e.g., compressor stations) will be located a minimum distance of 300 feet from individual Sclerocactus plants and/or populations where feasible (and in accordance with Core Area 1 and Core Area 2 conservation recommendations, as outlined below). • When the edge of an unavoidable surface disturbance[8] is located within 300 feet of populations or individuals of Sclerocactus, the following actions will be taken to minimize the impacts: o A qualified botanist will be on site to monitor surface-disturbing activities when cacti are within 300 feet of any surface disturbance. o Cacti within 300 feet of a proposed surface disturbance will be flagged immediately prior to surface-disturbing activities, and flags will be removed immediately after surface-disturbing activities are completed. Leaving cacti flagged for as short a time as possible will minimize drawing attention to the cacti and reduce the potential for theft; o New pipelines will be sited to maximize the distance from adjacent Sclerocactus wetlandicus, S. brevispinus, and hybrids. o Project personnel associated with construction activities will be instructed to drive at a speed limit of 15 miles per hour on unpaved roads and to remain on the existing roads and ROWs at all times.

[8] Unavoidable surface disturbance for this document is defined as a buried pipeline adjacent to an existing road or a well pad expansion. However, in limited cases as defined in the FWS/Newfield Conservation, Restoration, and Mitigation Strategy for the Pariette and Uinta Basin Hookless Cactus (FEIS Appendix J Biological Assessment - Attachment F) it may be possible to install a new well pad and road within 300 feet of cactus.

Source	Resource	Conditions of Approval
		○ All crews will be informed of potential Sclerocactus presence, identification, and legal repercussions associated with "take' of a listed species. ○ If a spill occurs within the Sclerocactus T&E potential, critical, or core habitats polygon, Newfield would provide a copy of the official spill report to USFWS within the same timeframe required by the regulatory agency. ○ Ground disturbing activities in Level 1 CCAs, and within 300 feet of individual Sclerocactus plants and/or populations, must occur outside of the flowering period, April 1 - May 30 (and in accordance with Core Area 1 and Core Area 2 conservation recommendations, as outlined below). • Surface pipelines will be located at a minimum of 50 feet from individual Sclerocactus plants and/or populations where feasible (and in accordance with Core Area 1 and Core Area 2 conservation recommendations, as outlined below). • New surface pipelines located closer than 50 feet to known *Sclerocactus* individuals will be secured in place to prevent pipeline movement (and in accordance with Level 1 and 2 CCA conservation recommendations, as outlined below). • Existing surface pipelines located closer than 50 feet to known Sclerocactus individuals will be secured in place to prevent pipeline movement (and in accordance with Core Area 1 and Core Area 2 conservation recommendations, as outlined below). • Dust abatement will be employed in suitable Sclerocactus habitat over the life of the project during the time of the year when Sclerocactus species are most vulnerable to dust-related impacts (March through August). ○ Only water and methods approved by the AO (no chemicals, reclaimed production water or oil field brine) will be used for dust abatement measures within cactus habitat. • Noxious weeds within Sclerocactus habitat may be controlled with herbicides, in accordance with the BLM Herbicide PEIS (http://www.blm.gov/wo/st/en/prog/more/veg_eis.html). Guidelines and the BLM's Standard Operating Procedures for Threatened and Endangered Plant Species (BLM Herbicide PEIS Appendix B Tables B-1 and B-2).

Source	Resource	Conditions of Approval
		○ Application for a Pesticide Use Permit will include provisions for mechanical removal, as opposed to chemical removal, for Utah Class A, B, and C noxious weeds within 50 feet of individual/populations of Sclerocactus. • Erosion control measures (e.g., silt fencing) will be implemented to minimize sedimentation to Sclerocactus plants and populations located down slope of proposed surface disturbance activities, and should only be implemented within the area proposed for disturbance. • All disturbed areas will be reclaimed with plant species native to Utah, or seed mixtures approved by the BLM and USFWS, which may include the use of sterile, non-native, non-invasive, annuals to help secure topsoil and encourage native perennials to establish. • The BLM AO can halt construction as necessary based on new plant location information obtained from sources other than the operator or the contractor hired by the operator. Core Conservation Area Level 1 (CCA): • New wells could be directionally drilled from existing well pads, and new pipelines could be installed in existing roads so long as no new surface disturbance is required. • Avoid new surface disturbance[9], including well pads, roads, pipelines, or any other surface disturbing activities where feasible. Expansion of existing facilities[10] will be allowed - e.g., widening existing access roads, expanding well pads, installation of pipelines to access existing facilities (along existing alignments or roadways). • Where new surface disturbance occurs within the Level 1 CCAs, mitigation must be completed following the Conservation and Mitigation Strategy For the Pariette Cactus and Uinta Basin Hookless Cactus, Newfield Greater Monument Butte Project (Strategy). Where new surface disturbance directly affects Sclerocactus (Sclerocactus are directly removed), a monetary amount

[9] Actions that occur entirely within previously disturbed areas (such as reopening reserve pits so long as the spoils do not disperse onto adjacent undisturbed areas or burying pipelines in existing roads), are not considered "new" surface disturbance. Temporary use areas (areas that are outside of the current edge of disturbance, i.e. outside reclaimed reserve pits, that would be used to erect and disassemble the drilling derrick) are considered "new" surface disturbance.

[10] BLM designated plugged and abandoned wells (P&A) for purposes of this EIS are considered by the BLM to be fully reclaimed but are given preference for construction of new well pads over previously undisturbed areas. A well that is BLM P&A status has had a Final Abandonment Notice (FAN) submitted by the company, accepted by the BLM thus releasing the company from obligation to the well (note: this definition differs from the State of Utah, which defines P&A as the well is plugged but the location is not reclaimed).

Source	Resource	Conditions of Approval
		($640 per Sclerocactus) will be contributed to the Sclerocactus Mitigation Fund-BLM to aid in the recovery of Sclerocactus species impacted by the project. These contributions are in addition to payments requested for indirect effects to Sclerocactus. Contributions will be negotiated between the Operator and the USFWS office and will be based on the number of Sclerocactus directly impacted and in relation to the USFWS's current management guidelines for Sclerocactus. • Ground disturbing activities in Level 1 CCAs, and within 300 feet of individual Sclerocactus plants and/or populations, must occur outside of the flowering period, April 1 - May 30. • Where access roads are widened, well pads are expanded, or buried pipelines access existing facilities, design projects to minimize impacts: o Locate project a minimum distance of 300 feet from individual Sclerocactus plants and/or populations (except for surface pipelines which is 50 feet). o Utilize existing well pads and infrastructure. o Use common ROWs for roads and utilities where possible. o Place signing to limit off-road travel in sensitive areas. • Several options for mitigation of Level 1 CCAs are present (see Strategy). If mitigation funds are established, funds will be paid to: Sclerocactus Mitigation Fund – BLM, Impact-Directed Environmental Accounts, National Fish and Wildlife Foundation Fifteenth Street NW, Suite 1100 Washington, DC 20005 Core Conservation Area Level 2: • New wells could be directionally drilled from existing well pads, and new pipelines could be installed in existing roads so long as no new surface disturbance is required. • New surface disturbance, including well pads, roads, pipelines, or any other surface-disturbing activities will not exceed a 5% surface disturbance threshold where feasible. • If the total cumulative surface disturbance is below the 5% threshold, and where access roads, buried pipelines, well pads, or other facilities requiring removal of vegetation (e.g., compressor

Source	Resource	Conditions of Approval
		stations) will be constructed, design project to minimize impacts locating a project a minimum distance of 300 feet from individual Sclerocactus plants and/or populations (except for surface pipelines which is 50 feet). • If the total cumulative surface disturbance is above the 5% threshold, and/or where new surface disturbance indirectly affects Sclerocactus (cactus within 300 feet of proposed disturbance), the mitigation will occur following the Strategy. • Where new surface disturbance directly affects Sclerocactus (cacti are directly removed), a monetary amount ($640 per cactus) will be contributed to the Sclerocactus Mitigation Fund-BLM to aid in the recovery of Sclerocactus species impacted by the project. These contributions are in addition to payments requested for indirect effects to cacti (see previous measure). Contributions will be negotiated between the Operator and the USFWS based on the number of cacti directly impacted and in relation to the USFWS' current management guidelines for Sclerocactus. • Several options for mitigation of Level 2 CCAs are available (see Strategy). If mitigation funds are established, funds will be paid to: Sclerocactus Mitigation Fund – BLM, Impact-Directed Environmental Accounts, National Fish and Wildlife Foundation, 1133 Fifteenth Street NW, Suite 1100, Washington, DC 20005 Sclerocactus Habitat Polygon: • Where access roads, buried pipelines, well pads, or other facilities requiring removal of vegetation (e.g., compressor stations) will be constructed, design project to minimize impacts by locating the project a minimum distance of 300 feet from individual Sclerocactus plants and/or populations (except for surface pipelines which is 50 feet). • Where new surface disturbance indirectly affects Sclerocactus (cactus within 300 feet of proposed disturbance), mitigation will occur following the Strategy. • Where new surface disturbance directly affects Sclerocactus (cacti are directly removed), a monetary amount ($640 per acre) will be contributed to the Sclerocactus Mitigation Fund-BLM to aid in the recovery of Sclerocactus species impacted by the project. Contributions will be negotiated between the Operator and the USFWS based on the number of cacti directly impacted

Source	Resource	Conditions of Approval
		and in relation to the USFWS' current management guidelines for Sclerocactus. • Several options for mitigation of the *Sclerocactus* Habitat Polygon are available (see Strategy). If mitigation funds are established, funds will be paid to: *Sclerocactus* Mitigation Fund – BLM, Impact-Directed Environmental Accounts National Fish and Wildlife Foundation 1133 Fifteenth Street NW, Suite 1100 Washington, DC 20005.
Section 7 Applicant Committed Measures and FEIS Appendix J See Volume 3 PDF Pages 1350 - 1353 and Pages 1357 - 1360.	Special Status Species – Ute Ladies' Tresses	• The edge of surface disturbing activities will be sited 300 feet or more from suitable habitat whenever possible. If possible, surface pipelines will be laid such that a 50-foot buffer exists between the edge of the right of way and suitable habitat, using stabilizing and anchoring techniques when the pipeline crosses habitat to ensure the pipelines do not move towards the habitat. • If suitable habitat is determined to be present within 300 feet of the proposed surface disturbance, surveys will be conducted within suitable habitat to determine occupancy. • Surveys: o Must be conducted by qualified individual(s) and according to Service accepted survey protocols, o Will be conducted in all suitable habitat within 300 feet of the area proposed for surface disturbance, o Will be conducted prior to initiation of project activities and within the same growing season, at a time when the plant can be detected, and during appropriate flowering periods (usually August 1st and August 31st in the Uinta Basin; however, surveyors should verify that the plant is flowering by contacting a BLM or USFWS botanist or demonstrating that the nearest known population is in flower), o Will include, but not be limited to, plant species lists, habitat characteristics, source of hydrology, and estimated hydroperiod o Will be valid for three consecutive years following the last survey. o Will be conducted for at least one year prior to any USFWS-defined temporary

Source	Resource	Conditions of Approval
		disturbance in suitable habitat (e.g., overland travel to access geotechnical boring location). o Will be conducted for three consecutive years prior to any USFWS-defined permanent disturbance (e.g., road widening, new road construction, placement of other infrastructure). Suitable habitat will be deemed unoccupied if no plants are detected in the three consecutive years of surveys. The surveys will be valid for three consecutive years following the Inst survey. o If three consecutive years of surveys cannot be performed prior to any USFWS defined permanent disturbance, the applicant and BLM will reinitiate Section 7 consultation. • If suitable habitat is deemed unoccupied, and direct disturbance to suitable habitat is not avoidable the following measures will be implemented: o All areas will be re-vegetated with species approved by USFWS and BLM Authorized Officer. o Avoid soil compaction in Ute ladies'-tresses habitat. o The upper part of the soil profile shall be salvaged and retained as intact as possible during construction. The soil profile shall be repositioned on the appropriately grazed backfilled trench to maintain a level soil surface and consistent, pre-construction hydrology. o Minimize soil disturbance by operating heavy equipment on top of temporary earth fills. o Minimize soil erosion with the use of silt fences. o Equipment will be cleaned to remove noxious weeds/seeds and petroleum products prior to moving on site. o Fueling of machinery will occur outside of suitable habitat. o Materials will not be stockpiled in the suitable habitat. o Fill materials will be free of waste, pollutants, and noxious weeds/seeds.

Source	Resource	Conditions of Approval
		○ Ingress and egress access will be kept to a minimum. ○ Excavated soils will be sorted into sub soils and top soils. When backfilling a disturbed site top soils will be placed on top to provide a seed bed for native plants. ○ Disturbed areas will be monitored and controlled for noxious and undesirable plant species during the life of the project. • Reinitiation of Section 7 consultation with our office will be sought if project activities are proposed within occupied habitat (within 300 feet of a Ute Ladies tresses individual).
FEIS Section 4.10.5	Special Status Species – White Tailed Prairie Dog	In accordance with the Conditional Use Stipulations included in Appendix K of the Vernal RMP and ROD: • Do not allow surface-disturbing activities within 660 feet of prairie dog colonies identified within prairie dog habitat. No permanent aboveground facilities are allowed within the 660-foot buffer. ○ Exception: An exception may be granted if the applicant submits a plan that indicates that impacts of the proposed action can be adequately mitigated or, if due to the size of the town, there is no reasonable location to develop a lease and avoid colonies the Field Manager will allow for loss of prairie dog colonies and/or habitat to satisfy terms and conditions of the lease. ○ Modification: The Field Manager may modify the boundaries of the stipulation area if portions of the area does not include prairie dog habitat or active colonies are found outside the current defined area, as determined by the BLM. ○ Waiver: May be granted if, in the leasehold, it is determined that habitat no longer exists or has been destroyed.
FEIS Section 4.10.5, Section 7 Applicant Committed Measures and FEIS Appendix J.	Special Status Species – Yellow Billed Cuckoo	• Suitable habitat within 0.5 mile of the action area will be identified and delineated on a map in accordance with the USFWS Utah Field Office Guidelines for identification of suitable breeding and nesting habitat for western yellow-billed cuckoo in Utah. Delineated suitable habitat will be submitted by the BLM as a shape file to USFWS's Utah Field Office. • If any project feature is proposed within 0.5 mile of suitable habitat, protocol level breeding

Source	Resource	Conditions of Approval
See Volume 3 PDF Pages 1350 - 1353		season surveys (A Natural History Summary and Survey Protocol for the Western Distinct Population Segment of the Yellow-billed Cuckoo, Final Draft 22 April 2015) will be conducted prior to any surface disturbance within 0.5 mile of suitable habitat. • Prior to any surface-disturbing activity within WYBC habitat during the June 1 through August 31 breeding season, surveys would be conducted by a qualified biologist to determine if breeding or nesting WYBC are present. If WYBC are present, surface disturbance or drilling activity would be precluded within one mile of occupied habitat to avoid disturbance to breeding birds or nests. • Surface disturbing activities will be sited 0.5 mile or more from suitable habitat whenever possible. For any project feature proposed within a 0.5 mile buffer of suitable habitat, the following measures will be implemented to minimize the effects of noise, human disturbance, and light pollution: o Construction and drilling activity shall occur outside the breeding and nesting season for western yellow-billed cuckoo (no construction and drilling activity will occur between June 1 and August 31). o Facilities and structures that generate short or long-term noise above ambient conditions shall be fitted with noise-abating equipment to preclude increases in noise levels (above ambient conditions) at the edge of suitable habitat. o Implement lighting with full cut off optics (no light above the 90-degree angle), short heights, light shielding, low illumination accent lighting, timers, and motion sensors to focus non-target lighting downwards on target areas and away from suitable habitat. o If the area is unoccupied, then the Authorized Officer may authorize the commencement of activity. • If proposed construction would occur within 0.5 mile of riparian habitat, the habitat will be analyzed in accordance USFWS's Yellow Billed Cuckoo Suitable Habitat Identification Guidelines to determine habitat suitability. Delineated suitable habitat will be submitted as a shape file to USFWS's Utah Field Office to identify survey needs.

Source	Resource	Conditions of Approval

		• If construction activities are sited within occupied habitat, the following will be implemented:
		  ○ Machinery will be equipped with noise mufflers to minimize increases in baseline noise levels at the source;
		  ○ Insecticides and herbicides will not be used in occupied habitat to preclude loss of prey base for cuckoo;
		  ○ Sediment control measures will be implemented to prevent project related sediment from moving downstream.
		• Vegetation management, including removal, mowing, drive-and-crush, or pesticide application, will not occur within 300 feet of suitable habitat. Pesticides include herbicides and insecticides.
		• Any temporary disturbance within suitable habitat for western yellow-billed cuckoo shall be reclaimed to preclude invasion of noxious plants, such as tamarisk and Russian olive.
		  ○ Any permanent impacts to suitable habitat for western yellow-billed cuckoo within the project area shall be offset at a 3:1 acreage ratio. For every 1 acre of new disturbance within suitable habitat, 3 acres will be restored. Restoration may include treatment of noxious weeds, planting of native cottonwoods and willows, and other measures that benefit yellow-billed cuckoos.

Applicant Committed Measures FEIS Section 2.2.12, FEIS Section 4.7.2, and BA Section 2.3.14	Vegetation[11] Including Noxious and Invasive Species	• Mulching, soil amendments, and other state-of-the-art techniques would be used on a site-specific basis as determined necessary to assure the highest possible revegetation success. • In areas that contain environmentally sensitive fragile soils and vegetation, the operator may be required to perform special measures such as mulching, installing erosion fencing, use of erosion fabric, etc. (per the direction of the AO) to stabilize any disturbed areas and ensure the reestablishment of long-term perennial vegetation. • Inter-seeding (i.e., seeding into existing vegetation), secondary seeding, or staggered seeding may be used as determined necessary on a site-specific basis to accomplish specific revegetation

[11] Measures from 2.2.12 and BA that deal with special status species have been moved to the special status species portion of this table. Measures from Section 4.7.2 that deal with water or wetlands have been moved to the water portion of this table.

Source	Resource	Conditions of Approval
		objectives. • Vegetation removed from short-term surface-disturbance areas would be spread over the disturbed site to capture native seed and facilitate revegetation. • In accordance with the appropriate AO's guidance and direction, regular, qualitative and quantitative field monitoring of reclaimed areas would be conducted over the life of the project to determine the effectiveness of the applied reclamation actions. Should the prescribed reclamation actions not have the desired or anticipated results, or are not moving in a direction to achieve the desired/anticipated results, revised reclamation objectives may be appropriate and additional or new reclamation methods would be implemented. • All products (such as mulches, straw bales, etc.) used for erosion control would be certified weed free. • Construction equipment and vehicles coming from outside of the Uinta Basin would be power washed prior to entering the MBPA. Any construction or operational vehicles traveling between the MBPA and areas outside of the Uinta Basin would be power-washed prior to re-entrance. • Areas disturbed by project-related activities, including roads, well pads, etc., with soils that are susceptible to wind erosion would be surfaced (covering of piles where appropriate, graveling or surfactants applied to roads, etc.) on a site-specific basis, as directed by the AO, to reduce fugitive dust generated by traffic and related activities. Such treatments would also be applied as directed by the AO on local and resource roads that represent a dust problem. • All applicable surface stipulations from Appendix K, subject to valid existing rights, and Fluid Minerals BMPs from Appendix R of the Vernal RMP (BLM 2008b) would be implemented. • As required by the Noxious Weed Act of 1974, as amended, and by Executive Order 13112-1999, noxious weeds would be controlled in the MBPA by Newfield on all disturbances associated with its existing well pads, road, and pipeline routes, as well as infestations that would occur as a result of the project. • Removal and disturbance of vegetation would be kept to a minimum through construction site management (e.g., using previously disturbed areas and existing easements where feasible,

Source	Resource	Conditions of Approval
		placing pipelines adjacent to roads, limiting well pad expansion, etc.). ○
Selected Alternative Description FEIS Section 2.6.1.1, Applicant Committed Measures FEIS 2.2.12, FEIS Sections 4.5.2, 4.6.2, and 4.7.2, FEIS Appendix J Biological Assessment Section 2.3.14, and Biological Opinion	Water Resources Including 100-year Floodplains, Wetlands/Riparian, Springs *(See also the Special Status – Fish section of these COAs)*	• No surface disturbance would occur within 500 feet of Pariette Creek or Pariette ponds. • No new well pad-related surface-disturbing activities would be allowed within active floodplains, public water reserves, or 100 meters of riparian areas. • No new pipeline- or road-related surface-disturbing activities would be allowed within active floodplains, public water reserves, or 100 meters of riparian areas, unless there are no practical alternatives or the action is designed to enhance the riparian resources. Unavoidable impacts would be fully mitigated. In addition: ○ The width of the construction areas shall be made as small as possible through the 100-year floodplains. ○ Construction activities in 100-year floodplains will not occur during active flooding events. ○ All staging areas and stockpiled material will be located outside of the 100-year floodplains. ○ The contractor will remove all construction material due to construction in the 100-year floodplains at the end of the project. ○ Equipment should be cleaned to remove noxious weeds/seed and petroleum products prior to moving on to the 100-year floodplain. ○ If fill materials are brought into the 100-year floodplain they will be free of waste, pollutants, and noxious weeds/seeds. ○ Employees and contractors will be instructed to travel at appropriate speeds to limit disturbance to soils on unpaved roads in 100-year floodplains. ○ Sediment control measures will be in conformance with the project's Storm Water Pollution Prevention Plan.

Source	Resource	Conditions of Approval
		• To ensure their protection under Section 404 of the Clean Water Act and EO 11990 – Protection of Wetlands, wetland evaluations and delineations would be completed for any surface disturbance locations occurring in potential wetland habitat. • Under Alternative D, the water collector well would be sited to avoid jurisdictional wetlands. • For all tributaries that drain directly to Pariette Draw or directly to the Green River, roads and well pads would be set back a minimum of 200 feet from the active stream channel (average 3 feet wide or greater without an associated riparian zone) unless site-specific analysis demonstrates that one of the following situations applies in which case, the well pad or road would not be placed closer than 100 feet from the stream channel: o the proposed well or road could be placed on higher terrain above the 100-year floodplain, o the 100-year floodplain can be demonstrated to be narrower than 200 feet in the area proposed for well location; or, o the well pad or road can be increased in height to avoid a predicted over-topping 50-year flood. • Pipelines that cross or are within 100-year floodplains will either be elevated above the predicted 100-year flood event on a pipe bridge, or buried at least 5 feet below the channel bottom or below the predicted scour depth for an equivalent flood event (whichever is deeper) and in conformance with hydrological design practices. • All new stream crossings would be kept to a minimum. In the case of an unavoidable stream crossing, culverts would be designed and constructed to allow fish passage. All stream crossings would be designed and constructed to keep impacts to riparian and aquatic habitat to a minimum. • Pipelines that cross stream channels will incorporate a sediment retention system along the construction corridor to minimize movement of sediment into the water courses. These could range from silt fencing and culverts to sediment retention basins, depending on the location. • Newfield will utilize the applicable USFWS BMPs for work in Utah streams where pipelines or roads cross a stream.

Source	Resource	Conditions of Approval
		• Newfield will utilize BLM Hydraulic Considerations for Pipeline Crossings of Stream Channels (prepared by the Utah State Office BLM, Salt Lake City, Utah). • Road crossings of drainages will be built to accommodate the 100-year flood, typically using at grade crossings rather than culverts. Crossings will be designed so they will not cause siltation or accumulation of debris, nor will the roadbed block the drainage. Any culverts used will be designed and constructed to allow passage of aquatic species. • As determined necessary on a site-specific basis (based on proximity to a 100-year floodplain), wells with the potential to contaminate surface waters will have automatic shutoff valves. • Any pipeline conveying produced water or other industrial liquid across the 100-year floodplains as conceptually depicted in FEIS Figure 3.6.3.2-1 (ROD Attachment 1) would be provided with shut-off valves immediately outside the 100-year floodplain on both sides of the crossing. • Storage and parking locations for hazardous materials, lubricants, fuel tanks or trucks, and refueling activities would be a minimum distance of 100 meters from wetlands, riparian areas, and channels with defined bed and banks. Such materials storage or refueling activities would be outside the 100-year floodplains as depicted in FEIS Figure 3.6.2.3-1 (ROD Attachment 1). • Flow monitors would be installed on produced water pipelines to detect possible leaks. If any of the following impacts are observed, the adaptive management mitigation identified in the long term water monitoring plan (see Appendix H) will be implemented: o Increased sedimentation; o Increased concentrations of inorganic constituents, including metals; o Increased concentrations of selenium, boron, or total dissolved solids; o Contamination with petroleum and other organic constituents; o Reduction of spring flows; and/or, o Reduction of water levels in wells. • While construction in the 100-year floodplain or wetlands is occurring, heavy equipment working on wet soils shall be placed on mats. Work should be conducted primarily while the ground is

Source	Resource	Conditions of Approval
		frozen or soils are dry. • Silt fence shall be properly installed in 100-year floodplains and wetlands where project disturbance may erode into waters during a precipitation event. • Produced liquid and natural gas gathering pipelines that are buried across water courses would be buried in accordance with guidelines established in the Gold Book and Hydraulic Considerations for Pipelines Crossing Stream Channels, Technical Note 423, April 2007. Specific burial depths for natural gas and produced liquids pipelines that cross perennial, intermittent, and ephemeral stream channels within the MBPA would be determined during the onsite process. • In accordance with 40 CFR 112.3, Newfield would prepare and maintain SPCC plans for active facilities. Newfield would inspect each facility subject to SPCC requirements on an annual basis to ensure appropriate spill prevention measures are maintained. A management review of the SPCC plans would be conducted every 5 years. • Newfield employees would be trained annually in spill prevention and reporting requirements. Contractors would be required to promptly report all accidental releases to a Newfield Supervisor. • Newly constructed gas and water lines would be pressure tested to evaluate structural soundness and reduce the potential for leaks. • Springs will be delineated and marked on maps and on the ground before development in order to keep impacts to springs to a minimum. • Appropriate BMPs needed to mitigate water impacts anticipated to occur from surface disturbing activities would be identified during the onsite and may include, but not be limited to: proper culvert design, installation of energy dissipation devices, proper site selection (e.g., avoidance of steep slopes, riparian areas, wetlands, areas subject to severe soil movement, and areas of shallow groundwater and natural watercourses), and utilizing closed loop drilling. • To the fullest extent possible, access roads proposed in valley/drainage bottoms would be sited on the toe of the adjacent slope to the valley bottom. Roads would have appropriate energy dissipaters (e.g., water bars and silt fences) where water leaves the road and is routed toward an

Source	Resource	Conditions of Approval
		adjacent drainage. • Well pads adjacent to drainages would be bermed to prevent runoff from entering the drainage. • As conditions dictate, and as determined by the AO, diversion ditches would be constructed around the pad. • Where diversion ditches are constructed to reroute drainages around well pads, ditches would be designed to return the diverted water back to the original channel. If it is not feasible to return diverted water back to its original channel, the water would be diverted to the nearest channel, with energy-dissipating devices installed to prevent channel degradation. • If proposed activities would result in the temporary or permanent placement of dredge or fill material into existing wetlands or Waters of the U.S., Newfield would adhere to the Army Corp of Engineers (ACE) Nationwide Permit General Conditions as well as the ACE Final Sacramento District Nationwide Permit Regional Conditions for Utah.

Attachment 3: Air Mitigation Strategy – Applicant Committed Environmental Protection Measures

This page intentionally left blank.

Air Mitigation Strategy – Applicant Committed Environmental Protection Measures

The purpose of the mitigation strategy outlined here, as incorporated into the Final EIS and ROD, is to ensure that implementation of the Greater Monument Butte Project will not result in net emissions increases of volatile organic compounds (VOC) from stationary sources located within the exterior boundaries of the Project area beyond VOC emissions levels for the 2012 operating year. To demonstrate the effectiveness of this "no net increase" strategy, both additions and reductions in VOC would be documented annually on an emissions balance sheet. This documentation along with the additional components of the mitigation strategy -- a Directed Inspection and Maintenance (DI&M) program, an Ozone Action Mitigation Plan, and the Applicant Committed Environmental Protection Measures -- shall be deemed to provide reasonable assurance that project activities analyzed in the GMBU FEIS do not cause or contribute to a Clean Air Act ozone NAAQS violation.

Strategy Principles:

- Be protective: Provide reasonable assurance that the Project will not cause or contribute to ozone violations in the Basin.
- Be accountable and transparent: Allow BLM and Newfield to publically document the project's VOC emissions.
- Be adjustable to changing regulatory environment:
    - Emissions reductions of VOC resulting from actions taken by Newfield or natural production decline (defined in the Technical Support Document) shall be used to create headroom for project activities that result in new sources of VOC emissions. In the event of a non-attainment designation on lands including the Project Area, the documented emissions reductions shall be considered by BLM in determining Newfield's compliance with applicable ozone conformity requirements to the extent possible.
    - Upon the implementation of any new regulation applying to activities within the Project area, such requirement(s) shall replace any comparable component of this mitigation strategy if BLM determines, according to the process outlined below, that compliance with the new requirement(s) commits Newfield to measures that will reduce VOC emissions.
        - Provide a process for internal review and assessment conducted by BLM, in consultation with Newfield, to assess whether components of the mitigation strategy can be removed for being equivalent in effect or duplicative of new state or federal air quality regulatory requirements, and whether it is necessary for BLM to continue to require the annual emissions balance sheet and subsequent annual reviews.
    - In the event of an ozone nonattainment designation and subsequent implementation of an ozone attainment FIP/SIP/TIP (or General Conformity or comparable provisions if the area is classified as marginal), the new requirements shall replace this mitigation strategy.
- Be Flexible: Newfield determines how to accomplish the no-net increase strategy.
- Be Cost Effective: Implementation of the components of this mitigation strategy should not impose significant increased operational costs on Newfield beyond those of the Applicant Committed Measures specified in the DEIS in the absence of promulgation and issuance of a new regulation or a SIP/FIP/TIP.

Incorporation of Strategy in NEPA Documentation:

Section 2.2.12.1.7 Adaptive Management, will be replaced with the following language:

Annual Emissions Balance Sheet[12]

Newfield will ensure that new stationary sources authorized by the ROD will not result in net increases of volatile organic compounds (VOC) emissions. This will be accomplished by achieving reductions of VOC emissions from existing stationary sources prior to operating new sources, balanced on a calendar year annual basis. Newfield will document such reductions in VOC, as well as additions in VOC, from stationary sources in an Annual Emissions Balance Sheet that will have sufficient information for the BLM AO to verify the Operator's actions.

The Project Area shall be defined as the area analyzed in the GMBU FEIS (this shall be the "geographic area" as referenced elsewhere in this document). Stationary sources include, but are not limited to, engines, heaters, glycol dehydrators, oil and produced water storage tanks, truck loading, pneumatic controls, pneumatic pumps, and fugitive leaks.

Newfield will develop and use the Initial Emissions Balance Sheet as follows:

- The reporting tool for the Initial Emissions Balance Sheet will be the emissions inventory workbook created by UDAQ and EPA for the Uinta Basin 2014 inventory (2014 emissions inventory workbook), which provides facility-by-facility and source-by-source emissions detail.
- Newfield will use the emissions quantification methods used in the 2014 emissions inventory workbook to calculate VOC emissions for the 2012 operating year. This calculation of VOC emissions for the 2012 operating year will serve as the initial inventory against which subsequent increases or decreases in VOC emissions will be calculated and documented.
- Technical corrections and revised calculation methodologies may be applied to the 2014 emissions inventory workbook following consultation between UDAQ, EPA, BLM and Newfield.

For subsequent year Annual Emissions Balance Sheets, the above-referenced 2012 emissions inventory calculated by using the 2014 emissions inventory workbook shall continue to serve as the template from which further emissions reductions and additions are calculated and documented. A separate 2015 or 2016 inventory of VOC emissions, as appropriate based upon the timing for the issuance of the ROD, will subsequently be prepared for comparison with the calculations of VOC emissions for the 2012 operating year to determine the net change in VOC emissions and available VOC headroom for project activities that result in new sources of VOC emissions.

VOC emissions reductions including, but not limited to, actions taken in response to voluntary actions, the implementation of applicant committed environmental protection measures, natural production decline (defined in the Technical Support Document), existing or new regulations, and/or ozone attainment and maintenance plans can be used to create headroom for project activities that result in new sources of VOC emissions.

Annually, or upon request by Newfield, the BLM AO will conduct an internal review and assessment and confer with Newfield to consider new state and federal regulatory requirements and evaluate if portions of this mitigation strategy are no longer necessary. Upon review and Newfield consultation, BLM may remove components of the mitigation strategy that are determined to be equivalent in effect or duplicative of state or federal regulatory requirements or otherwise create contradictory or overlapping requirements. The review will also evaluate the impact of new regulations upon project VOC emissions and the need to continue the annual emissions balance sheet requirement.

The implementation of General Conformity requirements following an ozone non-attainment designation shall

[12] The Annual Emissions Balance Sheet will be submitted to the BLM AO.

be considered equivalent to the annual emissions balance sheet provisions of this strategy, and the annual emissions balance sheet requirements may be terminated at Newfield's option. Upon adoption of a nonattainment FIP/SIP/TIP (or comparable provisions if the area is classified as marginal), this mitigation strategy in its entirety shall be replaced by the FIP/SIP/TIP.

Section 2.2.12.1.6 Monitoring Programs will be replaced with the following language:

Newfield will conduct Audio-Visual-Olfactory (AVO) leak inspections on all existing and new facilities within the Project Area on an annual basis and repair observed leaks. Newfield will utilize IR Camera observations in place of AVO inspections for 10% of facility inspections. If future regulations are implemented to address leak detection and repair requirements, the regulatory program will replace the voluntary inspection program.

- Newfield will develop, and submit for BLM approval,
    - a corrective action plan for the Project Area that would include appropriate timeframes to complete necessary repairs that may be identified in the future through the Monitoring Program.
    - an annual report listing the facilities where leaks were observed, the date the leak was observed, the cause of the leak, and the date corrective actions were completed at such facilities.

Section 2.2.12.1.9 Ozone Training for Operations Personnel will be added with the following language:

Newfield will develop an Ozone Action Mitigation Plan which includes an operator training component as well as a list of Project activities that could be delayed or minimized during ozone episodes.

For the purposes of the Ozone Actions Mitigation Plan, an ozone episode would be any next day that the UDAQ air quality forecast is Unhealthy for Sensitive Groups (Code Orange – minimum ozone concentration of 0.071) or higher as published on the UDAQ website (current link is: http://air.utah.gov/forecast.php?id=v4).

Newfield will develop and submit for BLM approval an Ozone Action Mitigation Plan which includes the following components:

- Newfield will incorporate in its current employee training program ozone awareness and specific actions for reducing ozone precursor emissions.
- To the extent practical, Newfield will halt, defer and/or otherwise schedule activities that may contribute to ozone formation to periods outside of ozone episodes.

Operations personnel shall receive training prior to ozone season. Training programs shall cover the following:

- Ozone – what it is and how it impacts air quality and human health.
- Ozone formation ingredients – NOx, VOCs, and weather conditions.
- Ozone attainment status in the Uinta Basin.
- Review of applicable regulations.
- What can be done to prevent and/or reduce emissions of ozone precursor gases – such as limiting driving, maintaining equipment, delaying optional activities (e.g. equipment and well blowdowns, well completions, etc.).
- The importance of proper maintenance of tank hatches, vapor capture and combustor systems, and other equipment that reduces emissions.

FEIS Modification:

In addition to the modifications outlined above, *Section 2.2.14 BLM Air Quality Control Measures* will be deleted. *Section 2.2.12 Applicant-Committed Environmental Protection Measures* (ACEPMs) will present all air quality mitigation in one section for more clear disclosure and ease of reading. The Work Practices section of *2.2.14 BLM Air Quality Control Measures* will be moved to a new 2.2.12.1.10 subsection.

Attachment 4: Final Cactus Conservation and Mitigation Strategy

This page intentionally left blank.

Final Conservation and Mitigation Strategy For the Pariette Cactus and Uinta Basin Hookless Cactus, Newfield Greater Monument Butte Project

5/26/2015

Introduction

Pariette cactus (*Sclerocactus brevispinus*) and Uinta Basin hookless cactus (*Sclerocactus wetlandicus*) (collectively referred to as *Sclerocactus*) are listed as threatened species under authority of the Endangered Species Act (ESA). Threats include mineral and energy development, illegal collection, recreational off-road vehicle use, and grazing [U.S. Fish and Wildlife Service (USFWS) 2010]. The primary goal of the endangered species program under the ESA is recovery of the species. In order to reach this goal, threats to the survival must be reduced and the species must be a secure, self-sustaining part of its ecosystem. While project proponents are not be required to recover a species through project-specific authorizations by Bureau of Land Management (BLM), under the Section 7 consultation process, the USFWS works with the applicant and action agency to develop conservation measures that benefit the species. A net benefit to *Sclerocactus* can be achieved through the protection of the cactus and suitable habitat throughout the species' range, reduction of threats through minimization of ground surface impacts, mitigation of project impacts, and restoration of previously disturbed lands.

Newfield is proposing to construct 5,750 wells on 1,245 new well pads, and accompanying roads and pipelines on its valid existing leases within the Greater Monument Butte Federal Oil and Gas Unit authorized by BLM. In the USFWS's designated core conservation areas (CCAs) for *Sclerocactus* and the *Sclerocactus* habitat polygon, Newfield is committed to avoiding direct impacts to *Sclerocactus* individuals when siting new well pads, well pad expansions, pipelines, access roads, and the installation of product flow lines that significantly reduce the impacts of truck traffic and associated dust impacts. Newfield commits to the *Sclerocactus* specific applicant committed conservation measures outlined in the USFWS Recommended Conservation Measures for *Sclerocactus*: Uinta Basin hookless cactus (*Sclerocactus wetlandicus*) and Pariette cactus (*Sclerocactus brevispinus*), 2014 (Appendix A). This includes a commitment to conduct surface disturbing activity outside of the *Sclerocactus* flowering period (March 15-August 30) for all work proposed within Level 1 CCAs and within 300 feet (ft) of *Sclerocactus* in Level 2 CCAs and the *Sclerocactus* Habitat Polygon. However, there are additional remaining potential impacts to *Sclerocactus* from Newfield's proposed action, including habitat disturbance and potential indirect impacts to the species from the remaining effects of dust.

This strategy has been devised to avoid, minimize, and mitigate for *Sclerocactus* throughout the Newfield Greater Monument Butte project area, while also being consistent with Newfield's valid existing lease rights, federal unit obligations, and proposed development, as well as BLM's legal authority and jurisdiction. The strategy is designed to allow the use of successful mitigation to offset Newfield's proposed new surface disturbance in Level 1 CCAs, surface disturbance above 5 percent or within 300 ft of *Sclerocactus* in Level 2 CCAs, and surface disturbance within 300 ft of *Sclerocactus* within the *Sclerocactus* Habitat Polygon.

Sclerocactus Habitat Mitigation

Tables 1 and 2 represent potential mitigation measures that may be completed in order to offset impacts associated with the Newfield Greater Monument Butte Project. Table 1 identifies mitigation options,

and Table 2 explains the amount of mitigation needed per acre of new surface disturbance. Descriptive text follows the tables.

Table 1. Mitigation options to offset impacts to *Sclerocactus* habitat.

Requested Disturbance	Conservation Easement/NSO	Habitat Restoration, *Sclerocactus* Survival, Recruitment	Reduction in Truck Traffic	Mitigation Fund
CCA 1: 8 New Well Pads	x	x		
CCA 1: Well Pad Expansion	x	x	x	x
CCA 2: Current disturbance >5% and < 25%	x	x	x	x
CCA 2: Current disturbance < 5% and *Sclerocactus* within 300 ft	x	x	x	x
Sclerocactus Habitat Polygon: Disturbance within 300 ft of *Sclerocactus*	x	x	x	x

Table 2. Mitigation Ratios (mitigated acres:disturbance acres)

Disturbance Location	Disturbance Type	Mitigation Method								
		Conservation Easement/NSO		Restoration of Entire Facilities[1] (full well pads, roads, and pipelines)			Restoration Facility Edges[1]	Truck Traffic Reduction		Mitigation Fund (Appendix B)
		High Cactus Densities (A.1)	Moderate Cactus Densities (A.2)	Habitat Restoration	+Cactus Survival	+Cactus Recruitment		CCA 1	CCA 2	
CCA 1	8 new well pads	3:1	--	5:1	3:1	2:1	--	--	--	--
	Well pad expansion	3:1	--	5:1	3:1	2:1	--	20:1	--	$7,510/acre
Occupied habitat in CCA 2 or *Sclerocactus* Habitat Polygon[2]	All	1:1	2:1	4:1	3:1	2:1	4:1	5:1	10:1	$6,260/acre (CCA2) or $2,550/acre (Habitat Polygon)
Unoccupied habitat where CCA 2 >5% Disturbance[2,3]	All	1:1	2:1	1:1	1:2	1:3	4:1	5:1	10:1	$6,260/acre

[1] Restoration must occur in equal or greater quality habitat compared to the location of the new disturbance; e.g., restoration as mitigation for impacts to CCA2 must occur in CCA2 or CCA1 polygons.

[2] Occupied is defined as habitat < 300 ft from *Sclerocactus* individuals. Unoccupied is defined as habitat > 300 ft from *Sclerocactus* individuals.

[3] Mitigation is not required in unoccupied habitat where CCA2 <5% disturbance, or in unoccupied habitats of the *Sclerocactus* Habitat Polygon.

This page intentionally left blank.

A. Establishment of Conservation Easements or Voluntary No Surface Occupancy in Occupied Habitat

Conservation easements or voluntary No Surface Occupancy (NSO) areas can be used to offset impacts in:

- Level 1 CCAs from 8 new well pads not to exceed 20 acres, or well pad expansion not to exceed limits analyzed in the Environmental Impact Statement (EIS),
- Level 2 CCAs that have current cumulative disturbance between 5 and 25 percent,
- Level 2 CCAs when disturbance is < 5 percent and within 300 ft of *Sclerocactus Sclerocactus* Habitat Polygon when disturbance is within 300 ft of *Sclerocactus*

The following *Sclerocactus* density criteria must be met for new conservation easements or NSO areas, unless otherwise approved by the USFWS:

A.1 Level 1 CCAs:

To offset new disturbance impacts in Level 1 CCAs, conservation easement or NSO areas must be occupied by *Sclerocactus* at a rate of at least 25 *Sclerocactus* per 40 acres, unless otherwise approved by the Service. *Sclerocactus* density rates would be determined by a USFWS qualified botanist;

A.2 Level 2 CCAs and *Habitat Polygon:*

To offset new disturbance impacts in Level 2 CCAs (above 5 percent per Level 2 CCA unit (occupied or unoccupied); Level 2 CCAs < 5 percent and within 300 ft of *Sclerocactus*; or the *Sclerocactus* Habitat Polygon, the establishment of conservation easements or NSO must be occupied by *Sclerocactus* at a rate of at least 15 *Sclerocactus* per 40 acres, unless otherwise approved by the USFWS.

In addition, new conservation easements or NSOs must meet the following criteria:

1. Parcel quality and size:
    a. At least 50 percent of the parcel is suitable habitat for *Sclerocactus*;
    b. The parcel is within the current range of *Sclerocactus*;
    c. The parcel has less than 5 percent existing surface disturbance;
    d. The parcel is a minimum of 40 acres;
    e. The surface of the conservation easement or NSO area is closed to future surface disturbing activities. Surface disturbing activities include but are not limited to new blading and leveling on ground surface, plowing, disking, harrowing, and any other activities that negatively affect habitat conditions or population stability; and
2. The conservation easement or NSO must be finalized and recorded prior to new disturbance.
3. Should the proposed easement or NSO parcel meet the criteria defined above, a proposal will be prepared by Newfield and submitted to the USFWS. Upon receipt, the USFWS will have 60 days to review and approve the conservation easement or NSO area.
4. The conservation easement or NSO shall be recorded with the property in perpetuity, or identified in the BLM land use plan as an NSO for the conservation and recovery of the *Sclerocactus*. The use of conservation easements or NSOs for mitigation will need to be approved by the USFWS on a site-specific basis. For BLM NSOs, USFWS approval will be in part dependent on the ability of BLM to: 1) reach an agreement for NSOs with lease holders, 2) ensure the long-term protection of the mitigation area by showing the intent to maintain the NSO designation in future land use plans, and 3) agree to discuss any future NSO changes and resultant additional conservation measures with USFWS.
5. The USFWS will be allowed access to the conservation easement to monitor the
6. *Sclerocactus* and its habitat.
7. The purpose of the conservation easement or NSO area is to: (1) preserve the property in its existing, comparable, or better condition as suitable habitat for *Sclerocactus*; (2) preserve and protect the

conservation values of the property; and (3) prevent any use of the property that will impair or interfere with *Sclerocactus*, its habitat, or other conservation values of the property.

8. Conservation Easement/NSO Monitoring and Management: Newfield will conduct a baseline assessment and mapping of the *Sclerocactus* population and assessment of habitat quality on conservation easement and NSO lands. Funding for future monitoring and management of NSOs on BLM land will be determined through coordination between Newfield and BLM.

   In the event that Newfield purchases private property and places a conservation easement on that property for the protection of *Sclerocactus* and/or its habitat, any future monitoring and management shall be contracted for and funded with Newfield's contributions to the *Sclerocactus* Mitigation Fund for this Greater Monument Butte Project.

   In the event that Newfield purchases a conservation easement through a third party private property owner for the protection of *Sclerocactus* and/or its habitat, then Newfield, USFWS, and the private property owner shall determine whether additional funds or other financial assurances to cover the costs of monitoring and any maintenance actions are deemed necessary. In the event such assurances are needed, then Newfield, USFWS, and the private property owner shall determine what mechanism will be most suitable at that time. Financial assurance for easements could be a one-time payment made by Newfield to an endowment which then would then bear interest to cover the monitoring and management costs. Financial assurances may also be similar one-time payments in the form of performance bonds, escrow accounts, insurance, collateral assignment of a certificate of deposit, certified or cashier's check, letter of deposit, or other approved instrument. Such assurances may be phased-out or reduced once it has been demonstrated that the easement is of low risk.

Conservation Easement or Voluntary NSO Exchange Ratios:

a. A 3:1 ratio (3 acres of conservation easement or NSO per 1 acre of new disturbance) will be implemented for Level 1 CCA disturbance if a conservation easement or NSO parcel is acquired according to the criteria as listed above (section A.1). No more than 20 acres of new well pads (associated with Newfield's proposed 8 new well pads) will be permitted in Level 1 CCAs. Disturbance acres for well pad expansions will not exceed the limit analyzed in the EIS.

b. A 1:1 ratio (1 acre of conservation easement or NSO per 1 acre of new disturbance) will be implemented for disturbance in Level 2 CCA and the *Sclerocactus* Habitat Polygon, if a conservation easement or NSO parcel is acquired according to the criteria as listed above (section A.1). All disturbances must be within the analyzed limit addressed in the EIS. This ratio will be used to offset impacts in Level 2 CCAs where new disturbance is within 300 ft of *Sclerocactus* or above the 5 percent disturbance threshold. This ratio will also be used to offset impacts where disturbance is within 300' of *Sclerocactus* within the *Sclerocactus* Habitat Polygon.

c. A 2:1 ratio (2 acres of conservation easement or NSO per 1 acre of new disturbance) will be implemented for disturbance in Level 2 CCA and *Sclerocactus* Habitat Polygon if a conservation easement or NSO parcel is acquired according to the criteria as listed above (section A.2). All disturbances must be within the analyzed limit addressed in the EIS. This ratio will be used to offset impacts in Level 2 CCAs where new disturbance is within 300 ft of *Sclerocactus* or above 5 percent disturbance threshold within Level 2 CCAs. This ratio will also be used to offset impacts where disturbance is within 300 ft of *Sclerocactus* within the *Sclerocactus* Habitat Polygon.

B. Sclerocactus Habitat Restoration, Sclerocactus Survival, and Sclerocactus Recruitment

There are opportunities in CCAs to reduce the existing surface disturbance of old well pads, roads, and cross-country pipeline rights-of-way, thereby restoring *Sclerocactus* habitat conditions and reducing fragmentation.

The applicant will use USFWS Mitigation Guidelines (USFWS 2014; Appendix B) and subsequent versions (as current information on arid lands restoration and *Sclerocactus* recovery evolves) to restore disturbed areas. Restoration includes additional measures beyond those used by the BLM in their reclamation guidelines. Topsoil development in arid lands is an extremely slow process. Once topsoil is removed, amendments may be necessary to provide the appropriate organic and inorganic soil constituents needed to support the biological community (Eldridge et al. 2012). The applicant will use the BLM Green River District Reclamation Guidelines and subsequent versions to reclaim disturbed areas. BLM reclamation guidelines require recontouring sites and reseeding them with native species. All areas will be reclaimed and restored and the applicant cannot re-disturb the restoration sites unless additional compensation (taking into account the prior loss of *Sclerocactus* habitats) fully offsets the loss.

Successful habitat restoration, survival, and recruitment (see Table 2) can be used to offset impacts in:

- Level 1 CCAs for new surface disturbance from the 8 new well pads.
- Level 1 CCAs for new surface disturbance from well pad expansion.
- Level 2 CCAs where cumulative disturbance level is between 5 and 25 percent for new surface disturbance.
- Level 2 CCAs that are below 5 percent cumulative disturbance for new surface disturbance that is within 300 ft of *Sclerocactus*.
- *Sclerocactus* Habitat Polygon for new surface disturbance where new disturbance is within 300 ft of *Sclerocactus*.

Restoration Standard

Restoration of Habitat shall be deemed sufficient if it meets the following criteria:

1. Reclamation meets the BLMs Green River District Reclamation Guidelines;
2. Restoration meets the 2014 Restoration Mitigation Guidelines (Appendix B); and
3. *Sclerocactus* are outplanted into the habitat via seed or starts from a Service approved authorized source and by a USFWS approved authorized individual that has been hired by Newfield.
4. If *Sclerocactus* do not survive within the first 5 years post outplanting, Newfield will consult with USFWS and outplant *Sclerocactus* a second time in order to achieve the Survival Standard. Only one additional outplanting is required (if the initial planting is not successful) after the initial *Sclerocactus* outplanting. After the initial outplanting, no *Sclercactus* monitoring is required past 5 years, regardless if a second outplanting is conducted.

Survival Standard

Survival of *Sclerocactus* shall be deemed sufficient if it meets the following criteria:

1. Within Level 1 CCAs an average of 8 or more *Sclerocactus* per acre are documented in the restored area after 5 years of monitoring, as verified by a botanist acceptable to the Service.
2. Within Level 2 CCAs an average of 4 or more *Sclerocactus* per acre rate are documented in the restored area after 5 years of monitoring, as verified by a botanist acceptable to the USFWS.

Recruitment Standard

Recruitment of *Sclerocactus* shall be deemed sufficient if it meets the following criteria:

- New seedlings germinate within *Sclerocactus* habitat and survive to the juvenile life stage

(approximately 2.5-4 cm).

Documentation and Monitoring

1. Documentation and Monitoring reports for restoration of habitat that will be sent to the USFWS on an annual basis shall include:
    a. A report detailing number *Sclerocactus* individuals outplanted on reclaimed and restored habitat each year, the source of the propagated *Sclerocactus,* restoration company qualifications, GIS location of the outplanted *Sclerocactus*, and all methods used in the propagation and outplanting.
    b. Third Year after Outplanting – report detailing the survival rate of the *Sclerocactus*, health (may be measured by size, color, or damage), recruitment, and reproduction, including photo documentation and field notes.
    c. Fifth Year after Outplanting – report detailing the survival rate of the *Sclerocactus*, health (may be measured by size, color, or damage), recruitment, and reproduction, including photo documentation and field notes.

Restoration, Sclerocactus Survival, and Sclerocactus Recruitment Ratios

Table 2 lists ratios associated with restoration, survival, and recruitment.

Bond

If Newfield would like to start oil and gas development work before achieving successful habitat restoration, they will implement restoration and they will contribute to a bond. The bond price will be based upon the cost of restoration work plus an additional 25 percent to cover inflation and future increases in restoration costs. The total bond price will be $9,388 ($7,510 plus 25 percent) per acre of new disturbance within Level 1 CCA. The total bond price will be $7,825 ($6,260 plus 25 percent) per acre of new surface disturbance within: (1) Level 2 CCAs above 5 percent disturbance, but below 25 percent disturbance; or (2) Level 2 CCAs < 5 percent disturbance and within 300 ft of *Sclerocactus*. The total bond price will be $3,188 ($2,550 plus 25 percent) per acre of new surface disturbance within 300 ft of *Sclerocactus* in the *Sclerocactus* Habitat Polygon.

If the applicant does not choose to secure a bond, they will be responsible for successful habitat restoration (*Sclerocactus* propagation, outplanting, survival, and recruitment after 5 years of monitoring) prior to new surface disturbance: for Level 1 CCA, above 5 percent cumulative disturbance within Level 2 CCAs, < 5 percent and within 300 ft of *Sclerocactus* in Level 2 CCAs, and within 300 ft of *Sclerocactus* in the *Sclerocactus* Habitat Polygon.

Bond Release

The bond will be released after:

- Newfield has implemented complete restoration actions that meet the Restoration Standard (above).

C. Reduction of Dust Impacts

Reduction of dust impacts can be used to offset impacts in:

- Level 1 CCAs for well pad expansions
- Level 2 CCAs and the *Sclerocactus* Habitat Polygon.

Removal of oil and gas production facilities and equipment and replacement with pipeline conveyance systems will result in significant truck traffic reduction, which in turn reduces dust and related indirect impacts on listed plant species. For example, according to Newfield production data, approximately 340 tanker trucks travel to existing facilities in Level 1 CCAs each month. This volume is projected to increase between 500 to 700 tanker trucks per month between 2015 and 2018, and during maximum production, truck traffic could increase to over 3,000 tanker trucks per month. If produced oil and gas can be conveyed with flow lines and offsite tank batteries, all tanker truck traffic to producing well pads will be eliminated. Traffic will then be limited to operational, safety, and environmental compliance inspections which are conducted every other day by pick-up truck, as well as periodic work-overs and their associated traffic. By installing flow lines and offsite tank batteries, it is estimated that total traffic will be reduced by 95 percent from current volumes, and this percentage will increase over time.

According to Newfield, a total of 131.2 acres of roads in Level 1 CCAs and 298.6 acres of roads in Level 2 CCAs will be affected by this 95 percent reduction of tanker truck traffic if the flow line installation occurs. Road acreage is calculated by the acres of road width disturbance. The following mitigation ratios provide an exchange of dust abatement efforts for corresponding well pad expansions in Level 1 CCAs and new disturbance less than 5 percent in Level 2 CCAs.

1. Reduction of Truck Traffic and Dust Ratio
    a. For every 20 acres of roads that have reduced truck traffic by 95 percent within Level 1 CCAs, a well pad can be expanded by 1 acre within Level 1 CCAs.
    b. For every 5 acres of roads that have reduced truck traffic by 95 percent within Level 1 CCAs, Newfield could disturb 1 additional acre within Level 2 CCAs or the *Sclerocactus* Habitat Polygon.
    c. For every 10 acres of roads that have 95 percent reduced truck traffic within Level 2 CCAs, Newfield could disturb 1 acre of terrain within Level 2 CCAs or the *Sclerocactus* Habitat Polygon.

D. Sclerocactus Mitigation Fund

Sclerocactus Mitigation Fund and guidelines for restoration are included in Appendix B.

Literature Cited

Eldridge, J.D., E. F. Redente, and M. Paschke. 2012. The Use of Seedbed Modifications and Wood Chips to Accelerate Restoration of Well Pad Sites in Western Colorado, U.S.A. Restoration Ecology 4:524-531.

USFWS. 2010. Recovery Outline for the Sclerocactus *wetlandicus*. Utah Ecological Services Field Office, Salt Lake City, Utah.

USFWS. 2014. 2014 Ecological restoration mitigation calculation guidelines for impacts to Sclerocactus *wetlandicus* and Sclerocactus *brevispinus* habitat. Utah Ecological Services Field Office, Salt Lake City, Utah.

Appendix A: Fish and Wildlife Service Recommended Conservation Measures for Sclerocactus: Uinta Basin hookless cactus (Sclerocactus wetlandicus)Pariette cactus (Sclerocactus brevispinus) March 11, 2014

Conservation measures are actions that the action agency and applicant agree to implement to further species recovery. The beneficial effects of conservation measures are taken into consideration for determining the overall project impacts to species. The following list of conservation measures for Uinta Basin hookless cactus (*Sclerocactus wetlandicus*) and/or Pariette cactus (*Sclerocactus brevispinus*) (collectively referred to as *Sclerocactus*) will help minimize the impacts of a proposed action to these threatened species.

SCLEROCACTUS SURVEYS

- Pre-project habitat assessments will be completed across 100 percent of the project disturbance area within potential habitat prior to any ground disturbing activities to determine if suitable *Sclerocactus* habitat is present.
- Pre-construction *Sclerocactus* surveys will occur following the pre-project habitat assessments that identified any suitable habitat within the project area. These pre- construction surveys must follow U.S. Fish and Wildlife Service (USFWS) Utah Field Office Guidelines for Conducting and Reporting Botanical Inventories and Monitoring of Federally Listed, Proposed, and Candidate Plants. Surveys will be conducted in suitable habitat prior to initiation of project activities, at a time when the plant can be detected, and during appropriate flowering periods:
    - *Sclerocactus brevispinus* surveys must be conducted between March 15th and June 30th, unless an extension is provided in writing by the USFWS
    - *Sclerocactus wetlandicus* surveys can be done any time of the year, provided there is no snow cover.
- *Sclerocactus* surveys will be conducted by a qualified botanist. Qualifications are defined in the USFWS Utah Field Office Guidelines for Conducting and Reporting Botanical Inventories and Monitoring of Federally Listed, Proposed and Candidate Plants, http://www.fws.gov/utahfieldoffice/SurveyorInfo.html. Qualified botanists must also attend the USFWS Uinta Basin Rare Plant Workshop, http://www.fws.gov/utahfieldoffice/UBRarePlants.html.
- Surveys will be valid for one year from the survey date for *Sclerocactus brevispinus* and *Sclerocactus wetlandicus*.
- *Sclerocactus* spot check surveys will be conducted on an annual basis by a qualified botanist, and reviewed by the Bureau of Land Management (BLM) and our office for all planned disturbance areas if the project has not been completed within the year following pre-construction plant surveys. Review of spot checks may result in additional pre-construction plant surveys as directed the BLM and our office. If the proposed action has not occurred within four years of the original survey, additional coordination with the BLM and our office must occur and a new clearance survey may be necessary prior to ground disturbing activities.
- *Sclerocactus* surveys for access roads, buried pipelines, well pads, and other facilities requiring removal of vegetation (e.g., compressor stations) will include the project area and/or right-of-way (ROW), and 300 feet (ft) from the edges of the project disturbance and/or ROW.
- *Sclerocactus* surveys for surface pipelines placed within an existing road ROW, and within 10 ft from the edge of the disturbed surface of the road, will include the ROW and 50 ft from the edge of the ROW on the pipeline side of the road.
- *Sclerocactus* surveys for cross-country surface pipelines (pipelines over 10 ft from a road), where the

pipeline will be laid by hand with minimal disturbance and no vehicle use will include the ROW and 50 ft from the edges of both sides of the ROW.

- Surveys for all other cross-country surface pipelines (vehicles or equipment used, not laid out by hand) will include the ROW and 300 ft from the edges of both sides of the ROW.
- *Sclerocactus* surveys will not be necessary when pipelines are buried in existing roads.

PROJECTS PROPOSED WITHIN *SCLEROCACTUS* HABITAT

General Measures

- Ground disturbing activities in Level 1 CCAs and within 300 ft of individual *Sclerocactus* plants and/or populations must occur outside of the flowering period, April 1 - May 30.
- Access roads, buried pipelines, well pads, and other facilities requiring removal of vegetation (e.g., compressor stations) will be located a minimum distance of 300 ft from individual *Sclerocactus* plants and/or populations where feasible (and in accordance with Level 1 and 2 CCA conservation recommendations, as outlined below).
- Surface pipelines will be located at a minimum of 50 feet from individual *Sclerocactus* plants and/or populations where feasible (and in accordance with Level 1 and 2 CCA conservation recommendations, as outlined below).
- New surface pipelines located closer than 50 feet to known *Sclerocactus* individuals will be secured in place to prevent pipeline movement (and in accordance with Level 1 and 2 CCA conservation recommendations, as outlined below).
- Only water and methods approved by the BLM (no chemicals, reclaimed production water or oil field brine) will be used for dust abatement measures within *Sclerocactus* habitat.
- Dust abatement will be employed in suitable *Sclerocactus* habitat over the life of the project during the time of the year when *Sclerocactus* species are most vulnerable to dust- related impacts (March through August).
- Noxious weeds within *Sclerocactus* habitat may be controlled with herbicides, in accordance with the BLM Herbicide PEIS (http://www.blm.gov/wo/st/en/prog/more/veg_eis.html). Guidelines and the BLM's Standard Operating Procedures for Threatened and Endangered Plant Species (Table 1).
- Application for a Pesticide Use Permit will include provisions for mechanical removal, as opposed to chemical removal, for Utah Class A, B, and C noxious weeds within 50 feet of individual/populations of *Sclerocactus*.
- Erosion control measures (e.g., silt fencing) will be implemented to minimize sedimentation to *Sclerocactus* plants and populations located down slope of proposed surface disturbance activities, and should only be implemented within the area proposed for disturbance.
- All disturbed areas will be reclaimed with plant species native to Utah, or seed mixtures approved by the BLM and our office, which may include the use of sterile, non-native, non-invasive, annuals to help secure topsoil and encourage native perennials to establish.

Level 1 CCAs:

- Avoid new surface disturbance, including well pads, roads, pipelines, or any other surface disturbing activities where feasible. Expansion of existing facilities will be allowed— e.g., widening existing

access roads, expanding well pads, installation of pipelines to access existing facilities (along existing alignments or roadways).

- Where access roads are widened, well pads are expanded, or buried pipelines access existing facilities, design projects to minimize impacts by:
    - Locating project a minimum distance of 300 ft from individual *Sclerocactus* plants and/or populations (except for surface pipelines which is 50 ft),
    - Utilizing existing well pads and infrastructure,
    - Using common ROWs for roads and utilities where possible, and
    - Placing signing to limit off-road travel in sensitive areas.
- Where new surface disturbance occurs within the Level 1 CCAs, mitigation must be completed following the Conservation and Mitigation Strategy For the Pariette Cactus and Uinta Basin Hookless Cactus, Newfield Greater Monument Butte Project (Strategy).
- Where new surface disturbance directly affects *Sclerocactus* (*Sclerocactus* are directly removed), a monetary amount ($640 per *Sclerocactus*) will be contributed to the *Sclerocactus* Mitigation Fund-BLM to aid in the recovery of *Sclerocactus* species impacted by the project. These contributions are in addition to payments requested for indirect effects to *Sclerocactus*. Contributions will be negotiated between the Operator and our office in consultation and will be based on the number of *Sclerocactus* directly impacted and in relation to our office's current management guidelines for *Sclerocactus*.
- Several options for mitigation of Level 1 CCAs are present (see Strategy). If mitigation funds are established, funds will be paid to: *Sclerocactus* Mitigation Fund – BLM Michelle Olson, Manager Impact-Directed Environmental Accounts National Fish and Wildlife Foundation Fifteenth Street NW, Suite 1100 Washington, DC 20005

Level 2 CCAs:

- New surface disturbance, including well pads, roads, pipelines, or any other surface disturbing activities will not exceed a 5 percent surface disturbance threshold where feasible.
- If the total cumulative surface disturbance is below the 5 percent threshold, and where access roads, buried pipelines, well pads, or other facilities requiring removal of vegetation (e.g., compressor stations) will be constructed, design project to minimize impacts by:
    - Locating project a minimum distance of 300 ft from individual *Sclerocactus* plants and/or populations (except for surface pipelines which is 50 ft).
- If the total cumulative surface disturbance is above the 5 percent threshold, and/or where new surface disturbance indirectly affects *Sclerocactus* (*Sclerocactus* within 300 ft of proposed disturbance), mitigation will occur following the Strategy.
- Where new surface disturbance directly affects *Sclerocactus* (*Sclerocactus* are directly removed), a monetary amount ($640 per cactus) will be contributed to the *Sclerocactus* Mitigation Fund-BLM to aid in the recovery of *Sclerocactus* species impacted by the project. These contributions are in addition to payments requested for indirect effects to cacti (see previous measure). Contributions will be negotiated between the Operator and our office based on the number of *Sclerocactus* directly impacted and in relation to the current management guidelines for *Sclerocactus*.
- Several options for mitigation of Level 2 CCAs are available (see Strategy). If mitigation funds are

established, funds will be paid to: *Sclerocactus* Mitigation Fund – BLM Michelle Olson, Manager Impact-Directed Environmental Accounts National Fish and Wildlife Foundation 1133 Fifteenth Street NW, Suite 1100 Washington, DC 20005

Sclerocactus Habitat Polygon:

- Where access roads, buried pipelines, well pads, or other facilities requiring removal of vegetation (e.g., compressor stations) will be constructed, design project to minimize impacts by:
    - Locating project a minimum distance of 300 ft from individual *Sclerocactus* plants and/or populations (except for surface pipelines, which is 50 ft).
- Where new surface disturbance indirectly affects *Sclerocactus* (Sclerocactus within 300 ft of proposed disturbance), mitigation will occur following the Strategy.
- Where new surface disturbance directly affects *Sclerocactus* (*Sclerocactus* are directly removed), a monetary amount ($640 per *Sclerocactus*) will be contributed to the *Sclerocactus* Mitigation Fund- BLM to aid in the recovery of *Sclerocactus* species impacted by the project. These contributions are in addition to payments requested for indirect effects to cacti (see previous measure). Contributions will be negotiated between the Operator and our office based on the number of *Sclerocactus* directly impacted and in relation to our current management guidelines for *Sclerocactus*.
- Several options for mitigation of the *Sclerocactus* Habitat Polygon are available (see Strategy). If mitigation funds are established, funds will be paid to: *Sclerocactus* Mitigation Fund – BLM Impact-Directed Environmental Accounts National Fish and Wildlife Foundation 1133 Fifteenth Street NW, Suite 1100 Washington, DC 20005

Appendix B: 2014 Ecological Restoration Mitigation Calculation Guidelines for impacts to Sclerocactus wetlandicus and Sclerocactus brevispinus Habitat

U.S. Fish and Wildlife Service, Utah Ecological Services Field Office December 2014

Background:

The State of Utah ranks as the 10th and 11th largest producers nationally for gas and oil, and the majority of the state's production is centered in the Uinta Basin (Vanden Berg 2014). Total producing and active oil and gas wells in the Uinta Basin number more than 13,000, on 9,197 well pads (BLM 2012), with surface disturbance totaling more than 45,000 acres (assumes average of 5 acres of disturbance per well pad). Bureau of Land Management (BLM) analysis of 2011 data on pending NEPA projects forecasts more than 70,000 acres of additional oil and gas construction related disturbance in the next 15-20 years (BLM 2012). Current and projected energy development in the Uinta Basin overlaps with more than 90 percent of the range of the threatened Pariette cactus and Uinta Basin hookless cactus.

In 2012 we developed landscape scale conservation guidelines for the threatened Pariette cactus and Uinta Basin hookless cactus. The guidelines were developed to conserve and recover the species and prevent further habitat loss and fragmentation from energy development. Our strategy involved establishing core conservation areas (CCAs) that included dense aggregations of the threatened cactus species along with disturbance limits and pollinator buffers that allow for continued connectivity among these aggregations. The protection of pollinators and their habitat is important because these species depend primarily on pollination to produce seed. In order to further manage recovery of these cactus species across the landscape, our CCAs are grouped geographically into 8 Conservation Units in order to ensure genetic and ecological representation over the range of the species.

Level 1 CCAs include the densest aggregations of known cactus locations and were delineated based on a 400 m buffer around known plant locations (the buffer distance is based on foraging distances of primary pollinators; Tepedino 2010). Within these Level 1 CCAs our goal is to have no new surface disturbance; well pad and road expansion may be considered, but only after avoidance and minimization efforts along with appropriate compensatory mitigation. Level 2 CCAs are adjacent to Level 1 CCAs and include less dense aggregations of cactus, but are still considered important for overall population and habitat connectivity in the Uinta Basin. Level 2 CCAs were developed using a 1,000 m buffer around plants to allow for genetic connectivity and pollinator travel between Level 1 CCAs, and to provide additional habitat for cactus expansion and recruitment (Service 2012). Our goal is to maintain no more than 5 percent total surface disturbance within these Level 2 CCAs (Service 2012). Disturbance over 5 percent in Level 2 CCAs can occur once ecological restoration of disturbed habitat is completed so that disturbance stays at or below 5 percent. We recognize that some of the Level 2 CCAs are already above 5 percent surface disturbance. For these areas, we recommend that any disturbance above 5 percent in Level 2 CCAs be reclaimed to keep total disturbance at or below 5 percent and cumulative disturbance including areas that are reclaimed stay below 25 percent (Service 2012).

Reclamation of arid lands is difficult and full ecological restoration within the habitat of listed cactus species in Utah has not been successful (Grossl et al. 2012). We define full ecological restoration as supporting appropriate native community components and structure, returning land to a state with moderate to high ecological function that can support most processes and components of the pre-disturbance natural community, integrating into the surrounding landscape, resilient to environmental stressors, similar to a reference ecosystem (Society for Ecological Restoration (SER) 2004) and especially supporting listed plants and their habitat. Avoidance and minimization of impacts to listed species and their habitat is the first step in offsetting impacts.

Where impacts to listed plants and their habitats cannot be avoided or minimized we will consider ecological restoration as mitigation to offset these impacts. However, because we are currently unable to ensure successful ecological restoration, initial efforts will focus on researching restoration methods that may lead to improved

techniques. As methods and inputs improve the estimated costs for restoration may change correspondingly. We have based the following 2014 mitigation costs on available information of the components needed for ecological restoration.

Ecological Restoration Components and Costs:

The following components are needed for ecological restoration of oil and gas impacts in the Uinta Basin:

1. *Treatment of non-native and invasive plants for 2 years.* Treatment and control of non- native plants is vital to reducing competition prior to establishing native plants (Sieg et al. 2003). Non-native and invasive plants increase dramatically in response to soil disturbance so treatment needs to be conducted before and after grading and re-contouring of well pads, roads and other disturbed areas (Sieg et al. 2003). These activities are required by BLM's Green River Reclamation Guidelines (see Objective 6; Attachment 1 *in* BLM 2011) so although we recognize that this activity is an important component of restoration we are not including them in our mitigation costs as long as they are implemented as part of BLM's requirements. Where these measures are not required as part of BLM reclamation requirements, these costs will apply in our mitigation calculation. Cost estimates were determined at \$0.02- \$0.03 per ft^2 (Musich Custom Spraying, Oct 29, 2014, personal communication) for a cost of \$1,307 per acre.

2. *Grading and plowing of disturbed site (well pad, road).* Well pads, roads and other disturbed sites result in soil loss and compaction (Buto et al. 2010). In addition, many sites are leveled so that the topography no longer matches the surrounding area thus leading to wind and water erosion, disruption of weathering processes, water path, sedimentation, barriers to species movement (Service 2010). Re-contouring disturbed sites to match surrounding topography integrates the restored area into the larger landscape and reduces negative impacts to ecological communities. Subsequent plowing is necessary to ensure a favorable recipient site prior to planting native seed or plants.

   Re-contouring of disturbed sites is required by the BLM Green River District's Reclamation Guidelines (see Objective 2 and 3: Attachment 1 *in* BLM 2011). Where these measures are not required as part of BLM reclamation requirements, these costs will apply in our mitigation calculation.

   Plowing of the site or similar soil improvement immediately prior to seeding is not required by BLM so we have incorporated it into our costs. We estimate that plowing costs will be \$500 per acre given that heavy equipment will be needed to loosen soil in preparation for direct seeding and to provide necessary aeration and sufficient drainage for *Sclerocactus* species (J&L Oilfield Service Inc., Josh Justice, Oct 2, 2014, personal communication) and the low end cost for leveling well pads (~4 acres) is estimated at \$2,000 per acre but average costs are \$6,025 per acre (or \$24,100 per well pad) which is the cost we are using for the mitigation calculation.

3. *Soil amendments including cobble, topsoil, char, wood chips, biological soil crust inoculant or other nutrients/minerals.* Restoring soils in arid lands is an important component for restoring and supporting native plant communities. Topsoil development in arid lands is an extremely slow process so once topsoil is removed amendments may be necessary to provide the appropriate organic and inorganic soil constituents needed support the biological community. (Whisenant 1995; Eldridge et al. 2012). In addition, we know that biological soil crusts are an important component of these arid ecosystesms so restoration will include re-establishment of biological soil crusts (Rosentreter and Belnap 2001; Bowker et al. 2005). This is an ongoing area of restoration ecology and we will likely learn more through experimentation and analysis. Current cost estimates for soil amendment were estimated to range from \$1,200 to \$6,000 per acre (Schneider 2014, Western States Reclamation, Inc,), and adding local topsoil would cost \$300 per dump truck load (12 yards which covers 3,600 ft^2 at 1 inch depth) (Allred Paving, KW Trucking, Tri-County Concrete, Oct 2014, personal communication). Eleven truck loads are needed to cover one acre with one inch of soil amendment, costing \$3,300 per acre. We are using the \$3,300 per

acre cost for our mitigation estimates.

4. *Collecting seed from a diversity of native plants.* Full restoration includes restoring the entire plant species composition that supports ecological functions and processes. Seed from native flowering plants will help increase diversity, and support pollinators with floral resources that are available at different times of year. Seed also needs to be collected from *Sclerocactus* in order to be able to propagate them for outplanting. Costs are estimated at $1,500 per acre as knowledgeable botanists and multiple trips are needed to gather seed from a diversity of species that best mimics intact site conditions.

5. *Planting seed from habitat specific native plants including wildflowers.* Establishing specific target native plants from the natural community where restoration is to occur is important in establishing the community components and processes (*i.e.,* pollination) important for a functioning ecosystem. Seed will be hand planted or drill seeded immediately after plowing or tilling of the site to ensure good seed-soil contact. Costs for this activity were estimated from two different sources ranging from $1,250 to $2,500 per acre (Schneider 2014) and $500 to $1,000 per acre, or a median cost of $750 per acre (Mike Thomas, Great Bear Restoration, MT, Mar 2014, personal communication). We are using the $750 per acre cost for our mitigation estimates.

6. *Listed Sclerocactus species propagation.* Propagating and planting juvenile to young adult plants will help establish cactus on the restored area. *Sclerocactus* species can take 4-6 years from seed propagation before it can outplanted on a restoration site. Costs for propagating cactus were estimated by Red Butte Garden (R. Reisor, Feb 11, 2014, personal communication), and total $100 per cactus.

7. *Planting propagated Sclerocactus plants. Sclerocactus* that are propagated will be planted at 10 cacti per acre in Level 1 CCAs and 5 cacti per acre in Level 2 CCAs to establish listed *Sclerocactus* species at the restored site. We expect mortality and reduced reproduction from planted *Sclerocactus* so we anticipate final survival and reproduction of 8 *Sclerocactus* in Level 1 CCAs and 4 *Sclerocactus* per acre in Level 2 CCAs. Costs for planting cactus were estimated by Red Butte Garden (R. Reisor, Feb 11, 2014, personal communication) and total $42 per cactus. For restoration activities, five *Sclerocactus* plants would be planted per acre for a cost of $210 per acre.

8. *Planting commercially available habitat specific native plant species seed (twice) including grasses and shrubs.* This task would lead to the establishment of the portion of native plant community that would integrate formerly disturbed areas into the landscape, support ecosystem functions and stabilize the site. The BLM requires establishment of a desired self-perpetuating plant community in their Green River District Reclamation Guidelines (see Objective 1; Attachment 1 *in* BLM 2011) so we have not included these requirements in our mitigation costs. Where these measures are not required as part of BLM reclamation, these costs will apply in our mitigation calculation. In addition, only native, habitat specific plant species will be allowed in listed *Sclerocactus* habitat in order to achieve full ecological restoration. Costs include seed mix purchase and planting of seed. Costs for purchasing an appropriate seed mix are $500 per acre and include *Artemisia nova*, *Atriplex canescens*, *Pleuraphis jamesii*, *Achnatherum hymenoides, Linum lewisii* and *Sphaeralcea munroana* (J. Poulos Apr. 2014, personal communication). Costs for direct seeding are $750 per acre and are discussed above in number 5.

9. *Monitoring.* Monitoring of the restoration site is necessary to determine if the site is proceeding toward ecological restoration goals and to help inform management decisions to ensure restoration goals are met. Monitoring is required as part of BLM's Green River District Reclamation Guidelines (Objective 8) so we have not included them in our mitigation costs. However, we will work with BLM on a project-specific basis to determine the goals, objectives, and requirements of restoration monitoring plans. Where these measures are not required as part of reclamation these costs will apply in our mitigation calculation.

Calculating Acres to be Mitigated:

Mitigation costs are based on the amount of habitat impacted and the quality of that habitat as determined by the U.S. Fish and Wildlife Service and delineated into 3 strata: Level 1 CCAs, Level 2 CCAs, and suitable habitat outside of the CCAs. Mitigation is applied only where impacts cannot be avoided. Mitigation will occur for any impacts occurring within Level 1 CCAs for any surface disturbances. Mitigation will occur in Level 2 CCAs where surface disturbance exceeds 5 percent. Mitigation will occur in suitable habitat where impacts are within 300 ft of listed *Sclerocactus* plants. This habitat mitigation approach does not apply to direct impacts to listed plants. Mitigation for direct impacts are addressed through another mitigation calculation as discussed below.

The amount of habitat impacted will be calculated as follows:

1. For Level 1 CCAs all disturbed acres inside designated Level 1 CCAs will be mitigated. To meet our objective of no disturbance in Level 1 CCAs, we anticipate the only additional disturbance will come from well expansions not new roads or well pads.
2. For Level 2 CCAs the number of acres currently disturbed that are not reclaimed, and exceed the 5 percent disturbance cap will be mitigated.
3. For impacts outside of Level 1 and 2 CCAs and within 300 ft of *Sclerocactus*:
    a. The total acreage of the well pad that is within 300 ft of *Sclerocactus* will be mitigated.
    b. The distance of the Right-of-Way (ROW) where the edge is within 300 ft of *Sclerocactus* for buried and cross country pipelines and 50 ft for hand-laid surface pipelines adjacent to roads multiplied times the width for the stretch of ROW (for a pipeline or road) will be mitigated.

Summary of Mitigation Costs:

Mitigation costs include topographical contouring, soil preparation, seed collection and planting, cactus propagation and planting, and monitoring. These costs vary based on the importance of the three habitat areas for *Sclerocactus*—Level 1 CCAs, Level 2 CCAs, and Suitable Habitat outside of CCAs.

Level 1 CCAs: Mitigation costs per acre in Level 1 CCAs includes costs associated with plowing the soil, amending the soil, propagating *Sclerocactus* and planting at a density of 10 cacti per acre, and collecting seed and planting a diversity of native plant species from adjacent sites. Level 1 CCAs areas support the highest density of *Sclerocactus* thus we have included costs for restoring a high density at 10 *Sclerocactus* per acres assuming some mortality and reduced reproduction from transplanting and poor soils.

Level 2 CCAs: Mitigation costs per acre in Level 2 CCAs includes costs associated with amending the soil, propagating *Sclerocactus* and planting at a density of 5 cacti per acre and collecting seed and planting a diversity of native plant species from adjacent sites.

Suitable habitat: Mitigation costs per acre in suitable habitat includes costs associated with collecting and planting a diversity of native seed and re-establishing biological soil crust by inoculation.

Other costs associated with restoration that are already required and included in BLM's Green River Reclamation Guidelines such as grading of site and seeding and establishment of common native plants commercially available are not included in our mitigation costs because we assume these restoration actions will be conducted as part of BLM's requirements. Where these actions are not required or completed these costs will be included in our total costs for mitigation.

Table 1. *Sclerocactus* compensatory mitigation calculation

Mitigation habitat type	Acres	Cost per acre	Explanation of restoration costs
Level 1 CCA (any level of disturbance)	1.0	$7,510.00	Includes amending soil, cactus propagation and planting (10 cacti per acre), and native species seed collection and planting. Assumes costs for BLM required measures are already being implemented.
Level 2 CCA (over 5% disturbance or within 300 ft of cactus)	1.0	$6,260.00	Includes amending soil, cactus propagation and planting (5 cacti per acre), and native species seed collection and planting. Assumes costs for BLM required measures are already being implemented.
Sclerocactus habitat (Disturbance within 300 ft of cactus)	1.0	$2,550.00	Native species seed collection and planting and biological soil crust inoculation. Assumes costs for BLM required measures are already being implemented.

Literature Cited:

Bowker, M.A., J. Belnap, D.W. Davidson, and S.L. Phillips 2005. Evidence for micronutrient limitation of biological soil crusts: importance to arid lands restoration. Ecological Applications 15(6): 1941-1951.

Bureau of Land Management (BLM) 2011. Green River District Restoration Guidelines. Vernal, UT. Available at http://www.blm.gov/style/medialib/blm/ut/vernal_fo/energy.Par.23238.File.dat/Reclamation%20Guidelines%20A-1.pdf

Bureau of Land Management (BLM) 2012. Greater Uinta Basin oil and gas cumulative impacts technical support document. Vernal Field Office, Vernal, UT. 27 pp.

Buto, S.G., Kenney, T.A., and Gerner, S.J., 2010. Land disturbance associated with oil and gas development and effects of development-related land disturbance on dissolved-solids loads in streams in the Upper Colorado River Basin, 1991, 2007, and 2025: U.S. Geological Survey Scientific Investigations Report 2010-5064, 56 p. Available at: http://pubs.usgs.gov/sir/2010/5064.

Eldridge, J.D., E. F. Redente, and M. Paschke 2012. The Use of Seedbed Modifications and Wood Chips to Accelerate Restoration of Well Pad Sites in Western Colorado, U.S.A. Restoration Ecology 4: 524-531.

Grossl, P., S. Babb and S.N. Strong 2012. Reclamation of abandoned oil and gas well pads in arid environments. Poster Abstract. Restoring the West Conference, Oct 30-31, 2012. Available at: http://digitalcommons.usu.edu/rtw/2012/posters/1/

Rosentreter, R and J. Belnap 2001. Biological Soil Crusts of North America in Belnap, J and O.L. Lange editors, Biological Soil Crusts: Structure, Function and Management. Springer-Verlag, Berlin

Sieg, C. H., B.G. Phillips and L.P. Moser 2003. Exotic invasive plants *in:* Frederici, Peter, editor. Ecological Restoration of Southwestern Ponderosa Pine Forests. Washington, DC: Island Press. p. 251-267.

Society for Ecological Restoration 2004. SER International Primer on Ecological Restoration. Vesion 2. Available from: http://www.ser.org/resources/resources-detail-view/ser- international-primer-on-ecological-restoration

Tepdino, V. 2010. "RE: the Greenleaf ms." Email to Jessi Brunson, U.S. Fish and Wildlife Service, Vernal Pilot Office, Vernal, Utah.

Schneider, J. 2014. Western States Reclamation, Inc. "RE: Reclamation costs" Email to Tova Spector, U.S. Fish and Wildlife Service, West Valley City, Utah.

U.S. Fish and Wildlife Service 2010. Recovery outline for the *Sclerocactus wetlandicus* (Uinta Basin Hookless Cactus). Utah Ecological Services Field Office, Salt Lake City, UT 15 pp.

U.S. Fish and Wildlife Service 2012. 2012 Energy Development Management Guidelines for *Sclerocactus wetlandicus* and *Sclerocactus brevispinus* Core Conservation Areas. Vernal Pilot Office, Vernal, Utah.

Vanden Berg, M. D. 2014. Utah's Energy Landscape, third edition. Circular 117, Utah Geological Survey, Utah Department of Natural Resources. 48 pp.

Whisenant, S. 1995. Landscape dynamics and arid land restoration *in:* Roundy, Bruce A.; McArthur, E. Durant; Haley, Jennifer S.; Mann, David K., comps. 1995. Proceedings: Wildland shrub and arid land restoration symposium; 1993 October 19-21; Las Vegas, NV. Gen. Tech. Rep. INT-GTR-315. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

Attachment 5: Biological Opinion

This page intentionally left blank.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

UTAH FIELD OFFICE
2369 WEST ORTON CIRCLE, SUITE 50
WEST VALLEY CITY, UTAH 84119

September 4, 2015

FWS/R6ES/UT

06E23000-2015-F-0040

Memorandum

To: Field Manager, Bureau of Land Management, Vernal, Utah

From: Utah Field Supervisor, Ecological Field Services, U.S. Fish and Wildlife Service, West Valle

Subject: Conclusion of formal section 7 consultation for Newfield Exploration Corporation Greater Natural Butte 5,750 Well Project

In accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.), and the Interagency Cooperation Regulations (50 CFR 402), this transmits our final biological opinion (BO) based on review of the Newfield Exploration Corporation's (hereafter, Newfield) Greater Natural Butte 5,750 Well Project (hereafter, Project) and its effects on Uinta Basin hook.less cactus *(Sclerocactus wetlandicus)* and Pariette cactus *(Sclerocactus brevispinus).* This BO is based on information provided in your June 2, 2015, Biological Assessment (BA), and subsequent email and letter correspondence (see Consultation History, below).

Ute ladies'-tresses *(Spiranthes diluvialis)* and western yellow-billed cuckoo *(Cocytus americanus)* were also analyzed in the BA. We concur that the project may affect, but is not likely to adversely affect Ute ladies'-tresses and western yellow-billed cuckoo based on largely on commitments to conduct ground disturbing activities outside of the flowering and nesting seasons, respectively, and reduce light and noise disturbance to the birds (emails between BLMand our office dated July 17, 2015 and August 6, 2015; see Consultation History, below).

Razorback sucker and Colorado pikeminnow were also analyzed in the BA. We concur that the project may affect, but is not likely to adversely affect razorback sucker and Colorado pikeminnow based on a very small level of impact from a 1 acre water well development in critical habitat and timing stipulations to avoid seasonal fish movements, and spawning and rearing activities.

The Project will require a maximum of 3,924 acre-feet (ac-ft) of water annually. A portion of the water for the Project will come from water rights #43-7478 and 47-1358, which are historic

sources. Water rights filed and developed prior to January 1988 are classified as "historic depletions" under the Upper Colorado River Endangered Fish Recovery Program's (Recovery Program) 1993 section 7 agreement and do not require further consultation. Because this water depletion is considered historic, the Recovery Program and its activities will serve as the conservation measures necessary to minimize adverse effects to listed fish. In addition, the other portion of the water for the Project has previously been completed and will not require further consultation. The consultations that have been previously completed are associated with water rights #41-3530, 47-1817, 47-1821, 47-1802, and 47-1804. These water rights were consulted on during the Castle Peak Eightmile Flat (06_F_0026), Rocky Point (12_F_0085), and 20-Acre Infill (12_F_0024) Projects.

Based upon the above information, the effects of the action on Western yellow-billed cuckoo, Ute ladies'-tresses, razorback sucker, and Colorado pikeminnow are expected to be insignificant. We may reconsider the determination for Western yellow-billed cuckoo, Ute ladies'-tresses, razorback sucker, and Colorado pikeminnow if project action changes or additional information about the distribution of the listed species becomes available.

Consultation History

Chronology of Consultation Events

- **October 22, 2014-April 8, 2015:** Meetings and correspondence with BLM and Newfield to discuss *Sclerocactus* Strategy.
- **June 2, 2015:** We received the BA and letter requesting formal consultation.
- **June 15, 2015:** We received edited acreage calculations for the amount of disturbance associated with this project in *Sclerocactus* habitat.
- **July 9, 2015:** Meeting was held between our office, BLM, and Newfield to discuss conservation measures and request accurate information regarding water depletions. We also received follow-up emails with corrected water right and depletion information from BLM.
- **July 17, 2015:** We received a letter from BLM stating that they have changed their determination from adversely modify critical habitat to may affect likely to adverselyaffect critical habitat for listed Colorado River fish. We also received an email from BLM with updated conservation measures for all listed species.
- **July 18, 2015:** We received updated conservation measures with additional questions from BLM. We had a phone conversation with BLM to clarify conservation measures.
- **August 6, 2015:** We received updated applicant-committed conservation measures from BLM and Newfield in an email.
- **August 10, 2015:** We had a phone conversation with BLM to discuss conservation measures for Ute ladies'-tresses and Western yellow-billed cuckoo.
- **August 27, 2015:** We received an email from BLM stating that they would implement the final conservation measures in the proposed action and ROD. We received a signed copy on September 2, 2015.
- **September 3, 2015:** We received an email from BLM changing their determination

for Colorado River fish critical habitat from may affect likely to adversely affect to may affect not likely to adversely affect the critical habitat.

Biological Opinion

I. Description of the Proposed Action

Newfield proposes to construct, drill, produce, and upon termination, reclaim:

- 750 vertical oil wells that will be converted into waterflood injection wells
- 2,500 deep gas wells
- 2,500 directionally drilled oil wells

Newfield proposes to construct:

- 226 miles of new roads and pipelines
- 21 new compressor stations
- one 50-MMscf/d centralized oil well gas processing plant
- 13 gas driven water treatment and injection facilities
- 12 gas oil separation plants
- 1 fresh water collector
- 6 water pump stations.

Newfield proposes to expand:

- 318 miles of existing roads
- 3 existing oil well compressor stations

As listed in Table 2.3.12-1 of the BA, maintenance and operations of wells, well pads, roads, and central facilities will occur throughout the life of the project. Upon abandonment, the operator will reclaim well pads, roads, and pipelines as directed by the surface owner. The anticipated life of each well is 20 to 30 years and it will take approximately 5 years for full abandonment and reclamation. Approximately 4,978 acres of disturbance will remain post interim reclamation. Reclamation will follow the measures outlined in Appendix D of the Environmental Impact Statement (EIS) for this Project and the Green River District Guidelines for Reclamation Plan (BLM 2011). Surface disturbance for well pads, roads, pipeline rights-of- way (ROW), and other surface facilities will be approximately 10,122 acres. The action area is located within Township 4 South, Range 1 East; Township 5 South, Range 3 West; Township 8 South, Range 15-19 East; Township 9 South, Range 15-19 East; and Township 10 South, Range 15-18 East.

Action Area

The action area is defined in 50 CFR 402 to mean "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." For the purposes of this consultation, we define the action area to encompass all surface disturbance within the Greater Monument Butte boundary plus a 300 ft buffer around surface disturbance, as these areas will be directly and indirectly affected by the action (Service 2014). Due to the programmatic nature of this project, specific locations of surface disturbance have not yet been identified.

Applicant Committed Conservation Measures

All general applicant-committed environmental protection measures as listed in Section 2.3.1.4 and Appendix G of the BA will be implemented.

- The Final Conservation and Mitigation Strategy for the Pariette Cactus and Uinta Basin Hookless Cactus Newfield Greater Monument Butte Project (Attachment 1, Appendix A) will be followed.

II. Status of the Species

The purpose of this section is to summarize the best available information regarding the current range-wide status of the listed plant species. Additional information regarding listed species may be obtained from the sources of information cited for these species.

Sclerocactus glaucus (Colorado hookless cactus; hereafter *S. glaucus),* which included three identified subpopulations, was listed as a threatened species in 1979 (44 FR 58870). The inclusion of these subpopulations under a single species was not supported by more recent genetic and morphological research. The argument to separate *S. glaucus* into three species is supported by recent genetic studies (Porter et al. 2007), common garden experiments (Welsh et al. 2003), and a reevaluation of morphological characteristics (Heil and Porter 2004). We currently recognize *S. glaucus* as three distinct species: *S. brevispinus* (Pariette cactus), *S. wetlandicus* (Uinta Basin hookless cactus), and *S. glaucus* (Colorado hookless cactus). These three species retain their threatened status (74 FR 47112, September 15, 2009).

Pariette cactus grows on fine soils in clay badlands derived from the Uinta geologic formation (Service 1990). It is found on "stony, gravelly, hilly terrain" and is frequently, although not always, associated with desert pavement (soil with a high percentage of thin rock fragments covering the surface). Pariette cactus habitat is a sparsely vegetated desert shrub land dominated by saltbush (*Atriplex*), rabbitbrush (*Chrysothamnus*), and horsebrush (*Tetradymia*) species (Service 1990).

Uinta Basin hookless cactus is generally found on coarse soils derived from cobble and gravel stream terrace deposits, or rocky surfaces on mesa slopes at 1,350 to 1,900 meters (4,400 to 6,200 ft) elevation (Service 1990; Heil and Porter 2004). However, the habitat type for Uinta Basin hook.less cactus has expanded with recent reports of individual cacti found in atypical habitat.

Both of the *Sclerocactus* species are outcrossing species, meaning they require pollen from the flower of a different plant to produce viable seed (Tepedino et al. 2010). Flowers of both *Sclerocactus* species typically open in mid-day and close late in the afternoon for three to five days (Tepedino et al. 2010). A broad assemblage of native, ground-nesting bees, mostly from the family Halictidae (Tepedino et al. 2010), pollinate *Sclerocactus.* These bees can travel from 0.4 to 1 kilometer (km) between plants (Tepedino pers. Comm. 17 November 2010). Other insects, including ants and beetles, may also pollinate Sclerocactus (Service 1990). Limiting the amount of fragmentation and disturbance within the habitats of Sclerocactus is important to maintain adequate pollinator habitats and healthy cactus populations.

Approximately 4 to 5 weeks after flowering, the fruits of these cacti species reach maturity, each containing approximately 20 seeds (Tepedino et al. 2010). The fruits open and fall away, leaving the seeds on the apex of the plant where they are washed to the ground and dispersed by rain

(Tepedino et al. 2010). The life history and population dynamics of these species are poorly known, but they are thought to be long-lived perennials, usually flowering after 3 or 4 years.

We have early population trend data for *Sclerocactus* that show an observed decline in population size and growth rate over a three year period from 2012-2014 (SWCA 2015). Population viability analysis also shows a negative population growth vital rate of 0.89 and 0.82 for Uinta Basin hookless cactus and Pariette cactus, respectively. Modeled data out to 10 years also shows a decline in population growth rate and population size (SWCA 2015). We recognize that this data covers a short period of time and that long-term data are required in order to fully understand the population trends. Information from this study will be updated as it becomes available. Additionally, as described below, the high levels of energy development result in the loss and fragmentation of habitat for these species. Thus, we conclude that it is likely that these species and their available habitat are declining.

Both Pariette cactus and Uinta Basin hookless cactus are included in this consultation because the proposed Project occurs in an area where both species could occur. Additional information on these species' life histories, population dynamics, status, and distribution is described in detail within the "Recovery Plan for the Uinta Basin Hookless Cactus" (Service 1990) and the more recent recovery outlines (Service 2010a; Service 2010b).

III. Environmental Baseline

Regulations implementing the Act (50 CFR 402.2) define the environmental baseline as follows:

- The past and present impacts of all Federal, State, or private actions and other human activities in the action area;
- The anticipated impacts of all proposed State or Federal projects in the action area that have already undergone formal or early section 7 consultation; and
- The impact of State or private actions which are contemporaneous with the consultation process.

Status of the Species within the Action Area

In April 2010, we developed recovery outlines for *Sclerocactus* (Service 2010a, Service 2010b). In 2013, we developed Level 1 Core Conservation Areas (CCAs), Level 2 CCAs, and a general suitable habitat polygon (Service 2013). These polygons can be adjusted annually as more known locations are documented. The CCAs were developed to guide the protection of important population areas of high cactus density and maintain connectivity across the range of both species (Service 2013). Core areas were based on pollinator travel distance and were designed to provide habitat connectivity between populations and individuals (Tepedino 2010). Level 1 CCA polygons include the densest concentrations of cactus locations and the most restrictive management recommendations. Level 1 CCA polygons were developed using a 400-meter buffer around plants to allow for pollinator travel. Level 2 CCA polygons include less-dense cactus areas and less restrictive management recommendations, while still maintaining a minimum amount of undisturbed habitat to protect *Sclerocactus* species. Level 2 CCA polygons were developed using a 1,000-meter buffer around plants.

The total area of potential *Sclerocactus* habitat, including CCAs, is currently 537,565 acres (Service 2013 *Sclerocactus* Habitat Polygon), which includes 421,665 acres of Uinta Basin

hookless cactus habitat, and 115,900 acres of Pariette cactus habitat. The project is located within the Upper Pariette, Lower Pariette, and Middle Green CCAs.

Factors Affecting the Species within the Action Area

Ongoing and proposed oil and gas development are the primary threats to *Sclerocactus* species from the combined impacts of road and well pad development, fugitive dust, erosion, isolation of populations due to habitat fragmentation, impacts to pollinators and seed dispersers, increased access by off-road vehicles and illegal collectors due to an expanded road network, and pesticide and herbicide use (BLM 2008). Both *Sclerocactus* species are sought by cacti and succulent collectors around the world.

Habitat loss associated with energy development is a major threat to these species across their known range. We used available GIS data (UDOGM 2015) to estimate the approximate amount of surface disturbance in the action area. There are 8,331 existing oil and gas wells, which exclude the location abandoned wells, within the *Sclerocactus* Habitat Polygon. We used GIS analysis to calculate the amount of disturbance in Level 1 CCAs, Level 2 CCAs, and the *Sclerocactus* Habitat Polygon by estimating that there is *5* acres of disturbance associated with each well. For every additional well on a shared well pad, we estimate .25 acres of disturbance. The Greater Monument Butte action area is located within the Upper Pariette, Lower Pariette, and Middle Green CCAs. We estimate that there is currently 9.3 percent disturbance within the Upper Pariette Level 2 CCA, 3.89 percent disturbance within the Lower Pariette Level 2 CCA, and 3.25 percent disturbance within the Middle Green Level 2 CCA associated with oil and gas development. We estimate that there is currently 6.94 percent disturbance within Upper Pariette Level 1 CCA, 4.66 percent disturbance within the Lower Pariette Level 1 CCA, and 2.44 percent disturbance within the Middle Green Level 1 CCA associated with oil and gas development. We estimate that there is currently 4.7 percent disturbance within the *Sclerocactus* Habitat Polygon associated with oil and gas development.

Surface disturbance can lead to increased dust, erosion, and storm water runoff that can impact *Sclerocactus* species. Construction activities, access roads, and vehicular traffic within and near occupied habitats increase fugitive dust and particulates. Dust accumulation is higher near roads, with fugitive dust depositing up to 984 ft from the source (Everett 1980). Dust accumulation may adversely impact photosynthesis, respiration, transpiration, water use efficiency, leaf conductance, growth rate, gas exchange, and growth (Eller 1977; Spatt and Miller 1981; Thompson et al. 1984; Farmer 1993; Sharifi et al. 1997; Trombulak and Frissell 2000; Hobbs 2001). Erosion and runoff from project activities can have direct impacts to cacti from buryingto direct removal of individuals. Erosion and runoff can be natural events, but are often worsened by human activities such as vegetation removal and alteration of stream courses, making these events more catastrophic. These augmented events can lead to greater damage tonative ecosystems through additional scour and burial of soils and plants. Increases in dust, erosion, and storm water runoff interact cumulatively with other negative effects to further fragment and disturb Sclerocactus populations.

Accidental loss occurs when a cactus is kicked, stepped on, or driven over by humans inadvertently. As roads and pipelines increase within occupied habitat, the chance for accidental loss increases. Other factors, such as livestock grazing, may exacerbate this situation by focusing impacts within the remaining interspaces between roads and wells, leading to further accidental loss.

Illegal collection of *Sclerocactus* historically was one of the primary threats to the conservation and recovery of this species (BLM 2008). The increase in the number of access roads within and near occupied habitats will allow greater access to rare plant populations. This potentially could increase illegal collection of the species.

Habitat fragmentation could occur as a result of the increased number of access roads, pipeline and other utility ROWs, and long-term surface disturbance from well pads and associated facilities. The anthropogenic fragmentation of plant habitats can decrease species density (Mustajarvi et al. 2001) and result in isolated, smaller populations that are more prone to extinction. Decreased species density has the potential to adversely impact pollination and reproductive success of *Sclerocactus* (Mustajarvi et al. 2001).

Invasive plant species directly compete for resources with native species, such as *Sclerocactus,* and alter habitat making it more difficult for the species to survive and thrive. Seeds from invasive species are often carried by vehicles and spread via vehicle-caused air turbulence (Forman and Alexander 1998). Within the action area, noxious and invasive species are often present in the soil seed bank, and once an area is disturbed, these species can quickly establish. In addition, competition from noxious and invasive species can further reduce special status species' population size. Invasive plants spread more easily when other land uses, such as livestock grazing, are concentrated within the remaining interspaces between roads and wells. The spread of invasive plants may change species composition within native plant communities. This may lead to increased livestock grazing on native grasses and shrubs that act as "nurse" plants for immature cacti. Nurse plants create an environment that is more favorable for successful establishment of immature cacti by providing shade, moisture, and protection from trampling. The cumulative pressures of energy development and grazing can lead to more invasive plants in *Sclerocactus* habitat.

Pollinators and their nesting sites are directly disturbed by oil and gas activities. Additionally, habitat alteration from invasive species can alter pollinator composition in the area, thereby possibly reducing the effectiveness of pollination within the native community. All of these connected actions reduce the ability of *Sclerocactus* to thrive within its native habitat.

IV. Effects of the Action

The effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

Approximately 4,295 acres of surface disturbance will occur within the *Sclerocactus* Habitat Polygon, which represents approximately 1 percent of habitat within the *Sclerocactus* Habitat Polygon. Approximately 116 acres from well pad expansions and pipelines buried adjacent to existing roads as well as 20 acres of new disturbance from new well pads will occur in Level 1 CCAs. This surface disturbance represents approximately 0.3 percent of habitat within Level 1 CCAs. Approximately 870 acres of surface disturbance will occur in Level 2 CCAs, which represents approximately 0.9 percent of habitat within Level 2 CCAs.

Newfield will complete site-specific surveys for *Sclerocactus* and submit survey results to our office. Based upon presence or absence of *Sclerocactus,* Newfield will implement applicable conservation measures. Impacts to *Sclerocactus* individuals from this action include an increase in the types of impacts mentioned in "Factors Affecting the Species within the Action Area," above. Particularly, we expect increases in fugitive dust, pollinator disturbance, weed invasion, accidental damage to individuals, and overall habitat fragmentation. Many of these direct impacts to individuals and populations resulting from oil and gas development will be minimizedthrough site-specific project design and conservation measures. Although these conservation measures will minimize the impacts of the action to *Sclerocactus* species, larger landscape-level changes, such as increased habitat fragmentation and habitat loss, pollinator disturbance, changes in erosion and water runoff, and increased weed invasion, cannot be entirely remediated. These disturbances will continue to negatively impact *Sclerocactus* species throughout the action area.

V. Cumulative Effects

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Declines in the abundance or range of many special status species are attributable to various human activities on Federal, state, and private lands, such as human population expansion and associated infrastructure development; construction and operation of dams along major waterways; water retention, diversion, or dewatering of springs, wetlands, or streams; recreation, including off-road vehicle activity; expansion of agricultural or grazing activities, including alteration or clearing of native habitats for domestic animals or crops; and introductions of non-native plant, wildlife, or fish or other aquatic species, which can alter native habitats or out-compete or prey upon native species. Many of these activities are expected to continue on Tribal, State, and private lands within the range of various federally protected wildlife, fish, and plant species, and could contribute to cumulative effects to the species within the action area. Species with small population sizes, endemic locations, or slow reproductive rates will generally be more susceptible to cumulative effects.

Non-federal activities have the potential to cumulatively affect *Sclerocactus,* as a significant portion of the species' range occurs on state, private, and tribal lands without federal mineral leases or federal surface rights. Quantified data on the future extent of these activities are difficult to obtain, but we must assume, for the purposes of this assessment, that some level of these activities are reasonably certain to occur, particularly energy and mineral exploration and development, livestock grazing, stone collecting, off-highway vehicle use, and illegal collecting. Where these future activities intersect *Sclerocactus* populations or habitats, they may cumulatively add to the existing and future impacts of activities authorized by federal agencies.

VI. Conclusion

After reviewing the current status of *Sclerocactus,* the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that this project, as described in this biological opinion, is not likely to jeopardize the continued existence of Pariette cactus and Uinta Basin hookless cactus. Approximately 4,295 acres of surface disturbance will occur within the *Sclerocactus* Habitat Polygon, which represents approximately 1 percent of habitat within the *Sclerocactus* Habitat Polygon. Surface disturbance within Level 1

CCAs represents approximately 0.3 percent of habitat within Level 1 CCAs. Surface disturbance within Level 2 CCAs represents approximately 0.9 percent of habitat within Level 2 CCAs. We reach this conclusion based upon the applicant committed conservation measures to avoid and minimize impacts within the range of the species as well as the scope of disturbance within *Sclerocactus* habitat.

VII. Incidental Take Statement

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering (50 CFR § 17.3). Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR § 17.3). Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

Sections 7(b)(4) and 7(o)(2) of the ESA generally do not apply to listed plant species. However, limited protection of listed plants from take is provided to the extent that the ESA prohibits the removal and reduction to possession of Federally listed endangered plants or the malicious damage of such plants on areas under Federal jurisdiction, or the destruction of endangered plants on non-Federal areas in violation of State law or regulation or in the course of any violation of a State criminal trespass law.

VIII. Reporting Requirements

Colorado River Fishes

In order to comply with the Colorado River Recovery Program and ensure exemption from prohibitions of section 9 of the Act, the BLM will monitor and report the progress of their action as follows:

1. The BLM is required to submit to our office an annual report of water depletions associated with oil and gas development, including the following information:
    - Project name and/or applicant name
    - Permit number and/or special use authorization
    - General location and legal description
    - Depletion amount in acre-feet
    - Timing of depletion
    - Identify if new or historic depletion
    - Sub-total water depletion (acre-feet) for each applicant
    - Total depletion for the entire year in acre-feet
    - Total number of APDs approved
    - Total number of wells spudded

Reports shall be due to our office on a yearly basis by October 31. The address for the Utah U.S. Fish and Wildlife Service Field Office is:

2369 West Orton Circle, Suite 50
West Valley City, Utah 84119

Uinta Basin hook.less cactus and Pariette cactus

Any annual *Sclerocactus* monitoring reports associated with the proposed actions must be submitted to us by January 31 each year following monitoring.

If listed plants are crushed or injured during Project activities, or upon locating dead, injured; or sick listed species, immediate notification must be made to our Salt Lake City Field Office at (801) 975-3330 and our Division of Law Enforcement, Ogden, Utah, at (801) 625-5570, and to the BLM (435) 781-4400. Pertinent information including the date, time, location, and possible cause of injury or mortality of each species shall be recorded and provided to the Service.

IX. Conservation Recommendations

- While construction in the 100-year floodplain or wetlands is occurring, heavy equipment working on wet soils shall be placed on mats. Work should be conducted primarily while the ground is frozen or soils are dry.
- Silt fence shall be properly installed in 100-year floodplains and wetlands where project disturbance may erode into waters during a precipitation event.
- Where construction is completed, disturbed areas that are not needed for future maintenance shall be restored to the original grade and elevation immediately following construction.
- Weed control measures will be implemented throughout the action area.

X. Reinitiation – Closing Statement

This concludes formal consultation on the action outlined in your request. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action was retained (or is authorized by law) and if: (1) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (2) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (3) a new species is listed or critical habitat designated that may be affected by the action.

We appreciated your efforts to work with us to protect threatened and endangered species. If the Project changes or it is later determined that the Project affects listed species differently than identified above; it may become necessary to reinitiate section 7 consultation. If we can be of further assistance, or if you have any questions, please feel free to contact Stephanie Graham at (801) 975-3330 ext. 155.

XI. Literature Cited

Bureau of Land Management. 2008. Record of Decision and Approved Resource Management Plan. BLM-UT-PL-09-003-1610. Vernal Field Office, Vernal, Utah. October 2008.

_ . 2011. Green River District Reclamation Guidelines for Reclamation Plans. United States Department of the Interior Bureau of Land Management. Access online at http://www .blm.gov/pgdata/etc/medialib/blrn/ut/price fo/oil and gas 2.Par.5635 .File.dat *I*Attachment%203%20-%20WTP%20Record%20of%20Decision[1].pdf. Revised March 2011.

Eller, B. M. 1977. Road dust induced increase of leaf temperature. Environmental Pollution, 13:99-107.

Everett, K. R. 1980. Distribution and properties of road dust along the northern portion of the haul road. In Environmental Engineering and Ecological Baseline Investigations along the Yukon River--Purdhoe Bay Haul Road, ed. J. Brown & R. Berg. US Army Cold Regions Research and Engineering Laboratory, CRREL Report 80-19, pp. 101-28.

Farmer, A. M. 1993. The effects of dust on vegetation-a review. Environmental Pollution 79:63- 75.

Forman, R. T. T., and L. E. Alexander. 1998. Roads and Their Major Ecological Effects. Annual Review of Ecology and Systematics. 29:207-231.

Heil, K. D., and J. M. Porter. 2004. *Sclerocactus.* In: Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 15+ vols. New York and Oxford. 4: 197-207.

Hobbs, M. L. 2001. Good practice guide for assessing and managing the environmental effects of dust emissions. Published September 2001 by Ministry for the Environment. P.O. Box 10-362, Wellington, New Zealand. 58 pp.

Mustajarvi, K. P. Siikamaki, S. Rytkonen, and A. Lammi. 2001. Consequences of Plant Population Size and Density for Plant-pollinator Interactions and Plant Performance. Journal of Ecology 89:80-87.

Porter, J. M., J. Cruse-Sanders, L. Prince, and R. Lauri. 2007. An assessment of genetic relationships among *Sclerocactus* brevispinus, S. wetlandicus, and S. Glaucus. Report to the U.S. Fish and Wildlife Service, Salt Lake City, Utah. 30pp.

Sharifi, M. R., A. C. Gibson, and P. W. Rundel. 1997. Surface Dust Impacts on Gas Exchange in Mojave Desert Shrubs. Journal of Applied Ecology 34:837-846.

Spatt, P. D., and M. C. Miller. 1981. Growth conditions and vitality of Sphagnum in a tundra community along the Alaska pipeline haul road. Arctic, 34:48-54.

SWCA Environmental Consultants. 2015. *Sclerocactus wetlandicus* (Uinta Basin Hook.less Cactus) and *Sclerocactus brevispinus* (Pariette Cactus) Range-Wide Demographic and Habitat Monitoring: Year 3 (2014) Report. Salt Lake City, Utah. 56 pp.

Tepedino, V. J., T. L. Griswold, and W. R. Bowlin. 2010. Reproductive biology, hybridization, and flower visitors of rare Sclerocactus taxa in Utah's Uinta Basin. Western North American

Naturalist 70:377-386.

Thompson, J. R., P. W. Mueller, W. Fluckiger, and A. J. Rutter. 1984. The effect of dust on photosynthesis and its significance for roadside plants. Environmental Pollution (Ser. A), 34:171-90.

U.S. Fish and Wildlife Service (Service). 1990. Recovery Plan for the Uinta Basin Hook.less Cactus. U.S. Fish and Wildlife Service, Region 6, Denver, Colorado. 26 pp.

__ . 2010a. Recovery outline for the *Sclerocactus wetlandicus* (Uinta Basin hook.less cactus). Utah Ecological Services Field Office, West Valley City, Utah. Available at: http:/www.fws.gov/mountainprairie/species/plants/uintabasinhooklesscactus/Recovery/OutlineApril 2010.pdf.

__ . 2010b. Recovery outline for the *Sclerocactus brevispinus* (Pariette cactus). Utah Ecological Services Field Office, West Valley City, Utah. Available at;

http:/www .fws.gov/mountain- prairie/species/plants/pariettecactus/Recovery/OutlineApril2010. pdf.

__. 2013. Draft Energy Development Management Guidelines for *Sclerocactus wetlandicus* and *Sclerocactus brevispinus* Core Conservation Areas. Utah Ecological Services Field Office, West Valley City, Utah. March 2013.

__ . 2014. Ecological effects of ground disturbance and roads on plants and recommended buffer distances, with emphasis on the Uinta Basin, Utah. Utah Ecological Services Field Office, West Valley City, Utah. March 2014.

Utah Division of Oil, Gas and Mining. 2015. GIS Dataset from Utah Division of Oil, Gas and Mining website (https://fs.ogm.utah.gov/pub/Oil&Gas/Database/). March 2015.

Attachment 6: Comment Responses

1. *EPA Comment:* While the Final EIS estimates the direct greenhouse gas (GHG) emissions caused by the proposed project, it should also quantify indirect GHG emissions caused by the proposal and its alternatives, including emissions associated with the end use of the oil and gas due to the reasonably close causal relationship to the project and as provided in the Final Guidance on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews (Guidance) finalized by the Council on Environmental Quality (CEQ) on August 1, 2016. Example tools for estimating and quantifying GHG emissions can be found on CEQ's NEPA.gov website. These emissions levels can serve as a basis for comparison of the alternatives with respect to GHG impacts.

   BLM Clarification: In its Memorandum of August 1, 2016, the CEQ explained that it does not expect agencies to apply the Memorandum's guidance to proposed actions for which a final EIS or EA has already issued (CEQ Guidance at 33–34). In the case of Monument Butte, the BLM published its FEIS on June 24 and fully complied with its obligation under NEPA to consider and disclose greenhouse gas emissions. The FEIS evaluates reasonably foreseeable greenhouse gas emissions associated with the proposed action and alternatives, using quantification wherever possible. For example, Table 1-1 in Appendix B compares total estimated greenhouse gas emissions for each of the alternatives. Appendices A-1 and A-2 to the Air Quality Technical Support Document provide detail on emissions of greenhouse gases in addition to CO2 for each alternative and for both oil and gas wells. Also, the FEIS Table 5.2.6-1 discloses global, U.S., and Utah greenhouse gas emissions as well as the emissions expected from the project alternatives.

   The FEIS did not attempt to quantify indirect emissions associated with the project because of uncertainties relating to the end uses of produced oil and gas and how to evaluate the potential GHG contributions of those end uses. A rough estimate of possible indirect CO2 emissions, however, can be made based on the information presented in the FEIS and other publicly available information. For informational purposes, we have summarized these possible indirect emissions by using the estimated amount of natural gas, crude oil, and natural gas liquids anticipated to be produced under the preferred alternative and the average of several emissions factors for each of those products. Using the assumptions outlined below, the total number of indirect greenhouse gas emissions from the preferred alternative is 60,466,974 Metric Tons of CO2 equivalent.

   With respect to the rough estimate of indirect CO2 emissions, it should be noted that it is difficult to discern with certainty what end uses for the fuels extracted from a particular leasehold might be reasonably foreseeable. For instance, some end uses of fossil fuels extracted from Federal leases include: combustion of transportation fuels, fuel oils for heating and electricity generation, as well as production of asphalt and road oil, and the feedstocks used to make chemicals, plastics, and synthetic materials. The table below is based on an approximation of these end uses on a national basis using the references cited. While the BLM based these estimates on national data about typical end use of

produced oil and gas, it is important to note that the BLM does not exercise control over the specific end use of the oil and gas produced from any individual federal lease.

Green House Gases Emission Factors (CO2)		
Source	**Conversion**	**Result**
Natural Gas (541,000 mmcf)		
EPA	120,000 lbs/mmcf	64,920,000,000 lbs
EIA	117.1 lbs/mcf	63,351,100,000 lbs
IPCC	56,100 kg/TerraJoule[13]	70,600,000,000 lbs
Average		66,290,366,667 lbs
Total		30,068,780 MT
0.054717 MT of CO2 per Mcf		26,602 MT
Crude Oil (335 mmbo)[14]		
IPCC	73,300 KG/TJ	68,154,040,816 lbs
Prolysium.org	432.71 kg/bl	65,740,521,542 lbs
Numero57.net	317 *kg/bl*	*48,160,997,732 lbs*
EIA.gov[15]	0.43 MT/bl	66,947,281,179 lbs
Average		30,366,812 MT
Natural Gas Liquids (10.100 mbbl (NCL))[16]		
IPCC	64,200 kg/TJ	69,185,000 lbs
EIA	13.7 lbs/gal of prop/buta mix	31,382 MT

[13] http://www.kylesconverter.com: 1 CF of NG = 1,055,056 Joules; 1 TerraJoule = One Billion Joules; 1 kilogram is 2.205 pounds

[14] Approach is to throw out the high and the low then average the remaining: High = 144 MMt; Low = 48 billion pounds

[15] http://www.kylesconverter.com: 2204.62 pounds per metric ton

[16] Assumption: 50% Plastics, 50% Propane/Butane mix per 42 gal Barrel

Green House Gases Emission Factors (CO2)	
Summary for the Monument Butte Project:	
Estimated Indirect Emissions Total	60,466,974 Metric Tons of CO2
Sources: Intergovernmental Panel on Climate Change (IPCC), 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2, Energy, 2006; Energy Information Agency (EIA) Carbon Dioxide Emissions Coefficients February 2, 2016; EPA Environmental Protection Agency Greenhouse Gas Equivalencies Calculator May 2016; Pyrolysium.org: http://pyrolysium.org/how-much-co2-produced-by-burning-one-barrel-of-oil/ 432.71 kg CO2 per barrel; Numero57.net: http://numero57.net/2008/03/20/carbon-dioxide-emissions-per-barrel-of-crude/ 317 kg CO2 per barrel EIA.gov: http://www.eia.gov/tools/faqs/faq.cfm?id=7&t=7 0.43 metric tons CO2/barrel	

Since the rough estimates above were developed using publicly available calculators and were based on projections of future production from the project that were disclosed in the EIS, the BLM has determined that they do not constitute new information requiring supplementation. This determination is also consistent with the CEQ's statement that it does not expect federal agencies to apply its August 1 Guidance to proposed actions for which there is a final EIS that has been issued.

2. *EPA Comment:* For the Monument Butte Project, the EPA recommends that the ROD identify the mitigation measures that will reduce GHG emissions and disclose the estimated GHG reductions associated with such measures. Many of the measures included for reducing ozone precursor emissions will have co-benefits for GHG emissions.

   BLM Clarification: Any VOC emissions reductions already calculated in the FEIS are also GHG reductions. Please refer to the disclosed reductions in FEIS Table 4.2.1.1.1-2.

3. *EPA Comment:* The Final EIS inappropriately evaluates GHG emissions associated with the project by comparing them to state, U.S. and global emissions to conclude that the emissions are small. Such comparisons are "not an appropriate method for characterizing the potential impacts associated with a proposed action and its alternatives and mitigations because this approach does not reveal anything beyond the nature of the climate change itself: the fact that diverse individual sources of emissions each make a relatively small addition to global atmospheric GHG concentrations that collectively have a large impact" (Guidance, pg.11).

BLM Clarification: The sentence of concern has been stricken from the FEIS through the Errata (Attachment 7).

4. *EPA Comment:* As the BLM proceeds with implementation of the selected alternative, the EPA recommends considering climate adaptation measures based on how future climate scenarios may impact the project. The National Climate Assessment (NCA), released by the U.S. Global Change Research Program contains scenarios for regions and sectors, including energy and transportation. We recommend that the BLM use NCA or other peer reviewed climate scenarios to inform implementation because this can improve resilience and preparedness for climate change. Changing climate conditions can affect a proposed project, as well as the project's ability to meet the purpose and need presented in the Final EIS. If impacts may be exacerbated by climate change, additional mitigation measures may be warranted. For example, remediation of disturbed sites may become more challenging if the project area becomes hotter and drier.

   BLM Clarification: The BLM's Colorado Plateau Rapid Ecoregional Assessment (2012) provides an estimate of where climate change may occur, and is incorporated by reference. Section 6.2.2.3 of the Report states that

   > *The MAPSS climate results were used to predict changes in temperature, precipitation, potential evapotranspiration, and runoff; a number of the key findings from these analyses were selected to assemble into an overall relative climate change map showing different levels of climate change potential that could then be used to assess relative impacts on the specific conservation elements (Section 5.4). The fuzzy model inputs included potential for summer temperature change and potential for winter temperature change averaged into a single factor, potential for runoff change from MAPSS modeling, potential for precipitation change, and potential for vegetation change, again from MAPSS modeling. Direction of the change was not important—only degree of departure from historic measures.*

   The project area is an area predicted to be subject to moderately low change (Figure 6-14A). In particular the REA states that the pinyon-juniper and sagebrush vegetation communities in the Uinta Basin are predicted to experience Moderately Low exposure to climate. It is already difficult to conduct reclamation in the project area due to its naturally dry climate, as disclosed in the EIS. It is anticipated that this difficulty will continue into the future. Since the direction of climate change is not known, it is impossible to predict whether the reclamation difficulty may decrease or increase. The Green River District Reclamation Guidelines have been developed with this difficulty in mind, and identify standards for successful reclamation.

5. *EPA Comment:* Our understanding based on review of Chapter 4 of the Final EIS and the BLM's response to the EPA's comments is that the mitigation measures incorporated in the Resource Protection Alternative for protection of surface water resources apply throughout the project area. However, in the description of Alternative D in Chapter 2, the measures appear under the heading of Pariette Wetlands ACEC, which makes the extent of their applicability unclear. We recommend that the ROD clarify that the measures apply throughout the project area to ensure protection of water quality and

riparian habitat.

BLM Clarification: The measures in question do apply throughout the project area. This clarification is reflected in Attachment 2, Conditions of Approval.

6. *EPA Comment:* The Final EIS includes, in Section 2.2.12, many valuable environmental protection measures that have been committed to by Newfield to reduce the impacts of the proposed project on a variety of resources. We note that the document states that the measures "would apply to all Federal lands within the MBPA [Monument Butte Project Area]." Although requiring implementation of ACEPMs outside of BLM-managed land and/or minerals is not within the BLM's jurisdiction, we nonetheless recommend confirming with Newfield whether they intend to apply their ACEPMs to all wells within the MBPA.

   BLM Clarification: The BLM discussed this language with Newfield upon receipt of this comment. Newfield confirmed that the intent is to apply the applicant committed measures to all lands, however there may be instances when it is not possible to apply those measures to non-Federal land.

7. *EPA Comment:* We recommend that the BLM clarify in the ROD and in an erratum to the Final EIS that the complete ozone mitigation strategy would be applied by Newfield throughout the MBPA.

   BLM Clarification: The ozone strategy is applicable throughout the MBPA. The full strategy as finalized, including the statement that it applies throughout the project area, is in Attachment 3.

8. *Western Environmental Law (WEL) Comment:* Conservation Groups hereby incorporate by reference our prior submitted comments and attached exhibits to the Draft Environmental Impact Statement for the Monument Butte Area Oil & Gas Development Project, dated March 5, 2014.

   BLM Clarification: The previously submitted comments were previously responded to in the FEIS Attachment 2. Note also, that many comments in this letter regarding impacts to/from human health, particulate matter, ozone, Class I airsheds, visibility, regional haze, cumulative emissions, and climate change were previously addressed in the FEIS and/or DEIS comment responses and so are not responded to in the ROD. The FEIS also includes detailed analysis of anticipated impacts to all those values.

9. *WEL and Wild Earth Guardians (WEG) Comment:* Critically, the BLM failed to consider the stricter EPA ozone standards that were recently finalized. FEIS at 3-4. On schedule, on October 1, 2015, EPA published a final rule to revise NAAQS for ozone to 70 parts per billion (ppb) from the current 75 ppb. Therefore it should have been included in the agency's analysis of alternatives and should have guided consideration of the proposed project.

   BLM Clarification: Thank you for pointing out this error. The correct value has been inserted into chapters 3, 4, and FEIS Appendices B and K through the Errata (Attachment 7). Please note that the analysis showed that exceedences of the standard would occur, regardless of the fact that the older, higher number was inadvertently left in the document, so no change to the analysis occurred as a result of this correction. In addition, the air mitigation strategy was developed in recognition of and response to the

area's high ozone numbers.

10. *WEL Comment:* Conservation Groups are concerned that the FEIS does not disclose accurate background air quality conditions, particularly with regards to PM2.5, PM10, and nitrogen dioxide.

    BLM Clarification: The background values in question in Chapter 3 and Appendix B were generated from available data in the Greater Natural Buttes FEIS (BLM 2012) and the USEPA Air Quality System Data Mart web site (USEPA, 2014), which was the most recent available data available for the timeframe and model specifications. They used available data from years 2007 through 2012. Appendix B and Chapters 3 and 4 were reviewed multiple times by air quality specialists with the BLM, EPA, and others with special expertise or jurisdiction including the rest of the RTAG, and adjustments to the inventories, models, and analyses were made based on their comments. The report in Appendix B was finalized in 2013, with updates (not re-modeling) occurring in 2014 and 2015 based on the RTAG and EPA reviews. Therefore, the BLM used the most recent and best available data.

11. *WEL Comment:* Regulatory monitors have produced three years of data, which demonstrate that the Uinta Basin is significantly exceeding both the 2008 NAAQS and the recently revised (2015) NAAQS. Thus, the BLM cannot rely on the outdated "unclassifiable" designation as an accurate indicator of air quality in the Uinta Basin.

    BLM Clarification: An attainment determination is pending for the Uinta Basin, but has not yet been made. Therefore there is no change to the "unclassifiable" designation.

12. *WEL Comment:* Determination of background air quality conditions is inconsistent with 40 CFR 50 Appendices K and N methodologies.

    BLM Clarification: 40 CFR Appendices K and N are regulatory standards for making compliance determinations. BLM does not have the authority to make a regulatory compliance determination, and compliance determinations are not applicable as the area is currently designated as unclassified. The numbers disclosed in the FEIS are the best available data for the disclosure and informed decision-making purposes under NEPA.

13. *WEL and UPHE Comment:* Simply maintaining [Uinta Basin] emissions at current levels is not a justifiable goal for the Applicant-Committed Environmental Protection Measures ("ACEPMs").

    BLM Clarification: Correction of the existing air quality situation of the Uinta Basin, and reduction of existing emissions, are outside the scope of the NEPA analysis of the proposed project, are outside the jurisdiction of the BLM, and are being addressed through other methods. The EIS addresses the impact of the proposed project to the existing environment and minimizes the foreseeable impacts.

14. *WEL Comment:* These ACEPMs must be mandatory and not at the discretion of the applicant as proposed. They provide too much discretion to the applicant and fail to require emissions reductions measures for important emissions sources such as liquids unloading and pipeline maintenance and repair.

    BLM Clarification: The ACEPMs are integral to the selected alternative and have been carried forward into the ROD Attachment 2, Conditions of Approval. The air mitigation

strategy in particular is applicable to the entire project area. Please note that the measures in total exceed regulatory requirements for the area. In addition, other recent regulatory measures were not accounted for in the EIS (FEIS at 4-5), so the emissions disclosed in the EIS are conservative estimates. These include emissions benefits that would accrue from implementation of the State of Utah's General Administrative Order DAQE-AN149250001-14, or new minor source permitting requirements for Indian Country, and the New Source Performance Standards (NSPS) for the Oil and Gas Sector finalized on June 3, 2016. 40 C.F.R. Part 60 Subpart OOOOa.

15. *WEL Comment:* The Annual Emissions Balance Sheet (AEBS)proposal states that the applicant will calculate VOC emissions using the methods used for calculating the 2014 Uinta Basin Inventory to establish a proposed 2012 baseline year. However, the applicant also states that the existing 2014 Inventory already provides facility-by facility and source-by-source emissions detail. We see no reason why the existing 2014 Inventory should not be used as the baseline year to avoid the unnecessary effort of calculating a 2012 baseline year.

    BLM Clarification: The 2012 emissions year was used so any activities completed since the DEIS was published for public review can be included for credit. However, using the 2014 methodology standardizes the calculations across the years.

16. *WEL Comment:* The AEBS also proposes that the applicant will document VOC reductions and additions that will have sufficient information for BLM to verify the Operator's actions. We believe that the BLM is not equipped to verify the emissions reductions claimed by the applicant. Rather, the applicant should be required to retain the services of a third-party verification provider subject to industry standards and with safeguards against conflicts of interest. The third-party verification provider would be responsible for certifying the accuracy of the information in the annual balance sheet that is submitted to BLM for review and approval.

    BLM Clarification: The emissions reporting envisioned in the ROD has direct corollary with similar regulatory permitting requirements (i.e. self-reporting). This is sufficient for purposes of the ROD, and does not require third-party contracting. If Newfield wishes to use a contractor, that is their prerogative.

17. *WEL Comment:* We also oppose the proposal that reductions in 2015 and 2016 be counted towards reductions required in the first year of the program. This amounts to providing early action credit for reductions that were achieved in the absence of the ACEPMs. Reductions below the baseline should only be counted for the calendar year during which the record of decision is issued and thereafter.

    BLM Clarification: BLM encourages proactive emissions reductions, and the emissions management outlined in the ROD achieves that. There is no restriction or regulatory provisions that preclude this. There is also no technical reason why these emissions reduction activities should not be counted.

18. *WEL Comment:* Notably, the AEBS only addresses VOCs. As we have detailed, methane is also a critically important climate pollutant emitted by oil and gas operations. Methane must also be included and accounted for in the AEBS program, either using existing methane emissions reporting in the 2014 Inventory, or using subsequent methane emissions reporting protocols developed subsequent to 2014.

BLM Clarification: Methane is not a significant ozone precursor, which is what the VOC mitigation is intended to address. There is no expectation or requirement that GHG be included in this emissions management system. However, many of the air quality reduction measures taken under this project will have co-benefits of reducing methane emissions.

19. *WEL Comment:* We find that Table 4.2.1.1.1-3 is deficient. It should include methane emissions, and a companion table that shows emissions reductions that are forecast to offset the additional emissions resulting from the annual development of proposed action.

    BLM Clarification: The table referenced in this comment is an annual emission net change for VOC and NOX. BLM inserted VOC and NOX into Table 4.2.1.1.1-3 because of the ozone NAAQS issues in the Basin; the Basin does not have a similar problem with methane NAAQS so it was not included in the subject table. Please note that maximum emissions for methane are forecast in Table 4.2.1.1.1-1. Also, any VOC emissions reductions already calculated in the FEIS are also GHG reductions. Please refer to the disclosed reductions in FEIS Table 4.2.1.1.1-2.

20. *WEL and WEG Comment:* Despite a plan that could yield over 334.9 million barrels of oil, 540,669 million cubic feet of natural gas, 10,085 million barrels of natural gas liquids, and 6.9 trillion cubic feet of natural gas from the deep gas development through 2035, the agency later offers that the approximately 3.3 million metric tons of CO2e produced annually "are less than about five hundredths of a percent of the U.S. total shown for 2010 and about 3 percent of the statewide total projected for 2020."

    BLM Clarification: The text in question has been stricken from the document through the Errata at the request of this comment and the EPA.

21. *WEL Comment:* BLM not only has the authority, but an obligation to address GHG emissions and methane waste.

    BLM Clarification: The BLM has quantified GHG emissions anticipated from this project and cumulatively. Refer to the FEIS chapters 4 and 5 and Attachment 2 Comment Responses for discussions of GHG and CO2e. Please note that many of the ACEPM's disclosed in the EIS significantly reduce potential fugitive emissions of methane (i.e. VOC controls).

22. *WEL Comment:* Include an estimate of the projected methane emission rates from drilling and production activities authorized by the proposed action.

    BLM Clarification: CH_4 emissions from all phases of the project are accounted for throughout the FEIS and Appendices B and K.

23. *WEL Comment:* The BLM's analysis must meaningfully contemplate a transition to renewable energy generation; not only as an alternative which may eventually suppress demand for oil and gas resources, but also as a pathway toward mitigating climate change as it relates to agency decision making on federal lands

    BLM Clarification: The proposed alternative is outside of the scope of the EIS, which is defined by the BLM's need statement as being to respond to a proposal to develop valid existing oil and gas leases within the Monument Butte project area.

24. *WEL Comment:* On February 8, 2016, the BLM released a proposed rule regarding waste

prevention (Waste Prevention, Production Subject to Royalties, and Resource Conservation: Proposed Rule, 81 Fed. Reg. 6616). The BLM must consider this federal rulemaking, and the implications that this rule would have on place-based action, such as the establishment of mandatory requirements to prevent methane venting, flaring and leaks, on the Monument Butte MDP, in its planning level decision-making.

BLM Clarification: The Monument Butte EIS is not a land-use-planning level document, and the proposed rule is not in force. However, Newfield, in coordination with BLM and EPA, has committed to many ACEPMs which are 1) above and beyond regulatory requirement for preventing waste and similar to the proposed rule requirements including but not limited to an advanced leak inspection program and other physical controls to minimize or eliminate fugitive emissions and 2) the best available science available at the time the EIS was prepared. In addition, the project will be subject to the New Source Performance Standards (NSPS) for the Oil and Gas Sector which was finalized on June 3, 2016. 40 C.F.R. Part 60 Subpart OOOOa. The new regulations require the use of Reduced Emissions Completions (green completions) on new oil wells and establish emission limitations for methane as well as VOCs.

25. *WEL Comment:* The letter recommended the below ACEPM refinements collected from various sources made in reference primarily, but not solely, to methane emissions/waste. The comment stated that the existing ACEPMs didn't go far enough to reduce emissions as written.

- WEL Recommendations
    - Routing gas to a flow line (or for field use) as soon as a well begins production.
    - Require operating practices such as curtailment of well production until well pressures can be accommodated by flow lines.
    - Require only low-bleed or no-bleed devices, such as electric or air driven controllers.
    - Use electric motor driven pneumatic controllers where electric power is available.
    - Use low- and no-bleed controllers instead of intermittent-bleed pneumatic devices.
    - Use desiccant dehydrators as an alternative to glycol dehydrators.
    - Control storage tank emissions from tanks older than August 23, 2011.
    - Conduct A-V-O inspections either monthly or quarterly for higher emissions equipment, and repair within five days of detection.
    - Use IR cameras for inspections unless exemptions are specifically sought, conduct inspections semi-annually, and conduct repairs within 15 days.
- BLM's proposed methane waste rule
    - Reduce the pace or phase development.
    - Curtail production.
    - Capture and sell gas emitted from drilling, completion, production testing, pipeline maintenance, liquids unloading, and oil wells (associated gas).
    - Replace existing high- or intermittent-bleed pneumatic controllers with low or no-bleed controllers.
    - Install emissions controls on all storage tanks.
    - Replace equipment or better maintain compressors and dehydrators.
    - Quarterly inspect leaks with optical gas imaging and repair immediately.
- BLM Colorado's Tres Rios Field Office LRMP
    - Centralize facilities by using liquid gathering systems and liquid transport pipelines.
    - Use reduced emission completions/recompletions (green completions).
    - Replace high-bleed pneumatics with low-bleed/no-bleed or air-driven.

- Install pneumatic devices on all existing wells.
- Install low bleed/no bleed pneumatic devices on all new wells.
- Use dehydrator emissions controls.
- Use electric compression.

- BLM Colorado's Comprehensive Air Resources Protection Protocol:
  - Multi-well pad directional or horizontal drilling.
  - Improved engine technology (Tier 2 or 4) for diesel drill rig engines
  - Selective Catalytic Reduction (SCR) for drill rig engines and/or compressors
  - Non-selective catalytic reduction (NSCR) for drill rig engines and/or compressors
  - Natural gas fired drill rig engines
  - Electrification of drill rig engines and/or compressors
  - Improved engine technology (Tier 2, 3, or 4) for all mobile and non-road diesel engines
  - Reduced emission (a.k.a. "green") completions.
  - Flaring of completion emissions
  - Minimize/eliminate venting and/or use closed loop process where possible during "blow downs"
  - Eliminate evaporation pits for drilling fluids
  - Electrification of wellhead compression/pumping
  - Wind (or other renewable) generated power for compressors.
  - Compressor seals – replace wit with dry or use mechanical seal.
  - Compressor rod packing system – use monitoring and replacement system.
  - Centralization (or consolidation) of gas processing facilities (e.g., separation, dehydration, sweetening).
  - Liquids gathering systems for condensate and produced water).
  - Water and/or fracturing liquids delivery system.
  - Eliminate use of open top tanks.
  - Capture and control of flashing emissions from all storage tanks and separation vessels with vapor recovery and/or thermal combustion units.
  - Capture and control of produced water, crude oil, and condensate tank emissions.
  - Capture and control of dehydration equipment emissions with condensers, vapor recovery, and/or thermal combustion.
  - Use zero emissions dehydrators or use desiccants dehydrators.
  - Install plunger lift systems to reduce well blow downs.
  - Install and maintain low VOC emitting seals, valves, hatches on production equipment.
  - Initiate equipment leak detection and repair program (e.g., including use of FLIR infrared cameras, grab samples, organic vapor detection devise, and/or visual inspection).
  - Install or convert gas operated pneumatic devices to electric, solar, or instrument (or compressed) air driven devices/controllers.
  - Use low or no bleed gas operated pneumatic devices/controllers.
  - Use closed loop system or thermal combustion for gas operated pneumatic pump emissions.
  - Install or convert gas operated pneumatic pumps to electric, solar, or instrument (or compressed) air driven pumps.
  - Install vapor recovery on truck loading/unloading operations at tanks.
  - Unpaved surface treatments including watering, chemical suppressants, and gravel.
  - Use remote telemetry and automation of wellhead equipment.
  - Speed limit restrictions on unpaved roads.
  - Reduce commuter vehicle trips through car pools, commuter vans or buses, innovative work schedules, or work camps.
  - Use of ultra-low sulfur diesel (e.g., in engines, compressors, construction equipment).
  - Reduce unnecessary vehicle idling.

    - Reduce pace of (phased) development.
- NRDC's ten methane emission control technologies:
    - Green completions.
    - Plunger lift systems.
    - Tri-ethelyne glycol dehydrator emission controls.
    - Desiccant dehydrators.
    - Dry seal systems.
    - Improved compressor maintenance.
    - Low-bleed or no-bleed pneumatic controller.
    - Pipeline maintenance and repair.
    - Vapor recovery units.
    - Leak monitoring and repair.

BLM Clarification: Please note that the above measures have already been included in the ACEPMs to the extent feasible. They were developed and refined over the course of the EIS, taking into consideration the technical imitations of the proposed development, anticipated impacts, and recommendations from the EPA and State of Utah and other agencies with jurisdiction or special expertise. Methane is not a pollutant with significant issues for this project. BLM worked with the project proponent within the confines of our authority to include mitigation in excess of the regulatory requirements. The final ACEPMs are not measured against what others may have done (there is no NEPA requirement to do so) but in context of the proposed project, and as a result are unique to this project..

26. *WEL Comment:* The agency is obligated to identify and describe how the infrastructure investments identified in the EIS (i.e., gathering pipelines, compressor stations and processing facilities) will be located and adequately sized to accommodate estimated levels of production of natural gas for the duration of the proposed project to ensure that the methane captured is able to make it to market for sale and not be vented or flared.

    BLM Clarification: It is unclear to the BLM what specific obligation WEL is referring to. The BLM has regulations and policies on how gas capture is to be accomplished and measured, and those regulations and policies will be followed. Please note that central gathering and processing facilities, pipelines, and other infrastructure are included in the proposed action to minimize potential waste of produced minerals.

27. *WEL and WEG Comment:* Include a quantitative assessment of methane's long-term (100-year) global warming impact and short term (20-year) warming impact using the latest peer reviewed science. EPA's GHG inventory, which BLM has relied upon, assumes that methane has a global warming potential of 21. IPCC's new research has calculated that methane's GWP is 87. A calculation of CO2e based on the various updated global warming potentials indicates that BLM's estimates of total carbon emissions associated with methane releases are four times lower than what they should be. We would submit that for the BLM to most accurately disclose the greenhouse gas emissions associated with the Monument Butte project, the agency must analyze CO2e emissions based on both the 20-year and 100-year global warming potentials for methane, which should be 84 and 36, respectively.

FEIS Disclosure	21 GWP 100-year	25 GWP 100-year	28 GWP 100-year	36 GWP 100-year	84 GWP 20 year
12,218 tons	256,578	305,450	342,104	439,104	1,026,312

BLM Clarification: It is beyond the scope of the NEPA analysis of the proposed project to explore and present analytical methodologies that are neither approved nor required. BLM relies on vetted and approved guidance to conduct analysis, and until such time as clear detailed guidance is provided will continue to follow existing practices.

28. *WEL Comment:* EPA has identified well over 100 proven technologies and practices to reduce methane waste from wells, tanks, pipelines, valves, pneumatics, and other equipment and thereby make operations more efficient. www.epa.gov/gasstar/tools/recommended.html. BLM must consider these emission reduction strategies in its NEPA analysis both to address impacts of the proposed action, as well as to satisfy the requirements of SO 3226, FLPMA, and the MLA.

    BLM Clarification: A version of all of the referenced measures has already been included in the ACEPMs to the extent feasible. Please note that the ACEPMs as written already exceed regulatory requirements of either the State or the EPA, and were developed over the course of the EIS, taking into consideration the technical imitations of the proposed development, anticipated impacts, and recommendations from the EPA and State of Utah and other agencies with jurisdiction or special expertise. Some of the refined measures as suggested by WEL, all of which were considered during the preparation of the EIS, are not feasible for the proposed action from a technical or safety point of view. The rest of the refined measures proposed in WEL's comment are outside of the BLM's authority to implement or enforce unless the applicant commits to them because they are outside of the regulatory requirements of the Clean Air Act.

29. *WEL Comment:* The BLM must consider the resilience of our communities and their ability to adapt and respond to climate change in its NEPA analysis. Any action taken that undermines a community's welfare and capacity to provide for itself in the face of recognized changes to climate – such as the largely unabated development of oil and gas resources – fails to realize the agency's multiple use mandate under FLPMA, and, further, is indefensible pursuant to BLM's mandate to act as stewards of our public lands.

    BLM Clarification: The resilience of the community to changes in oil and gas operations is discussed in the EIS (EIS at 5-44). As disclosed in the FEIS, the lack of scientific models that predict climate change on a regional or local level prevents a project-specific quantification of potential future impacts on climate change. Similarly, the BLM's Colorado Plateau Rapid Ecoregional Assessment (2012) section 6.2.2.3 predicts that the Monument Butte project area will be subject to moderately low change (Figure 6-14A); however it acknowledges the direction of change is unknown.

30. *WEL and WEG Comment:* Notably, with regards to air quality, it appears that an analysis and assessment of truck traffic emissions impacts, to the extent it was fully completed, was limited solely to the Monument Buttes Project Area ("MBPA"). Indeed, the Air Quality Technical Support Document ("AQTSD") indicates that dispersion modeling of emissions was limited to emissions produced in the project area, not off-site. For

example, as trucks travel to and from Vernal, Utah or other towns in the region, the agency fails to identify how ambient air quality may be affected in the areas that they travel. Similarly, given that the oil produced as part of the proposed action will be trucked to refineries in and near Salt Lake City, the EIS must address the direct and indirect impacts that emissions from these trucks will have to air quality in the Salt Lake City area.

The Final EIS is also silent on the air quality and greenhouse gas impacts of oil refining, even though this is clearly an action connected with the proposed oil and gas development. Although the BLM may assert that refining of oil would take place regardless of whether the proposed action is approved, the fact is that the oil proposed to be drilled for and produced would not be refined if the BLM were to reject the proposed action. In fact, the oil that would otherwise be produced as part of the proposed action would stay in the ground and would never be refined. While the BLM may assert that it does not know where the oil will be refined, there is sufficient information to indicate the oil will be refined in facilities within or near Salt Lake City, as that is where oil currently produced in the Uinta Basin is refined. The BLM can easily analyze and assess such impacts by relying on EPA greenhouse gas inventory data (see Greenhouse Gas Reporting Data for Refineries in Utah in 2012 (attached to DEIS comments), and by relying on emissions calculation methodology from the EPA (see EPA, Emission Estimation Protocol for Petroleum Refineries (attached to DEIS comments).

The EIS also does not analyze or assess the connected combustion impacts of the produced oil and gas. Given that oil and gas is produced for one primary reason, to be consumed as fuel, the combustion impacts are a connected action and must be analyzed. Here, the EIS does not acknowledge these connected actions. Using emission factors provided by the EPA, it appears that greenhouse gas emissions may approach 4.8 billion metric tons or more under the proposed action. See http://www.epa.gov/cleanenergy/energy-resources/refs.html. We presume that the final use of the condensate and natural gas will be through combustion. However, it is very likely that the condensate and possibly the natural gas will be used to make products that are not intended for combustion, such as plastics, which are produced through energy intensive (i.e., carbon intensive) processes.

BLM Clarification: Those activities that are within the scope of this NEPA analysis are included in the emissions impacts. In addition, in related to dispersion modeling comments, the modeling protocol was reviewed by EPA and an interagency technical review group and found to be sufficient and representative of best practices. For an example of the off-site trucking from operations that was analyzed under the proposed action, please refer to FEIS Appendix B PDF page 124 of 1426. There are other offsite trucking estimations included throughout Appendix B.

The BLM has no authority to direct or regulate the end use of the produced oil and gas. As a result, the BLM can only provide an estimate of potential greenhouse gas emissions using national approximations of where or how the end use will occur because oil, condensate, and natural gas could be used for combustion of transportation fuels, fuel oils for heating and electricity generation, as well as production of asphalt and road oil, and the feedstocks used to make chemicals, plastics, and synthetic materials. Historically most of the produced oil has been trucked to refineries on the Wasatch Front, but in

recent years an increasing and unknown percentage of product is being trucked to the railway for transport to refineries in other states, such as Texas. Also, produced gas could be transported by pipeline to consumers anywhere in the United States. In response to this comment, the BLM has prepared an estimates of emissions associated with trucking, refining, and end uses. See response to EPA Comment

31. *WEL and WEG Comment:* FLPMA and applicable regulations require compliance with applicable pollution control laws, including State and Federal air, water, noise, or other pollution standard or implementation plans. The BLM may claim that it is only obligated to ensure the operator complies with state and federal air quality regulations, but such a claim flies in the face of FLPMA's plain and unambiguous language and also appears flatly contrary to its own regulations. FLPMA and applicable regulations require compliance with federal air quality standards. Although reliance on federal and state air quality regulations may be appropriate where such standards are clearly protecting the NAAQS, where such standards are not protecting the NAAQS—such as in the Uinta Basin—the BLM has an affirmative and independent duty to protect air standards and ensure compliance with the NAAQS.

    BLM Clarification: The selected alternative does not authorize any action that would be out of compliance with any laws intended for protection of the environment. In addition, no on-the-ground disturbance is authorized as a result of this ROD. Additional permitting, including applicable permitting required by regulation, will be necessary. Finally, the BLM has no jurisdiction over air quality regulation.

32. *WEL Comment:* BLM and the Service rely on a number of previous consultations regarding Newfield's existing water rights and their depletion effects on the endangered fish, but these consultations are severely outdated, failing to take into account a great deal of new information that has emerged since the Service issued its biological opinions in 2005, 2006, 2011, and 2012. Specifically, new information about (1) climate change effects on stream flows (rising temperatures, earlier snowmelt and streamflow, decreasing snowpack, declining runoff and streamflow, increasing drought severity, reduced reservoir levels, unsustainable demand for water, and increased effects from toxic spills and mercury pollution), (2) long-term drought and increased water demand which has drastically reduced water supplies, and (3) declining razorback sucker and Colorado pikeminnow populations, reveal effects of the action that may affect the species in a manner or to an extent not previously considered, and therefore trigger reinitiation of consultation.

    BLM Clarification: Although climate change is not specifically mentioned, the FEIS and the Biological Assessment do document the effects of reduced streamflow ("flow depletion" and "reductions in flow"), increased sedimentation, and potential for contamination to fish and their associated habitats from Alternative D in addition to "authorized water usage". According to the BLM REA, the project area is an area predicted to be subject to moderately low climate change (REA Figure 6-14A). In particular the REA states that the pinyon-juniper and sagebrush vegetation communities in the Uinta Basin are predicted to experience Moderately Low exposure to climate. Since the direction of change is not known, it is impossible to predict whether the streamflow may decrease or increase.

33. *WEL Comment:* The EIS and BA should address the potential for a catastrophic blowout, which could have devastating effects on critical habitat even if not occurring within the 100-year floodplain. It is also possible that large volumes of chemical substances escape undetected until reaching surface sediments or waters, but the BA does not address such hazards, which could result in chronic sub-lethal effects. The potential for leaks and spills of produced water is also ignored. The BA also makes no mention of the potential for truck accidents which may result in the spillage of large volumes of produced waters, wastewaters, fracking fluids, or other chemicals which may be transported to or from the project site. The BA fails to discuss baseline environmental conditions regarding the existing risk of spills from all past and present projects, as well as any foreseeable risks of spills from state and private future projects. The FEIS and the BA fail to explain how mitigation measure of siting wells outside the floodplain would mitigate spills from pipelines located directly in the streams at nearly 1000 places.

BLM Clarification: Although trucks and produced water are not specifically mentioned in the fish impact sections, the FEIS and the BA do document the potential for an general increased risk of accidental spills of pollutants such as natural-gas condensate and oil into the Green River or its tributaries", including "contaminates" and catastrophic spills of up to 400-barrels (16,800 gallons), and acknowledges that magnitude of the impacts would depend on type, duration, and timing. See the EIS at page 4-126-127 and the BA at PDF page 1085 of 1426. Many additional mitigation measures were developed and committed to by the BLM, FWS, and Newfield during the consultation process. The FEIS in the cumulative impact section does address the past and present and reasonably foreseeable increase in potential releases of natural gas, condensate, hydrocarbons, or other toxic substances into the Green River or its tributaries. See the FEIS at page 5-25. There are additional measures besides siting outside the floodplain which will mitigate the potential for spills from pipelines. For example:

> *Natural gas-condensate pipelines that cross mapped 100-year floodplain, mapped riparian, or wetland areas would be routinely pigged (as technically feasible) and would have emergency shutoff valves located immediately outside the floodplain.*
>
> *Natural gas pipelines that cross perennial, intermittent, and ephemeral stream channels would be buried below the predicted scour depth for an equivalent flood event. The construction requirements for each type of crossing would be determined on a site-specific basis and would consider the technical guidance of the document entitled, "Hydraulic Considerations for Pipeline Crossings of Stream Crossings," which is found in Appendix B of the Vernal RMP (BLM 2008b).*
>
> *Natural gas pipelines that cross perennial, intermittent, and ephemeral stream channels would have automatic shutoff valves directly beyond the area at risk of flooding to reduce the magnitude of contamination in the event of an accidental pipeline break.*
>
> *Natural gas pipelines that cross perennial, intermittent, and ephemeral stream channels would be buried at least 5 feet below the channel bottom.*

Please note that the surface water quality portions of the FEIS do analyze accidental spills

from tanker trucks including produced water, glycol, fracking fluids, or petroleum products. This information was available to the FWS during the consultation process even though it was not mentioned by name in the BA. See the FEIS at 4-54-55

34. *WEL Comment:* On September 2015, BLM revised its section 7 determination to "may affect, not likely to adversely affect," without explaining its rationale as to why these sedimentation effects would no longer be "likely to affect" the endangered fish. In an email to the Service, BLM explained its revised determination was "[b]ased on [the Service's] recommendation, and in consideration of the applicant committed and BLM committed mitigation measures, as well as the small size of the impact in critical habitat." Id. An accompanying memo described additional measures incorporated into the proposed project. All of the measures geared towards reducing sedimentation impacts, however, are exclusively aimed at restoration of the fishes' critical habitat in the Green River's 100-year floodplain and do not address upstream sedimentation sources that the above passage from the BA identified as being problematic (e.g., sedimentation of the Pariette Draw). Further, even if restoration of disturbed critical habitat is intended to reduce sedimentation yield overall, the record does not support that such measures would be effective, in light of BLM's observation of "poor reclamation success" for "previously disturbed areas within the MBPA and surrounding region." BA at 87.

    BLM Clarification: There are additional measures that are being taken to reduce sedimentation. For example:

    > *Erosion and sedimentation would be reduced through the use of BMPs, including but not limited to berms, sediment control structures, grading, mulching, revegetation, and interim reclamation.*
    >
    > *Best Management Practices (BMPs) would be used to minimize sedimentation, temporary erosion of stream banks, and needless damage or alteration to the Green River streambed. BMPs should also ensure construction related byproducts do not enter the riverine ecosystem that will cause negative impacts to aquatic organisms.*
    >
    > *Sediment control measures will be implemented to prevent project-related sediment from entering the critical habitat of the flowing stream channel.*
    >
    > *Pipelines that cross stream channels will incorporate a sediment retention system along the construction corridor to minimize movement of sediment into the water courses. These could range from silt fencing and culverts to sediment retention basins, depending on the location.*
    >
    > *Natural gas-condensate pipelines that cross mapped 100-year floodplain, mapped riparian, or wetland areas would be routinely pigged (as technically feasible) and would have emergency shutoff valves located immediately outside the floodplain.*
    >
    > *Natural gas pipelines that cross perennial, intermittent, and ephemeral stream channels would be buried below the predicted scour depth for an equivalent flood event. The construction requirements for each type of crossing would be determined on a site-specific basis and would consider the technical guidance of the document entitled, "Hydraulic*

Considerations for Pipeline Crossings of Stream Crossings," which is found in Appendix B of the Vernal RMP (BLM 2008b).

Natural gas pipelines that cross perennial, intermittent, and ephemeral stream channels would have automatic shutoff valves directly beyond the area at risk of flooding to reduce the magnitude of contamination in the event of an accidental pipeline break.

Natural gas pipelines that cross perennial, intermittent, and ephemeral stream channels would be buried at least 5 feet below the channel bottom.

35. *WEL and Utah Native Plant Society (UNPS) Comment:* The document incorrectly lumps S. wetlandicus and S. brevispinus together in analyzing impacts numerous times. This is wrong and requires correction. You cannot lump these two species together any longer, and as was commonly done in the past. The BLM's analysis of effects to the two listed cactus species, S. wetlandicus and S. brevispinus, is founded on the erroneous assumption that both species have identical habitat and life cycle requirements.

    BLM Clarification: Pariette Cactus and Uinta Basin hookless cactus are described separately. See the EIS at 3-54-55 and the BA PDF page 1080-1081. Their habitat overlaps, so the core conservation areas are treated collectively. In addition, impacts are similar, so the impacts are treated similarly. See the EIS at 3-55-56, 4-128, and BA PDF page 1081-1082. Please note that Uinta Basin hookless cactus is found primarily in the Lower Pariette Core areas. The FEIS at 5-31 and 5-32 breaks down the cumulative impact to the Upper Pariette and Lower Pariette Core areas, so the proportional impacts to the different species may be inferred by that table.

36. *WEL and UNPS Comment:* The Center for Native Ecosystems and the Utah Native Society have previously petitioned the BLM to consider designation of an expanded Area of Critical Environmental Concern that would be more effective in protecting habitat for both S. wetlandicus and S. brevispinus, including areas outside the immediate drainage. BLM must avoid actions, such as the proposed Monument Butte project, that would impair its ability to meet its ACEC obligation. The ACEC should fully protect S. brevispinus and drilling SHOULD NOT BE ALLOWED IN ITS HABITAT, period. It is one of the most critically imperiled species in Utah as result of Newfield's activities. The BLM acknowledged having overlooked our joint 2006 ACEC request but has failed to act on it. The request pre-dates this project and cannot continue to be allowed to stay in limbo while this project is then approved.

    BLM Clarification: In the Vernal RMP ROD, the BLM acknowledged the oversight and committed to address the issue in the next planning cycle. The present NEPA analysis (Draft and Final EISs) of the proposed project is not a land use planning document. In addition, this analysis concerns the proposed development of valid existing rights. The BLM's ACEC Manual 1613 identifies valid existing rights as factors which may influence management prescriptions for the ACEC. In addition, the BLM's Planning Manual 1601 Valid specifies that all decisions made in land use plans and subsequent implementation decisions, will be subject to valid existing rights. Therefore, no change in management of the valid existing rights is anticipated when the review of the proposed ACEC occurs.

37. *WEL and UNPS Comment:* The assumption that a 300-foot buffer will alleviate impacts to the plants' survival ignores the uncontested opinion of Dr. Tepedino that the plants are dependent on pollinators with a flying range of 400-1000 meters, and require a buffer distance of at least 1 mile. In our 2006 ACEC recommendations based on the based available information then available also from Dr. Tepedino he recommended an ABSOLUTE MINIMUM DISTANCE OF 800 METERS. There are confusing references to 300 feet with regards to the Sclerocacti that should be struck/corrected.

    BLM Clarification: Comment noted. The BLM did cite Dr. Tependino's research in the EIS. See FEIS page 3-56. Please note that the FWS has regulatory responsibility regarding management of listed species, therefore the BLM has adopted and consulted on their recommended buffer of 300 feet.

38. *WEL Comment:* The FEIS and Biological Assessment's conclusion that the project, despite disturbing some approximately 16,000 acres of habitat (with a substantially larger indirect footprint) will not jeopardize the continued existence of the two cacti is founded in large part on monetary contributions to a Sclerocactus Mitigation Fund. See FEIS at 4-167 to 4-169. The "amount is based on an estimate for the cost to grow and transplant a cactus to the wild." FEIS at 4-167. These assumption, however, are unsupported by evidence that (a) suitable and protected habitat for transplanted cacti exists, (b) transplantation can be successful, or that (c) available habitat and likelihood of success will contribute to the survival and recovery of the species, despite the acknowledged certainty of unmitigatable habitat loss from the project , FEIS at 4-170.

    BLM Clarification: Comment noted. Please note that the FWS has regulatory responsibility (jurisdiction) and special expertise regarding management of listed species in general, and the two Sclerocactus species in particular, therefore the BLM has adopted and consulted on their recommended determination of impacts and mitigation strategy.

39. *WEL Comment:* The FEIS and BA also fail to take into account significant new information regarding effects of ground-level ozone and climate change on the listed cacti and their pollinators.

    BLM Clarification: The BLM is unaware of any studies that document the effects of ground-level ozone on the cacti and their pollinators. Please note that the high ozone levels occur in snowy winters when the plants and their pollinators are dormant, and presumably covered by snow (or by soil and rocks in the case of S. brevispinus, which has been noted to recede into the ground during the winter months), so it is reasonable to assume that impacts to individual plants or pollinators are minimal. According to the BLM REA, the project area is an area predicted to be subject to moderately low climate change (REA Figure 6-14A). In particular the REA states that the pinyon-juniper and sagebrush vegetation communities in the Uinta Basin are predicted to experience Moderately Low exposure to climate change. Since the direction of climate change is not known, it is not possible to reasonably predict the effects of such change on the cacti or their pollinators.

40. *WEL and UNPS Comment:* Page D-4 of the Appendix mentions that fact that a BLM sensitive species, Yucca sterilis, occurs in the project area. There is no reference to it in terms of mitigation. And yet the Utah Native Plant Society ranks that species as "extremely high" priority i.e. one of only 38 species (that includes Sclerocactus

brevispinus) in that category. There is an occurrence of it along the section of road that trucks will be extensively using. Where are the other occurrences in relationship to this project? And where is the analysis for the impacts on that species? Without knowing the locations of remaining sterile yucca occurrences, the amount of remaining habitat, the effects of loss of 1,213 acres to the project, and the reliability of the proposed mitigation measures, BLM's conclusion that the project "is not likely to result in a trend towards federal listing of the species," FEIS 4-161, is arbitrary and unsupported. Review of the projected project locations suggests that at least one known occurrence of Y. sterilis occurs along a road that would be affected by heavy vehicle traffic. The FEIS fails to map or disclose species occurrences, or to conduct any analysis whatsoever of the effects of vehicle traffic and resulting dust, erosion, and human disturbance on the survival of individual populations or the overall trend for the species and its habitat.

BLM Clarification: The BLM tries not to disclose the specific locations of sensitive plant species in public documents to protect them from collection. However, all proposed site specific actions within the MBPA would be evaluated in relation to the habitat for this species on an individual basis. If such actions are proposed within suitable habitat for Yucca sterilis then clearance surveys for the species would be required before ground disturbance could occur. If a population of Y. sterilis is identified during the clearance surveys then the proposed action would be required to avoid the population by an established buffer distance of 300 feet. This measure was inadvertently omitted from the FEIS, and has been added back in via the errata, and carried forward as a COA into Attachment 2. Additional mitigation measures to protect identified populations of Y. sterilis may be developed and applied on a site-specific basis as necessary. Since the species is thought to exclusively reproduce vegetatively through rhizomes, pollinator impacts due to the proposed action are not anticipated. Dust impacts due to truck traffic on access roads in the MBPA are possible; however, implementation of the proposed action would not represent a significant increase in traffic to the project area from current levels. Dust impacts in general are addressed on FEIS page 4-139.

41. *UNPS Comment:* On P. 2 of the appendix there is a statement that ". . . the Pariette wetlands ACEC was developed, in part to protect Sclerocactus brevispinus." This is absolutely not true. The narrow band of Pariette wetlands was designed to protect riparian areas along the draw and a very narrow riparian corridor (as evidence by the map you sent as well). It only somewhat protects rare Sclerocacti and the species that it somewhat helps to protect is S. wetlandicus and NOT S. brevispinus, or if S. brevispinus, only to a VERY minor degree. Page 2 requires correction, and a different analysis is required.

    BLM Clarification: The statement in question was prepared by the FWS, and is contained in a draft document. The draft document was attached to the EIS as a result of public comment which requested the documentation behind the USFWS management guidelines for the Core Conservation Areas. The relevant portions of this document to the FEIS are the Purpose and Explanation of Core Conservation Areas, Implications for Future Consultations, and General Management Recommendations sections, not the History of Sclerocactus and Energy Development in the Uinta Basin section in which the erroneous statement is found. No change to the FEIS is necessary.

42. *UNPS Comment:* Since the USFWS has already determined that S. brevispinus is

warranted for being recognized as endangered, your analysis should reflect that and it should be treated as an endangered rather than a threatened species, and hence the need for completely separate impact and other analyses.

BLM Clarification: The 12-month finding on the petition to list S. brevispinus as an endangered or threatened species (72 FR 53211, dated September 18, 2007) reviewed information available at the time, and made the recommendation that listing S. brevispinus is warranted. However, the species was precluded from listing at the time because it already receives protection under the Endangered Species Act due to its threatened status, and is therefore not a high priority for a revised listing. The BLM will continue to protect the species and ensure that no actions are authorized, funded or carried out that are likely to jeopardize the continued existence of the species. When and if the status of the species is changed to endangered, and/or following the completion of the Recovery Plan for the species, the BLM will incorporate additional conservation measures to protect the species as necessary.

43. *WEG Comment:* The project would effectively industrialize this entire region, effectively handing over American public lands to Newfield Energy Company to do with as they please. Despite ostensibly being managed for all Americans, the BLM's Vernal Field Office is already virtually completely dedicated to the oil and gas industry. The Monument Butte project would perpetuate this de facto transfer of public lands into private hands.

    BLM Clarification: The proposed action involves the development of valid existing federal leases and does not propose or involve in any way the transfer of land or mineral custody to another party.

44. *WEG Comment:* BLM did not fully disclose direct, indirect, and cumulative greenhouse gas emissions, namely the Crescent Point energy Project, the Greater Chapita Wells project, the BLM leasing projects, the Enefit Utility project, and Applications for Permit to Drill being considered for approval in the region.

    BLM Clarification: Direct and indirect greenhouse gas emissions expected from the project are disclosed in Table 4-1 of FEIS Appendix B Air Quality Technical Support Document for the proposed Monument Butte Oil and Gas Development Project page 4 of 85 among others. Cumulative emission impacts are incorporated by reference to IPCC's fourth assessment report for global emissions, Inventory of US Greenhouse Gas Emissions and Sinks for US emissions, and the Greater Natural Buttes Table 4.1-7 for Utah emissions. The emission years for the Greater Natural Buttes analysis specifically, as the analysis most specific to the region of the Monument Butte project area, are reported values for 1990, 2000, and 2005. Those emissions were then used to predict emissions for 2010, and 2020. Although the Chapita, Enefit, and Crescent Point projects and other current or recent Applications for Permit to Drill did not exist at that time of the measured values, the emission future year predictions are sufficient to cover those projects, especially since oil and gas development was occurring then at a faster rate as compared to now due to the current decline in gas and oil prices. The Greater Natural Buttes FEIS paragraph regarding Table 4.1-7 states that "the 2020 predictions reflect a reasonable best estimate of statewide No Action GHG emissions". See the Greater Natural Buttes FEIS page 4-10.

45. *WEG Comment:* BLM failed to conduct any analysis and assessment of climate impacts using readily available methodologies, namely the social cost of carbon protocol. Depending on the discount rate and the year during which the carbon emissions are produced, the Interagency Working Group estimates the cost of carbon emissions, and therefore the benefits of reducing carbon emissions, to range from $11 to $220 per metric ton of carbon dioxide. In its most recent update to the Social Cost of Carbon Technical Support Document, the White House's central estimate was reported to be $36 per metric ton. Although often utilized in the context of agency rulemakings, the protocol has been recommended for use and has been used in project-level decisions. Using the discount rates from the most recent Technical Support Document, the climate costs could range from as low as $94.88 million to as high as $931.6 million annually. However, this is based on the BLM's disclosures in the FEIS, which fail to account for all direct, indirect, and cumulative greenhouse gas emissions. The climate costs would actually be much higher, and therefore represents a significantly conservative estimate of carbon costs. We are not suggesting that the BLM conduct a comprehensive cost-benefit analysis, but rather highlighting how carbon costs shed important light on the significance of the climate impacts of the Monument Butte project

Discount Rate 2016	*5.0%*	*3.0%*	*2.5%*	*3.0% 95th percentile*
SCC Value $/ton of CO_2e	*$11*	*$38*	*$57*	*$108*
Total Costs	*$33,421,729*	*$115,456,882*	*$173,185,323*	*$328,140,612*

BLM Clarification: EPA and other federal agencies use the social cost of carbon (SC-CO_2) to estimate the climate benefits of rulemakings. The FEIS is not a rule making effort. CO_2 emissions have been estimated for the project and disclosed in the FEIS. Climate change has also been disclosed to the extent possible.

46. *WEG Comment:* The FEIS plainly discloses that under the Proposed Action, as well as the BLM's preferred alternative, the amount of VOC emissions will actually increase as compared to the No Action Alternative. As the FEIS states, total VOC emissions under the No Action Alternative are projected to be 2,116.9 tons per year, whereas emissions under the Proposed Action will be 10,360.9 tons per year. Although the BLM claims that emissions will be reduced under the Proposed Action, this is actually a misleading claim in the FEIS. There will not be a reduction in emissions, but rather with the implementation of the agency's "Adaptive Management" strategy, the increase in emissions under the Proposed Action would not be as great. The FEIS confirms this, showing, for example, that under the Proposed Action emissions of VOCs from a subset of activities would be more than 12,000 tons annually without Adaptive Management, but nearly 4,000 tons annually with mitigation. See FEIS at 4-8. This does not represent a reduction in emissions as compared to the No Action Alternative; it simply shows that emissions will not be as high as if the BLM refused to require any mitigation.

BLM Clarification: Page 4-19 of the EIS states that the proposed action's impacts are expected to be lower than the no action alternative over its first couple of years due to the

proposed action's applicant committed measures. Given that the drilling rate under both alternatives is assumed to be the same (up to 360 wells per year), and that the no action alternative is anticipated to occur over a 2.2 year timeframe, this is an accurate statement. Stated another way, drilling 720 ACEPM and regulation controlled wells would result in fewer emissions than drilling 720 wells subject only to the applicable regulations. No change to the EIS is warranted.

47. *WEG Comment:* Pursuant to Clean Air Act, the BLM is prohibited from undertaking any activity in a nonattainment area that does not conform to an applicable implementation plan, including a state and/or federal implementation plan. See 42 U.S.C. § 7506(a)(c); see also 40 C.F.R. §93.150(a). Specifically, the BLM must make a conformity determination for any activity authorized in an ozone nonattainment area that has direct and indirect emissions of VOCs or nitrogen oxides ("NOx") that exceed 100 tons per year. See 40 CFR § 93.153(b)(1).13 Although the Uinta Basin is not yet designated an ozone nonattainment area by the EPA, all indications are that such a designation will be made by October of 2017. Once that designation is made, then Clean Air Act general conformity requirements will apply to the Monument Butte project and any Record of Decision, particularly given that federal agency action will be ongoing through the issuance of Applications for Permits to Drill ("APD"). 1) The agency must explicitly commit to make a general conformity determination for any and all outstanding development left to be approved under the Record of Decision once the nonattainment designation is made and 2) The agency must explicitly state that it must deny any subsequently reviewed APD and/or APDs that do not conform to any implementation plan under the Clean Air Act. To this end, we would urge the BLM to conduct a general conformity analysis now in order to eliminate significant future uncertainty and risk. Most importantly, we would urge the BLM to conduct such an analysis in order to ensure adequate protection of clean air and public health.

    BLM Clarification: FEIS Table 1.6-1 Key Federal, State, and Local Permits, Approvals, and Authorizing Actions for Construction, Operation, Maintenance, and Abandonment of the Proposed Project species that the project is subject to EPA and Utah Clean Air Act permitting programs. There is no way to conduct a conformity analysis now since the SIP/TIP/FIP to which the BLM would supposedly be conforming does not exist.

48. *WEG Comment:* In its EIS, the BLM consistently avoids using 2013 data on the ground that it has not been sufficient error-checked. But there is a wealth of directly-measured 2013 data on VOC and ozone emissions available from a special study by the Institute of Arctic and Alpine Research (INSTAAR), University of Colorado, Boulder. That study's field measurements of various constituent VOCs were found to range between two-to-three hundred times regional and seasonal background levels. The study reasoned that the difference between measured concentrations of non-methane hydrocarbons (NMHC) and background levels of those compounds represented fugitive emissions. Based on that assumption, it estimated fugitive NMHS emissions equivalent to 1.4 million barrels of oil, or the equivalent of the annual average NMHC emissions of 100 million cars. Combining fugitive methane with fugitive NMHC, the study estimated a total hydrocarbon/natural gas production loss rate of 8.4−15.9%.

    BLM Clarification: Appendix G "Far-Field Modeling for the Newfield Exploration Company Monument Butte Oil and Gas Development Project Environmental Impact

Statement" cites several 2013 data sources. Page 1-4 discusses high values of zone monitored in the Uintah Basin, page 2-8 and Table 2-4 on pages 2-12 and 2-13 discusses the November 2013 "Utah State BLM Emissions Inventory Technical Support Document" which was prepared for the BLM ARMS strategy, and page 3-6 Table 3-1 cites the DEQ 2013 monitoring data. In addition, Appendix B "Air Quality Technical Support Document for the Proposed Monument Butte Oil and Gas Development Project" Table 3-2 on page 22 of 85 includes 2013 values for ozone and NO_2, and Table 3-3 Pre-Project Background Ambient Air Quality Values Used in AQIA has been revised to incorporate 2013 data for NO_2 and O_3. Table 3-3 in particular was carried forward into the FEIS Table 3.2.3.2-1 on page 3-8.

49. *Utah Physicians for a Healthy Environment (UPHE) Comment:* VOC concentrations that seasonally approach the notorious levels suffered by Mexico City are not a worthy objective for an Environmental Impact Statement to set, particularly where the approval of the project is offered ahead of time, and compliance is sought when the leverage of project approval has already been given away. This is not an effective regulatory approach, particularly if the goal is bring VOC levels down to levels that protect human health, rather than to merely avoid further deterioration. A credible, basin-wide VOC reduction plan should be drawn up, and [Newfield] should agree to follow it, before approval of the project is granted.

    BLM Clarification: Comment noted. One of the BLM's purposes in its NEPA analysis of the proposed project is to assess measures to minimize impacts to the extent possible within the confines of the proposed development of valid existing rights. A Basin wide VOC reduction plan is outside the scope of this process. However, BLM is participating with other jurisdictional agencies in other efforts independent of this project to identify and respond to the monitored air quality violations.

50. *UPHE Comment:* In this EIS, the BLM analyzes the impact on human health of approving [Newfield]'s project by focusing almost exclusively on whether, and how often, and by how much, ozone concentrations in the Uinta Basin violate the NAAQS ambient air standard. The BLM proposes to deal with the reality that the Uinta Basin is already in violation of that standard by approving of [Newfield]'s proposed massive expansion of current drilling in the basin, but promising to require [Newfield] to adapt its processes, or even slow its project build out, just enough to get the basin's ozone pollution barely back under the limit. See EIS, page 2-7. This focus on the NAAQS standard is misplaced if genuinely protecting human health is the objective because the standard is a political compromise that doesn't reflect the current scientific consensus. Substantial harm to human health has been consistently demonstrated by epidemiological studies and animal models to be caused by ozone exposure to concentrations well below the current NAAQS standard, as can be seen from the research summarized in the letter.

    BLM Clarification: Comment noted. Please note that the BLM makes no claim in the FEIS to be able to eliminate a basin-wide ozone issue through this project alone. However, BLM is participating with other jurisdictional agencies in other efforts independent of this project to identify and respond to the monitored air quality violations.

51. *UPHE Comment:* The EIS has no air dispersion model of the impact of the implementing the project (Alternatives A and D) on the concentration of VOCs or ozone.

It does, however, have a model of another project in Colorado that makes reference to the [Newfield] project. It purports to show that the [Newfield] project would only add 2% to the background level of ozone (even though the background level of ozone would still be well in excess of the NAAQs of 70 ppb.) This, however, lacks credibility when compared to 40% increase in NOx that is projected and the 33% increase in VOC that is projected. As to why such substantial increases in these ozone precursors would have virtually no effect on ozone concentrations, the EIS says only that the effect of ozone precursors on ozone is "non-linear."

BLM Clarification: This comment is incorrect, and it is unclear what Colorado model the comment refers to. For this project the BLM utilized the Air Resource Management Strategy model to disclose cumulative impacts, and to determine the project specific effects, the model was run again with the project subtracted from the model. The model protocol was reviewed by multiple agencies with jurisdiction or special expertise before the model was run. The statement that the NOx and VOC reaction is non-linear is correct. The relationship between the two is being studied to improve understanding.

52. *Beatty & Wozniak (B&W) Comment:* The ROD approving the Final EIS for the Project will be programmatic and subject to site-specific approvals. BLM must ensure operational flexibility is provided for site-specific conditions. Specifically, for the numerous prohibitions and numerous restrictions placed on development in the FEIS, BLM must include exception, waiver and modification criteria to afford operational flexibility for Newfield. These criteria will also afford regulatory flexibility for BLM. Without this operational and regulatory flexibility, there will be significant waste of federal oil and gas resources.

    BLM Clarification: Exception, waiver, and modification criteria are planning concepts. This document is not a land use planning effort, therefore the application of those criteria would be inappropriate.

53. *B&W Comment:* The Record of Decision should explicitly acknowledge the scope of ACMs adopted in the FEIS to address air quality issues and the collaborative efforts of Newfield, BLM and EPA in developing that package of ACMs.

    BLM Clarification: The BLM acknowledges that the ACEPMs involve the implementation of protective measures that go beyond what the BLM has the regulatory authority to require and were collaboratively developed between Newfield, the BLM and the EPA.

54. *B&W Comment:* The BLM did not account for the emissions benefits that would accrue from implementation of the State of Utah's General Administrative Order DAQE-AN149250001-14, or new minor source permitting requirements for Indian Country. FEIS at 4-5. The FEIS also does not account for emission reductions that will result from implementation of New Source Performance Standards (NSPS) for the Oil and Gas Sector finalized on June 3, 2016. 40 C.F.R. Part 60 Subpart OOOOa. While in some respects these new regulations update the Subpart OOOO regulations promulgated in 2012, the new standards also impose emissions controls on new and modified existing source categories. For example, the new regulations require the use of Reduced Emissions Completions (green completions) on new oil wells, while the preexisting regulations required such controls only for new natural gas wells. These regulations will

materially reduce emissions from new, reconstructed, and modified sources within the oil and gas sector over and above emissions benefits accounted for in the FEIS. Just as important, the OOOOa regulations establish emission limitations for methane, a greenhouse gas, as well as VOCs. "The actions taken to comply with the final NSPS are anticipated to prevent significant new emissions between now and 2020, including 300,000 tons of methane; 150,000 tons of VOCs; and 1,900 tons of [hazardous air pollutants]." See 81 Federal Register 35824, 35827 (June 3, 2016). The methane emissions prevented in 2030 are anticipated to be 510,000 tons. While BLM lacks the statutory authority to regulate air quality, these regulations represent comprehensive mitigation of emissions of greenhouse gases and their effect on the environment. It also is important to note that many of the ACMs developed to reduce emissions of volatile organic compounds also will have the significant co-benefit of reducing emissions of methane, the principal component of natural gas and a greenhouse forcing gas.

BLM Clarification: Comment noted. This comment is correct in that the listed requirements were not accounted for in the EIS, so their resulting benefits to air quality are not quantified. This means that the existing EIS analysis is a conservatively high estimate of the actual impacts that may occur under the various alternatives.

55. *B&W Comment:* In addition, EPA has stated its intent to propose a Federal Implementation Plan for the Uintah and Ouray Reservation in an effort to reduce emissions from existing oil and gas facilities within Indian Country. While EPA has not released any specific information on the rules to be proposed, the intent as communicated would be to reduce emissions from existing sources. These future emissions benefits also were not acknowledged as a possibility or accounted for in the FEIS analysis. EPA also has announced its intention to promulgate nationwide regulations to reduce methane emissions from existing sources in the oil and gas sector and is preparing an information request to inform the development of such regulations. Finally, BLM has proposed a venting and flaring rule that would reduce VOC and methane emissions from many sources including certain activities not covered by any of the EPA programs. All of these measures, if adopted and implemented, will provide additional emissions benefits over and above those for which BLM took credit in evaluating the proposed action.

    BLM Clarification: Comment noted.

56. *B&W Comment:* The Final Report of the 2014 Uinta Basin Winter Ozone Study provides a valuable insight into what is known about winter ozone formation and efforts to model those episodes. That 2014 Final report was the culmination of a multi-phase study that began in 2012 in order to better understand winter ozone formation. Specifically, the study was designed to identify emission sources and to assess the unique photochemical processes that cause elevated winter ozone concentrations in the Uinta Basin. This study can be found at the following Utah DEQ website address: http://www.deq.utah.gov/locations/U/uintahbasin/ozone/docs/2015/02Feb/UBWOS_2014_Final. pdf.

    The Final 2014 Report built upon reports on the 2012 and 2013 field seasons. The 2012 report included measurements of ambient ozone and ozone precursor levels as well as meteorological conditions. While the meteorological conditions during the 2012 study period were not conducive to the formation of ozone (there were no exceedances during that period), the study authors collected valuable data. The 2013 report was able to take

advantage of meteorological conditions that were favorable to ozone formation and provided significant additional information about winter ozone formation in the Basin. http://www.deq.utah.gov/locations/U/uintahbasin/ozone/strategies /studies/UBOS-2013.htm. While the 2012 and 2013 reports provided substantial new information, they also suggested that additional field measurements would be useful to address areas of uncertainty, particularly involving the chemical conditions that are involved in winter ozone formation. The result of that additional work was the 2014 Uinta Basin Winter Ozone Study.

This compendium of studies currently represents the best available science regarding the formation of ozone during winter periods in the Uinta Basin. Nevertheless, the 2014 Final report makes clear that significant questions and uncertainties remain about the mechanisms of winter ozone formation in the Basin.

In addition, the 2014 Final Report carefully surveyed the efforts of governmental and academic institutions to develop photochemical air quality models that would accurately and reliably predict ozone exceedances. The box model evaluations are useful in providing a superficial level of understanding of winter ozone formation, but they do not provide an assessment of the impact of basin-wide VOC or NOx emission reductions on ozone levels sufficiently robust to allow formulation of a comprehensive regulatory control structure. Meteorological modeling done by Utah State University and the BLM functioned well in mimicking natural conditions, while an EPA model run "failed to capture the intensity and longevity of cold pools, either not simulating a strong enough inversion or eroding the cap too quickly." Id. at 6-7. Several different entities conducted photochemical modeling for the Uinta Basin: the National Oceanic and Atmospheric Administration, the BLM, Utah State University, Utah Department of Air Quality, and EPA. Each set of model runs provided useful information, but none produced model results that were well correlated with monitored data.

BLM Clarification: Comment noted. The BLM has disclosed in the FEIS that data regarding winter ozone formation is lacking and that ozone formation is being further studied. The 2014 Winter Ozone study is a referenced document in the EIS under the citation UDEQ-DAQ 2014.

57. *B&W Comment:* EPA, Utah Department of Air Quality, the Ute Indian Tribe, industry and others have been working for several years on an updated oil and gas emissions inventory for the Uinta Basin. The first phase of the 2014 Uinta Basin Emissions Inventory is now available and a summary of that new inventory is attached as Appendix A to this letter. Significant additional work is needed to finalize this new emission inventory, but it is already clear that the new emissions inventory contains important new information. Among other things, this new emissions inventory reveals that VOC emissions are approximately 49% lower than previous emission inventory estimates. The inventory also notes that there are significant differences in emissions profiles between oil and gas wells in Duchesne and Uintah Counties. The regulatory agencies, industry, and others have more work to do in finalizing this new and improved emissions inventory, and understanding its implications for development of a comprehensive regulatory program to manage ozone levels in the Uinta Basin. This new inventory reinforces the need for greater collaboration among stakeholders and as well as for careful analysis before finalizing additional regulatory requirements. This new

development provides additional support for acknowledging that while the FEIS contains the best science available, the mechanism for winter ozone formation remains subject to significant uncertainty, and that creates concomitant uncertainty about the effectiveness of potential control measures.

BLM Clarification: Comment noted. The BLM has already disclosed in the FEIS that the emissions from the project as disclosed are believed to be conservatively high. See FEIS page 4-6.

58. *B&W Comment:* In Sierra Club v. Federal Energy Regulatory Commission, 2016 U.S. App. LEXIS 11744 (D.C. Cir. 2016), the Sierra Club complained that the Federal Energy Regulatory Commission (FERC) should have evaluated the direct effects of authorizing construction at a natural gas export facility but also the indirect impacts of associated exports that might result. The court, however, emphasized that the FERC did not have the authority to authorize exports themselves; the Department of Energy has the exclusive authority to do so. As a result, the court concluded that the FERC analysis did not have to address the indirect effects of the potential export of natural gas since the agency "has no ability to prevent a certain effect due to "that agency's "limited statutory authority over the relevant action." Id. at 29, citing Public Citizen, 541 U.S. at 771; see also Sierra Club v. Federal Energy Regulatory Commission, 2016 U.S. App. LEXIS 11747 (D.C. Cir. 2016). Likewise, the BLM has no authority to direct or regulate the fate of oil and natural gas produced from these leases. For Newfield's upstream project here, BLM could not possibly anticipate how, where, or for what purpose the natural gas and oil produced from this project would be used. There simply is no close causal relationship between the action evaluated in the FEIS and the eventual downstream use in some form at some place for that oil and gas.

    BLM Clarification: Comment noted. Those activities that are within the scope of this EIS are included in the emissions impacts. See also the response to EPA Comment 1 and WEL and WEG Comment 30.

59. *B&W Comment:* The preamble to the OOOOa regulations, which are now in effect for the oil and gas sector, provided an exhaustive review of the environmental and public welfare impacts of climate change and the anthropomorphic emissions that are driving climate change. 81 Fed. Reg. 35833 -35840 (June 2, 2016). The EPA referred back to its 2009 "Endangerment Finding" for greenhouse gases, under Clean Air Act section 202(a)(1). 74 Fed. Reg. 66496 (Dec. 15, 2009). In that document, EPA provided exhaustive information about trends in greenhouse gas emissions and the increasing concentrations of those gases in the atmosphere. EPA relied upon scientific assessments and observations recorded since the 2009 Endangerment Finding. Some of the referenced documents are listed in this letter.

    BLM Clarification: Comment noted. The BLM's Colorado Plateau Rapid Ecoregional Assessment (2012) also provides an estimate of where climate change may occur. The project area is in an area predicted to be subject to moderately low change (Figure 6-14A). In particular the REA states that the pinyon-juniper and sagebrush vegetation communities in the Uinta Basin are predicted to experience Moderately Low exposure to climate change. However, the direction of such climate change is not known.

60. *B&W Comment:* The BLM recently developed a landscape level Rapid Ecoregional

Assessment (REA) program to support planning and landscape level decision making over large geographic areas. Under this program, BLM developed an REA for the Colorado Plateau, which includes the Uinta Basin and eastern Utah. The Colorado Plateau REA includes a regional climate assessment, which provides an overview of a range of projected changes in temperature, precipitation, and hydroclimate variables for the region. This report presents a qualitative narrative regarding potential long-term landscape-level future conditions and impacts based upon different climate change scenarios. This qualitative assessment provides additional context for the negligible incremental increase of project greenhouse gas emissions quantified and presented in the FEIS. This report also provides additional explanation regarding the uncertainty and complex challenges of landscape level climate modeling. The Record of Decision should incorporate this report by reference and provide a short qualitative overview. The Colorado Plateau REA should also be included in the administrative record.

BLM Clarification: Comment noted. The Colorado Plateau REA has been referenced several times in responding to climate change comments received on the FEIS.

61. *B&W Comment:* The BLM should provide an overview of the Cactus Strategy, emphasizing how the cactus strategy will promote population growth through restoration, survival and recruitment standards.

BLM Clarification: The full cactus strategy can be found in Attachment 4 of this ROD. There are standards tied to recovery of the species that will promote population growth through restoration, as opposed to maintenance of the status quo, such as the juvenile recruitment standard for reclamation acceptance.

Attachment 7: Errata

The errata section of this ROD illustrates the BLM's revisions to the Final EIS. The revisions have been developed from either comments received or BLM's internal review of the Final EIS. The added text is in **bold** and deleted text is in ~~strikethrough~~.

- Page 2-32 Section 2.2.12.1.7. The original applicant committed measure agreed to between BLM, EPA, and Newfield stated *"The purpose of the mitigation strategy outlined here, as incorporated into the Final EIS and ROD, is to ensure that implementation of the Greater Monument Butte Project will not result in net emissions increases of volatile organic compounds (VOC) from stationary sources located within the exterior boundaries of the Project area beyond VOC emissions levels for the 2012 operating year."* This commitment to apply the strategy within the exterior boundary of the project area was inadvertently left out of the FEIS. That clarification is therefore being made here, and is integral to the Decision. Please refer to Attachment 3 of this ROD for the entire mitigation wording.
- Page 2-70 – 2-71 Lines 42-4. Language was inserted here as a placeholder for the Biological Opinion and Cactus Strategy. This errata corrects the measure to reflect the actual language from the Biological Opinion.
    - ~~No new well pads would be allowed except as allowed under the FWS/Newfield Conservation, Restoration, and Mitigation Strategy for the Pariette and Uinta Basin Hookless Cactus (Appendix J Biological Assessment – Attachment F). In limited cases, well pad expansions could occur and new pipelines could be installed directly adjacent to existing roads so long as new surface disturbance is minimized, use of existing disturbance is maximized, the appropriate mitigation from Section 2.6.1.2 is applied, and a monetary amount (determined by the USFWS) is contributed to the Sclerocactus mitigation fund.~~
    - **Where new surface disturbance occurs within the Level 1 CCAs, mitigation must be completed following the Conservation and Mitigation Strategy For the Pariette Cactus and Uinta Basin Hookless Cactus, Newfield Greater Monument Butte Project (Strategy). Where new surface disturbance directly affects Sclerocactus (Sclerocactus are directly removed), a monetary amount ($640 per Sclerocactus) will be contributed to the Sclerocactus Mitigation Fund-BLM to aid in the recovery of Sclerocactus species impacted by the project. These contributions are in addition to payments requested for indirect effects to Sclerocactus. Contributions will be negotiated between the Operator and the USFWS office and will be based on the number of Sclerocactus directly impacted and in relation to the USFWS's current management guidelines for Sclerocactus.**
- Page 2-71 Lines 21-38 Language was inserted here as a placeholder for the Biological Opinion and Cactus Strategy. This errata corrects the measure to reflect the actual language from the Biological Opinion.
    - ~~Scenario 2) New surface disturbance would be allowed as described below, so long as new and existing surface disturbance would not exceed the 5% disturbance cap recommended in the Draft Management Guidelines for the Core Conservation Areas (Appendix I) except as allowed under the FWS/Newfield Conservation, Restoration, and Mitigation Strategy for the Pariette and Uinta Basin Hookless Cactus (Appendix J – Biological Assessment Attachment F).~~
        - ~~New well pads would be allowed in areas where the mineral resource can't be reached from existing pads or to accommodate deep gas drilling; and~~
        - ~~Well pad expansions to accommodate additional wells, and buried pipeline installation~~

~~directly adjacent to existing roads to accommodate conversion of existing producing wells to injection, would be permitted so long as the new surface disturbance is minimized, use of existing disturbance is maximized, and the appropriate mitigation from Section 2.6.1.2 is applied.~~

- ~~In sections where existing well pads exceed four pads per section, no new well pads would be allowed, unless reclamation of current pads occurs so that the total existing plus new well pad count is four per section.~~

- ~~Well pad expansions to accommodate additional wells, and buried pipeline installation directly adjacent to existing roads to accommodate conversion of existing producing wells to injection, would be permitted so long as the new surface disturbance is minimized, and the appropriate mitigation from Section 2.6.1.2 is applied.~~

- **Scenario 2) New surface disturbance, including well pads, roads, pipelines, or any other surface-disturbing activities will not exceed a 5% surface disturbance threshold where feasible.**
- **If the total cumulative surface disturbance is below the 5% threshold, and where access roads, buried pipelines, well pads, or other facilities requiring removal of vegetation (e.g., compressor stations) will be constructed, design project to minimize impacts locating a project a minimum distance of 300 feet from individual Sclerocactus plants and/or populations (except for surface pipelines which is 50 feet).**
- **If the total cumulative surface disturbance is above the 5% threshold, and/or where new surface disturbance indirectly affects Sclerocactus (cactus within 300 feet of proposed disturbance), the mitigation will occur following the Strategy.**
- **Where new surface disturbance directly affects Sclerocactus (cacti are directly removed), a monetary amount ($640 per cactus) will be contributed to the Sclerocactus Mitigation Fund-BLM to aid in the recovery of Sclerocactus species impacted by the project. These contributions are in addition to payments requested for indirect effects to cacti (see previous measure). Contributions will be negotiated between the Operator and the USFWS based on the number of cacti directly impacted and in relation to the USFWS' current management guidelines for Sclerocactus.**
- **Several options for mitigation of Level 2 CCAs are available (see Strategy). If mitigation funds are established, funds will be paid to: Sclerocactus Mitigation Fund – BLM, Impact-Directed Environmental Accounts, National Fish and Wildlife Foundation, 1133 Fifteenth Street NW, Suite 1100, Washington, DC 20005**

- Page 2-74 Lines 1 to 2 states that up to 13 new water treatment and injection facilities would be constructed under Alternative D. However, six of the water treatment and injection facilities already exist.
  - Construction of up to ~~13~~ **seven new and expansion of six existing** gas driven water treatment and injection facilities for management and distribution and injection of produced water
- Page 3-4 Table 3.2.2.1-1, O^3 row. Replace 0.075 ppm with 0.070 ppm.
- Page 3-8 Table 3.2.3.2-1, O^3 row. Replace 0.075 ppm with 0.070 ppm.
- Page 3-9 line 14. Replace 0.075 ppm with 0.070 ppm.

- Page 4-4 Line 19 stated "no project-specific ozone impact modeling has been conducted, because the tools needed for such modeling are not yet available" and Page 4-15 lines 19-21 stated "The ARMS modeling platform was not yet available at the time of the draft EIS development and thus no project-specific photochemical modeling was performed for the Proposed Action and Alternatives at that time." This statement was true at the draft stage, but the ARMS model platform became available between draft and final so the project specific model was run and the results were incorporated into the FEIS. These statements should have been deleted from the FEIS. The FEIS does retain the incorporation of the Greater Natural Buttes model results. However, please refer to page 4-16 lines 32 through page 4-17 line 30 and FEIS Appendix K for the results of the project specific ARMS ozone model.
- Page 4-6. This page was inadvertently formatted landscape orientation, but printed portrait orientation, so some of the words go off the page. The full wording is below.
    - approximately 16 years). Accordingly, emission increases for the MBPA have also been estimated on an annual development basis.
    - Annual development emissions for NOx and VOC from the Proposed Action were estimated on an annual basis for calendar years 2012 through 2022. The annual development emissions are shown in **Table 4.2.1.1.1-3**. Only NOx and VOC emissions were estimated on an annual basis, because they are the pollutants thought responsible for ozone formation in the Uinta Basin. The annual development emissions for 2012 through 2022 provide a 10-year view of how emissions would increase as the Proposed Action is developed. As indicated, it would require at least 16 years to reach full development of the Proposed Action.
- Page 4-17 line 10. Replace 0.075 ppm with 0.070 ppm. No change to the analysis is necessary as a result of this correction.
- Page 4-25 Line 32 refers to Section 2.2.14. The BLM-required mitigation measures present in this section in the DEIS were modified or replaced by additional applicant committed measures between draft and final, and then moved into section 2.2.12.1 of the FEIS. Please replace every reference to Section 2.2.14 with a reference to Section 2.2.12.1.
- Page 4-162 Line 9. Due to technical limitations on smaller pipelines, the words "as technically feasible" have been added to the pigging requirement of this mitigation measure.
    - Natural gas-condensate pipelines that cross mapped 100-year floodplain, mapped riparian, or wetland areas would be routinely pigged **(as technically feasible)** and would have emergency shutoff valves located immediately outside the floodplain.
- Page 4-163 Line 34. Insert the following Special Status Species mitigation measure which was inadvertently left out of the FEIS.
    - 1) Within suitable habitat, site-specific inventories will be conducted to determine occupancy. The inventories will be conducted for lands within 300 feet of proposed surface disturbance; 2) In suitable habitat, the project infrastructure will be designed to minimize impacts; and 3) Within occupied habitat, the project infrastructure will be designed to avoid direct disturbance and to minimize indirect impacts to populations and individual plants. The nearest proposed surface disturbance to a plant will be at least 300 feet away.
- Page 4-163 Line 42. The biological opinion and/or the applicant committed measures upon which the biological opinion was founded, changed "potential habitat" to "suitable habitat". "Surveys will be conducted in ~~potential~~ suitable habitat prior to initiation of project activities
- Page 4-164 between Lines 10 and 11, add the following measures from the Biological Opinion:
    - Surveys will be valid for one year from the survey date for *Sclerocactus brevispinus* and *Sclerocactus wetlandicus.*

- Sclerocactus spot check surveys will be conducted on an annual basis by a qualified botanist, and reviewed by the Bureau of Land Management (BLM) and our office for all planned disturbance areas if the project has not been completed within the year following pre-construction plant surveys. Review of spot checks may result in additional pre- construction plant surveys as directed the BLM and our office. If the proposed action has not occurred within four years of the original survey, additional coordination with the BLM and our office must occur and a new clearance survey may be necessary prior to ground disturbing activities.
- Sclerocactus surveys for access roads, buried pipelines, well pads, and other facilities requiring removal of vegetation (e.g., compressor stations) will include the project area and/or right-of-way (ROW), and 300 feet (ft) from the edges of the project disturbance and/or ROW.
- Sclerocactus surveys for surface pipelines placed within an existing road ROW, and within 10 ft from the edge of the disturbed surface of the road, will include the ROW and 50 ft from the edge of the ROW on the pipeline side of the road.
- Sclerocactus surveys for cross-country surface pipelines (pipelines over 10 ft from a road), where the pipeline will be laid by hand with minimal disturbance and no vehicle use will include the ROW and 50 ft from the edges of both sides of the ROW.
- Surveys for all other cross-country surface pipelines (vehicles or equipment used, not laid out by hand) will include the ROW and 300 ft from the edges of both sides of the ROW.
- *Sclerocactus* surveys will not be necessary when pipelines are buried in existing roads.

- Page 4-165 Line 25 per the Biological Opinion: "Ground disturbing activities ~~in potential Sclerocactus habitat, and~~ **in Level 1 CCAs**, and within 300 feet of individual Sclerocactus plants and/or populations…

- Page 4-165 between Lines 37 and 39, add the following measures from the Biological Opinion
  - New surface pipelines located closer than 50 feet to known *Sclerocactus* individuals will be secured in place to prevent pipeline movement (and in accordance with Level 1 and 2 CCA conservation recommendations, as outlined below).

- Page 4-165 line 43 per the Biological Opinion: "Only water **and methods approved by the AO** (no chemicals, reclaimed production water or oil field brine)…"

- Page 4-166 Line 1 per the Biological Opinion: "Dust abatement will be employed in ~~potential~~ **suitable** Sclerocactus habitat over the life…"

- Page 4-166 Line 19 per the Biological Opinion, add the following to the end of this measure: "**, which may include the use of sterile, non-native, non-invasive, annuals to help secure topsoil and encourage native perennials to establish**."

- Page 4-167 Lines 3-8. Language was inserted here as a placeholder for the Biological Opinion and Cactus Strategy. This errata corrects the measure to reflect the actual language from the Biological Opinion.
  - Avoid new surface disturbance, including well pads, roads, pipelines, or any other surface disturbing activities ~~except as allowed by the FWS/Newfield Conservation, Restoration, and Mitigation Strategy for the Pariette and Uinta Basin Hookless Cactus (see Biological Assessment – Attachment to Appendix J, Biological Opinion)~~ **where feasible**. Expansion of existing facilities will be allowed - e.g., widening existing access roads, expanding well pads, installation of pipelines to access existing facilities (along existing alignments or roadways).

- Page 4-167 lines 19-36. Language was inserted here as a placeholder for the Biological Opinion and Cactus Strategy. This errata corrects the measure to reflect the actual language from the Biological

Opinion.

- ~~When new surface disturbance occurs within the CCA1 area, a monetary amount will be contributed to the Sclerocactus Mitigation Fund to aid in the recovery of Sclerocactus species impacted by the project.~~
- ~~Where new surface disturbance directly affects Sclerocactus (cacti are directly removed), a monetary amount will be contributed to the Sclerocactus Mitigation Fund to aid in the recovery of Sclerocactus species impacted by the project. These contributions are in addition to payments requested for indirect effects to cacti (see previous measure). Contributions will be negotiated between the Operator and the USFWS based on the number of cacti directly impacted and in relation to the USFWS' current management guidelines for Sclerocactus.~~
- ~~Funds will be paid to: Sclerocactus Mitigation Fund Michelle Olson, Manager Impact Directed Environmental Accounts National Fish and Wildlife Foundation 1133 Fifteenth Street NW, Suite 1100 Washington, DC 20005~~
- **Where new surface disturbance occurs within the Level I CCAs, mitigation must be completed following the Conservation and Mitigation Strategy For the Pariette Cactus and Uinta Basin Hookless Cactus, Newfield Greater Monument Butte Project (Strategy). Where new surface disturbance directly affects Sclerocactus (Sclerocactus are directly removed), a monetary amount ($640 per Sclerocactus) will be contributed to the Sclerocactus Mitigation Fund-BLM to aid in the recovery of Sclerocactus species impacted by the project. These contributions are in addition to payments requested for indirect effects to Sclerocactus. Contributions will be negotiated between the Operator and the USFWS office and will be based on the number of Sclerocactus directly impacted and in relation to the USFWS's current management guidelines for Sclerocactus.**
- **Several options for mitigation of Level 1 CCAs are present (see Strategy). If mitigation funds are established, funds will be paid to: Sclerocactus Mitigation Fund – BLM, Impact-Directed Environmental Accounts National Fish and Wildlife Foundation Fifteenth Street NW, Suite 1100 Washington, DC 20005**

- Page 4-167 – 4-168 Lines 40-3. Language was inserted here as a placeholder for the Biological Opinion and Cactus Strategy. This errata corrects the measure to reflect the actual language from the Biological Opinion.
  - New surface disturbance, including well pads, roads, pipelines, or any other surface-disturbing activities will not exceed a 5% surface disturbance threshold **where feasible** ~~except as allowed by the FWS/Newfield Conservation, Restoration, and Mitigation Strategy for the Pariette and Uinta Basin Hookless Cactus (see Biological Assessment – Attachment to Appendix J, Biological Opinion)~~.
- Page 4-168 Line 34. This errata corrects the measure to reflect the actual language from the Biological Opinion. "Sclerocactus ~~Potential~~ Habitat Polygon"
- Page 4-168 Lines 42-44. This errata corrects the measure to reflect the actual language from the Biological Opinion. "Where new surface disturbance indirectly affects Sclerocactus (cactus within 300 feet of proposed disturbance), ~~a monetary amount will be contributed to the Sclerocactus Mitigation Fund to aid in the recovery of Sclerocactus species impacted by the project~~ **mitigation will occur following the Strategy**."
- Page 4-168 – 4-169 Lines 42-13. Language was inserted here as a placeholder for the Biological Opinion and Cactus Strategy. This errata corrects the measure to reflect the actual language from the

Biological Opinion.

- Where new surface disturbance directly affects Sclerocactus (cacti are directly removed), a monetary amount ($640 per acre) will be contributed to the Sclerocactus Mitigation Fund-**BLM** to aid in the recovery ~~requested for indirect effects to cacti (see previous measure)~~ of Sclerocactus species impacted by the project. Contributions will be negotiated between the Operator and the USFWS based on the number of cacti directly impacted and in relation to the USFWS' current management guidelines for Sclerocactus.
- ~~Funds will be paid to: Sclerocactus Mitigation Fund, Michelle Olson, Manager, Impact Directed Environmental Accounts, National Fish and Wildlife Foundation, 1133 Fifteenth Street NW, Suite 1100, Washington, DC 20005~~
- **Several options for mitigation of the *Sclerocactus* Habitat Polygon are available (see Strategy). If mitigation funds are established, funds will be paid to: *Sclerocactus* Mitigation Fund – BLM, Impact-Directed Environmental Accounts National Fish and Wildlife Foundation 1133 Fifteenth Street NW, Suite 1100 Washington, DC 20005**

- Page 4-51 Line 1, Page 4-94 Line 29, Page 4-123 Line 38, Page 4-161 Line 37, and Page 4-169 Line 15, all identify the application of the Vernal RMP Appendix K Surface Stipulations Applicable to all Surface-Disturbing Activities. However, most of the leases under scrutiny in this EIS are pre-existing rights which the RMP cannot amend. Therefore, this measure in all instances has been changed as follows:
  - "All applicable surface stipulations from Appendix K**, subject to valid existing rights**, and Fluid Minerals BMPs from Appendix R of the Vernal RMP (BLM 2008b) would be implemented.
- Page 4-191 Lines 41-42. The low profile tank measure has been modified as follows because low profile tanks within 0.5 mile of the green river are already applicant proposed, and recreationists do utilize other portions of the project area:
  - Low-profile tanks would be used to reduce visual impacts to recreationists **in visually sensitive areas** at the direction of the AO.
- Page 5-8 Lines 18-19. Strike this sentence: ~~These emissions are less than about five hundredths of a percent of the U.S. total shown for 2010 and about 3 percent of the state-wide total projected for 2020.~~
- Page 6-1 Lines 19-31 omitted some consultation dates, and reported incorrect dates on a few lines. Corrected dates are as follows:
  - **December 22, 2010: The BLM sent an initiation of consultation letter which summarized the proposed project to the thirteen tribes with ties to the Basin.**
  - **September 20, 2012: The BLM sent a letter announcing the October 11 meeting, and inviting the proposed consulting parties to participate.**
  - ~~September 9, 2012~~ **September 27, 2012:** The Laguna Pueblo Tribe response indicated no significant impact.
  - **September 27, 2012: A response letter was received from Duchesne County acing the invitation to participate.**
  - ~~October 11, 2012~~ **October 01, 2012:** The Hopi Tribe response requested continued consultation.
- FEIS Attachment 2 page 37 2nd paragraph, last full line. Replace 0.075 ppm with 0.070 ppm.

- FEIS Attachment 2 page 38, last line. Replace 0.075 ppm with 0.070 ppm.
- FEIS Appendix B page 21 of 85 Table 3-1 O^3 line. Replace 0.075 ppm with 0.070 ppm.
- FEIS Appendix J (PDF page 1313) Cactus Mitigation Strategy Page 11. The final bullet on this page refers to Table 1. This reference should be to the BLM Herbicide PEIS Appendix B Tables B-1 and B-2.
- FEIS Appendix J Biological Opinion. There is a digital error in the FEIS Biological Opinion which causes some of the pages to appear blank. The Biological Opinion has been attached to this ROD as Attachment 5 to mitigate this error.
- FEIS Appendix K page 3-6 Table 3-1 ozone line. Replace 75 with 70 in 3 instances. Also in footnote 9 of this table, replace 0.075 ppm with 0.070 ppm.
- FEIS Appendix K page 3-11 Table 3-6, footnote. Replace 0.075 ppm with 0.070 ppm.

This page intentionally left blank.

Attachment 8: Appeals Form 1842-1

This page intentionally left blank.

Form 1842-1
(September 2006)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

INFORMATION ON TAKING APPEALS TO THE INTERIOR BOARD OF LAND APPEALS

DO NOT APPEAL UNLESS
1. This decision is adverse to you,
AND
2. You believe it is incorrect

IF YOU APPEAL, THE FOLLOWING PROCEDURES MUST BE FOLLOWED

1. NOTICE OF APPEAL.....

A person who wishes to appeal to the Interior Board of Land Appeals must file in the office of the officer who made the decision (not the Interior Board of Land Appeals) a notice that he wishes to appeal. A person served with the decision being appealed must transmit the *Notice of Appeal* in time for it to be filed in the office where it is required to be filed within 30 days after the date of service. If a decision is published in the FEDERAL REGISTER, a person not served with the decision must transmit a *Notice of Appeal* in time for it to be filed within 30 days after the date of publication (43 CFR 4.411 and 4.413).

2. WHERE TO FILE

NOTICE OF APPEAL.....
State Director
BLM Utah State Office
440 West 200 South, Suite 500
Salt Lake City, Utah 84101-1345

WITH COPY TO SOLICITOR...
Regional Solicitor
U.S. Department of the Interior
6201 Federal Building
125 South State Street

3. STATEMENT OF REASONS

Within 30 days after filing the *Notice of Appeal*, file a complete statement of the reasons why you are appealing. This must be filed with the United States Department of the Interior, Office of Hearings and Appeals, Interior Board of Land Appeals, 801 N. Quincy Street, MS 300-QC, Arlington, Virginia 22203. If you fully stated your reasons for appealing when filing the *Notice of Appeal*, no additional statement is necessary (43 CFR 4.412 and 4.413).

WITH COPY TO SOLICITOR.....
Regional Solicitor
U.S. Department of the Interior
6201 Federal Building
125 South State Street
Salt Lake City, Utah 84138-1180

4. ADVERSE PARTIES.....

Within 15 days after each document is filed, each adverse party named in the decision and the Regional Solicitor or Field Solicitor having jurisdiction over the State in which the appeal arose must be served with a copy of: (a) the *Notice of Appeal*, (b) the Statement of Reasons, and (c) any other documents filed (43 CFR 4.413).

5. PROOF OF SERVICE.....

Within 15 days after any document is served on an adverse party, file proof of that service with the United States Department of the Interior, Office of Hearings and Appeals, Interior Board of Land Appeals, 801 N. Quincy Street, MS 300-QC, Arlington, Virginia 22203. This may consist of a certified or registered mail "Return Receipt Card" signed by the adverse party (43 CFR 4.401(c)).

6. REQUEST FOR STAY.....

Except where program-specific regulations place this decision in full force and effect or provide for an automatic stay, the decision becomes effective upon the expiration of the time allowed for filing an appeal unless a petition for a stay is timely filed together with a *Notice of Appeal* (43 CFR 4.21). If you wish to file a petition for a stay of the effectiveness of this decision during the time that your appeal is being reviewed by the Interior Board of Land Appeals, the petition for a stay must accompany your *Notice of Appeal* (43 CFR 4.21 or 43 CFR 2801.10 or 43 CFR 2881.10). A petition for a stay is required to show sufficient justification based on the standards listed below. Copies of the *Notice of Appeal* and Petition for a Stay **must** also be submitted to each party named in this decision and to the Interior Board of Land Appeals and to the appropriate Office of the Solicitor (43 CFR 4.413) at the same time the original documents are filed with this office. If you request a stay, you have the burden of proof to demonstrate that a stay should be granted.

Standards for Obtaining a Stay. Except as otherwise provided by law or other pertinent regulations, a petition for a stay of a decision pending appeal shall show sufficient justification based on the following standards: (1) the relative harm to the parties if the stay is granted or denied, (2) the likelihood of the appellant's success on the merits, (3) the likelihood of immediate and irreparable harm if the stay is not granted, and (4) whether the public interest favors granting the stay.

Unless these procedures are followed, your appeal will be subject to dismissal (43 CFR 4.402). Be certain that **all** communications are identified by serial number of the case being appealed.

NOTE: A document is not filed until it is actually received in the proper office (43 CFR 4.401(a)). See 43 CFR Part 4, Subpart B for general rules relating to procedures and practice involving appeals.

(Continued on page 2)

43 CFR SUBPART 1821--GENERAL INFORMATION

Sec. 1821.10 Where are BLM offices located? (a) In addition to the Headquarters Office in Washington, D.C. and seven national level support and service centers, BLM operates 12 State Offices each having several subsidiary offices called Field Offices. The addresses of the State Offices can be found in the most recent edition of 43 CFR 1821.10. The State Office geographical areas of jurisdiction are as follows:

STATE OFFICES AND AREAS OF JURISDICTION:

Alaska State Office ---------- Alaska
Arizona State Office --------- Arizona
California State Office ------- California
Colorado State Office -------- Colorado
Eastern States Office --------- Arkansas, Iowa, Louisiana, Minnesota, Missouri
and, all States east of the Mississippi River
Idaho State Office ---------- Idaho
Montana State Office --------- Montana, North Dakota and South Dakota
Nevada State Office ---------- Nevada
New Mexico State Office ---- New Mexico, Kansas, Oklahoma and Texas
Oregon State Office ---------- Oregon and Washington
Utah State Office ---------- Utah
Wyoming State Office -------- Wyoming and Nebraska

(b) A list of the names, addresses, and geographical areas of jurisdiction of all Field Offices of the Bureau of Land Management can be obtained at the above addresses or any office of the Bureau of Land Management, including the Washington Office, Bureau of Land Management, 1849 C Street, NW, Washington, DC 20240.

From:	Thomas, Nathan
To:	(b) (6) @comcast.net; Nancy Brown; Benjamin Pykles; David Yoder; Steve Bloch; Christopher Merritt; Brad Westwood
Subject:	Re: 2016_BLM_Utah_Annual_Report.pdf - Request for access
Date:	Tuesday, October 11, 2016 10:23:28 PM
Attachments:	2016_BLM_Utah_Annual_Report.pdf

Some of you may have had difficulty opening the annual report from the Google invite. Here it is as an attachment.

On Tue, Oct 11, 2016 at 8:35 AM, (b) (6) @comcast.net (via Google Drive) <drive-shares-noreply@google.com> wrote:

(b) (6) @comcast net is requesting access to the following PDF:
<https://ssl.gstatic.com/docs/documents/share/images/services/pdf-3.png>
2016_BLM_Utah_Annual_Report.pdf
<https://drive.google.com/a/doi.gov/file/d/0B8ZtAMA9O282QmJIdDRHVDJWUUk/view?usp=sharing_erxpa_nl&userstoinvite=jerry_cpaa@comcast net&ts=57fcf8c8>
Open sharing settings
<https://drive.google.com/a/doi.gov/file/d/0B8ZtAMA9O282QmJIdDRHVDJWUUk/view?usp=sharing_erxpa_np&userstoinvite=jerry_cpaa@comcast net&ts=57fcf8c8&actionButton=1>

Google Drive: Have all your files within reach from any device.
Google Inc. 1600 Amphitheatre Parkway, Mountain View, CA 94043, USA Logo for Google Drive
<https://drive.google.com>

--

Nate Thomas
Deputy Preservation Officer BLM Utah

Cultural Resource Program Lead

440 West 200 South, Suite 500
Salt Lake City, Utah 84145

(801) 539-4276

BLM-Utah Cultural Resource Annual Report for Fiscal Year 2016

A Report Compiled by the BLM-Utah State Office

September 1, 2016

Table of Contents

Background 4

Executive Summary 4

BLM-Utah's Highlights for Fiscal Year 2016 5

- Overview 5
- One-Time Respect and Protect Funds 6
- Summary of Section 106 Compliance and Cultural Resource Program Activities 8
  - Summary statistics: Nathan Thomas, Utah State Office Deputy Preservation Officer 8
  - Requirements of the Statewide Small-Scale Undertakings Programmatic Agreement: Nathan Thomas, Utah State Office Deputy Preservation Officer 9
  - Travel Management Programmatic Agreement: Nathan Thomas, Utah State Office Deputy Preservation Officer 9
- Stabilization 10
  - Stabilization of six ancestral Puebloan structures: Cameron Cox, Monticello Field Office Archaeologist 10
- Monitoring 11
  - The St. George Field Office's Site Stewardship Program: Geralyn McEwen, Archaeological Technician and Lori Hunsaker, Archaeologist-St. George Field Office 11
  - The Development of Vernal Field Office's Site Stewardship Program: David Grant, Vernal Field Office Archaeologist 14
- Research 16
  - Milford Flat Fire Post-Fire Archaeological Site Stabilization Results: Stacey Whitman-Moore, Fillmore Field Office Archaeologist 16
- Planning 19
  - Cultural Heritage and Values Risk Assessment for BLM-Utah's Solar Energy Zones: Jamie Palmer, Cedar City Field Office Archaeologist 19
- Tribal Consultation 20
- Native American Graves Protection and Repatriation Act (NAGPRA) Activities 20
  - Repatriation of two individuals to the Confederated Tribes of the Goshute Reservation: Diana Barg, Utah State Office Archaeologist 20
- Museum Collections Management 21
  - Managing the Cerberus Collection: Diana Barg, Utah State Office Archaeologist 21

Paleontology 23
New Regional Paleontologist: Nathan Thomas, Utah State Office Deputy Preservation Officer 23
Enforcement of Heritage Protection Authorities 24
Protecting the Lake Mountain Petroglyphs: Mike Sheehan, Salt Lake Field Office Archaeologist 24
Heritage Education, Interpretation, Outreach and Tourism 25
Project Archaeology Girl Scout Camp at Cedar Mesa: Samantha Kirkley, State Coordinator for Project Archaeology at Southern Utah University 25
Respect and Protect: A Public Awareness Program to Eliminate the Looting and Vandalism of Archaeological, Paleontological, and Natural Resources in Utah: Aaron Curtis, Branch Chief of Outdoor and Heritage Resources and Ashley Losey, Utah State Office Archaeologist 26

On the cover: A visitor views the late-Pueblo period ruins at Monarch Cave, San Juan County Utah.

Background

The Bureau of Land Management (BLM), consistent with its authorities and responsibilities under the General Land Policy and Management Act of 1976 (FLPMA) is charged with managing public lands in a manner that will "protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resources, and archaeological values" and "that will provide for outdoor recreation and human occupancy and use."

Directly related to these responsibilities, the BLM also has specific responsibilities and authorities under the National Historic Preservation Act of 1966, as amended (NHPA) to protect and enhance historic properties and to consider how agency approved actions and programs may affect historic properties. Such actions and programs include, but are not limited to: federal mineral resource exploration and extraction, off-highway vehicle (OHV) area and route designations, right-of-way approvals, range improvements, renewable energy development, outdoor recreation, prescribed fires, and vegetation treatments.

To further its abilities to meet the goals of the FLPMA and the NHPA, the BLM has developed policies and procedures for implementing its responsibilities under the NHPA through the *National Programmatic Agreement (nPA) between the BLM, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers* (2012). BLM-Utah has furthered its coordination with the Utah State Historic Preservation Office (Utah SHPO) through the development of the *Statewide Small-Scale Undertakings Programmatic Agreement*. The focus of this agreement is to outline the BLM-Utah's and Utah SHPO's roles and responsibilities when implementing Section 106 of the NHPA for small-scale undertakings.

Executive Summary

As required by *BLM's Cultural Resource Management Program Annual Report* and the reporting requirements of the *Statewide Small-Scale Undertakings Programmatic Agreement*, this report and the attached documentation, summarizes BLM-Utah's accomplishments for the management of cultural and paleontological resources, including the associated collections and data, and tribal consultation for fiscal year 2016. This report highlights some of the exemplary projects conducted by BLM-Utah, including NHPA Section 106 Compliance, Stabilization, Identification, Monitoring, Research, Planning, Tribal Consultation, Native American Graves Protection and Repatriation Act (NAGPRA) activities, paleontological management, museum collections management, enforcement of heritage protection authorities and heritage education, interpretation, outreach and tourism. This report also summarizes the cultural resource training hosted by BLM during the previous year, the results of any field office technical reviews, and any concerns the BLM has identified in its NHPA Section 106 efforts.

BLM-Utah's Highlights for Fiscal Year 2016

Overview

In FY2016, BLM-Utah continued to be a national leader in managing the range of prehistoric, historic, traditional cultural properties and Native American sacred sites on our public lands. With a significant one-time budget increase in FY2016, BLM –Utah funded over 45 cultural resource and paleontological management projects throughout Utah. These projects ranged from stabilizing prehistoric structures on Cedar Mesa, to stabilizing the historic Central Pacific Railroad in Box Elder County; from conducting an ethnographic study of the Monticello Field Office, to studying the lifeways of historic Chinese railroad workers at the Price Field Office.

From the positive working relationship with the State Historic Preservation Officer, the BLM maintained its core cultural resource program of inventorying, monitoring, and stabilizing cultural resources on BLM-managed land in Utah. For example, a thorough inventory of petroglyphs and protective fence construction was conducted in the Lake Mountains areas, which are cultural resources at risk from damage from target shooting. BLM-Utah also continued to make great progress towards providing appropriate access, protection, and interpretation of cultural resources across the State.

Field and monument offices continued a strong tradition of partnering with interested publics and partner organization to identify and monitor significant cultural resources. For example, the Red Cliffs National Conservation Area received national-level funding to support a research project with the Western Rock Art Research group that is focused on identifying rock art sites in the National Conservation Land unit. Similarly, Color Country District partnered with the Southwest Utah National Conservation Lands Friends for archaeological site stewardship, environmental education, and other volunteer work. Site stewardship programs with volunteer groups continues to be an important function of BLM-Utah's cultural resource program, which benefits our work, provides more presence on the ground, and engages a broader section of the public in cultural resource awareness. These programs grew substantially in FY2016.

BLM-Utah formally established partnerships with the Friends of Cedar Mesa and Southern Utah University in FY2016. From these partnerships, the state of Utah will have a statewide archaeological Site Stewardship program and a statewide Project Archaeology program. Project Archaeology is BLM's national program for training teacher to provide archaeological science and archaeological ethics training to their students. BLM-Utah has partnered with Tread Lightly! and the Friends of Cedar Mesa to help prevent looting of cultural and paleontological resources. The highlight of this year for this effort was the official launch or kick-off event for the Respect and Protect anti-looting campaign. Unfortunately, BLM-Utah was also forced to investigate a violation of the Archaeological Resources Protection Act in FY2015 at the Great Stone Face Rock Art Site. This type of investigation highlights our challenges and responsibilities to maintain effective stewardship of the State's cultural heritage.

Finally, BLM-Utah is proud of our proactive and effective government-to-government coordination and consultation with our Tribal partners. These relationships are essential, important, and valued.

In FY2016, BLM-Utah hosted a statewide recreation and cultural workshop in Moab for staff members. This workshop was a unique opportunity to share experiences in person and develop shared direction and guidance for cultural resource management across BLM-Utah. At the site-level, we focused on ensuring that appropriate protective measures were in place for key cultural resources. For example, we redesigned protective measures for the 10th century Ancestral Puebloan farmstead in Red Cliffs National Conservation Area. State-wide, the BLM has been moving towards digital cultural resource reports and accurate GIS database. This work is on-going and represents a substantial leap forward in access to the information our staff need to be effective cultural resource managers.

One-Time Respect and Protect Funds

In January of 2016, the Washington Office notified BLM-Utah of a significant one-time budget increase for cultural resource and paleontological projects From, January 14th to January 29th; all BLM-Utah offices developed and submitted project proposals to be considered for funding. On March 22, 2016 BLM-Utah's Executive Leadership Team approved the projects

To support the goals of BLM-Utah's upcoming "Respect and Protect" public outreach program, 100% of these funds were invested in on-the-ground projects and partnerships that seek to proactively protect cultural and paleontological resources and educate the public land visitors about these resources and responsible outdoor ethics.

Approximately one-third of the funding was invested in existing and new statewide partnerships, including the development of the "Respect and Protect" public outreach campaign to eliminate the looting of cultural and paleontological resources, the establishment of a statewide Project Archaeology program, the establishment of a statewide Site Stewardship program, and the continuation of tribal consultations regarding the Cerberus museum collection. Approximately one-sixth of the funding was provided to the BLM Monticello Field Office to protect at-risk cultural resources in the greater Cedar Mesa area and to support new and existing program partnerships.

Field office projects that were funded included 1) heritage tourism development and site stabilization, 2), boots-on-the ground projects, and 3) public outreach, education and volunteer projects. The following table lists the projects that were funded by these one-time funds.

Office	Project Title
Grand Staircase-Escalante National Monument	Paleontology Lab Volunteer Program
	National Monument Seasonal Cultural Resource Management Support
	Big Water Visitor Center Paleontology Exhibit Updates
	Live Broadcast of Paleontology Excavation to Public Schools
	Mini-Public Land Exhibits for Community Businesses
	Old Pahrea Townsite Interpretation
	National Monument 20th Anniversary Youth Heritage Education Events in Local Communities

Cedar City	Historic Charcoal Kilns Stabilization and Heritage Tourism Development
	Iron County Old Spanish National Historic Trail Signage
Richfield	Koosharem Archaeology Site Heritage Tourism Development
	Richfield Seasonal Cultural Resource Management Support
	Richfield Travel Management Plan Cultural Resource Monitoring Study
St. George	St. George Heritage Resources Youth Conservation Corps Internship
	Washington County Heritage Education Events and Petroglyph Patrol Volunteer Program Support
	SUNCLF Site Stewardship Volunteer Program Support
Vernal	John Jarvie Historic District Stone Cabin Stabilization
Vernal	John Jarvie Historic District Restoration Initiative
	Vernal Site Stewardship Volunteer Program Establishment
	Vernal Project Archaeology Heritage Education Efforts
Price	Chinese Railroad Worker Camp Heritage Education and Outreach Efforts
	Cleveland-Lloyd Dinosaur Quarry Signage Updates
	Cleveland-Lloyd Dinosaur Quarry Youth Conservation Corps Internship
	Nine Mile Canyon Site Stabilization and Heritage Tourism Development
Salt Lake	Lake Mountain Seasonals
	Lake Mountain Petroglyph Protection
	Central Pacific Railroad Stabilization and Heritage Tourism Development
Fillmore	Rock Art Monitoring & Section 110 Survey Seasonal
	Great Stone Face Petroglyphs Intensive Recordation Seasonal
Canyon Country	Canyon Country Paleontology Heritage Education Videos
Moab	Moab Civilian Conservation Corps Camp Heritage Tourism Development
	Moab Heritage Resources Youth Conservation Corps Internship
	Poison Spider Trail and Potash Road Heritage Tourism Development
	Mill Canyon Heritage Tourism Development
	Kane Creek Heritage Tourism Development
	Doellings Bowl Fossil Stabilization
	Hells Revenge Dinosaur Tracksite Stabilization and Heritage Education
Monticello	Monticello Seasonal Cultural Resource Management Support

	Butler Wash Dinosaur Tracksite Heritage Tourism Development
	Edge of Cedars Scanning Project for Site Stewardship Volunteer Support
	San Juan County Schools Rock Art Heritage Education Event
	Cedar Mesa Prehistoric Ruin Stabilization and Protection
	Additional Prehistoric Ruin Stabilization - Comb Ridge
	Immediate stabilization - Three Kiva
	Cedar Mesa Cultural Resource and Recreation Management Partnership
	Cedar Mesa Ethnographic Landscape Study: Phase 1
Utah State Office	Statewide Project Archaeology Program Partnership
	Statewide Site Stewardship Program Partnership
	Cerberus Collection Operations and Tribal Consultation
	Statewide Respect and Protect Public Awareness Campaign Partnership
	Cerberus Collection Interpretive Plan Partnership
	State History NAGPRA Partnership
	UGS Paleo Data Partnership

This table lists all of the projects and partnerships that were funded through FY2016 one-time funds received from the Washington Office.

The funding of so many projects and partnerships was a landmark moment for cultural resource management in Utah, especially when BLM-Utah has not been able to fund projects in the field the past two fiscal years. The effects of funding these projects will have a positive effect on these cultural resources and partnerships for many years to come.

Summary of Section 106 Compliance and Cultural Resource Program Activities

Summary statistics: Nathan Thomas, Utah State Office Deputy Preservation Officer

From July 31, 2015 to August 1, 2016 field and monument offices reported that Class III surveys were conducted on 285 individual undertakings. These undertakings were conducted on BLM lands (public land) and those non-BLM lands which were connected to the undertaking. The total amount of acres surveyed included 71,586 acres of BLM land and 6,732 acres of non-BLM land. From these surveys 775 newly discovered sites were located and recorded on BLM lands and 66 were located and recorded on non-BLM lands. 446 of these sites were determined to be eligible to the National Register of Historic Places.

The total number of cultural resource sites that received some form of proactive physical protection or monitoring was 811. This included 720 sites that were monitored, 30 sites where an anti-

looting/vandalism sign was placed, 8 sites that were fenced, 17 sites that were stabilized and 36 sites that received some sort of ongoing protection measure such as fence repair, sign replacement or reapplication of mud to adobe walls.

In regards to Section 106 activities, a total of 170 historic properties were avoided by project redesign. The Utah State Office issued 91 cultural resource use permits for survey and recordation and 3 Archaeological Resource Protection Act permits for data recovery.

BLM-Utah continues to be the leader in the State of Utah for public outreach. Field and monument offices conducted 216 public presentations at avocational meetings, community groups, and fairs. The total number of people directly contacted for these presentations was approximately 6,000. 38 visits to Classrooms and youth groups, 5 field schools were hosted, 7 college presentations, 17 public enhancement projects (i.e. interpretive signs), and 28 popular media presentations were also conducted.

Requirements of the Statewide Small-Scale Undertakings Programmatic Agreement: Nathan Thomas, Utah State Office Deputy Preservation Officer

In October of 2015, BLM-Utah held is second Annual Coordination meeting for the Small-Scale PA. This meeting was held at the Red Cliffs Lodge, near Moab, Utah. In the following month, the Utah State Office released an Instruction Memorandum (IM) to all district, field, assistant field managers and archaeologists to reemphasize the importance of the stipulations in this agreement. Specifically mentioned in this IM is the Standardized Reporting Procedures, Quarterly Reporting, Annual Coordination Meeting, Public Notification, Field Office Technical Reviews, Manager Training Requirements and multiple standardized SHPO correspondence letters were also attached.

From July 31, 2015 to the end of the FY2016, Field Office Technical Reviews were conducted at the Fillmore, Price, Salt Lake, St. George, and Vernal Field Offices. Manager Training took place at the Fillmore, Kanab, Price, Salt Lake, and St. George Field Offices. From the beginning of October 2015 to the end of September 2016, field offices submitted 33 out of 44 quarterly reports. Missing reports were not submitted because there was nothing to report or a archaeologist position was vacant.

Travel Management Programmatic Agreement: Nathan Thomas, Utah State Office Deputy Preservation Officer

The Travel Management Programmatic Agreement is still under development. This year BLM-Utah submitted two subsequent draft agreements for consulting parties to review. These drafts were each followed by a consulting party meeting. In total, 5 consulting party meetings have taken place through the development of this agreement. BLM-Utah has been pleased with the amount of consulting party involvement, including the numerous county government representatives, historic preservation community and off-highway vehicle enthusiasts. BLM-Utah hopes to release another draft early this winter.

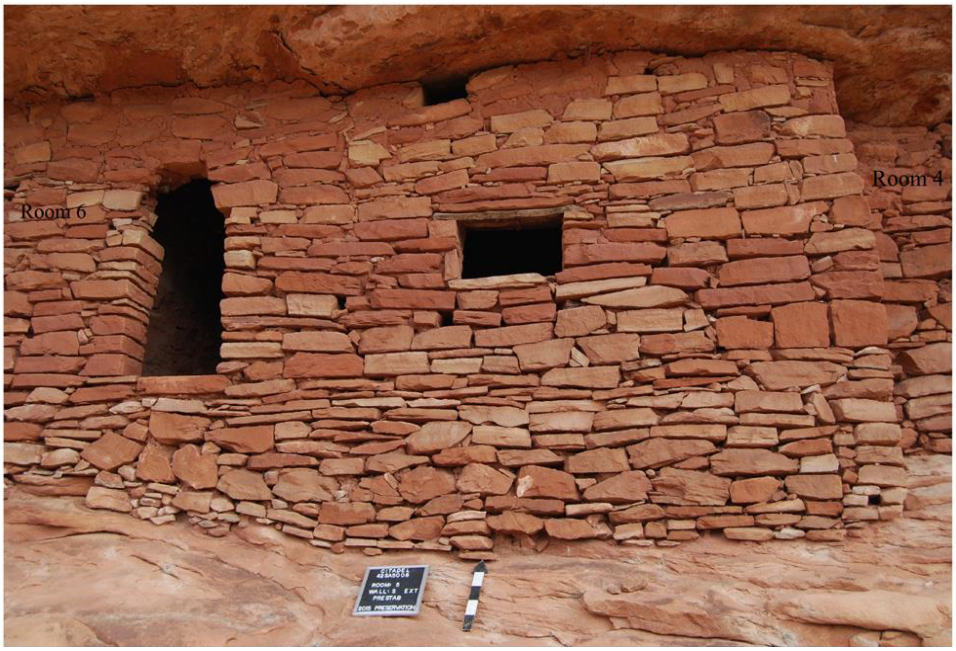
Stabilization

Stabilization of six ancestral Puebloan structures: Cameron Cox, Monticello Field Office Archaeologist

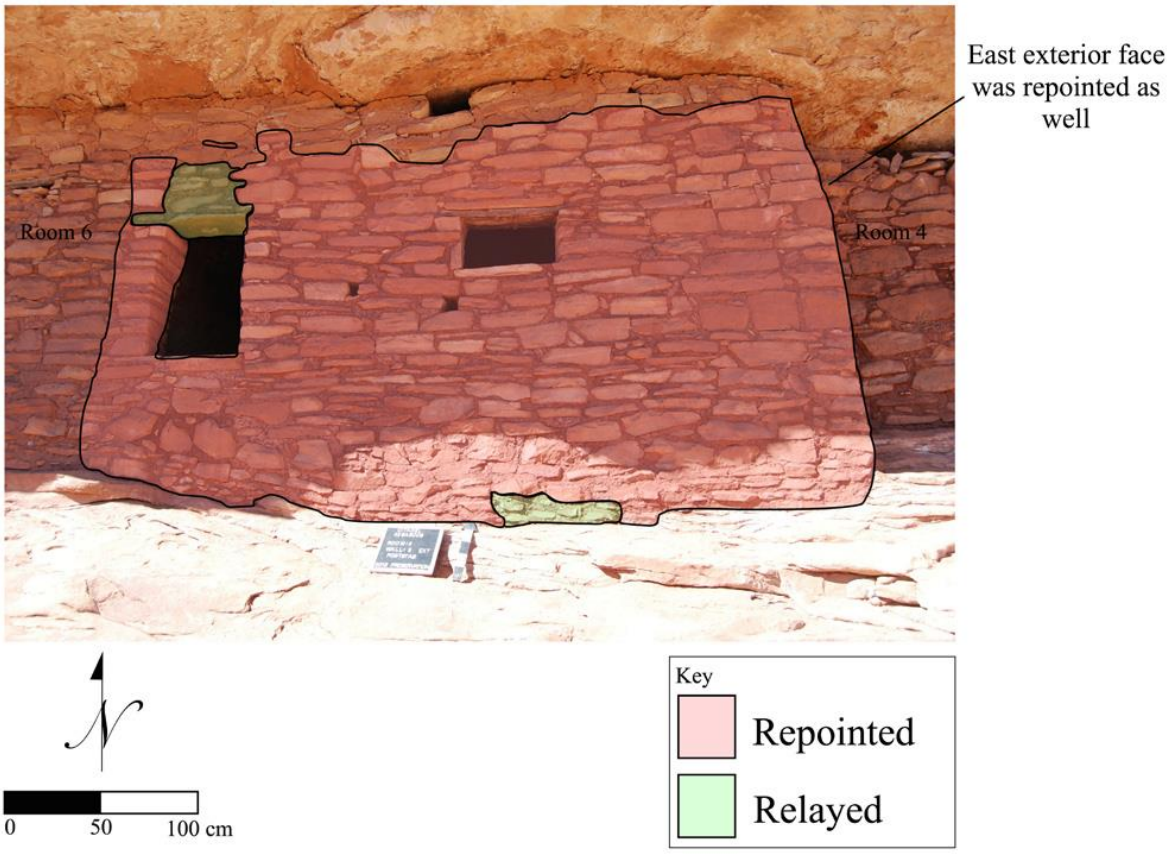
The Bureau of Land Management, Monticello Field Office (BLM) contracted Woods Canyon Archaeological Consultants of Cortez, CO to conduct a major stabilization and structural repair effort of six ancestral Puebloan architectural sites on BLM managed lands within San Juan County, Utah. These sites include: Road Canyon Citadel, Long Fingers, Monarch's Cave, Moon House, and Cold Spring Cave, and Three Kiva Pueblo.

The main goals of the project were to slow or stop human caused deterioration to the sites due to high visitation, as well as provide a safe environment for public enjoyment. Intended work at the sites included: repointing of mortar, resetting of stones, capping or sealing of walls, moving soil to level uneven ground surfaces, consolidation of visitor trails and reclamation of any unauthorized user-created trails at each site. Prior to any stabilization efforts a condition assessment was conducted by Woods Canyon or Stratified Environmental and Archaeological Services. All condition assessments were reviewed by American Indian Tribes and the Utah Division of State History.

Stabilization fieldwork was completed between April and June of 2016. All stabilization procedures conducted were low impact, non-invasive, completely reversible, and oriented toward retaining the original fabric and integrity of these prehistoric ruins. These preservation activities will help maintain and enhance the scientific, educational and interpretive values, as well as provide continued professional exploration and public enjoyment of BLM managed lands in the Monticello Field Office.



This picture shows the south exterior 42SA5008 – Room 5, before it was stabilized.



This picture illustrates what portions of the south exterior of 42SA5008 Room 5, were re-pointed with new mortar or where the stones were re-layed. Note the new mortar in-between each stone and the stabilization of the top of the door and the foundation. These actions will stabilize this structure for additional public visitation for years to come.

Monitoring

The St. George Field Office's Site Stewardship Program: Geralyn McEwen, Archaeological Technician and Lori Hunsaker, Archaeologist-St. George Field Office

The Saint George Field Office (SGFO) has had an active site steward program since 2003 and was one of the first offices in the nation to implement a paleontological site steward program. Site stewards assist the BLM by regularly visiting assigned archaeological and paleontological sites to monitor and document signs of vandalism and change. Vandalism is a serious and increasing issue, but with the assistance of these volunteers, BLM can effectively and expeditiously address damage and minimize future incidents of vandalism.

This year the SGFO worked with our partner Southwest Utah National Conservation Lands Friends (SUNCLF) to oversee the efforts of 23 volunteer stewards, who:

- Put in over 200 hours of volunteer time,
- Monitored over 40 sites,

- Cleaned up graffiti at the Red Reef Shelter in the Red Cliffs NCA (pictured below),
- Trained and mentored new stewards,
- Staffed public outreach events (pictured below), and
- Acted as docents at the Orson-Adams House (a restored mid-nineteenth century era house pictured below).

The SGFO and SUNCLF used Respect and Protect funding to initiate a site steward "lite" program called Petroglyph Patrol. Petroglyph Patrol volunteers will hike along trails at the Land Hill ACEC, which is heavily visited by the public and has a high concentration of rock art and other types of archaeological sites that are managed for public use. Volunteers will also monitor other heritage public use sites during peak visitation times to provide a visible steward presence and encourage appropriate and sustainable visitation practices. The program has received a substantial amount of media attention and attracted a new and diverse group of volunteers. We will be training over 20 new volunteers at the end of August.

This photograph shows SGFO personnel and SUNCLF site stewards removing graffiti at Red Reef Shelter

This photograph shows the restored and interpreted Orson-Adams House where SUNCLF site stewards serve as docents to provide tours to the public.

SUNCLF site stewards and BLM's Seymour Antelope promote Respect and Protect during an agency sponsored 'Get Outdoors Day.'

The Development of Vernal Field Office's Site Stewardship Program: David Grant, Vernal Field Office Archaeologist

The focus of Vernal Field Office (VFO) Cultural Resource Site Stewardship Program was to train volunteers to monitor cultural resources and to find people interested in being site stewards for federal agencies. We felt that there existed a need to develop a program to help monitor and protect the significant number of cultural resources that exist not just within the VFO but in the region. This program was designed to fulfill this need and help us jump start our own site monitoring program.

In order to find the needed volunteers we reached out to groups interested in archaeology, universities, and the public in general. Most of the volunteers who participated with this training are affiliated with the Utah Rock Art Research Association (URARA), Utah Statewide Archaeological Society (USAS) and the Colorado Archaeological Society (CAS). However, two of the volunteers were locals with little or no exposure to archaeology and just looking for an opportunity to serve, and one of the volunteers came from across the state in response to a posting about the program on the BLM-Utah Facebook page.

For two weeks in the month of June, fourteen volunteers from all over the region participated in in this training. During training they discovered 22 previously unrecorded archaeological sites, monitored 19 previously recorded archaeological sites and 1 paleontological site, and surveyed approximately 350 acres. Also the volunteers help intensively record two archaeological sites during an amazing class on how to record rock art. Thanks to the dedicated efforts of these volunteers we identified two sites that are being impacted from natural/human causes and plans have been started to construct fences to protect these treasures.

The program achieved its goals to train volunteers to monitor cultural resources and four of the volunteers signed up to be site stewards for the VFO. Other volunteers who participated in the training have contacted their local federal agency offices to pursue site monitoring opportunities. Equipment that was purchased with this funding will continue to be utilized to monitor, record and stabilized cultural resources. Additionally, some of the funding was utilized to promote BLM-Utah's "Respect and Protect" campaign.

The VFO plans on continuing to conduct this training on an annual basis. The Respect and Protect funding associated with this project provided the office with the necessary materials we need to conduct this training. Further outreach to regional and local organizations is needed to find more site stewards for the VFO. We are excited about the new Statewide Site Stewardship program that is being implemented and hope it augments our own efforts.

A Vernal Field Office site steward examines petroglyphs during a field visit.

Vernal Field Office site stewards sit inside of the protective fence, while they record the Sweetwater Petroglyphs. To earn his Eagle Scout award and with the assistance of the Vernal Field Office, Stockton Palmer a local Boy Scout from Troop 243, built this fence to protect the Sweetwater Petroglyphs.

Research

Milford Flat Fire Post-Fire Archaeological Site Stabilization Results: Stacey Whitman-Moore, Fillmore Field Office Archaeologist

In 2007 the Milford Flat Fire (MFF) burned more than 363,000 acres of land in Millard and Beaver counties. Immediately following the fire, BLM conducted a Class III survey of approximately 100,000 acres to identify and document cultural resources within potential Emergency Stabilization and Restoration (ESR) areas. From this survey, 752 archaeological sites were discovered and documented. After this survey, the BLM completed a variety of ESR treatments, including chaining, drill seeding, and ATV harrowing. These treatments occurred next to and within the boundaries of these documented sites. After these treatments, BLM with the assistance of HRA Inc., Conservation Archaeology (HRA), saw the need to determine reexamine a sample (n=153) of the treated and untreated sites to answer the following questions:

1. Are differences between the post-fire and present site condition observations the result of the archaeologists' perceptions, natural site formation processes, or fire related processes?
2. How did the post-fire treatment decisions affect the condition of the site today?
3. Did treatment decisions prove beneficial or harmful to the archaeological sites?

Treatment Type	Revisited Sites
Chained	50
Avoided	37
ATV Harrowed	23
Drill Seeded	27
Other	16

Table 1. Treatment types for revisited sites after the MFF. This table shows how a variety of treatments were tested during this project.

To evaluate site changes in revisited sites, HRA compared site boundaries (same, moved, larger, or smaller), total artifact quantities (same, increased, decreased, and unknown), maximum artifact density (same, increased, decreased, unknown), and differences in tool assemblages. Figures 1 through 3 demonstrate that most of the sites were unchanged. When they did change, they typically changed in multiple ways (i.e. if the site boundary changed, usually the artifact quantity and maximum density changed as well). Nonetheless, National Register eligibility changed in only seven percent of the 153 revisited sites, demonstrating that the majority of the revisited sites retained their significance after the fire and the treatment that followed.

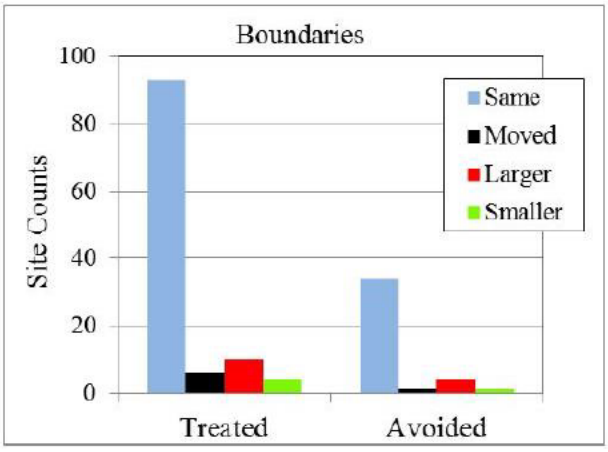


Figure 1. Site boundary changes at revisited sites.

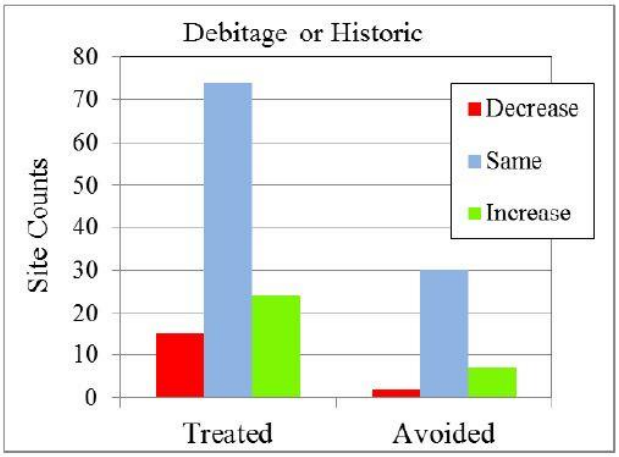


Figure 2. Changes in the total quantity of artifacts at revisited sites.

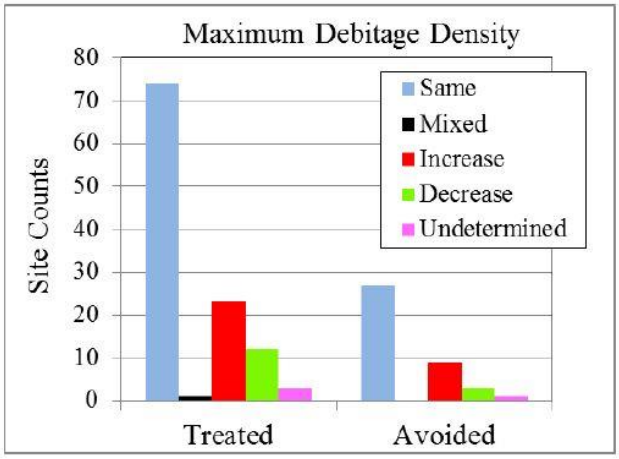


Figure 3. Changes in the maximum density of debitage observed at revisited sites.

Overall, nearly half of the revisited sites were unchanged and found to be in the same condition reported after the MFF (see Table 2). Through analysis, HRA inferred that treated sites had a higher incidence of reburial than untreated sites, and avoided sites had a higher incidence of slope wash and collection than treated sites. In addition, examination of sites according to treatment type concluded that drill seeded sites tended to continue to erode after treatment, whereas ATV harrowed sites tended to change by deflation, slope wash, and particularly by reburial.

Treatment Type*	Unknown	Changed**	Unchanged
ATV Harrow*** (N=32)	0	25 (78.1%)	7 (21.8%)
Avoided (N=38)	1 (2.6%)	19 (50.0%)	18 (47.3%)
Chained (N=50)	1 (2.2%)	21 (42.0%)	28 (56.0%)
Drill Seeded (N=28)	1 (3.5%)	13 (46.4%)	14 (50.0)
	$\chi^2 = 10.41$ DoF = 3 (don't use Unknown or Other categories) Critical $p = 0.017$ (probability of random result)		

*Other sites (N=5) not included

**Includes evidence of deflation, reburial, collection, mixed effects, slope wash, or water erosion

*** Includes sites partially treated to avoid artifact concentrations and dunes

Table 2. Summary of changes by treatment type.

HRA's findings are complex; however, they tend to support the conclusion that treated prehistoric lithic scatter sites fare better than untreated sites. They demonstrated that sites were not harmed by the treatments and nearly half of the sites were unchanged. This study also supports research that suggests post-fire erosion can harm surface artifact scatters as much, or even more, than drill seeding or chaining. However, certain types of archaeological sites, for example, sites with architecture or thermal features, can be damaged by drill seeding and chaining. HRA's study showed that the inventory and treatment methods employed for the MFF were effective in protecting the archaeological resources, and those values that make those resources National Register eligible.

Reference

Roberts, Heidi and Amanda J. Landon 2016. *Here Today, Buried Tomorrow: Revisiting 153 Archaeological Sites Recorded After the Milford Flat Fire ESR.* Submitted by HRA, Inc., Conservation Archaeology, Las Vegas, Nevada. Prepared for Bureau of Land Management.

Planning

Cultural Heritage and Values Risk Assessment for BLM-Utah's Solar Energy Zones: Jamie Palmer, Cedar City Field Office Archaeologist

As part of their solar regional mitigation strategy, the Utah State and Cedar City Field Office contracted with the Environmental Science Division of the Argonne National Laboratory to construct a Cultural Heritage and Values Risk Assessment (CHVRA) for its solar energy zones. BLM-Utah will use the CHVRA to understand the distribution of known cultural resources and to approach their management in a more holistic, landscape-scale fashion.

To craft the CHVRA, Argonne is using the Rapid Ecoregional Assessment framework. Argonne will use this structure to capture past activity areas and resources that shaped the cultural history in the CHVRA. In addition, Argonne is analyzing how various change agents (e.g. development and climate change) might affect cultural resources in the future. This is not Argonne's first foray into a project of this nature. In 2015, Argonne created a CHVRA for BLM-Colorado's San Luis Valley-Taos Plateau solar project. BLM-Colorado and Argonne collaborated with tribes, federal and state agencies, archaeologists, subject matter experts, and stakeholders to identify and prioritize cultural resources in the CHVRA. To facilitate

the CHVRA process, BLM-Colorado and Argonne worked together with the interested parties in several meetings, workshops, and webinars.

In August 2016, BLM-Utah and Argonne held their kick-off CHVRA webinar. In this webinar, BLM-Utah introduced and explained the CHVRA process. The webinar attendees also learned that the CHVRA is a paradigm shift from project-by-project approach to a landscape-scale approach. This landscape-scale approach is an important tool for land use planning and collaboration for future mitigation and protection of regionally significant cultural resources. FY2017 will include a number of stakeholder meetings to develop this forward thinking project.

Tribal Consultation

The Acting Utah State Director, Acting Associate State Director, and Deputy State Director for Natural Resources contacted 32 Indian Tribes in Arizona, Colorado, Idaho, New Mexico, and Utah to introduce the Tribes to the Cerberus Collection management website and to encourage them to participate in the NAGPRA process. The phone calls also included discussions about BLM-Utah's Respect and Protect program and the Travel Management Programmatic Agreement.

Field and monument offices conducted a total of 69 face to face consultations with Indian Tribes during FY2016. In person consultation meetings regarding the Cerberus Collection were held with the Hopi Tribe and the Ute Mountain Ute Tribe. The Utah State Office also met with the Native American Remains Review Committee for the state of Utah to discuss reburial options on public lands.

Native American Graves Protection and Repatriation Act (NAGPRA) Activities

Repatriation of two individuals to the Confederated Tribes of the Goshute Reservation: Diana Barg, Utah State Office Archaeologist

BLM-Utah repatriated two individuals and associated funerary objects to the Confederated Tribes of the Goshute Reservation on the morning of April 15, 2016. These two individuals were excavated by University of Utah Archaeologist, Elmer Smith next to the town of Ibapah in the 1950's. The individuals and associated funerary objects were being cared for by the Natural History Museum of Utah, who facilitated the packing and physical transfer of the remains and objects to Virgil M. Johnson, Chairman of the Goshute Tribes. Virgil Johnson and Jenna Whitlock, BLM-Utah Acting State Director, signed a transfer of custody form officially transferring custody and responsibility from the BLM to the Tribe. Nathan Thomas, BLM-Utah Deputy Preservation Officer and Michelle Knoll, Natural History Museum of Utah Assistant Curator of Archaeology, signed disposition forms to formally release the NAGPRA objects from the museum's care and into the care of the Tribe.

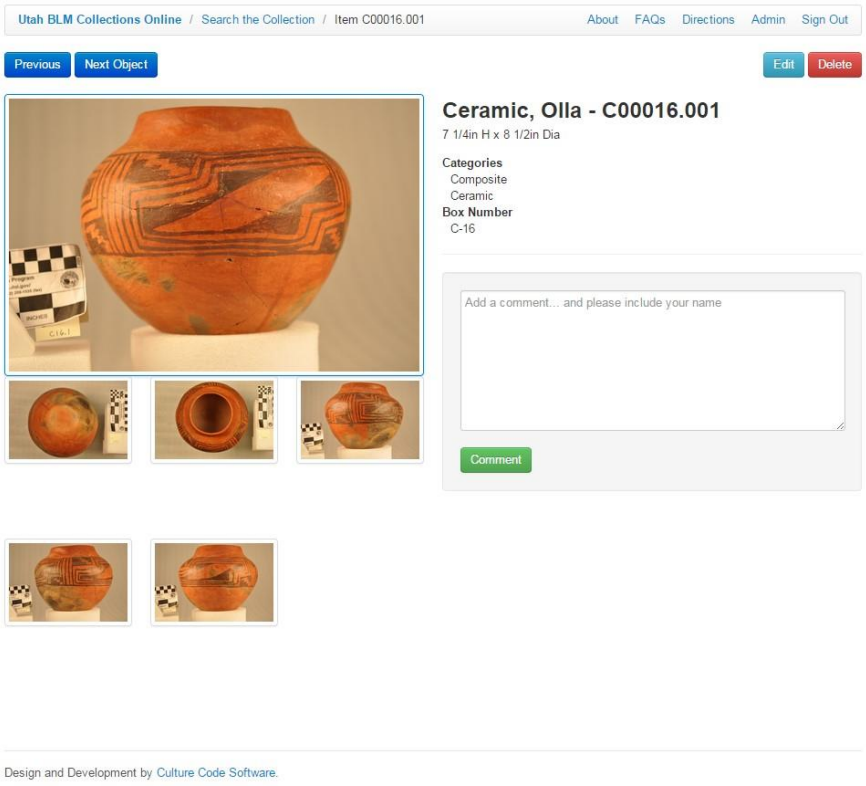
The repatriation proceeded in excellent form with all parties in agreement and working towards the common goal of returning the Goshute ancestors home. The Federal Register Notice regarding this NAGPRA Claim is found in Volume 74, Number 47, Doc E9-5351.

Museum Collections Management

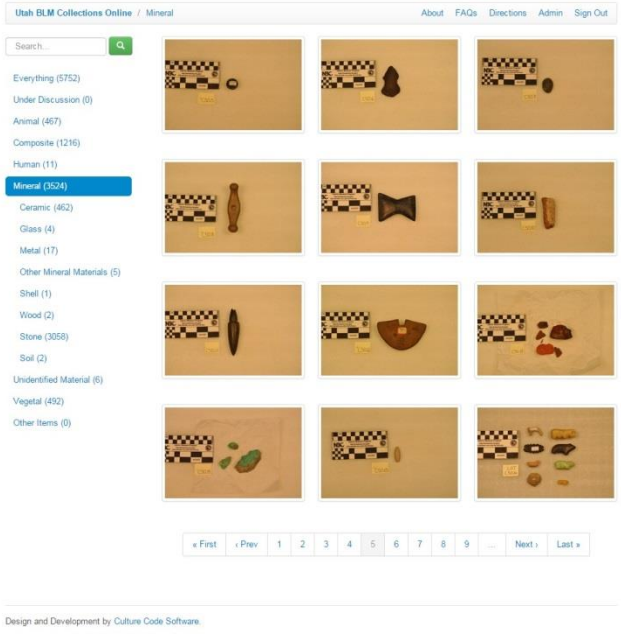
Managing the Cerberus Collection: Diana Barg, Utah State Office Archaeologist

In 2016, BLM-Utah enhanced government-to-government coordination and consultation with tribes across a four state region and introduced strategies favorable to tribal participation with the Cerberus Collection. In order to facilitate nation-to-nation consultations regarding the approximately 50,000 objects in the Cerberus Collection, the BLM Utah State Office developed a secure consultation website where designated tribal representatives are able to review photos and associated records of materials in the collection. The secure collections database is an innovative approach to support BLM-Utah's consultation efforts with tribal nations and allows each tribe remote access to the collections information so they may work within their own timeframes and following their own protocols when consulting and developing NAGPRA Claims. The website was introduced to tribes through an August 28, 2015 consultation letter and draft NAGPRA Collections Summary. The NAGPRA Collections Summary was updated in FY2015 and FY2016 and is in the process of being finalized. Currently 12 tribes have requested access to the secure website and four additional tribes are in the process of requesting access. One request for additional information and photographs was facilitated and one in-person meeting with Tribal representatives has taken place at the collections facility.

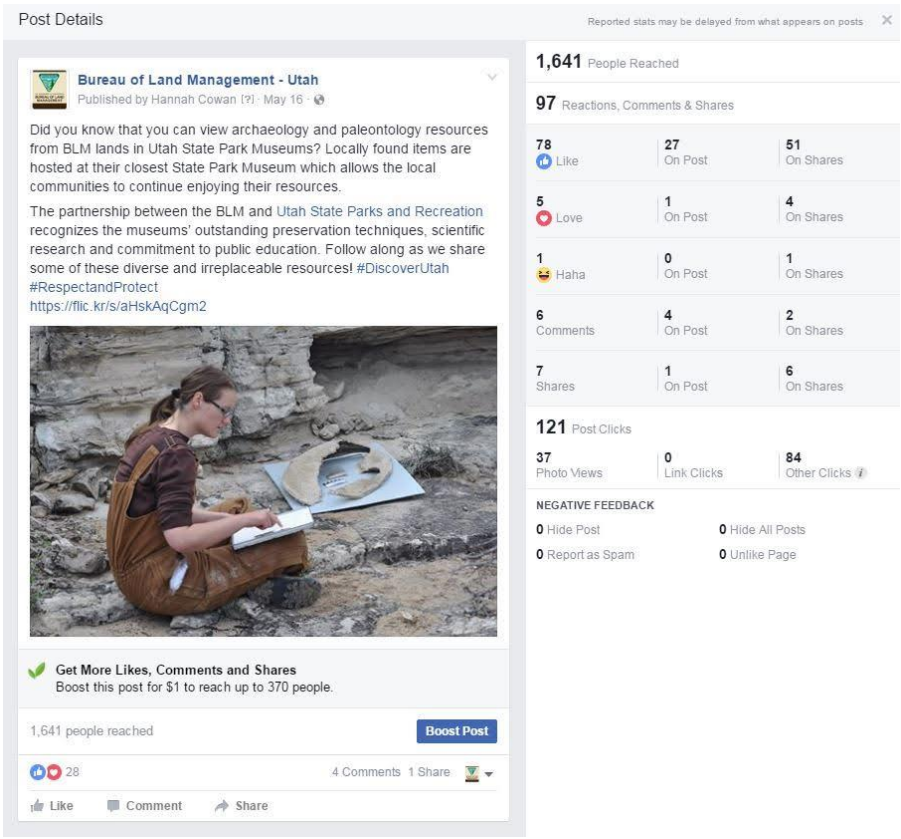
National Council for Preservation Education intern Courtney Ewert, housing perishable artifacts from the Cerberus Collection at the Utah Natural History Museum.



Screen shot of the Cerberus Collections Website. This secure and password protected website was developed in FY2016 to facilitate consultation NAGPRA consultations with Tribes.



Additional screen shot of the Cerberus Collections Website. This secure and password protected website was developed in FY2016 to facilitate consultation NAGPRA consultations with Tribes.



Social media screen shot of a post to promote the museum collections partnership established in FY2016 with Utah State Parks.

Paleontology

New Regional Paleontologist: Nathan Thomas, Utah State Office Deputy Preservation Officer

Greg McDonald started as the regional paleontologist (Utah, Nevada, Oregon, Washington) in late January 2016. His Initial responsibility was to process all of the paleontology permit applications and renewals for Utah. He was involved in the Respect and Protect initiative and has participated in 4 outreach meetings (Salt Lake, Vernal, St. George, Price). He gave a presentation at the annual meeting of the Utah Friends of Paleontology in Moab. He also attended the annual Oregon-BLM archaeology meeting in Baker City, Oregon and the 20th Anniversary celebration for Grand Staircase Escalante National Monument.

Greg brings a well of museum collection management knowledge to this position. This year he served as an instructor for the DOI Museum Program Managing Museum Property Class held in Salt Lake and as an instructor for the DOI Museum Program class on Curating Natural History Collections in Salt Lake and Washington DC. His partnership work this past year included the establishment of a cooperative program between the Moab Field Office and the Salt Lake School for Science Education for a one week program on paleontology in the summer of 2017. Working with Price Field Office on stabilization of fossils at Cleveland Lloyd Dinosaur Quarry and developing interpretive signage at Fossil Point.

Enforcement of Heritage Protection Authorities

Protecting the Lake Mountain Petroglyphs: Mike Sheehan, Salt Lake Field Office Archaeologist

Rock art in and around the Eastern Lake Mountains is unique and interesting in that it is typically found on small boulders as opposed to large vertical panels. Over the past several years it has become increasingly clear that rock art in the area is vulnerable to damage from target shooting. Documented damage to petroglyphs includes but is not limited to bullet impacts and paint spatter (cans of paint used as targets explode upon bullet impact). In some cases entire panels of rock art have been destroyed from bullet impacts alone.

The photograph on the right shows a boulder with repatinated petroglyphs and some errant gunfire damage. The photograph on the left shows the same boulder 15 months later with even more damage.

As a result of the damage to the petroglyphs in this area, the Salt Lake Field Office has taken measures to prevent damage from target shooting. In April, 2016 the Salt Lake Field Office transferred 160 acres of land to Utah County under the Recreation and Public Purposes Act for a shooting range. For the 160-acre shooting range, Utah County proposes two short-distance ranches of 25 and 50 yards for pistols and two long-distance ranges of 100 and 300 yards for large-caliber rifles. Each would have 10 shooting stations. The county will construct a continuous earthen berm, 10 feet high and 8 feet thick around the down-range parts of the firing lanes. These berms will dampen the noise and help in the recovery of spent lead. The primary purpose of this range is to protect private property and petroglyphs in the area.

After the land was transferred the Salt Lake Field Office, constructed a buck and pole fence that further deters target shooters from using the locations that contain petroglyphs. The last physical protection measure conducted this summer was to hire and post seasonal park rangers in the area, to educate and direct target shooters away from the petroglyphs.

For additional management of the shooting in this area, the Salt Lake Field Office is starting the Eastern Lake Mountains Shooting Plan Amendment (ELMTSPA). The ELMTSPA represents a major effort to:

analyze target shooting in this area, evaluate various alternatives for management and to make a planning level decision to direct the future management of this area.

Through all of these efforts the Salt Lake Field Office has been working with an active group of consulting parties and cooperating agencies. Consulting parties, include the Utah Long Range Shooters, the Utah Shooting Sports Council, the Utah Rock Art Research Association (URARA), the Utah Archaeological Research Institute (UARI), the Utah Statewide Archaeological Society (USAS), the Archaeological Conservancy and last but not least the Utah State Historic Preservation Office. Cooperating agencies include the Utah School Institutional and Trust Lands Administration (SITLA), the municipalities of Saratoga Springs and Eagle Mountain, The SLFO also reached out to local Tribal groups as part of the consultation effort.

Heritage Education, Interpretation, Outreach and Tourism

Project Archaeology Girl Scout Camp at Cedar Mesa: Samantha Kirkley, State Coordinator for Project Archaeology at Southern Utah University

In partnership with the Bureau of Land Management, the United States Forest Service and Edge of the Cedars State Park, Project Archaeology and Southern Utah University developed and conducted a three day archaeology camp for Girl Scouts and tribal youth over Memorial Day weekend 2016. The camp was set on the Manti-La Sal National Forest, instruction was given at Edge of the Cedars, and field excursions were on BLM lands on Cedar Mesa. Eighteen girls (ages 10-16) and four leaders from the Moab and Bluff areas attended the camp. Several of the scouts represented the Navajo Nation. All of the girls received an archaeology patch for completion of the Project Archaeology curriculum requirements.

This is the archaeology patch and camp patch that was developed by the group for this Project Archaeology camp.

Respect and Protect: A Public Awareness Program to Eliminate the Looting and Vandalism of Archaeological, Paleontological, and Natural Resources in Utah: Aaron Curtis, Branch Chief of Outdoor and Heritage Resources and Ashley Losey, Utah State Office Archaeologist

Since the early 20th century, Utah has had a long and well-documented history of archaeological, paleontological, and other natural resources being looted and vandalized on federal, state, and tribal lands. Unfortunately, these issues have continued to the present day, and numerous incidents on BLM-administered public lands have recently received national and international media attention. In order educate the public about the consequences of these behaviors and promote more responsible outdoor ethics, the Utah State Office and Tread Lightly! have initiated a partnership to develop and implement a statewide public awareness campaign called "Respect and Protect" to engage the public in the stewardship of our nation's priceless cultural and natural heritage. To date, 2 Native American tribes, 7 federal agencies, 10 state government agencies, 2 county governments, 11 universities and colleges, 9 museums, 22 non-profit organizations, 21 private sector businesses, and 38 individuals have participated in an online survey and/or regional stakeholder meetings to identify the key issues and messages the public awareness campaign should emphasize.

After an extensive effort, Tread Lightly! in coordination with the Utah State Office, developed the logo for Respect and Protect.

Communication Goals

The ultimate goal of the *Respect and Protect* public awareness program is to eliminate the looting and vandalism of archaeological, paleontological, and natural resources in Utah. Another primary goal of the program is to expand the partnership with any Native American tribes, local, state, and federal agencies, museums, non-profit organizations, and private sector business that are interested in supporting the campaign's goals. Expanding the partnership as much as possible will amplify the key messages and ensure these messages are consistently communicated across the state, regardless of jurisdiction.

Key Issues

In late 2014, BLM-Utah and Tread Lightly! initiated the development of this program by inviting hundreds of stakeholders to participate in an online survey to identify the key issues the campaign should address. 212 individuals completed the online survey, which identified the following key issues:

- The looting of archaeological and paleontological resources that occurs for financial gain or personal use demonstrates a clear lack of respect for Native American cultures and/or America's collective cultural and natural history. Other looting, such as taking home an arrowhead, pot shard, or small fossil, demonstrates a lack of knowledge about laws prohibiting these behaviors and/or a lack of understanding about the relevance of archaeological resources to contemporary Native American communities.

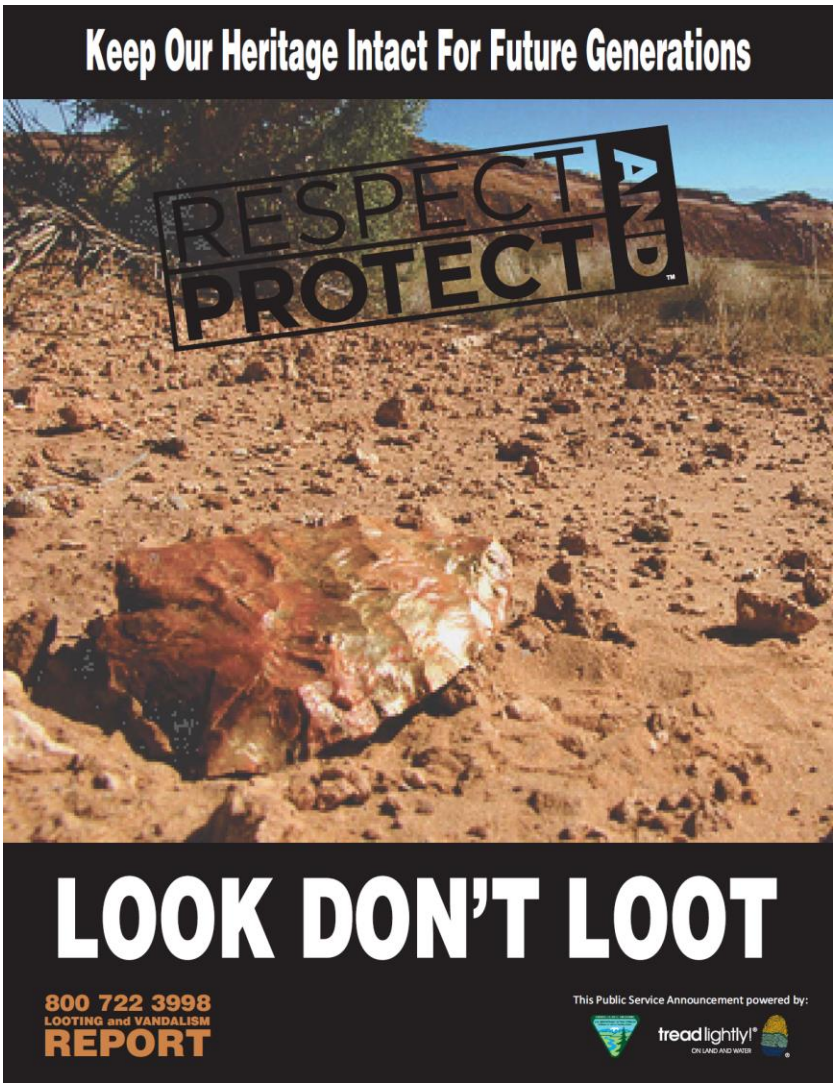
- The intentional vandalism of archaeological, paleontological, and other natural resources demonstrates a clear lack of respect for Native American cultures and/or America's collective cultural and natural history.
- The unintentional vandalism of archaeological, paleontological, and natural resources due to uninformed behaviors and/or poor outdoor ethics demonstrates the need for consistent messaging promoting responsible outdoor recreation etiquette.
- There is a need to expand and enhance stewardship and education opportunities for the public to more actively protect these resources and educate Utah residents and visitors about the consequences of these behaviors.
- There is a need for law enforcement efforts to deter and prevent these illegal behaviors and hold individuals responsible.

Key Messages

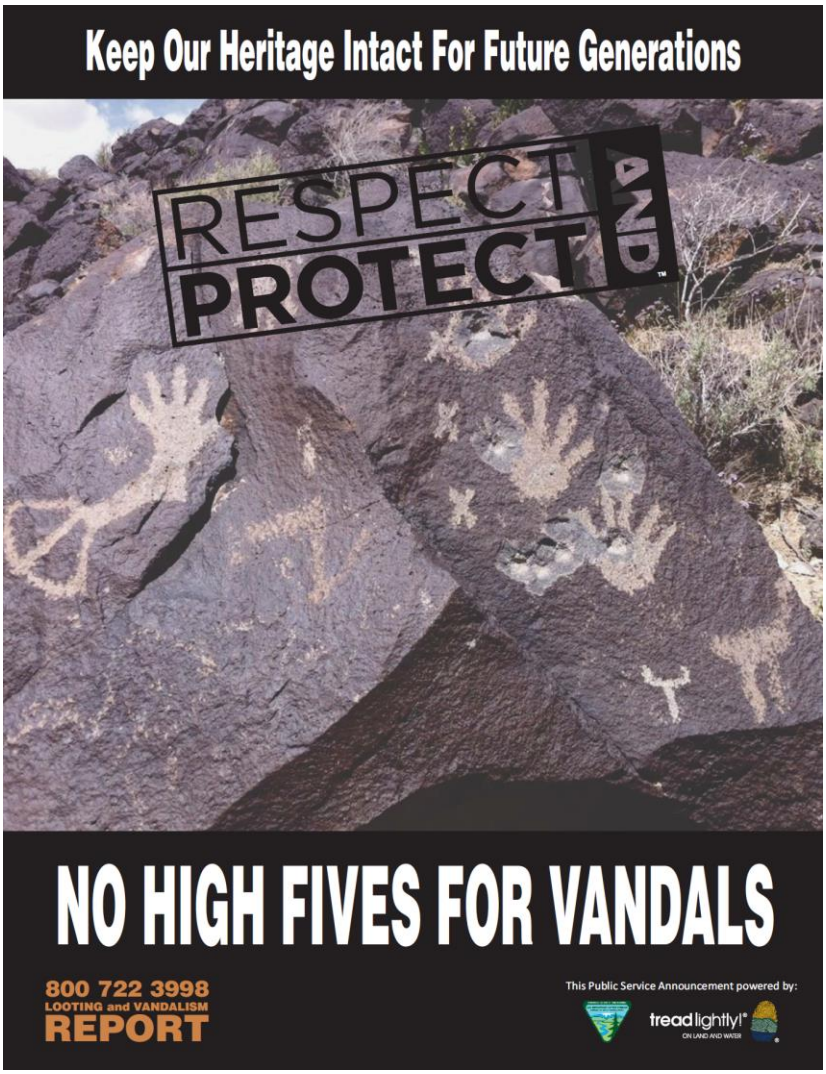
In the spring of 2015, BLM-Utah and Tread Lightly! hosted four regional stakeholder meetings in Moab, Price, St. George, and Salt Lake City to present the online survey results and discuss the key messages the public awareness campaign should promote. A wide variety of public service announcements will eventually be developed in support of the program, however, all program materials will address at least one of the below key messages:

- **The number of archaeological, paleontological, and other natural resources that have been looted or vandalized in Utah is unacceptable.** It is up to us a stewards of our nation's cultural and natural heritage to work together to eliminate this illegal behavior. There are a wide variety of volunteer opportunities available to protect archaeological, paleontological, and natural resources, as well as numerous organizations and initiatives that can provide educational services about these resources in your local community.
- **Archaeological and paleontological sites should be enjoyed respectfully.** The public can minimize their impacts by leaving artifacts and fossils in place, not entering or sitting on structures, using existing trails, and not touching rock art. Members of the public who find archaeological or paleontological resources that are exposed or in danger of being damaged should leave the objects in place and contact the appropriate authorities. An archaeologist or paleontologist will visit the location, professionally document at-risk resources, and ensure they are appropriately protected.
- **Archaeological resources found on Utah's public lands are still culturally and religiously significant to many Native American communities today.** The looting and vandalism of these resources have real and personal consequences to these Americans, and these behaviors represent blatant disrespect of native cultures.
- **The looting and vandalism of archaeological and paleontological resources represent an irreplaceable loss** of important scientific data that could have expanded our understanding of America's cultural and natural history.
- **The looting and vandalism of archaeological and paleontological resources from federal, state, and tribal lands is against the law.** Members of the public who witness these behaviors taking place and/or suspect that such incidents have occurred should contact the appropriate authorities. These authorities will investigate these incidents and prosecute individuals participating in these behaviors to the maximum extent allowable by law.

As more BLM-State Offices and other partners join this effort, these key message may be customized to fit the need of the offices, agencies and partners.



A draft public service announcement to prevent the public from illegally collecting artifacts.



A draft public service announcement to prevent the public from vandalizing rock art.

The Future for Respect and Protect

FY2014 to FY2016 represent the creation and first stages of the Respect and Protect program in Utah. The upcoming years will see the expansion of the program from just Utah-BLM, to BLM nationally and other agencies such as the United States Forest Service and organizations such as the Society for American Archaeology. The external communications for Respect and Protect will also start to take hold across Utah and the nation. Respect and Protect's key messages will be distributed through a BLM national website, social media, online and print media marketing, media engagement (i.e. press releases), outdoor billboards, and brand awareness efforts. BLM will be monitoring and tracking the success of the program annually by the number of public service announcements, social media posts, volunteer projects and events, number of advertisements, visitors to the website, number of facilities who display the information, number of individuals who saw the campaign and the number of

individuals who report looting and vandalism incidents to the 1-800 tip hotline promoted through campaign materials.

This photograph was used in a social media post to promote Respect and Protect. Although not directly stated, it shows how visitors should respect pictographs by not touching them and only taking photographs.

From: Boyd, David
To: David Boyd
Subject: News Release: BLM White River Field Office employees receive Director's Superior Service Award
Date: Monday, October 31, 2016 5:26:45 PM

News Release
White River Field Office, Colorado

Oct. 31, 2016
Contact: David Boyd, Public Affairs Specialist, (970) 876-9008

BLM White River Field Office employees receive Director's Superior Service Award

DENVER – On Oct. 20, three Meeker-based employees received the Director's Award for Superior Service. Wildlife Biologist Edward Hollowed, Planning and Environmental Coordinator Heather Sauls and Mining Engineer Paul Daggett were members of the interdisciplinary team that developed the White River Field Office Oil and Gas Development RMP Amendment, which was approved in 2015.

The Amendment addresses development of the Uinta-Piceance Basin, which is one of five basins in the West that contain the bulk of the federal onshore natural gas resource.

"It takes significant time and energy to make sure the BLM engages diverse stakeholders and the public through the planning process," said Linda Lance, BLM Deputy Director of Programs and Policy. "This team collaborated with 13 Cooperating Agencies, interest groups and the public to develop innovative management solutions that addressed development and mitigation at the landscape scale."

As members of the interdisciplinary team, Hollowed, Sauls and Daggett were challenged to consider not only the importance of this energy reserve for the Nation but also potential impacts on spectacular natural resources including 300,000 acres of lands with wilderness characteristics, one of the largest migratory mule deer herds in the country, and visitors' experiences in Dinosaur National Monument.

The approved plan includes a three-tiered approach to lands with wilderness characteristics, adaptive management to address impacts to mule deer populations, a threshold strategy for year-round development to reduce surface disturbance, and the Dinosaur Trail Master Leasing Plan that considers how adjacent development might impact Dinosaur National Monument.

###

Photo Caption: Left to right Heather Sauls, BLM State Director Ruth Welch, Kent Walter, BLM Deputy Director for Programs and Policy Linda Lance, and Paul Daggett. Sauls, Daggett and Ed Hollowed (not pictured) were recently honored with the BLM Director's Award for Distinguished Service for their work on the White River Field Office Oil and Gas Development RMP Amendment.

(Individual photos available as well)

--

David Boyd

Bureau of Land Management

Public Affairs Specialist

NW Colorado District

(970) 876-9008
(970) 319-4130 (cell)

From:	Nathan Matthews
To:	uformp@blm.gov; Nathaniel Shoaff
Subject:	Sierra Club comments on Uncompahgre Draft RMP/EIS
Date:	Tuesday, November 1, 2016 9:56:31 PM
Attachments:	SCRockyMountainChapterUncompahgreComment.pdf

Please accept these comments from Sierra Club on the draft RMP/EIS. These comments are in addition to the comments submitted by the Western Environmental Law Center et al., to which Sierra Club is also a signatory.

Please confirm receipt of these comments, and let me know if you have any difficulty with the attachemnt.

Thanks,

Nathan Matthews

--

Nathan Matthews
Staff Attorney
Sierra Club Environmental Law Program

2101 Webster Street, Suite 1300
Oakland, CA 94612
(415) 977-5695
Nathan.Matthews@sierraclub.org

November 1, 2016

Project Manager, Uncompahgre RMP
Bureau of Land Management
Uncompahgre Field Office
2465 South Townsend Ave.
Montrose, CO 81401
Email: uformp@blm.gov

Submitted via email

Re: Comments on the Uncompahgre Field Office's Draft Resource Management Plan and Environmental Impact Statement

Dear Uncompahgre RMP Project Manager:

The Sierra Club's Rocky Mountain Chapter and Our Wild America and Beyond Coal Campaigns submit the following submit the following comments regarding the Bureau of Land Management ("BLM") Uncompahgre Field Office ("UFO") Draft Resource Management Plan ("Draft RMP") and Environmental Impact Statement ("EIS"). These comments are in addition to the comments submitted by the Western Environmental Law Center *et al.*, to which Sierra Club is also a signatory.

We agree that revision to the Uncompahgre RMP is long overdue, as the existing plan does not reflect present circumstances and national climate policies. DEIS 1-2. As has been made abundantly clear by President Obama, addressing climate change is one of our most important and urgent national priorities. In recent years, the United States has become an international leader in the fight against climate change and the Obama Administration has taken important and ambitious steps to start to address the problem and our contribution to it. Unfortunately, the Draft Plan for the Uncompahgre, if finalized as proposed, would be a step backward on critically important climate issues.

Under BLM's Draft Plan, the public lands at issue here would be used to generate more than 11 million tons of coal, 7,500 barrels of oil, and more than 3,746,000 thousand cubic feet of natural gas every year for the next two decades. DEIS p. 4-42, Table 4-11. All told, BLM's plan would result in the massive methane and carbon dioxide emissions -- more than half a billion tons of CO2e over twenty years -- at precisely the same time that our President and the world's leading climate scientists are saying it is more important than ever to sharply reduce our greenhouse gas emissions.

It is clear that emissions from the use and development of coal, oil, and natural gas resources are the primary driver of climate change. BLM has the opportunity to lead the Administration's efforts to address the climate problem by setting management priorities for these public lands that help us achieve our national climate objectives rather than perpetuate status quo management that we can no longer afford. As President Obama stated in his final State of the Union: "Now we've got to accelerate the transition away from old, dirtier energy sources. Rather than subsidize the past, we should invest in the future . . . ."[1] On behalf of our millions of members and supporters, Sierra Club and its Rocky Mountain Chapter, Beyond Coal and Our Wild America Campaigns urge BLM to consider -- and ultimately adopt -- an alternative that prevents new leasing of coal, oil, and natural gas in the Uncompahgre planning area. Any other approach would harm the climate, contribute to myriad environmental and public health effects of climate disruption, and hinder our ability to meet our national climate objectives and international greenhouse gas reduction targets.

Sierra Club is America's largest and most influential grassroots environmental organization, with more than 2.4 million members and supporters nationwide. Sierra Club is dedicated to exploring, enjoying, and protecting the wild places of the Earth; to practicing and promoting the responsible use of the Earth's resources and ecosystems; to educating and enlisting humanity to protect and restore the quality of the natural and human environment; and to using all lawful means to carry out these objectives.

The Sierra Club and its Rocky Mountain Chapter, which includes more than 17,000 members that live in Colorado, have spent many years working to protect communities and public lands in Colorado from the harmful effects of coal, oil, and natural gas development. The Rocky Mountain Chapter has helped communities across the Front

[1] President Obama, State of the Union (Jan. 13, 2016), available at https://www.whitehouse.gov/the-press-office/2016/01/12/remarks-president-barack-obama-%E2%80%93-prepared-delivery-state-union-address.

Range and elsewhere advocate for a local voice in the development of fossil fuels, and in particular fracking, near their homes and schools, supported drilling moratoria in Ft. Collins, Longmont, Broomfield, Boulder County, and elsewhere, and worked collaboratively with the U.S. Forest Service to help protect the pristine Thompson Divide in the White River National Forest. The Sierra Club and its Rocky Mountain Chapter spent years with allies fighting to protect the Roan Plateau from oil and gas development and have been a key part of the coalition working to protect the Sunset Roadless Area and nearby wilderness-capable public lands from the harmful effects of coal mining and exploration.

I. Contents

I. The RMP Must Include Goals and Objectives for Limiting Contributions to Climate Change 4

II. BLM Must Fully Consider Additional Alternatives, Including "No Fossil Fuel Leasing" Alternatives 6

A. BLM Must Consider, and Should Adopt, an Alternative That Prohibits All Future Fossil Fuel Leasing 6

B. BLM Must Consider Other Alternatives that Limit Additional Fossil Fuel Development 9

C. BLM Must Consider Alternatives That Mandate Additional Mitigation Measures 10

1. Coal Mine Methane Capture or Flaring 10

2. Planning to Reduce Oil and Gas Methane Emissions 13

III. BLM Failed to Take a Hard Look at Numerous Impacts 14

A. The Draft RMP/EIS Fails to Consider the Full Range of Reasonably Foreseeable Oil and Gas Development 14

B. The Draft RMP/EIS Fails to Take A Hard Look at Climate Impacts 15

1. BLM Understates Greenhouse Gas Emissions 15

2. BLM Must Take A Hard Look at Indirect Effects on U.S. Energy Markets 18

3. BLM Must Address the Severity and Significance of Greenhouse Gas Emissions 21

C. The Draft RMP/EIS Fails to Take a Hard Look at Impacts to Surface and Groundwater 24

IV. Conclusion 26

II. The RMP Must Include Goals and Objectives for Limiting Contributions to Climate Change

According to the President, "no challenge poses a greater threat to our children, our planet, and future generations than climate change."[2] Climate change poses two challenges for federal agencies: first, an agency must prepare for climate change's effects on the agency's mission and actions, and second, agencies must also limit their actions' contribution to climate change.[3]

Here, the goals and objectives proposed for the RMP only do the former. BLM proposes to adopt the goal of ensuring resilience in the face of climate change. DEIS at 2-24. But BLM must also adopt the goal of preventing, rather than merely withstanding, climate change's harms, as the agency has recently done for RMPs covering adjacent areas. BLM's recently adopted RMP for the adjacent Tres Rios field office provides an appropriate example, where BLM included the following goal: "Administrative and permitted activities emit the lowest practicable greenhouse gas emissions and have the smallest ecological footprint possible to promote sustainable natural resource management."[4] Objectives adopted for individual alternatives to effectuate this goal should specify specific emission limits and budgets.

Prevention, rather than merely adaptation to, climate change is required by the Federal Land Management Policy Act ("FLPMA") and federal policy. FLPMA requires that "[i]n managing the public lands the Secretary [of the Interior] shall, by regulation or otherwise, take any action necessary to *prevent* unnecessary or undue degradation of the lands." 43 U.S.C. § 1732(b) (emphasis added). The recent Presidential Memorandum, *Mitigating Impacts on Natural Resources from Development and Encouraging Related Private Investment*, affirms that "It shall be the policy of the Department[] of … the Interior, …

---

[2] https://www.whitehouse.gov/sites/whitehouse.gov/files/achievements/atf_climate_booklet.pdf

[3] Council on Environmental Quality, Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews at 2 (August 1, 2016), https://www.whitehouse.gov/sites/whitehouse.gov/files/documents/nepa_final_ghg_guidance.pdf

[4] Record of Decision for the Approved Resource Management Plan for Public Lands Administered by the Tres Rios Field Office, Dolores, Colorado at II-63, (Feb. 27, 2015), http://www.blm.gov/style/medialib/blm/co/field_offices/san_juan_public_lands/land_use_planning/approved_lrmp.Par.81229.File.dat/TRFO%20ROD%20and%20ARMP%20508%20Compliant.pdf

to avoid and then minimize harmful effects to land, water, wildlife, and other ecological resources (natural resources) caused by land- or water-disturbing activities."[5] BLM's recently-proposed "Planning 2.0" rule recognizes that this policy should apply to land use planning, adopting "avoiding impacts" as the first and most important step in the "mitigation hierarchy," 81 Fed. Reg. at 9686, *id. at* 9725 (proposed 40 C.F.R. § 1601.0-5). President Obama has specifically instructed BLM, in its management of fossil fuel extraction on federal lands, to reduce the greenhouse gas emissions that contribute to climate change.[6]

These policies and concerns must be integrated into land use planning; they cannot be postponed to the lease or later stage. Climate change presents the quintessential situation in which BLM must "weigh long-term benefits to the public against short-term benefits," 43 U.S.C. § 1712(c)(7), and BLM's development and adoption of land use plans must consider the available scientific evidence, *id.* § 1712(c)(2), including the evidence regarding climate change, the impact of fossil fuel extraction and use in general, and the effects of *federal* fossil fuel leasing in particular.[7]

The proposed RMP's failure to adopt goals and objectives regarding limiting greenhouse gas emissions from activities in the decision area was arbitrary and capricious. BLM adopted precisely such goals in the recent amendment to plan for the adjacent Tres Rios field office, and BLM has not provided -- and cannot provide -- a rational basis for failing to do so here.

---

[5] https://www.whitehouse.gov/the-press-office/2015/11/03/mitigating-impacts-natural-resources-development-and-encouraging-related (emphasis added).

[6] *See, e.g.,* White House, Fact Sheet: Administration Takes Steps Forward on Climate Action Plan by Announcing Actions to Cut Methane Emissions (Jan. 14, 2015) https://www.whitehouse.gov/the-press-office/2015/01/14/fact-sheet-administration-takes-steps-forward-climate-action-plan-anno-1.

[7] *See, e.g.*, Peter Erickson and Michael Lazarus, How Would Phasing Out U.S. Federal Leases for Fossil Fuel Extraction Affect CO_2 Emissions and 2°C Goals? 1, 31-32, Stockholm Environment Institute Working Paper 2016-02 (May 2016), available at https://www.sei-international.org/mediamanager/documents/Publications/Climate/SEI-WP-2016-US-fossilfuel-leases-climate.pdf.

III. BLM Must Fully Consider Additional Alternatives, Including "No Fossil Fuel Leasing" Alternatives

NEPA requires agencies to "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources." 42 U.S.C. § 4332(2)(E), (2)(C). The analysis of alternatives "is characterized as 'the heart' of the environmental impact statement." *Colo. Envtl. Coal. v. Dombeck*, 185 F.3d 1162, 1174 (10th Cir. 1999) (quoting 40 C.F.R. § 1502.14). In the EIS, the agency must "[r]igorously explore and objectively evaluate *all* reasonable alternatives" in response to a "specif[ied] ... purpose and need." 40 C.F.R. §§ 1502.13, 1502.14(a) (emphasis added); *see also New Mexico ex rel. Richardson*, 565 F.3d at 703 (stating that "an EIS must 'rigorously explore and objectively evaluate' all reasonable alternatives to a proposed action, in order to compare the environmental impacts of all available courses of action," (quoting 40 C.F.R. § 1502.14)).

A. <u>BLM Must Consider, and Should Adopt, an Alternative That Prohibits All Future Fossil Fuel Leasing</u>

As the President has recognized, "ultimately, if we're going to prevent large parts of this Earth from becoming not only inhospitable but uninhabitable in our lifetimes, we're going to have to keep some fossil fuels in the ground rather than burn them and release more dangerous pollution into the sky."[8] BLM is uniquely situated among federal agencies in its ability to keep fossil fuels in the ground.

The draft RMP/EIS's elimination of alternatives that would prohibit future coal, oil, and gas leasing without detailed analysis, DEIS 2-15, was improper. BLM believed that these alternatives were: prohibited by the Federal Land Management Policy Act and Mineral Leasing Act, inconsistent with the goals adopted by the RMP, and not necessary to protect resource values. DEIS 2-16. Each argument is mistaken.

FLPMA's incorporation of "the principles of multiple use and sustained yield", 43 U.S.C. 1712(c)(1), does not preclude BLM from closing the Uncompahgre decision area, or any other land management unit, to further fossil fuel leasing. The Tenth Circuit has squarely rejected the argument that FLPMA's multiple use provisions permit BLM to exclude no lease alternatives from review in the RMP context:

[8] President Barack Obama, Statement by the President on the Keystone XL Pipeline (Nov. 6, 2015), https://www.whitehouse.gov/the-press-office/2015/11/06/statement-president-keystone-xl-pipeline

> BLM's obligation to manage for multiple use does not mean that development *must* be allowed on [a particular piece of public lands]. Development is a *possible* use, which BLM must weigh against other possible uses – including conservation to protect environmental values, which are best assessed through the NEPA process. Thus, an alternative that closes the [proposed public lands] to development does not necessarily violate the principle of multiple use, and the multiple use provision of FLPMA is not a sufficient reason to exclude more protective alternatives from consideration.

New Mexico ex rel. Richardson v. Bureau of Land Mgmt., 565 F.3d 683, 710 (10th Cir. 2009).

The keystone of multiple use is to "take[] into account the long-term needs of future generations for renewable and nonrenewable resources;" closing the planning area to future fossil fuel leasing is essential to, rather than inconsistent with, that purpose. 43 U.S.C. § 1702(3). In addition, substantial portions of the planning area will be open to fossil fuel development even if BLM closes the area to *further* leasing. Twenty-five percent of the fluid mineral estate is already leased. DEIS 4-12. Insofar as FLPMA requires some accommodation of fossil fuel extraction on federal lands, that accommodation has already been provided, as the Uncompahgre and other planning areas have been open to such extraction throughout their history, substantial portions are already leased, and development of those leases will likely continue even if areas are entirely closed to further leasing. FLPMA's principle of "multiple use" must be understood in light of the FLPMA obligation to prevent "unnecessary or undue degradation," 43 U.S.C. § 1732(b). Because BLM has not shown any need for additional fossil fuel leasing and development, and degradation caused by such development would be unnecessary and undue.

Nor does the Mineral Leasing Act preclude no-lease alternatives.[9] Contrary to the draft RMP/EIS's assertion, nothing in the MLA "directs field offices to apply the least

[9] Although not relied upon by BLM, we also note that neither the Federal Coal Leasing Act Amendments nor the Federal Onshore Oil and Gas Leasing Reform Act limit BLM's authority to close some or all areas to further coal, oil, or gas leasing in the RMP process. *See WildEarth Guardians v. Salazar*, 859 F. Supp. 2d 83, 87 (D.D.C. 2012) , 43 C.F.R. § 3425.1-8(a)(3), *Western Energy Alliance v. Salazar*, 709 F.3d 1040, 1044 (10th Cir. 2013).

restrictive management constraints necessary to achieve resource goals and objectives for principal uses of public lands" in any way that would preclude adopting an RMP that prohibits further leasing. DEIS at 2-16. Courts have consistently held that section 226 of the MLA provides BLM with the discretion to decline to issue leases. *See, e.g., Udall v. Tallman*, 30 U.S. 1, 4 (1965), *Bob Marshall All. v. Hodel*, 852 F.2d 1223, 1229-30 (9th Cir. 1988). *See also Ash Creek Min. Co. v. Lujan*, 969 F.2d 868, (10th Cir. 1992) (affirming that federal courts lack authority to order federal lands to be leased and "the decision to offer the lands in question for competitive leasing would be in the sole discretion of the Secretary. MLA § 2(a), [30] U.S.C. § 201"). The language quoted above from the Draft Plan does not appear in the MLA or the implementing regulations. BLM's Land Use Planning Handbook states that "When applying leasing restrictions, the least restrictive constraint *to meet the resource protection objective* should be used."[10] Even on its own terms, however, this non-binding policy statement does not apply to the threshold question of whether BLM can adopt a goal of reducing contribution to climate change, or objectives of eliminating greenhouse gas emissions. BLM can and should adopt such a goal, and leasing restrictions are the only means of achieving it guaranteed to be effective.

Further fossil fuel leasing categorically fails to meet even the goals and objectives proposed by the draft RMP/EIS, which would only permit coal, oil, and gas development that is "environmentally sound" or "environmentally responsible." DEIS 2-178, 2-187. As BLM has recognized, fossil fuel development is the major source of air pollution within the planning area, and the level of pollution correlates with the amount of such development. DEIS 2-385. Additional leasing and development will have significant direct and indirect effects, especially with regard to greenhouse gas emissions. Prohibiting that leasing is the only way to fully prevent the harm done by these emissions: although the draft RMP includes some technological measures to limit greenhouse gas emissions, and we have proposed others, these measures cannot reduce downstream indirect emissions, and only partially reduce direct emissions.Therefore, the only way achieve the necessary reduction in greenhouse gas emissions, and to avoid additional harm to all "resource values" impacted by climate change, is to prohibit

[10] BLM, Land Use Planning Handbook, H-1601-1 (March 11, 2005), (emphasis added) http://www.blm.gov/style/medialib/blm/wo/Information_Resources_Management/policy/blm_handbook.Par.38665.File.dat/h1601-1.pdf.

further expansion of fossil fuel extraction by closing the decision area to further leasing.[11]

Finally, prohibiting further fossil fuel leasing does not conflict with the proposed RMP/EIS's other goals. BLM proposes the goal of "provid[ing] opportunities to develop fluid minerals consistent with other resource goals and uses to support local and national energy needs," DEIS 2-187, but nothing in the draft RMP/EIS evaluates those energy needs, much less shows that satisfying those needs requires development of *additional* fossil fuels beyond areas already leased.

B. BLM Must Consider Other Alternatives that Limit Additional Fossil Fuel Development

BLM must "'[r]igorously explore and objectively evaluate all reasonable alternatives.'" *New Mexico ex rel. Richardson v. Bureau of Land Mgmt.*, 565 F.3d 683, 708 (10th Cir. 2009) (quoting 40 C.F.R. § 1502.14(a)). Here, by BLM's own admission, the alternatives selected for detailed analysis each present only a "a *slightly different* mix of resources and resource uses." DEIS 2-6 (emphasis added). BLM did not evaluate any alternative that BLM expected to result in decreases in future coal production: BLM anticipates the *exact same* level of coal production and associated air emissions across all alternatives. *See, e.g.*, DEIS at 4-27 to 4-36, 4-42. For oil and gas, BLM expects the alternatives to lead to only slight changes in production: between 16 and 19 conventional, and between 23 and 31 coalbed methane, new oil and gas wells per year.[12]

These slight differences fail to span the "full spectrum" of available alternatives.[13] For example, CEQ had explained that when considering " a proposal to designate wilderness areas within a National Forest …. [a]n appropriate series of alternatives might include dedicating 0, 10, 30, 50, 70, 90, or 100 percent of the Forest to wilderness."[14]

---

[11] *See* Land Use Planning Handbook at 24 (areas should be closed when "appropriate protection can be ensured only by closing the lands to leasing.").

[12] *See* Emissions Inventory Technical Support Document at A-1 and B-1.

[13] CEQ, "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations," Question 1, http://energy.gov/sites/prod/files/G-CEQ-40Questions.pdf.

[14] *Id.*

Here, alternatives that would have reduced future fossil fuel development below these levels were reasonable. BLM must consider alternatives that lead to reduced coal development, and more significant reductions in oil and gas activity, whether by closing areas to further fossil fuel leasing or by some other method. These alternatives should span a range of possible development intensities. For example, BLM could develop an alternative that reduces greenhouse gas emissions, relative to a no action/business as usual baseline, by the amounts specified in U.S. emission reduction targets.[15] Another benchmark would be an alternative that restricted oil and gas development to levels sufficient to avoid contributing to ozone levels that violate the recently-adopted national ambient air quality standard. DEIS 4-49 to 4-50. All told, alternatives could impose substantial restrictions on future fossil fuel leasing and development while still falling far short of "implement[ing] exclusive" or "maximum" environmental protection. DEIS 2-15.

C. BLM Must Consider Alternatives That Mandate Additional Mitigation Measures

1. Coal Mine Methane Capture or Flaring

BLM must consider and analyze alternative that requires all coal mines operating in the Uncompahgre planning area to mitigate climate impacts by capturing or flaring the mine's methane emissions. Technologies to capture or flare methane are readily available, both flaring and capture have been studied or used at coal mines in the planning area, and BLM has already confirmed that it has the authority to require methane capture and flaring at underground mines on public lands. Moreover, doing so here would generate significant savings on the greenhouse gas emissions that will result from BLM's plan over the next two decades.

As noted, NEPA requires agencies to "[r]igorously explore and objectively evaluate all reasonable alternatives" and to "[d]evote substantial treatment to each alternative considered." 40 C.F.R. § 1502.14(a)-(b). These alternatives must "include reasonable alternatives not within the jurisdiction of the lead agency." *Id.* at 1502.14(c). NEPA also requires agencies to identify measures to mitigate the adverse environmental impacts of their actions. 40 C.F.R. §§ 1502.14(f), 1502.16(h). According to CEQ's recent NEPA Climate Guidance, when analyzing the climate impacts under NEPA, "an agency

[15] We reiterate that meeting these *nationwide* targets will require *federal* agencies to do more than a pro-rata share, such that BLM should instead adopt a no fossil fuel leasing alternatives.

should compare the anticipated levels of GHG emissions from each alternative – including the no-action alternative – and mitigation actions to provide information to the public and enable the decision maker to make an informed choice."[16] Both the CEQ's 2014 Draft and 2016 Final NEPA climate guidance instruct agencies to "consider the potential for mitigation measures to reduce or mitigate GHG emissions and climate change effects when those measures are reasonable and consistent with achieving the purpose and need for the proposed action."[17] The guidance specifies that mitigation measures could include, among other things, "capturing or beneficially using GHG emissions such as methane."[18]

BLM's draft plan, however, does not address potential climate mitigation measures and does not consider an alternative requiring methane capture, methane flaring, or any other way to mitigate the climate impact of methane emissions from coal mines in the planning area. This is a significant oversight for an area containing some of the most methane-heavy mines in the country. BLM estimates that under each of the alternatives considered, coal mines in the planning area will emit more than 3 million tons of CO_2-e every year in direct emissions from operation of the mines, "primarily from fugitive methane emissions." DEIS at 4-39; *see* DEIS Tables 4-9 and 4-10, pp. 4-38, 4-39.

Although neither mitigation measures nor alternatives must be within an agency's jurisdiction in order to be incorporated in the agency's NEPA review, (40 C.F.R. 1502.14(c)), BLM has explicitly stated that it has authority to require coal mines operating on public lands to capture methane in order to mitigate climate impacts. In 2014, as part of BLM's "advanced notice of proposed rulemaking" on coal mine methane capture, BLM spelled out this authority in clear terms both as to new and existing mines:

> Based on the readjustment authority [30 U.S.C. § 207], the BLM may readjust lease terms to both authorize and require lessees to capture otherwise vented [waste mine methane] to use or sell. The BLM also has authority under the same section of the MLA to include such terms and conditions in new coal leases.[19]

[16] CEQ Guidance at 11.

[17] *Id.* at 19.

[18] *Id.*

[19] 79 Fed. Reg. 23,923 (Apr. 29, 2014) (emphasis added).

Coal mine methane generally is removed from underground mines one of two ways, and in both instances coal companies can either capture the methane and put it to beneficial use generating power or flare it in ways that lowers its climate impact. First, methane can be removed by moving vast quantities of air, including dilute quantities of methane, through a mine's ventilation system. This is termed "ventilation air methane" (often called "VAM"). Second, methane drainage wells drilled into the coal seam from above can be used to capture, flare, or (more commonly) vent methane directly into the atmosphere. Captured methane can then be used to generate electricity either at the site or sold into the marketplace. A number of underground coal mines operating on federal lands use both methods to remove methane – including the West Elk Mine, which has thus far resisted all voluntary incentives to either capture or flare its methane emissions and instead currently emits all of its methane directly into the atmosphere.

A recent report published by the state of Colorado confirms that both methane capture and flaring are feasible within the Uncompahgre planning area.[20] As explained in that 2016 report, the Oxbow mine has been flaring methane since 2012, and the West Elk mine has the potential to generate more than 17 megawatts of electricity from the mine's ventilation air methane system.[21] Moreover, EPA reported in 2014 that it had identified "40 projects where flaring has been practiced, either in conjunction with energy recovery technologies or as a stand-alone mitigation technology."[22]

BLM's failure to consider an alternative requiring methane flaring or capture as a condition of mining coal on public lands in the planning area violates NEPA and must be corrected by the agency.

---

[20] State of Colorado, Coal Mine Methane in Colorado, Market Research Report at 14 (Mar. 2016), available at https://www.colorado.gov/pacific/sites/default/files/atoms/files/Coal%20Mine%20Methane%20Report%202016%20FINAL%203_2016.pdf (last viewed Oct. 21, 2016).

[21] *Id*. at 18, 38.

[22] EPA, Coal Mine Methane Flaring: Technology and Case Studies (Sep. 2014).

2. *Planning to Reduce Oil and Gas Methane Emissions*

BLM also should have considered an alternative that would have imposed planning measures to reduce the air pollution emitted from oil and gas production by, for example:

1. Controlling the timing, pace, and location of development to maximize economies of scale in oil and gas fields;

2. Aligning oil and gas production with construction of gas capture infrastructure on the lease, unit, or communitization area so that oil production does not outpace gas capture; and

3. Synchronizing upstream production operations with midstream gas pipeline and processing capacity to ensure that gas is transported to market for sale and use by consumers.

We previously recommended these measures in comments regarding BLM's anticipated methane venting and flaring rule.[23] BLM responded by explaining that it was "considering the integrated approach suggested by the commenters" and that BLM recognized that "[p]art of the solution to flaring, … is to align the timing of well development with that of capture and processing infrastructure development, and to create incentives for operators to capture rather than flare." 81 Fed. Reg. 6616, 6662 (Feb. 8, 2016). However, neither the proposed methane rule nor the proposed RMP adopt measures to achieve this effect. Thus, at this stage, it is entirely unclear precisely how in fact BLM "is considering the integrated approach" we have recommended.

[23] See Comments submitted to the U.S. Bureau of Land Management by Western Environmental Law Center et al. on April 22, 2016, pp. 30-41 (https://www.regulations.gov/#!documentDetail;D=BLM-2016-0001-9084).

IV. BLM Failed to Take a Hard Look at Numerous Impacts

A. The Draft RMP/EIS Fails to Consider the Full Range of Reasonably Foreseeable Oil and Gas Development

The draft RMP/EIS fails to consider the full scope of reasonably foreseeable future oil and gas development, and associated environmental impacts, by failing to adequately address likely growth in Mancos Shale oil and gas development. The draft relies on outdated estimates of the amount of gas available, and fails to account for the possibility of future boom in development of this gas. By underestimating reasonably foreseeable future oil and gas development, BLM impermissibly understated the likely greenhouse gas and other air emissions from those activities.

The Reasonably Foreseeable Development Scenario for Oil and Gas for the Uncompahgre Field Office (Feb. 16, 2012) ("RFD") acknowledges that "[s]hale gas production could become important in the part of the Piceance Basin that lays in the northeast part of the Study Area ... if Mancos Shale exploration occurring there is determined to be economically successful." RFD at 57. However, the RFD and draft RMP/EIS do not appear to have included such development in their predictions of future activity. *Id.*; DEIS at 3-120 to 3-121.

Although shale gas production in the decision area has not reached levels seen in some other regions, future growth beyond that predicted in the RFD is reasonably foreseeable. As BLM recently recognized in the foreseeable development scenario for the Farmington, New Mexico office, unfavorable economics may delay "significant activity … for the Mancos gas play" for several years, but "once the economics become favorable, the activity is anticipated to rapidly increase."[24] Here, however, the forecasts of foreseeable future development do not appear to have accounted for such an increase. More broadly, the draft RMP/EIS and RFD do not appear to have followed BLM's instruction, in BLM's Fluid Mineral Leasing Handbook, to "Always assume at least one boom and bust cycle over the life of the plan."[25]

---

[24] BLM, RFD for Farmington, NM, Executive Summary (Oct. 2014), http://www.blm.gov/style/medialib/blm/nm/field_offices/farmington/farmington_planning/ffo_planning_docs/rmpa_mancos.Par.52727.File.dat/SJB%20Mancos%20RFD%20final%20report-10.27.pdf

[25] Fluid Mineral Leasing Handbook at III-8, http://www.blm.gov/style/medialib/blm/wo/Information_Resources_Management/policy/blm_handbook.Par.44374.File.dat/H_1624_1.pdf

While an increase in Mancos Shale production could be foreseen even on the basis of material cited in the RFD, the RFD and draft RMP/EIS also fail to account for recent information demonstrating that far higher levels of development are possible. The RFD relies on a 2003 assessment of the amount of gas available in the broader Uinta-Piceance Basin. RFD at 82 (citing U.S. Geological Survey Uinta-Piceance Assessment Team, 2002[26]). The USGS has recently explained that its prior assessments sorely understated technically recoverable oil and gas volumes. As USGS explained, "The previous USGS assessment of the Mancos Shale in the Piceance Basin ... estimated 1.6 trillion cubic feet of shale natural gas."[27] USGS now believes that this understates recoverable gas by a factor of 40, and that "The Mancos Shale in the Piceance Basin of Colorado contains an estimated mean of 66 trillion cubic feet of shale natural gas, 74 million barrels of shale oil and 45 million barrels of natural gas liquids."[28] These revised USGS estimates must be incorporated into the NEPA and planning process.[29]

B. The Draft RMP/EIS Fails to Take A Hard Look at Climate Impacts

1. *BLM Understates Greenhouse Gas Emissions*

The draft RMP/EIS understates impacts on climate by both understating the impact of each ton of greenhouse gas emitted and by understating the likely total of emissions.

First, the draft RMP/EIS errs by using long-outdated estimates of the "global warming potential," or "GWP," of greenhouse gases other than carbon dioxide. GWP expresses warming caused by a greenhouse gas relative to the warming caused by an equivalent mass of carbon dioxide. GWP allows emissions of non-CO_2 pollutants to be expressed in terms of CO_2-equivalent. The draft RMP/EIS uses estimates provided by the Intergovernmental Panel on Climate Change more than twenty years ago. DEIS 4-38. These estimates have twice been superseded by updated IPCC reports, most recently, in

[26] https://pubs.usgs.gov/dds/dds-069/dds-069-b/

[27] https://www.usgs.gov/news/usgs-estimates-66-trillion-cubic-feet-natural-gas-colorado-s-mancos-shale-formation

[28] *Id.*

[29] Fluid Mineral Leasing Handbook at III-4.

September 2013, when the IPCC released its Fifth Assessment Report.[30] For example, this report estimates, on the basis of more recent and thorough science, that methane from fossil sources has 36 times the global warming potential of carbon dioxide over a 100 year time frame and at least 87 times the global warming potential of carbon dioxide over a 20-year time frame.[31] Both the EPA and the Department of Energy have recognized that the newer estimates represent the best available science regarding the impact of non-CO2 GHGs. Specifically, although EPA uses the older IPCC values in compiling EPA's GHG Inventory, EPA has explained that EPA believes more recent estimates to be more accurate and better reflect scientific consensus; EPA uses the old values for the narrow purpose of compiling the inventory because the convention establishing the inventory has specified old values and has not been updated.[32] The Department of Energy has similarly recognized that the Fifth Assessment Report values using climate feedbacks (*e.g.*, 36 and 87 for methane) reflect the current scientific consensus.[33]

Second, the draft RMP/EIS understates the volume of greenhouse gases likely to be emitted by oil and gas development. BLM estimates emissions using a "bottom up" methodology that principally functions by multiplying "emission factor" estimates of emissions from individual activities, such as venting associated with completion of a single well, by "activity factors," estimates of those events' frequency. *See* Garvin Heath, *et al*., National Renewable Energy Laboratory, Estimating U.S. Methane Emissions from the Natural Gas Supply Chain at iv (August 2015) (describing these terms and methodology)[34], Air Emission Inventory Technical Support Document at 10-37 (explaining analysis conducted here).

---

[30] IPCC, Climate Change 2013: The Physical Science Basis: Chapter 8, page 714, Table 8.7.

[31] *Id.*

[32] https://www3.epa.gov/climatechange/ghgemissions/gwps.html

[33] Department of Energy, Opinion and Order 3357-C, DOE/FE Dkt. 11-161-LNG, at 30 (Dec. 4, 2015) ("We agree with Sierra Club that using 20- and 100-year methane GWPs of 87 and 36 is most appropriate for use today and that climate carbon feedbacks should be captured in the GWP values for methane."), *available at* www.fossil.energy.gov/programs/gasregulation/authorizations/2011_applications/ord3357c.pdf.

[34] http://www.nrel.gov/docs/fy16osti/62820.pdf; *but see* https://www.epa.gov/sites/production/files/2016-08/documents/revision_under_consideration_for_ghgi_ng_and_petro_uncertainty_4_2016.pdf at 2 ("For natural gas systems, calculations are commonly more complex than simply multiplying an emission factor by an activity factor.").

Here, the draft RMP/EIS relies on long-outdated inputs in applying this method of assessment. Many of the emission factor estimates used in the Air Emission Inventory TSD are taken from a *1995* EPA document. However, as EPA has recognized, those estimates were developed "when the industry practices were much different from now. In some cases, the emissions factors were developed using limited sample data and knowledge about the industry's operations (e.g., wells, compressors)."[35] More recent and accurate is available, and should have been used here. There have been numerous published, peer-reviewed studies providing more recent measurements of emissions, which BLM should have used.[36] For example, EPA, in preparing its most recent nationwide inventory of greenhouse gas emissions, "used multiple recently published studies as well as [greenhouse gas reporting program] Subpart W data to revise the [1990s era] emission factors and activity data for majority of the natural gas systems emission sources and many petroleum systems production segment emission sources."[37] Reflecting this improved data, EPA's estimate of methane emissions from the oil and gas sector rose by 34%, relative to the prior estimate.[38]

---

[35] EPA, Greenhouse Gas Emissions Reporting from the Petroleum and Natural Gas Industry: Background Technical Support Document at 47 (Apr. 12, 2010), *available at* https://www.epa.gov/sites/production/files/2015-05/documents/subpart-w_tsd.pdf.

[36] *See, e.g.*, *See* Allen, *et al.*, Measurements of methane emissions at natural gas production sites in the United States, Proceedings of the National Academy of Sciences 110:44 (Oct. 29, 2013) at 17,768-17,773, *available at* http://www.pnas.org/content/110/44/17768.full.pdf+html (supplemental appendices and tables *available at* http://www.pnas.org/content/suppl/2013/09/11/1304880110.DCSupplemental/sapp.pdf); Prasino Group, *Final Report For Determining Bleed Rates for Pneumatic Devices in British*

Columbia (Dec. 18, 2013), at 15, available at http://scek.ca/sites/default/files/ei-2014-01-final-report20140131.pdf.

[37] EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: Revisions under Consideration for Natural Gas and Petroleum Systems Uncertainty Estimates at 7, (April 2016), https://www.epa.gov/sites/production/files/2016-08/documents/revision_under_consideration_for_ghgi_ng_and_petro_uncertainty_4_2016.pdf

[38] See, e.g., Envt'l Def. Fund, New EPA Stats Confirm: Oil & Gas Methane Emissions Far Exceed Prior Estimates (Apr. 15, 2016), https://www.edf.org/media/new-epa-stats-confirm-oilgas-methane-emissions-far-exceed-prior-estimates; Gina McCarthy, Remarks on Climate Action at CERA in Houston, Texas (Feb. 24, 2016), available at https://yosemite.epa.gov/opa/admpress.nsf/8d49f7ad4bbcf4ef852573590040b7f6/5c432a7068e191e985257f630054fea8!OpenDocument (acknowledging that "methane emissions from existing sources in the oil and gas sector are substantially higher than we previously understood").

Even EPA's revised inventory likely likely underestimates the total amount of methane that is emitted by the oil and gas sector, because "bottom-up" analyses, such as the one BLM used here and EPA's inventory, consistently produce estimates far lower than those indicated by "top-down" studies that measure atmospheric concentrations of methane in areas with heavy oil and gas development, and estimate the oil and gas sector's contribution to those levels using isotopic analysis. One top-down analysis of emissions of Colorado's Denver-Julesberg Basin estimates an emission rate of 2.6% to 5.6%.[39] Another study of Utah's Uinta Basin indicated an emission rate of 6% to 12%.[40] Peer-reviewed studies that have compared bottom-up and top-down studies have recognized that top-down studies consistently produce higher estimates, and indicate likely underestimates in bottom-up studies.[41]

Here, BLM must recalculate its emission estimates using more recent data, and BLM must address whether the resulting estimates are consistent with the emissions estimates provided by these top-down studies. Because the draft RMP/EIS and air emission inventory TSD do not identify methane emissions from gas production specifically, Sierra Club, decisionmakers, and the public cannot readily provide this comparison.

2. *BLM Must Take A Hard Look at Indirect Effects on U.S. Energy Markets*

Federal agencies have long understood that decisions they make regarding management of public lands and waters impact not only the resources within those areas, but can also affect broader energy markets. By expanding or contracting the supply of coal, oil, and natural gas, BLM's decisions here will alter not only how much of the planning area's resources are used, but also the prices at which they are available

---

[39] Gabrielle Pétron et al., A New Look at Methane & Non-Methane Hydrocarbon Emissions from Oil and Natural Gas Operations in the Colorado Denver-Julesburg Basin, 119 J. Geophysical Research 6836, 6850 (2014), available at http://onlinelibrary.wiley.com/doi/10.1002/2013JD021272/epdf.

[40] Anna Karion et al., Methane Emissions Estimate from Airborne Measurements Over a Western United States Natural Gas Field, 40, Geophysical Research Letters 4393, 4393 (2013), available at http://onlinelibrary.wiley.com/doi/10.1002/grl.50811/full.

[41] A.R. Brandt et al., Methane Leaks from North American Natural Gas Systems, 343 Science 733 (2014), available at http://www.novim.org/images/pdf/ScienceMethane.02.14.14.pdf (comaring top-down and bottom-up estimates); *see also* Clean Air Task Force, NRDC, and Sierra Club, *Waste Not*: Common Sense Ways to Reduce Methane Pollution from the Oil and Natural Gas Industry at 9-11 (Jan. 2015), http://catf.us/resources/publications/files/WasteNot.pdf

in the market. Those price shifts will most certainly be significant enough to alter demand for both fossil fuels and renewable resources such as wind and solar, and those changes in the market could lead to stark differences in greenhouse gas emissions that must be quantified here. Admittedly, if each of the alternatives BLM evaluates are identical in the amount of fossil fuels produced -- as is the currently the case for coal and nearly so for oil and gas -- then the market impacts of those alternatives will be identical. However, this analysis would be particularly useful comparing BLM's action alternatives with a "no leasing" conservation alternative that limits supply of coal, oil, and natural gas. BLM's failure to even acknowledge this issue flies in the face of decades of Department of Interior precedent, ignores relevant modeling already conducted on the market and climate impacts of expanding coal production in the Uncompahgre planning area, and fails to use readily available tools that would allow BLM to analyze and disclose the climate impacts of its proposal.

As the Secretary of Interior has recognized, opening up more federal lands for fossil fuel production could not only affect the amount of coal produced, but also the amount of wind and solar generation in our energy grid. That is why, in ordering a comprehensive study of the climate impacts of the federal coal program, the Secretary directed the Department of Interior to evaluate "how the administration, availability, and pricing of Federal coal affect regional and national economies (including job impacts), and energy markets in general, including the pricing and viability of other coal resources... and other energy sources."[42] The Secretary further directed the Department to study, "[t]he impact of possible program alternatives on the projected fuel mix and cost of electricity in the United States."[43]

BLM makes no attempt to analyze market changes and instead ignores the issue altogether. Nor can BLM simply punt on market effects until it finishes that programmatic review. Simply because BLM might complete a discretionary review, untethered from any particular proposal, at some point in the future does not mean that BLM can dodge meaningful consideration of its proposals here. The Draft Plan prepared by BLM, if not vastly improved, would constitute an unlawful dodge – preventing both the public and decisionmakers from fully understanding the environmental impacts of the choice BLM is making.

---

[42] Secretarial Order 3338 at 8 (Jan. 15, 2016) available at http://www.blm.gov/style/medialib/blm/wo/Communications_Directorate/public_affairs/news_release_attachments.Par.4909.File.dat/FINAL%20SO%203338%20Coal.pdf (last visited July 1, 2016).

[43] *Id.*

BLM's failure to study the market effects of its plan is particularly egregious because BLM was a cooperating agency on the U.S. Forest Service's preparation of a supplemental Draft EIS that looked at the market effects of a proposal to open up additional lands *for coal production in much of the Uncompahgre planning area*. The U.S. Forest Service's 2015 analysis, though flawed in significant respects, nonetheless used a robust energy-economy model to predict impacts to wind and solar generation from a proposal that would open up approximately 170 million tons of coal on otherwise protected lands in Colorado. After using ICF's Integrated Planning Model to study the market and climate impacts of its proposal, the Forest Service concluded:

> Changes in gross production and consumption of coal from the North Fork Coal Mining Area are expected to have an effect on production and consumption of other fuel sources, including alternative supplies of coal, natural gas, and other energy supplies such as renewables.[44]

The Forest Service explained that opening up 170 million tons of coal for mining would cause "the mixture of fuels [to] shift[], including increases in production and consumption of underground coal, and decreases in production and consumption of substitute fuel sources such as surface coal, natural gas, and renewable energy," with the result being a net 131 million ton increase in greenhouse gas emissions.[45] As a cooperating agency to that analysis, BLM cannot now pretend that it does not exist. If the BLM no longer stands by that analysis, it should say so. If it somehow does not think the analysis is relevant to BLM's decision here, it should say so. But ignoring recent analysis looking at the same resources studied here, prepared with input from the same agency, is arbitrary and capricious.

In addition to the recent Forest Service analysis, ICF International's Integrated Planning Model has been used to evaluate these types of market responses to numerous state and federal proposals in recent years. A recent, but by no means exhaustive list, of examples include the following projects and analyses: EPA, Clean Power Plan; State Department, Keystone XL Pipeline; Surface Transportation Board, Tongue River Railroad; and

---

[44] U.S. Forest Service, Rulemaking for Colorado Roadless Areas Supplemental Draft Environmental Impact Statement, p. 80 (November 2015), *available at* http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd485194.pdf (last visited Nov. 1, 2016).

[45] *Id.* at 81.

Washington Department of Ecology, Millennium Bulk Export Terminal. There are additional energy market models that could further inform BLM's evaluation here, particularly with regard to oil and gas. We point to the recent use of the Integrated Planning Model not to suggest BLM must use this particular model in revamping its analysis, but rather to note that this analysis can and has been done across a wide range of agencies studying the market and climate impacts of a variety of fossil fuel extraction and infrastructure proposals. BLM's refusal to study the market impacts of its decision here is thus not only out of touch with how energy markets work, it is out of step with the way in which other federal agencies review the market and climate impacts of their decisions under NEPA.

Understanding the market and climate impacts of a decision to allow extensive development of coal, oil, and natural gas resources is essential to making an informed decision -- particularly when weighed against an alternative that would prohibit new fossil fuel leasing in the area, as Sierra Club and others have advocated. BLM violated NEPA by failing to either use available tools to provide that essential information or explain why it could not do so. Under NEPA regulations, agencies "shall" explain in an EIS (1) why essential information is incomplete or unavailable; (2) its relevance to reasonably foreseeable impacts; (3) a summary of existing science on the topic; and (4) the agency's evaluation based on any generally accepted theoretical approaches. 40 C.F.R. § 1502.22(b). BLM's failure to conduct this analysis violates NEPA and must be corrected before BLM finalizes the Uncompahgre RMP revision.

3. *BLM Must Address the Severity and Significance of Greenhouse Gas Emissions*

In addition to correcting BLM's flawed assessment of the amount and potency of greenhouse gas emissions, BLM must provide discussion and context for assessing the severity or significance of those emissions. One way to do so is by using the social cost of carbon dioxide and other greenhouse gases, as discussed in the separate comments submitted by Western Environmental Law Center *et al*., p. 62-68. Another tool BLM must use is to address the impact of BLM's management plan for the Uncompahgre planning area -- which anticipates adding more than half a billion tons of CO2-e to the atmosphere over the next twenty years -- on the numerous federal policies and international agreements that call for steep reductions in U.S. greenhouse gas emissions by 2025 and 2030.

In order to take the hard look NEPA requires, BLM must provide the public and decision-makers with an up to date review of the Obama Administration's climate objectives and international climate agreements and assess whether its Draft Plan is consistent with those goals and commitments.

NEPA regulations direct federal agencies, "to discuss any inconsistency of a proposed action with any approved State or local plan and laws (whether or not federally sanctioned)," 40 C.F.R. § 1506.2(d), and require agencies to address "possible conflicts between the proposed action and the objectives of Federal, regional, State, and local (and in the case of a reservation, Indian tribe) land use plans, policies and controls for the area concerned." 40 C.F.R. § 1502.16(c). CEQ's NEPA Climate Guidance interprets these regulations to encompass the requirement to address "approved federal, regional, state, tribal, or local plans, policies, or laws for GHG emission reductions or climate adaptation to make clear whether a proposed project's GHG emissions are consistent with such plans or laws."[46]

BLM has made no attempt to comply with this mandate. The U.S. has set ambitious greenhouse gas emission reduction targets and established itself as an international leader on protecting the climate. For example, in December 2015 the international climate summit in Paris produced an historic agreement establishing the ambitious goal of limiting warming to 1.5 degrees Celsius above pre-industrial times, a target that will require ambitious emission reductions beyond those currently identified.[47]

Domestically, President Obama's Clean Power Plan, currently stayed pending litigation, calls for reducing power sector emissions to 30 percent below 2005 levels by 2030.[48] In November 2014, the President announced a joint U.S.-China agreement aimed at reducing climate pollution that called for even more aggressively cutting net greenhouse gas emissions to 26-28 percent below 2005 levels by 2025. *Id.*

---

[46] CEQ NEPA Climate Guidance at 28-29.

[47] White House, U.S. Leadership and the Historic Paris Agreement to Combat Climate Change (Dec. 12, 2015), https://www.whitehouse.gov/the-press-office/2015/12/12/us-leadership-and-historic-paris-agreement-combat-climate-change (last visited Oct. 30, 2016).

[48] White House Fact Sheet, U.S.-China Joint Announcement on Climate Change and Clean Energy Cooperation (November 11, 2014), available at http://www.whitehouse.gov/the-press-office/2014/11/11/fact-sheet-us-china-joint-announcement-climate-change-and-clean-energy-c (last visited Oct. 30, 2016).

Although much of the climate information in BLM's Draft Plan is from 2010 or earlier, recent climate science demonstrates that increasing greenhouse gas emissions from coal, oil, and natural gas extraction and combustion would undermine our national climate objectives and conflict with the international commitments our country made as part of the historic United Nations Framework Convention on Climate Change conference in Paris in December 2015.

In September 2016, both the White House Council of Economic Advisors and the peer-reviewed journal Nature published reports concluding that existing domestic climate policies are very likely insufficient to meet our commitments made as part of the December 2015 Paris Agreement.[49] Even the White House's own analysis shows that existing policies -- including the currently stayed Clean Power Plan -- *might* allow us to meet our Paris commitments, but only if we make the most optimistic assumptions possible for each of several uncertainties in our assessment of likely emissions and their impact.

Finally, Oil Change International's recent "The Sky's Limit" report identifies the global carbon budget needed to reach the Paris and Clean Power Plan emission reduction goals and concludes that "[t]he oil, gas, and coal in already-producing fields and mines are more than we can afford to burn while keeping likely warming below 2°C;" and that "[t]he oil and gas alone [in already producing fields] are more than we can afford for a medium chance of keeping to 1.5°C."[50] The report further concludes that "at current rates of emissions, the carbon budget for a likely chance of limiting warming to 2°C will be fully exhausted by 2037, and by 2025 for a medium chance at 1.5°C."[51] This dramatic finding underscores the urgent need to take immediate and drastic steps to reduce greenhouse gas emissions. Merely ten more years of status quo emissions would

---

[49] Jeffrey B. Greenblatt and Max Wei, Assessment of the climate commitments and additional mitigation policies of the United States, Nature Climate Change (Sept. 26, 2016); White House Council of Economic Advisors, The Economic Record of the Obama Administration: Addressing Climate Change (Sept. 2016), available at https://www.whitehouse.gov/sites/default/files/page/files/20160921_record_climate_energy_cea.pdf (last viewed Sept. 30, 2016).

[50] Oil Change International, The Sky's Limit: Why The Paris Climate Goals Require A Managed Decline Of Fossil Fuel Production, ES-6 (Sep. 2016), and available at http://priceofoil.org/content/uploads/2016/09/OCI_the_skys_limit_2016_FINAL_2.pdf.

[51] *Id.* at 12.

entirely exhaust the total amount of carbon dioxide we can emit – forever – and still have even a "medium chance (50%)" of limiting global temperatures to the internationally-agreed upon 1.5°C increase above pre-industrial times.[52]

Decisions that purport to merely extend the status quo for greenhouse gas emissions would in reality drive us dangerously close to expensive and destructive global temperature increases. BLM must acknowledge this reality in order to give the public and decisionmakers the appropriate context in which to view the competing alternatives here. As proposed, BLM's Draft plan predicts that the coal, oil, and natural gas generated in the Uncompahgre planning area over the twenty years would release more than half a billion tons of CO2-e into our atmosphere. BLM's plan is thus in direct conflict with our international climate commitments and domestic greenhouse gas reduction targets, but BLM fails to reconcile or even acknowledge this conflict.

More fossil fuel leasing, or even a continuation of the status quo, is totally out of step both with our Administration's priorities and the latest science on the urgent need to reduce greenhouse gas emissions. At a minimum, NEPA requires BLM to address these inconsistencies and explain the extent of the conflict so that both the public and decisionmakers have an accurate understanding of the climate impacts of BLM's proposal.

C. The Draft RMP/EIS Fails to Take a Hard Look at Impacts to Surface and Groundwater

BLM has recognized, as it must, that fluid mineral leasing, exploration, and development impact water resources. "Use, storage, and transportation of fluids, such as produced water, hydraulic fracturing fluids, and condensate, have the possibility of spills that could migrate to surface or groundwater, causing human health impacts." DEIS 4-83. Waters can also be affected by activities other than fluid spills, such as sedimentation or mobilization of underground contaminants. "Hydraulic fracturing," in particular, "could disturb surface water and groundwater hydrology and impact water quality." DEIS 4-130.

[52] *Id.* at 13.

However, BLM failed to take a hard look at these impacts. While we summarize many areas where additional analysis is required in the companion comment submitted with Western Environmental Law Center *et al.*, we highlight several of these impacts here.

For one, BLM cannot provide a "hard look" at the impacts of spills without discussing the contaminants that might be present in spilled fluid. BLM recognizes that fracturing fluid contains numerous "chemical additives," and that hydraulic fracturing presents a risk of spill of these chemicals, or of fracturing fluid or wastewater that contains them. DEIS 4-83; *see also id.* at 4-61, 4-80,[53] 4-445. But BLM provides no discussion of what these additives might be, the amounts used, or the consequences of a spill of any particular additive, chemical, or other hazardous material.

We agree that, insofar as hydraulic fracturing occurs at all, the chemicals used should be "biodegradable, non-toxic neutral pH, residual free, non-corrosive, non-polluting and non-hazardous in the forms and concentrations being used," and we support BLM's identification of this as a "best management practice." DEIS at G-10. BLM must do more, however, and prohibit use of chemicals that fail to meet these criteria. The draft RMP/EIS does not clearly state that adherence to identified best management practices is mandatory. Even if BLM requires that additives meet this standard, a "hard look" requires BLM to identify chemicals that are likely to be used, and to assess the impacts of a spill of those particular chemicals.

In addition to discussing the particular chemicals that will foreseeably be used and potentially spilled, BLM must take a hard look at the broader efficacy of the BLM's Onshore Orders, the Colorado Oil and Gas Conservation Commission's requirements for well completions, and the "stipulations and site-specific condition of approvals for drilling, completions, and fluids management" that BLM asserts will protect water resources. DEIS at 4-83. As explained by BLM's Handbook on Planning for Fluid Mineral Resources, it is not enough for BLM to identify mitigation measures: BLM must take a hard look at "The residual impacts that would remain following the application of the mitigation measures ... *i.e.*, effectiveness of mitigation measures in ameliorating potential impacts."[54] *See New York v. Nuclear Regulatory Comm'n*, 681 F.3d 471, 481 (D.C.

[53] The DEIS identifies "spills of hazardous materials *in water bodies*" as an "indicator" of impacts on water resources. DEIS at 4-80 (emphasis added). BLM must recognize that spills are likely to impact water resources even when the spill is not directly into a water body; for example, material spilled on soil can be mobilized by rain and then reach surface or groundwater.

[54] Planning for Fluid Mineral Resources at III-8.

Cir. 2012) ("merely pointing to [a] compliance program is in no way sufficient to support a scientific finding" of no "significant environment[al] impact."). BLM has not provided such an analysis. For example, although BLM argues that effects would be minimized by adherence to BLM's onshore orders, DEIS 4-83, in formulating Onshore Order #8, "Oil and Gas; Hydraulic Fracturing on Federal and Indian Lands," BLM's NEPA analysis was "not intended to analyze the effects that may result from actual hydraulic fracturing activities," and instead only considered the incremental effects of the "procedures" the rule would require "prior to, during, and subsequent to hydraulically fracturing an oil and gas well," such as performing a cement evaluation log.[55]

In short, although BLM has recognized that fluid mineral development in general, and hydraulic fracturing of shale and other tight formations in particular, poses a risk of spills or other releases of hazardous chemicals into the environment, BLM has not provided an assessment of the likelihood of such a release or the consequences thereof. This falls far short of the hard look NEPA requires.

V. Conclusion

We appreciate your consideration of these comments, and BLM's willingness to facilitate public participation by extending the public comment period. For the reasons described above, however, we believe the draft RMP/EIS to be seriously flawed in its treatment of fossil fuel production. BLM should consider and adopt an alternative that prohibits further fossil fuel leasing, and additional analysis is needed to provide a hard look at the impacts of fossil fuel development.

Sincerely,

Nathan Matthews
Staff Attorney
Sierra Club
2101 Webster Street, Suite 1300
Oakland, CA 94612
415.977.5695
nathan.matthews@sierraclub.org

Nathaniel Shoaff
Staff Attorney
Sierra Club Environmental Law Program
2101 Webster Street, Suite 1300
Oakland, CA 94612
415.977.5610
nathaniel.shoaff@sierraclub.org

[55] BLM, Environmental Assessment: Proposed Hydraulic Fracturing Rule, at 4, https://www.regulations.gov/contentStreamer?documentId=BLM-2013-0002-0003.

From: Boyd, David
To: David Boyd
Subject: News Release: BLM releases environmental assessment on May 2017 oil and gas lease parcels
Date: Wednesday, November 9, 2016 4:37:05 PM
Attachments: May 17 lease EA nr11-9-16.pdf

News Release
White River Field Office, Colorado

Nov. 9, 2016

Contact: David Boyd, Public Affairs Specialist, (970) 876-9008
Courtney Whiteman, Public Affairs Specialist, (303) 239-3668

BLM releases environmental assessment on May 2017 oil and gas lease parcels
Proposal includes lands in Grand, Jackson, Moffat, Rio Blanco and Routt counties

MEEKER, Colo. – Today the Bureau of Land Management began a 30-day public comment period on a preliminary environmental assessment evaluating offering about 100,000 acres of federal minerals in northwestern Colorado for oil and gas leasing.

The environmental assessment, maps and lease stipulations are available for review at http://on.doi.gov/2b39pWq.

The proposal includes 20 parcels totaling 27,529 acres in Grand County; 12 parcels totaling 9,155 acres in Jackson County; four parcels totaling 1,928 acres in Moffat County; 45 parcels totaling 45,159 acres in Rio Blanco County; and 25 parcels totaling 16,885 acres in Routt County.

The BLM received 119 comments during the public scoping period announced in August to help identify issues to be addressed in this environmental assessment.

“Public involvement is an important part of our evaluation of the proposal,” said Northwest District Manager Andrew Archuleta. “The most effective comments during this comment period will be specific to the proposal and the environmental assessment.”

Comments need to be received by Dec. 12, 2016. They should be e-mailed to blm_co_may_2017_lease_sale@blm.gov, or mailed to the White River Field Office, Attn: May 2017 Lease Sale, 220 E. Market St., Meeker, CO 81641.

The State of Colorado receives 49 percent of the proceeds from each mineral lease sale and from mineral royalties, with the remainder going to the U.S. government. In Fiscal Year 2015, Colorado received about $247 million from royalties, rentals and bonus bid payments for all federal minerals, including oil and gas. Statewide, more than 22,900 jobs are tied to mineral and energy development on public lands.

Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment—including your personal identifying information—may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

# # #

--

David Boyd

Bureau of Land Management

Public Affairs Specialist

NW Colorado District

(970) 876-9008
(970) 319-4130 (cell)

U.S. Department of the Interior
Bureau of Land Management

News Release

White River Field Office, Colorado

Nov. 9, 2016

Contact: David Boyd, Public Affairs Specialist, (970) 876-9008
Courtney Whiteman, Public Affairs Specialist, (303) 239-3668

BLM releases environmental assessment on May 2017 oil and gas lease parcels

Proposal includes lands in Grand, Jackson, Moffat, Rio Blanco and Routt counties

MEEKER, Colo. – Today the Bureau of Land Management began a 30-day public comment period on a preliminary environmental assessment evaluating offering about 100,000 acres of federal minerals in northwestern Colorado for oil and gas leasing.

The environmental assessment, maps and lease stipulations are available for review at http://on.doi.gov/2b39pWq.

The proposal includes 20 parcels totaling 27,529 acres in Grand County; 12 parcels totaling 9,155 acres in Jackson County; four parcels totaling 1,928 acres in Moffat County; 45 parcels totaling 45,159 acres in Rio Blanco County; and 25 parcels totaling 16,885 acres in Routt County.

The BLM received 119 comments during the public scoping period announced in August to help identify issues to be addressed in this environmental assessment.

“Public involvement is an important part of our evaluation of the proposal,” said Northwest District Manager Andrew Archuleta. “The most effective comments during this comment period will be specific to the proposal and the environmental assessment.”

Comments need to be received by Dec. 12, 2016. They should be e-mailed to blm_co_may_2017_lease_sale@blm.gov, or mailed to the White River Field Office, Attn: May 2017 Lease Sale, 220 E. Market St., Meeker, CO 81641.

The State of Colorado receives 49 percent of the proceeds from each mineral lease sale and from mineral royalties, with the remainder going to the U.S. government. In Fiscal Year 2015, Colorado received about $247 million from royalties, rentals and bonus bid payments for all federal minerals, including oil and gas. Statewide, more than 22,900 jobs are tied to mineral and energy development on public lands.

Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment—including your personal identifying information—may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

# # #

From: Boyd, David
To: David Boyd
Subject: CORRECTED News Release: BLM releases environmental assessment on May 2017 oil and gas lease parcels
Date: Thursday, November 10, 2016 12:29:21 PM

Reflects corrected web link. May 2017 Lease sale.

News Release
White River Field Office, Colorado

Nov. 10, 2016

Contact: David Boyd, Public Affairs Specialist, (970) 876-9008
Courtney Whiteman, Public Affairs Specialist, (303) 239-3668

BLM releases environmental assessment on May 2017 oil and gas lease parcels
Proposal includes lands in Grand, Jackson, Moffat, Rio Blanco and Routt counties

MEEKER, Colo. – Today the Bureau of Land Management began a 30-day public comment period on a preliminary environmental assessment evaluating offering about 100,000 acres of federal minerals in northwestern Colorado for oil and gas leasing in the May 2017 competitive lease sale.

The environmental assessment, maps and lease stipulations are available for review at http://on.doi.gov/2fAHITp.

The proposal includes 20 parcels totaling 27,529 acres in Grand County; 12 parcels totaling 9,155 acres in Jackson County; four parcels totaling 1,928 acres in Moffat County; 45 parcels totaling 45,159 acres in Rio Blanco County; and 25 parcels totaling 16,885 acres in Routt County.

The BLM received 119 comments during the public scoping period announced in August to help identify issues to be addressed in this environmental assessment.

“Public involvement is an important part of our evaluation of the proposal,” said Northwest District Manager Andrew Archuleta. “The most effective comments during this comment period will be specific to the proposal and the environmental assessment.”

Comments need to be received by Dec. 12, 2016. They should be e-mailed to blm_co_may_2017_lease_sale@blm.gov, or mailed to the White River Field Office, Attn: May 2017 Lease Sale, 220 E. Market St., Meeker, CO 81641.

The State of Colorado receives 49 percent of the proceeds from each mineral lease sale and from mineral royalties, with the remainder going to the U.S. government. In Fiscal Year 2015, Colorado received about $247 million from royalties, rentals and bonus bid payments for all federal minerals, including oil and gas. Statewide, more than 22,900 jobs are tied to mineral and energy development on public lands.

Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment—including your personal identifying information—may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

# # #

--

David Boyd

Bureau of Land Management

Public Affairs Specialist

NW Colorado District

(970) 876-9008
(970) 319-4130 (cell)

From: Boyd, David
To: David Boyd
Subject: News Release: BLM's Northwest Resource Advisory Council meets Dec. 8 in Grand Junction
Date: Tuesday, November 22, 2016 12:12:55 PM
Attachments: agenda dec 16 NW RAC 12-8-16.pdf
NW RAC Dec 16 nr 11-21-16.pdf

News Release
Northwest District, Colorado

Nov. 22, 2016

Contact: David Boyd, Public Affairs Specialist, (970) 876-9008

BLM's Northwest Resource Advisory Council meets Dec. 8 in Grand Junction

SILT, Colo. – The Bureau of Land Management's Northwest Resource Advisory Council will meet Thursday, Dec. 8 in Grand Junction at the Courtyard Marriott, 765 Horizon Drive.

The meeting runs from 8 a m. to 3 p m. and is open to the public, with public comment periods related to items on the agenda scheduled for 10 a.m. and 2 p m.

Agenda items include an overview of BLM's oil and gas leasing program, a BLM budget overview, the proposed Buffalo Horn Land Exchange, vegetation treatments for Greater Sage Grouse, and field office updates.

The Northwest Colorado RAC meets quarterly in northwestern Colorado. It is one of several citizen advisory councils to BLM Colorado. Its 15 members are appointed by the Secretary of the Interior and represent a broad range of public land interests, including environmental, local government, wild horse and burro, and commercial activity. The Northwest RAC advises the BLM Colorado Northwest District, which includes the Colorado River Valley, Kremmling, Little Snake and White River field offices. For more information about the NW RAC, visit: https://www.blm.gov/get-involved/resource-advisory-council/near-you/colorado/northwest-rac.

###

Northwest Colorado Resource Advisory Council Meeting
Dec. 8, 2016

Courtyard by Marriott
Grand Junction, Colorado

AGENDA
8 a m. – Housekeeping

8:05 a.m. – Introductions

8:15 a.m. – RAC 101, Success Stories, Lessons Learned – David Boyd

9 a m. – Proposed Buffalo Horn Land Exchange – Heather Sauls

9:30 a.m. – Vegetation Treatments Programmatic EA – Erin Jones

10 a m. – Public comment period

10:15 a m. – Break

10:30 a m. – District and Field Manager Updates

11:15 a m. – BLM Budget overview – Amy Carmichael

Noon – Working Lunch

12:30 p m. – Federal Oil and gas Leasing Overview – Lonny Bagley

2 p.m. – Public comment period

2:15 p m. – Group discussion, resolutions other tasks

2:30 p m. – Schedule 2017 NW RAC meetings – Boyd
• Suggested dates: Feb. 22-23, Silt; May 17-18, Meeker; Aug. 16-17; Dec. 6-7

2:50 p m. Next meeting agenda items

3 p.m. Adjourn

--

David Boyd

Bureau of Land Management

Public Affairs Specialist

NW Colorado District

(970) 876-9008
(970) 319-4130 (cell)

BLM Resource Advisory Councils

Partners Across The West

Northwest Colorado Resource Advisory Council Meeting

Dec. 8, 2016

Courtyard by Marriott
Grand Junction, Colorado

AGENDA

8 a.m. – Housekeeping

8:05 a.m. – Introductions

8:15 a.m. – RAC 101, Success Stories, Lessons Learned **–** David Boyd

9 a.m. – Proposed Buffalo Horn Land Exchange – Heather Sauls

9:30 a.m. – Vegetation Treatments Programmatic EA – Erin Jones

10 a.m. – Public comment period

10:15 a.m. – Break

10:30 a.m. – District and Field Manager Updates

11:15 a.m. – BLM Budget overview – Amy Carmichael

Noon – Working Lunch

12:30 p.m. – Federal Oil and gas Leasing Overview – Lonny Bagley

2 p.m. – Public comment period

2:15 p.m. – Group discussion, resolutions other tasks

2:30 p.m. – Schedule 2017 NW RAC meetings – Boyd

- Suggested dates: Feb. 22-23, Silt; May 17-18, Meeker; Aug. 16-17; Dec. 6-7

2:50 p.m. Next meeting agenda items

3 p.m. Adjourn

U.S. Department of the Interior
Bureau of Land Management

News Release

Northwest District, Colorado

Nov. 22, 2016

Contact: David Boyd, Public Affairs Specialist, (970) 876-9008

BLM's Northwest Resource Advisory Council meets Dec. 8 in Grand Junction

SILT, Colo. – The Bureau of Land Management's Northwest Resource Advisory Council will meet Thursday, Dec. 8 in Grand Junction at the Courtyard Marriott, 765 Horizon Drive.

The meeting runs from 8 a.m. to 3 p.m. and is open to the public, with public comment periods related to items on the agenda scheduled for 10 a.m. and 2 p.m.

Agenda items include an overview of BLM's oil and gas leasing program, a BLM budget overview, the proposed Buffalo Horn Land Exchange, vegetation treatments for Greater Sage Grouse, and field office updates.

The Northwest Colorado RAC meets quarterly in northwestern Colorado. It is one of several citizen advisory councils to BLM Colorado. Its 15 members are appointed by the Secretary of the Interior and represent a broad range of public land interests, including environmental, local government, wild horse and burro, and commercial activity. The Northwest RAC advises the BLM Colorado Northwest District, which includes the Colorado River Valley, Kremmling, Little Snake and White River field offices. For more information about the NW RAC, visit: https://www.blm.gov/get-involved/resource-advisory-council/near-you/colorado/northwest-rac.

###

From: Kyle Tisdel
To: NMLeasesalecomments@blm.gov
Subject: Protest, Jan 2017 Lease Sale
Date: Monday, December 5, 2016 4:21:40 PM
Attachments: Protest_FFO Jan 2017 Lease_12.6.16.pdf

Please find the attached Protest, submitted on behalf of Amigos Bravos, Center for Biological Diversity, Chaco Alliance, Diné CARE, Earthworks, Friends of the Earth, Natural Resources Defense Council, San Juan Citizens Alliance, Sierra Club, and WildEarth Guardians, concerning the January 2017 oil and gas lease sale. I have also sent a hard copy of the protest and exhibits via FedEx overnight delivery. Should you have any questions please do not hesitate to contact me.

Regards.

_____

Kyle J. Tisdel
Attorney, Climate & Energy Program Director
Western Environmental Law Center
208 Paseo del Pueblo Sur, #602
Taos, New Mexico 87571
Ph: 575.613.8050

tisdel@westernlaw.org

www.westernlaw.org

Defending the West

_____

Northwest
1216 Lincoln Street
Eugene, Oregon 97401
(541) 485-2471

Rocky Mountains
103 Reeder's Alley
Helena, Montana 59601
(406) 443-3501

Southwest
208 Paseo del Pueblo Sur #602
Taos, New Mexico 87571
(575) 751-0351

Defending the West www.westernlaw.org

Western Environmental Law Center

December 6, 2016

Sent via Overnight Express Delivery

Amy Lueders, New Mexico State Director
U.S. Bureau of Land Management
New Mexico State Office
301 Dinosaur Trail
Santa Fe, New Mexico 87508
Email: NMLeasesalecomments@blm.gov

Re: PROTEST: DOI-BLM-NM-F010-2016-0001-EA
Farmington Field Office, January 2017 Oil & Gas Lease Sale

Dear State Director Lueders:

The Western Environmental Law Center, along with Amigos Bravos, Center for Biological Diversity, Chaco Alliance, Diné Citizens Against Ruining Our Environment, Earthworks, Friends of the Earth, Natural Resources Defense Council, San Juan Citizens Alliance, Sierra Club, and WildEarth Guardians (together "Citizen Groups"), submit the following Protest regarding the Bureau of Land Management ("BLM") Farmington Field Office ("FFO") Environmental Assessment ("EA") and unsigned Finding of No Significant Impact ("FONSI") for the January 2017 Oil and Gas Lease Sale, which includes four parcels and approximately 843 acres of Federal mineral estate in the Greater Chaco area, south of Counselor, NM.

INTEREST OF PROTESTING PARTIES

The **Western Environmental Law Center** ("WELC") uses the power of the law to defend and protect the American West's treasured landscapes, iconic wildlife and rural communities. WELC combines legal skills with sound conservation biology and environmental science to address major environmental issues in the West in the most strategic and effective manner. WELC works at the national, regional, state, and local levels; and in all three branches of government. WELC integrates national policies and regional perspective with the local knowledge of our 100+ partner groups to implement smart and appropriate place-based actions.

Amigos Bravos is a statewide river conservation organization guided by social justice principles. Amigos Bravos' mission is to protect and restore the waters of New Mexico, and ensure that those waters provide a reliable source of clean water to the communities and farmers that depend on them, as well as a safe place to swim, fish, and go boating. Amigos Bravos works locally, statewide, and nationally to ensure that the waters of New Mexico are protected by the best policy and regulations possible.

The **Center for Biological Diversity** ("Center") is a non-profit environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center also works to reduce greenhouse gas emissions to protect biological diversity, our environment, and public health. The Center has over one million members and activists, including those living in New Mexico who have visited these public lands in the FFO for recreational, scientific, educational, and other pursuits and intend to continue to do so in the future, and are particularly interested in protecting the many native, imperiled, and sensitive species and their habitats that may be affected by the proposed oil and gas leasing.

The **Chaco Alliance** is a grassroots citizens group dedicated to protecting and preserving Chaco Culture National Historical Park. We are interested in all threats to the park and its surrounding landscape, especially the threat created by energy development in the area.

Diné Citizens Against Ruining Our Environment ("Diné C.A.R.E.") is an all-Navajo organization comprised of a federation of grassroots community activists in Arizona, New Mexico and Utah who strive to educate and advocate for our traditional teachings derived from our Diné Fundamental Laws. Our goal is to protect all life in our ancestral homeland by empowering local and traditional people to organize, speak out, and determine the outlook of the environment through civic involvement and engagement in decision-making process relating to tribal development.

Earthworks is a nonprofit organization dedicated to protecting communities and the environment from the adverse impacts of mineral and energy development while promoting sustainable solutions. Earthworks stands for clean air, water and land, healthy communities, and corporate accountability. We work for solutions that protect both the Earth's resources and our communities.

Friends of the Earth is a 501(c)(3) organization with over 33,000 members and 496,000 activists nationwide. Friends of the Earth fights to create a more healthy and just world. Our current campaigns focus on promoting clean energy and solutions to climate change, ensuring the food we eat and products we use are safe and sustainable, and protecting marine ecosystems and the people who live and work near them. Friends of the Earth advocates for an end to all new federal fossil fuel lease sales like the one planned for January 2017 from the BLM Farmington Field Office. Our members and activists have submitted comments during NEPA reviews of dozens of proposed coal, oil and gas lease sales, and 41,761 members sent petitions to President Obama to demand executive action to stop all new federal fossil fuel lease sales to protect public lands and waters and combat climate change.

Natural Resources Defense Council ("NRDC") is a non-profit environmental membership organization with more than 440,000 members throughout the United States. Approximately 5,000 of these members reside in New Mexico. NRDC members use and enjoy public lands in New Mexico, including lands managed by the Bureau of Land Management within the Farmington Field Office planning area. NRDC members use and enjoy these lands for a variety of purposes, including: recreation, solitude, scientific study, and conservation of natural resources. NRDC has had a longstanding and active interest in the protection of public lands in New Mexico, the responsible development of oil and gas resources, and the protection of public health from environmental threats.

Founded in 1986, **San Juan Citizens Alliance** ("SJCA") organizes people to protect our water and air, our lands, and the character of our rural communities in the San Juan Basin. SJCA focuses on four program areas, including the *San Juan Basin Energy Reform Campaign*, which ensures proper regulation and enforcement of the oil, gas, and coal industry and transitioning to a renewable energy economy. SJCA has been active in BLM and National Forest oil and gas issues in the San Juan Basin since the early 1990s, and has commented on virtually every multi-well drilling program, lease sale, and programmatic environmental review conducted in the region by the federal land management agencies since the early 1990s. SJCA's members live, work, and recreate throughout the San Juan Basin and San Juan Mountains. SJCA's members' health, use and enjoyment of this region is directly impacted by the decisions identified in this protest.

Sierra Club was founded in 1892 and is the nation's oldest grassroots environmental organization. The Sierra Club is incorporated in California, and has approximately 600,000 members nationwide and is dedicated to the protection and preservation of the environment. The Sierra Club's mission is to explore, enjoy and protect the wild places of the earth; to practice and promote the responsible use of the earth's ecosystems and resources; and to educate and enlist humanity to protect and restore the quality of the natural and human environments. The Sierra Club has a New Mexico chapter, known as the Rio Grande chapter, with members that live in and use this area for recreation such as hiking, climbing, backpacking, camping, fishing and wildlife viewing, as well as for business, scientific, spiritual, aesthetic and environmental purposes.

WildEarth Guardians protects and restores wildlife, wild places, wild rivers, and the health of the American West. As part of its Climate and Energy Program, Guardians works to advance clean energy and expose the true cost of fossil fuels. Guardians works to protect and restore the San Juan Basin in northwestern New Mexico in order to safeguard its cultural heritage, natural values, communities, and open spaces.

Citizen Groups Protest All Four Parcels

Citizen Groups protest the inclusion of all four parcels to be offered in the January 2017 lease sale, as identified below by Lease Parcel Number:

NM-201701-001; NM-201701-002; NM-201701-003; NM-201701-004.

These four parcels all involve Navajo Allotment lands, with a federal mineral estate administered by the FFO. Citizen Groups' Protest is focused on potential impacts to the planning area from oil and gas development authorized by BLM action, and are specifically concerned with impacts to air quality, greenhouse gas ("GHG") emissions and waste, climate change, water resources, human communities, as well as other land use values in the planning area. Citizen Groups find it particularly troubling that, despite our extensive comments outlining deficiencies with the preliminary EA and the agency's failure to take a hard look at site-specific impacts, the final EA closely mirrors the draft. Accordingly, our Protest reiterates many of the same concerns expressed in our earlier comments.

The four Navajo Allotment parcels included in the sale and similar parcels that have already been deferred or postponed *three times* by the agency, having recognized the need for additional consultation and baseline landscape level review. These parcels were first included in the original group of 26 parcels proposed for BLM's October 2014 oil and gas lease sale, DOI-BLM-NM-F010-0154-EA, and were then amongst the five parcels included in the January 2015 lease sale, DOI-BLM-NM-F010-2014-0227-EA. Most recently, three parcels were included in the October 2016 lease sale, which was postponed this spring. Notably, these parcels were earlier "deferred until after the FFO Mancos Shale/Gallup Formation RMPA/EIS alternatives have been developed." Oct. 2014 Lease Sale EA at 14. Then, with the January 2015 lease sale, the parcels were deferred because "additional time is required to evaluate public comments regarding potential drainage, tribal consultation, and environmental justice." BLM Press Release, December 30, 2014. Critically, on October 21, 2016, BLM announced "the beginning of a scoping process to solicit public comments and to identify issues specifically related to analysis of Bureau of Indian Affairs (BIA) managed mineral leasing and associated activity decisions … as part of the EIS for the Farmington RMPA." 81 Fed. Reg. 72,819 (Oct. 21, 2016). In short, BLM reinitiated the scoping period for the Mancos Shale Resource Management Plan Amendment (" Mancos RMPA") and environmental impact statement ("EIS") specifically to solicit greater tribal involvement. This consultation bears directly on the four parcels at issue here, and, having just reinitiated scoping, BLM has yet to develop its range of alternatives—the precise reason these parcels have been previously deferred, starting back in 2014. As recognized by BLM, "[a]ll four parcels are located on surface administered by the Bureau of Indian Affairs (BIA) above federal minerals." EA at 5. It is without logic or coherent reasoning that BLM has chosen, nevertheless, to move forward with the sale of these four Navajo allotment parcels in the Greater Chaco region.

Accordingly, Citizens Groups hereby incorporate by reference our prior administrative comments, protests, and exhibits submitted for these prior lease sales, including October 2014 Scoping Comments (March 24, 2014), Draft Environmental Assessment Comments (May 28, 2014), and Protest (August 14, 2014), January 2015 Draft Environmental Assessment Comments (September 23, 2014) and Protest (November 19, 2014), October 2016 Scoping Comments (March 14, 2016), January 2017 Scoping Comments (June 17, 2016), and Draft Environmental Assessment Comments (September 2, 2016). Because the four parcels at issue here have previously been offered and deferred and/or postponed by the FFO, all prior administrative engagement is properly before the agency and should be considered and included in the administrative record for this lease sale. These incorporated comments and exhibits offer detailed

technical information, expert reports, and legal analysis that the agency is required to consider in its decisionmaking process for the proposed action. *See Forest Guardians v. U.S. Fish and Wildlife Service*, 611 F.3d 692, 717 (10th Cir. 2010) ("The purpose behind NEPA is to ensure that the agency will only reach a decision on a proposed action after carefully considering the environmental impacts of several alternative courses of action and *after taking public comment into account*.").

Because the Mancos RMPA remains incomplete, the applicable land use plan for this action is the 2003 Farmington RMP, with "the analysis of projected surface disturbance impacts … based on well densities listed in the Reasonable Foreseeable Development (RFD) Scenario included in the 2003 Farmington RMP." However, as will be explained in further detail, reliance on the 2003 RMP and RFD fails to demonstrate that impacts associated with the proposed leasing will not be significant, or that leasing will otherwise sufficiently protect resources in the FFO. This is due to the fact that, by the BLM's own admission, the RMP and RFD do not account for the environmental impacts of horizontal drilling and multi-stage hydraulic fracturing of the Mancos Shale formation. Yet by leasing these parcels, the BLM is poised to facilitate just this kind of unforeseen development, despite any analysis as to the actual environmental impacts on both project and programmatic level.

STATEMENT OF REASONS IN SUPPORT OF CITIZEN GROUPS' PROTEST OF BLM'S JANUARY 2017 COMPETITIVE OIL & GAS LEASE SALE

I. BLM Cannot Lease the Subject Parcels while the Mancos Shale/Gallup Formation RMP and EIS Remains Uncompleted.

As provided in Comments—and implicitly recognized by the agency's original decision to defer all the allotment parcels from the October 2014 lease sale—it is unlawful for the agency to move forward with the sale of oil and gas resources while work on the required Mancos RMPA and EIS is underway. *See* 40 C.F.R. § 1506.1(c). Specifically, the agency stated that allotment parcels—including the four parcels offered here—were being "deferred until after the FFO Mancos Shale/Gallup Formation RMPA/EIS alternatives have been developed." Oct. 2014 Lease Sale EA at 14. This decision is consistent with the agency's duty under NEPA "to stop actions that adversely impact the environment, that limit the choice of alternatives for the EIS, or that constitute an 'irreversible and irretrievable commitment of resources.'" *Conner v. Burford,* 848 F.2d 1441, 1446 (9th Cir. 1988). When an EIS is underway, as here, NEPA regulations established by the Council of Environmental Quality ("CEQ") prohibit an agency from taking any actions that could undermine that decision-making process. *See* 40 C.F.R. § 1506.1(c).

The FFO is now attempting to reverse course, and in so doing, violates NEPA. In deciding to proceed with the sale of these four parcels, the agency now claims "[t]hese parcels were considered for lease in the October 2014, January 2015, and October 2016 Competitive Oil and Gas Lease Sales, but deferred due to the need for additional Tribal consultation and Environmental Justice analysis." 2014 Draft EA at 4. BLM's recent re-initiation of the scoping

period for the Mancos RMPA—specifically to include BIA and increase tribal consultation, which specifically include these parcels—only underscores the erroneousness of the agency's decision to proceed with the January 2017 lease sale. *See* 81 Fed. Reg. 72,819.

Notably, that BLM is engaged in consultation does not obviate the agency's independent NEPA obligations for this sale. The whole point of NEPA is to study the impact of an action on the environment *before* the action is taken. *See Conner,* 848 F.2d at 1452 (NEPA requires that agencies prepare an EIS before there is "any irreversible and irretrievable commitment of resources"). Where "[i]nterim action prejudices the ultimate decision on the program," NEPA forbids it. 40 C.F.R. §§ 1506.1(c)(1)-(3). Action prejudices the outcome "when it tends to determine subsequent development or limit alternatives." *Id.* Proceeding with the sale of these four allotment parcels—or any other major Federal action impacting resources in the planning area—is impermissible due to the inherent prejudice that this action will cause to the pending Mancos RMPA and EIS, and will limit the choice of alternatives considered therein—including a decision not to lease additional lands for oil and gas.

The agency cites regulations at 43 C.F.R. § 3162.2-2 to justify the sale, claiming: "They are being reconsidered for sale as the parcels have been recently identified as being drained or to be drained by offending wells as early as July 2017. Drainage is the uncompensated loss of hydrocarbons, inert gases or geothermal resources from wells on adjacent non-jurisdictional lands or jurisdictional lands resulting in revenue losses to the Federal government." EA at 5. Critically, however, these regulations provide that where uncompensated drainage of Federal mineral resources may be occurring, offering unleased lands for sale is only one of several options. Other options include: the execution of an agreement under which the United States would be compensated for the drainage; entering into a communitization agreement; or approval of a unit agreement "that provides for payment of a royalty on production attributable to unleased mineral resources." *See* 43 C.F.R. § 3162.2-2 (b), (c), (d). In fact, BLM recognized: "Drainage of the federal mineral estate by producing wells adjacent to the federal mineral estate lands would result in the establishment of a Compensatory Royalty Agreement (CRA) to collect royalties, or in the absence of a CRA, the continuing loss of royalties to the United States and the State of New Mexico." EA at 11. Nevertheless, the agency suggests it is compelled to offer these lands for lease, and that this is the only option to ensure that royalty revenues are not lost. Indeed, these regulations do not mandate that the agency take any action at all, expressly qualifying every option as a step the agency *may* take. *See id.* Given the agency's NEPA obligation to avoid prejudice or limit alternatives, 40 C.F.R. § 1506.1(c), as well as myriad other resource concerns identified herein, offering these lands for lease is the one option the agency should avoid.

As acknowledged in the FFO's EA: "the lease purchaser has the exclusive right to use as much of the leased lands as is necessary to explore and drill oil and gas within the lease boundaries." EA at 11. Once oil and gas lease rights are conveyed, lessees have a right to drill, and the impact on the environment from the exercise of those rights cannot be undone, which is exactly the situation NEPA disallows—allowing new activity that limits alternatives in the future. For example, once this lease sale is held, the agency will no longer be able to consider an

alternative in the Mancos Shale RMP that disallows oil and gas development on these parcels, which the agency's subsequent analysis may deem as necessary.

Although the FFO consistently asserts that any impacts from the lease sale would be "linked to as yet undetermined future levels of lease development," it would be entirely disingenuous for the agency to attempt to segregate this lease sale from the "shale oil play" that has motivated the Mancos Shale RMPA and EIS. EA at 52. For one thing, by the BLM's own admission, the entire purpose of offering the proposed leases for sale is to facilitate their development in order to address drainage of the Mancos Shale that is occurring from neighboring drilling and production activities. *See* EA at 51. Clearly development of the proposed leases for the purpose of developing the Mancos Shale for oil is not speculative. Indeed, it is the entire purpose for undertaking proposed leasing.

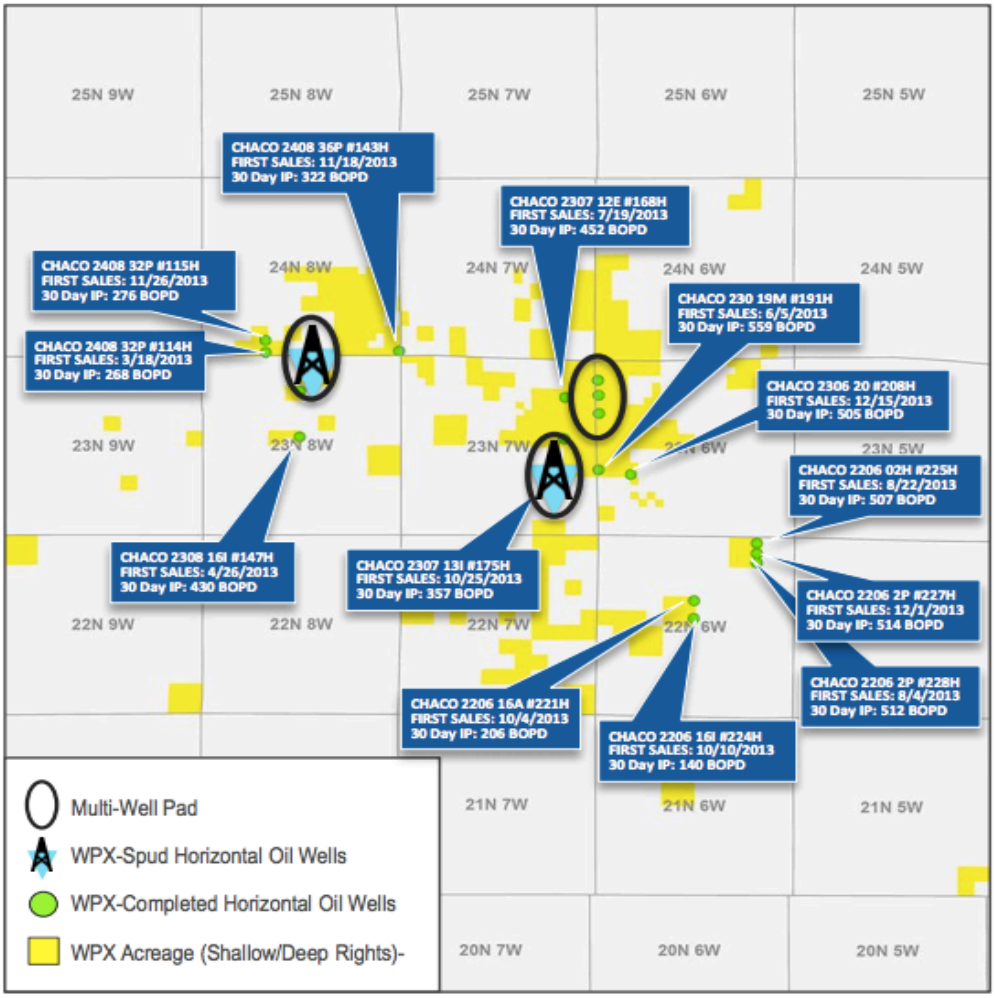
The agency's failure to anticipate the new "oil boom" in the San Juan Basin is precisely why updated planning documents are needed. The agency admits:

> [Oil and gas] development may include constructing a well pad and access road, drilling a well using conventional pit system or closed-loop system, hydraulically fracturing the well, installing pipelines and/or hauling produced fluids, regularly monitoring the well, and competing work-over tasks throughout the life of the well. In Farmington, typically, all of these actions are undertaken during development of an oil or gas well: it is reasonably foreseeable that they may occur on leased parcels.

EA at 17-18. By the agency's own admission it is foreseeable that the mere act of leasing these parcels will result in a significant levels of development. Moreover, all of these parcels are included in the planning area and reasonably foreseeable development analysis area for the Mancos RMPA. Therefore, proceeding with the leasing of these parcels will prejudice the pending Mancos Shale RMP and EIS process, in direct violation of NEPA.

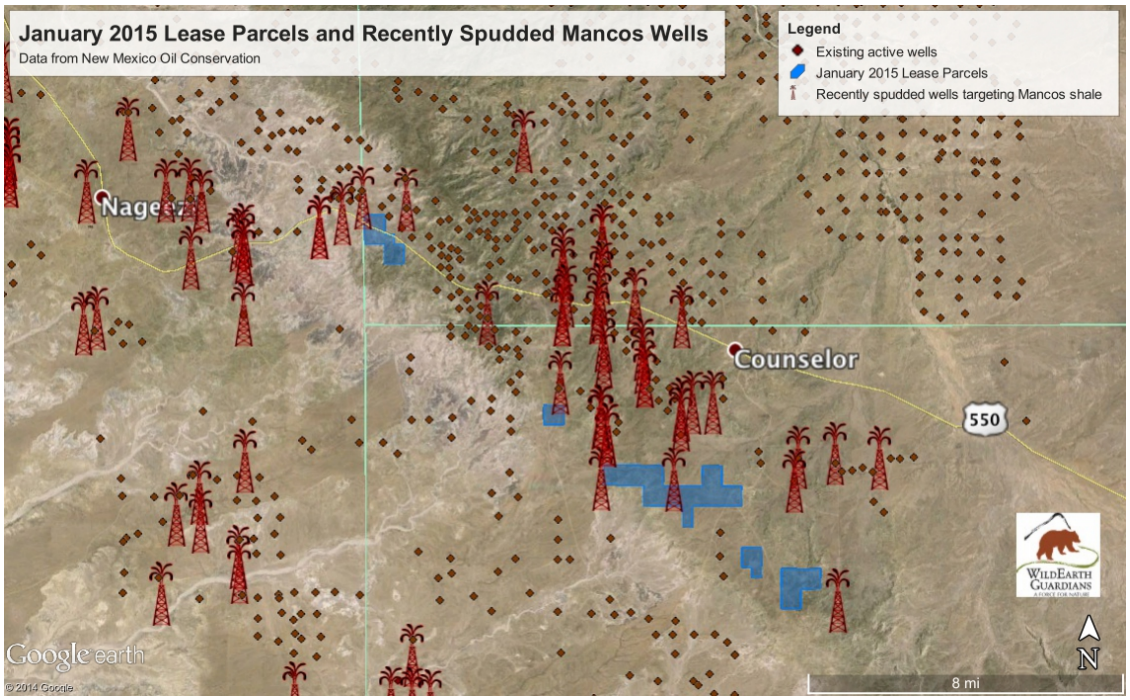
The potential for foreseeable development is underscored by the fact that the BLM has already approved over 365 APDs in the area that clearly authorized the tapping of the Mancos Shale, and is weighing approval of many additional APDs in this area. Even the companies themselves are touting their development of the Mancos shale. Although now outdated, WPX also confirmed in a recent presentation that it has completed and spudded numerous Mancos shale wells using horizontal drilling in the area of the proposed leases.[1] The map below, from page 11 of WPX's presentation, illustrates the extent of Mancos shale development in the area:

[1] *See* WPX Energy, *Operational update*, available at: http://www.wpxenergy.com/media/YE2013_EarningsPresentation_Final.pdf.



WPX Energy Map of Mancos Shale Development in the Area of the Proposed Leasing.

A simple map of this area prepared by WildEarth Guardians confirms that a number of wells that appear to clearly target the Mancos shale have been drilled in the vicinity of the proposed lease parcels. The map shows the lease parcels in blue and the proximity of wells that have been recently drilled by Encana, WPX, and LOGOS. This map further underscores that development of the proposed leases is not remotely speculative, and that the BLM has the means to fully analyze and assess impacts associated with Mancos shale drilling.



Map of Proposed Lease Parcels and Recently Drilled Mancos Shale Wells.
Map prepared using Google Earth using BLM and NMOCD Data.

As provided, while CEQ regulations require a moratorium on any further leasing until the Mancos RMPA and EIS are completed, such a decision is also well within the discretion of the FFO. As provided in BLM Instruction Memorandum No. 2010-117 (May 17, 2010):

> As outlined in the Land Use Planning Handbook (H-1601-1), the Resource Management Plan (RMP) underlies fluid minerals leasing decisions. Through RMP effectiveness monitoring and periodic RMP evaluations, state and field offices will examine resource management decisions to determine whether the RMPs adequately protect important resource values in light of changing circumstances, updated policies, and new information (H-1601-1, section V, A, B). The results of such reviews and evaluations may require field office resource information updates and land use plan maintenance, amendment, or revision. In some cases state and field office staff may determine that the public interest would be better served by further analysis and planning prior to making any decision whether or not to lease.

(emphasis added). There can be no better example than the present situation of where the public interest would be better served by completing the Mancos Shale RMP and EIS *before* deciding whether it is appropriate to lease additional public lands. According to BLM oil and gas statistics, there are currently 5,027,750 acres of leased land that is "in effect" in New Mexico; but only approximately 70% of which is in production. *See* BLM, Oil and Gas Statistics by Year for Fiscal Years 1988–2012 (previously included as Scoping Exhibit 120). Indeed, 90% of available public lands in the FFO have already been leased. Before additional public lands are

sold to oil and gas industry and committed to development, the agency must understand the additional impacts of developing the Mancos Shale/Gallup formation.

II. BLM Cannot Rely on the 2003 RMP EIS to Justify the Proposed Leasing or a Finding of No Significant Impact

While the FFO is to be commended for acknowledging the inability of the 2003 RMP/EIS and RFD to continue serving their necessary planning function, at the same time, the BLM cannot simultaneously rely on the 2003 RMP/EIS and RFD to justify the January 2017 lease sale. Indeed, BLM's EA explicitly tiers to the analysis contained in the 2003 RMP/EIS, *see* EA at 7, which, as explained in the agency's Federal Register Notice for the Mancos Shale RMP, is no longer capable of guiding such decision-making:

> As full-field development occurs, especially in the shale oil play, additional impacts may occur that previously were not anticipated in the RFD or analyzed in the current 2003 RMP/EIS, which will require an EIS-level plan amendment and revision of the RFD for complete analysis of the Mancos Shale/Gallup Formation.

79 Fed. Reg. 10548 (Feb. 25, 2014). However, the inability of the current RMP/EIS and RFD to support the proposed leasing, or to provide any reasonable analysis from which to tier, is further underscored by the details of its shortcomings.

For one thing, the 2003 Farmington RMP never contemplated commercially viable development of the Mancos Shale, whether for oil or gas, utilizing horizontal drilling techniques. This is significant because all indications are that the proposed leases are meant to facilitate horizontal drilling of the Mancos shale. The RFD (which was actually prepared in 2001, two years prior to the adoption of the RMP) stated:

> Horizontal drilling is possible but not currently applied in the San Juan Basin due to poor cost to benefit ratio. If horizontal drilling should prove economically and technically feasible in the future, the next advancement in horizontal well technology could be drilling multi-laterals or hydraulic fracturing horizontal wells. Multilaterals could be one, two or branched laterals in a single formation or single laterals in different formations. Hydraulic fracturing could be a single fracture axial with the horizontal well or multiple fractures perpendicular to the horizontal well. These techniques are currently complex and costly, and therefore typically inappropriate for most onshore U.S. reservoirs. Comprehensive engineering and geologic research will be required in the near future in order for these techniques to become viable within the 20-year time frame anticipated by this RFD.[2]

[2] BLM, *Oil and Gas Resource Development for the San Juan Basin, New Mexico, a 20-year, Reasonably Foreseeable Development (RFD) Scenario Supporting the Resource Management Plan for the Farmington Field Office, Bureau of Land Management* (July 2, 2001) at 8.3.

In other words, at the time the RFD was prepared and the RMP finalized, horizontal drilling and fracking was not viable.

Although the RFD makes clear that viable shale gas and oil development using horizontal drilling would not occur within 20 years, the RFD nevertheless contemplated 300 Mancos shale gas and oil wells, including development and exploration wells. *See* RFD at 5.27. However, the RFD contemplated "behind pipe" access to Mancos shale reserves through vertically drilled wells into the Dakota formation. RFD at 5.27. In other words, the RFD considered access to the Mancos shale only as an afterthought to drilling vertical Dakota wells, and certainly did not contemplate horizontally drilled wells into the Mancos shale. To the extent that the RFD contemplated development only of the Mancos shale, it was only in a region called the "fractured Mancos oil play" in the southeastern portion of the Basin, which was described only as "probable" development. RFD at 5.27. Again, the RFD did not contemplate horizontal drilling, whether for development or exploration.

The company, WPX (formerly Williams Production), a major oil and gas producer in the San Juan Basin, has confirmed that the RFD never contemplated the impacts of horizontal drilling of the Mancos shale, whether for exploration or development. The company recently stated in its Middle Mesa development proposal that, "When the [RMP] FEIS was prepared, horizontal drilling had been attempted as an experimental technique in the San Juan Basin, but faced technical problems and not yet been proven economically viable[.]"[3] The BLM has concurred, noting that only the recent advancement in horizontal drilling technology that "has made Mancos stand-alone wells economically viable," explaining:

> [A]t the time of the RFD[S] report, horizontal drilling and multi-stage hydraulic fracturing was in its infancy, since then, the technology has evolved to be more efficient and less costly as in the past. Horizontal drilling and multi-stage fracturing is a common practice throughout the U.S. even though the RFD[S] only hinted at its future success and usage.[4]

Here, "hinting" at environmental impacts does not suffice to demonstrate that such impacts were fully analyzed and assessed as required under NEPA or that the RFD sufficiently considered the impacts of this practice or demonstrated that there would be no significant impacts. The RFD simply does not suffice to demonstrate that the BLM has adequately considered the cumulative impacts of Mancos shale oil or gas development, and in particular horizontal drilling and fracking to develop Mancos shale, in the FFO. In light of the shortcomings of the RFD, as well as significant new information demonstrating that the Mancos shale is being targeted for horizontal drilling for gas and oil, it is clear that both the RMP and EIS are now inadequate under NEPA.

---

[3] Williams Production Co., *Proposal for Rosa Middle Mesa Development* at 3 (previously included as Exhibit 1).

[4] BLM, *Unconventional gas reservoirs, hydraulic fracturing, and the Mancos Shale* (Nov. 30, 2011) at 6 (previously included as Exhibit 2).

Taken together with BLM's clear concession that the current RMP/EIS does not address the latest surge in Mancos shale development, it is clear that unless and until the RMP Amendment and EIS are completed, there exist no sufficient environmental considerations of horizontal drilling and fracking of the Mancos shale.[5] To this end, the BLM cannot rely on the 2003 RMP/EIS to support approval of the proposed leases or any determination that impacts will not be significant.

III. BLM Should Prepare a Programmatic EIS of its Oil and Gas Leasing Program and Use Its Broad Discretion Not to Lease the Proposed Parcels.

Several Citizens Groups, including WildEarth Guardians and Center for Biological Diversity, have submitted petitions to the U.S. Department of the Interior calling for an oil and gas leasing moratorium and programmatic review of the oil and gas leasing program.[6] Moreover, the White House Council on Environmental Quality ("CEQ"), the federal agency tasked with managing the federal government's implementation of NEPA, released *Final Guidance for Federal Department and Agencies on Consideration of Greenhouse as Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* (hereafter, "Final Guidance") (previously included as Draft Exhibit 3). CEQ's Final Guidance also states that "[i]n the context of long-range energy, transportation, and resource management strategies…it would be useful and efficient to provide an aggregate analysis of GHG emissions or climate change effects in a programmatic analysis and then incorporate by reference that analysis into future NEPA reviews." In particular, CEQ identifies "issuing leases for oil and gas drilling" as a "site-specific action[] that may benefit from being able to tier to a programmatic NEPA review."

---

[5] In light of this, we would submit that BLM must presume that the lands proposed for leasing are not "available" due to the failure of the current RMP/EIS to account for the significant impacts of horizontal drilling and fracking of Mancos shale. In this case, the BLM clearly made lands available for leasing based on its understanding of environmental considerations at the time the RMP/EIS was adopted. Given that horizontal drilling and fracking techniques were not accounted for, it would be absurd to believe that the RMP decision made lands available for leasing for the purpose of horizontal drilling of the Mancos Shale. Indeed, BLM's Handbook on the issuance of oil and gas leases explicitly states that eligible lands are available for leasing only when all statutory requirements and reviews, "including compliance with the National Environmental Policy act (NEPA) of 1970," have been met. BLM Handbook, H-3101-1, Section I.A.1.

[6] *See* UC Irvine School of Law Environmental Law Clinic, on Behalf of WildEarth Guardians, *Petition Requesting a Programmatic Environmental Impact Statement Addressing the Bureau of Land Management's Oil and Gas Leasing Program and Formal Adoption of the Council on Environmental Quality's Guidance for Greenhouse Gas Emissions and Climate Change Impacts*, January 20, 2016 (previously included as Draft Exhibit 1); Center for Biological Diversity, *Petition for a Moratorium on the Leasing of Federal Public Land Fossil Fuels Under the Mineral Leasing Act, 30 U.S.C §§ 226, 241*, July 12, 2016 (previously included as Draft Exhibit 2).

Within this context, the BLM FFO has broad discretion and remove the four parcels from nomination. Given the proximity of these parcels to already deferred areas—which are not divided by geography as much as they are by field office boundaries—deferral is the only reasonable option. As was true with the Taos Field Office parcels, the agency's chosen path of opening this area up to oil and gas development would threaten the water resources serving both the communities and the surrounding area—which is particularly true given the unique geology and hydrologic movement underlying the planning area—a fact entirely absent from the EA, and with BLM offering no evidence of agency comprehension. Quite simply, developing this area for oil and gas represents an unnecessary and avoidable risk that would threaten the area's other important multiple use resources, not least of which are local populations already forced to endure human health impacts and environmental degradation from existing oil and gas development and other extractive practices, as well as the areas rich cultural resources and heritage sites.

BLM has broad discretion—and often the responsibility, though too often ignored—not to lease public lands for minerals development to safeguard other multiple use, environmental, and human health resources and values. *See, e.g., Udall v. Tallman*, 380 U.S. 1 (1965); *Rocky Mountain Oil & Gas Association v. U.S. Forest Service*, 157 F.Supp.2d 1142 (D. Mont. 2000). BLM's authority to open these four parcels to oil and gas development is derived from the Mineral Leasing Act of 1920, 30 U.S.C. § 181 *et seq.* Nowhere does the Mineral Leasing Act ("MLA") mandate that any particular lands be offered for lease. Rather, the Act states generally that "[a]ll lands subject to disposition under this chapter which are known or believed to contain oil or gas deposits *may* be leased by the Secretary." 30 U.S.C. § 226(a) (emphasis added). The Ninth Circuit has held that the "permissive word 'may' in § 226(a) allows the Secretary to lease such lands, but does not require him to do so…. [T]he Secretary has discretion to refuse to issue any lease at all on a given tract." *Burglin v. Morton*, 527 F.2d 486, 488 (9th Cir. 1975). The Supreme Court reached the same conclusion in *Udall v. Tallman*, 380 U.S. 1, 4 (1965), in which the Court declared that the Mineral Leasing Act "left the Secretary discretion to refuse to issue any lease at all on a given tract." *See also Bob Marshall Alliance v. Hodel*, 852 F.2d 1223, 1230 (9th Cir. 1988) (providing that refusal to issue leases constitutes a "legitimate exercise of the discretion granted to the Interior Secretary"); *McDonald v. Clark*, 771 F.2d 460, 463 (10th Cir. 1985) ("While the statute gives the Secretary the authority to lease government lands under oil and gas leases, this power is discretionary rather than mandatory."); *McTiernan v. Franklin,* 508 F. 2d 885, 887 (10th Cir. 1975) (under § 226(a), the government "may refuse to issue any lease at all on a given tract"); *Pease v. Udall,* 332 F.2d 62, 63 (9th Cir. 1964) (Mineral Leasing Act "has consistently been construed as leaving to the Secretary, within his discretion, a determination as to what lands are to be leased thereunder"); *Pacific Legal Foundation v. Watt,* 529 F.Supp. 982, 991 n.14 (D. Mont. 1982) (under § 226(a), "the Secretary has discretion either to issue or refuse to issue oil and gas leases").

Indeed, BLM's discretion over oil and gas leasing is so great that courts have held that the agency may decide not to allow leasing even after the lands have been offered for lease and a qualified applicant selected. In *McDonald,* the Tenth Circuit Court of Appeals provided: "The fact that land has been offered for lease does not bind the Secretary to actually lease the land, nor is the Secretary bound to lease the land when a qualified applicant has been selected."

McDonald, 771 F.2d at 463. The Court continued, saying "the Secretary may withdraw land from leasing at any time before the actual issuance of the lease, even if the offer was filed long before the determination not to lease was made." *Id.* (citing *Arnold v. Morton,* 529 F.2d 1101, 1106 (9th Cir. 1976); *Schraier v. Hickel*, 419 F.2d 663, 665-67 (D.C. Cir. 1969)).

Moreover, nothing in the Federal Onshore Oil and Gas Leasing Reform Act ("FOOGLRA") requires BLM to open lands at the behest of the oil and gas industry. The MLA, as amended by FOOGLRA in 1987, 30 U.S.C. § 181 *et seq*., simply requires BLM to *consider* oil and gas leasing on land consistent with the RMP. As identified above, just because land is identified for leasing does not mean that it must be leased. If review of a potential lease proposed for sale reveals problems, or that other resources and values should be protected, the agency can decide not to lease, period, and in fact, may be duty-bound, pursuant to laws such as FLPMA, not to lease to ensure that other resources and values are protected. For example, in *Marathon Oil Co.*, 139 IBLA 347 (1997), BLM removed parcels from a competitive lease sale for environmental reasons, even after they had been offered for sale pursuant to industry nomination. In that case, the IBLA held that "BLM enjoys considerable discretion to depart from its RMP in any specific case, and it may well be able to justify excluding these parcels from leasing for environmental purposes." *Id.* at 356.

The MLA and FOOGLRA do not in any way restrict the factors that BLM may consider when exercising its considerable discretion under § 226(a). Therefore, even if the BLM bases its decision entirely on the public's overwhelming opposition to oil and gas development in this area, it has the authority to do so. Indeed, it would be irresponsible for BLM's FFO to propose these four lease parcels for sale without first performing the necessary due diligence and environmental review to determine, on a site-specific basis, whether these lands should be conserved as is.

Based on this expansive authority and discretion, we implore BLM FFO to reconsider its assent to the nomination of the four parcels in January 2017 Oil and Gas Lease Sale, and remove these parcels from consideration.

IV. BLM is Required to Prepare an EIS, and Failed to Provide a Convincing Statement of Reasons Why the Lease Sale will Impact the Environment No More than Insignificantly.

As Citizen Groups have consistently maintained, an EIS should be prepared before subject parcels can be offered at the January 2017 oil and gas lease sale. An EIS is required when a major federal action "significantly affects the quality of the human environment." 42 U.S.C. § 4332(2)(C); 40 C.F.R. § 1502.4. A federal action "affects" the environment when it "will or *may* have an effect" on the environment. 40 C.F.R. § 1508.3 (emphasis added); *Airport Neighbors Alliance v. U.S.,* 90 F.3d 426, 429 (10th Cir. 1996) ("If the agency determines that its proposed action *may* 'significantly affect' the environment, the agency must prepare a detailed statement on the environmental impact of the proposed action in the form of an EIS.") (emphasis added). Similarly, according to the Ninth Circuit:

> We have held that an EIS *must* be prepared if 'substantial questions are raised as to whether a project ... *may* cause significant degradation to some human environmental factor.' To trigger this requirement a 'plaintiff need not show that significant effects *will in fact occur*,' [but instead] raising 'substantial questions whether a project may have a significant effect' is sufficient.

Idaho Sporting Cong. v. Thomas, 137 F.3d 1146, 1149-50 (9th Cir. 1998) (citations omitted) (emphasis original). Given the magnitude of the proposed action and possible direct, indirect and cumulative impacts to both the natural environment and human communities, BLM's FONSI is completely unsupportable.

Critically, the FFO has also failed to "put forth a convincing statement of reasons' that explains why the project will impact the environment no more than insignificantly. This account proves crucial to evaluating whether the [agency] took the requisite 'hard look.' " *Ocean Advoc. v. U.S. Army Corps of Engrs*., 402 F.3d 846, 864 (9th Cir. 2005). Nowhere in BLM's EA and unsigned FONSI does there exist a convincing statement explaining the insignificance of impacts from this sale. To the contrary, BLM suggests that any real analysis of impacts can be pushed off until the APD stage—which, as described above, is wholly deficient. If BLM proceeds in its refusal to perform an EIS, it must provide a detailed accounting of each NEPA significance factor, as provided in 40 C.F.R. § 1508.27, explaining why the project will impact the environment no more than insignificantly. The cursory and evasive manner in which BLM has addressed these significance factors in the EA unsigned FONSI is insufficient to meet the agency's NEPA mandate.

V. BLM Impermissibly Relies on Mitigation Measures to Avoid a Finding of Significance.

Although it is possible that "some or all of the environmental consequences of oil and gas development may be mitigated through lease stipulations, it is equally true that the purpose of NEPA is to examine the foreseeable environmental consequences of a range of alternatives *prior* to taking an action that cannot be undone." *Montana Wilderness Ass'n v. Fry*, 310 F.Sup.2d 1127, 1145 (D.Mont., 2004) (citation omitted) (emphasis added); 40 C.F.R. § 1501.2. "[M]itigation measures, while necessary, are not alone sufficient to meet the [Agency's] NEPA obligations to determine the projected extent of the environmental harm to enumerated resources *before* a project is approved." *Northern Plains Resource Council v. Surface Transportation Board,* 668 F.3d 1067, 1085 (9th Cir. 2011) (emphasis in original). Consequently, if BLM discovers significant impacts at the APD stage, it may no longer be able to prevent them.

Here, BLM has relies on future, unspecified and general mitigation to avoid a finding of significance, in violation of the agency's NEPA mandate. The EA generically offers: "Site specific mitigation measures and Best Management Practices (BMPs) would be attached as Conditions of Approval (COAs) for each proposed exploration and development activity authorized on a lease." EA at 11. Unfortunately, very little additional specificity is provided elsewhere in the EA. And while the agency does provide a list of lease stipulations by parcel, these are "[s]tandard terms and conditions as well as lease stipulations from the BLM FFO 2003

RMP … and Lease Notices development through the parcel review and analysis [which] would apply to address site specific concerns or new information not identified in the land use planning process." EA at 6. In other words, these stipulations are not specifically aimed at mitigating any direct, indirect, or cumulative impact from the proposed action, nor are they linked to site-specific concerns. In fact, the type of detailed mitigation that NEPA calls for would be impossible without first analyzing the site-specific impacts of leasing and development, which the FFO expressly acknowledges has not been done.

The mitigation measures proposed by the agency must be reasonably developed, which, here, is not the case. "A 'perfunctory description,' or 'mere listing of mitigation measures, without supporting analytical data,' is insufficient to support a finding of no significant impact." *National Parks & Conservation Ass'n v. Babbitt*, 241 F.3d 722, 735 (9th Cir. 2001). The court, when determining the sufficiency of the mitigation measures, considers "whether they constitute an adequate buffer against the negative impacts that may result from the authorized activity. Specifically, [the court] examine[s] whether the mitigation measures will render such impacts so minor as to not warrant an EIS." *Id.; see also, Hill v. Boy,* 144 F.3d 1446, 1451 (11th Cir.1998) (explaining that where an agency relies on an assumption to reach a FONSI, the assumption must be supported by substantial evidence). Moreover, the proposed mitigation underlying the FONSI "must be more than a possibility" in that it is "imposed by statute or regulation or have been so integrated into the initial proposal that it is impossible to define the proposal without mitigation." *Wyoming Outdoor Council v. U.S. Army Corps of Eng'rs,* 351 F.Supp.2d 1232, 1250 (D.Wyo. 2005). Here, the agency offers nothing more than the statement that site-specific mitigation measures and BPMs would be attached as COAs—and fail to even offer a list what these potential measures might be.

Similarly, with regard to cumulative impacts, the agency must provide *some* explanation of how or why compensatory mitigation will reduce the cumulative adverse impacts on the resources in question to insignificance. Bare assertions of mitigation are insufficient. *O'Reilly v. U.S. Army Corps of Eng'rs,* 477 F.3d 225, 235 (5th Cir.2007) ("[A] bare assertion is simply insufficient to explain *why* the mitigation requirements render the cumulative effects of this project less-than-significant, when considered with the past, present, and foreseeable future development in the project area." (emphasis in the original)). Here, in describing the fluctuating cumulative impacts of oil and gas development, the agency offers generally: "Conserving as much land as possible and applying appropriate mitigation measures will alleviate the cumulative impacts." EA at 66. The FFO offers *nothing* else to address cumulative impacts. This type of vague and conclusory statement is entirely insufficient and fails to meet the FFO's obligations under NEPA.

VI. BLM Failed to Consider Existing, New, and Revised National Policy on Climate Change.

The NEPA is our "basic national charter for the protection of the environment," achieving its purpose through "action forcing procedures. . . requir[ing] that agencies take a *hard look* at environmental consequences." 40 C.F.R. § 1500.1; *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989) (citations omitted) (emphasis added). This includes the

consideration of best available information and data, as well as disclosure of any inconsistencies with federal policies and plans.

In 2014, President Obama described climate change as an "urgent and growing threat . . . that will define the contours of this century more dramatically than any other."[7] In that same year, the U.S. pledged to reduce its greenhouse gas ("GHG") emissions 26-28 percent below 2005 levels by 2020.[8] Since then, the President has also announced a new goal to cut methane emissions from the oil and gas sector by 40-45 percent below 2012 levels by 2025,[9] and set standards to reduce carbon dioxide emissions from the electricity sector by 32 percent from 2005 levels by 2030.[10] In 2015, President Obama recognized, "ultimately, if we're going to prevent large parts of this Earth from becoming not only inhospitable but uninhabitable in our lifetimes, we're going to have to keep some fossil fuels in the ground rather than burn them and release more dangerous pollution into the sky."[11] In his final State of the Union address, President Obama again noted the federal government's commitment to fighting climate change, vowing "to accelerate the transition away from old, dirtier energy sources," and making a powerful promise "to change the way we manage our oil and coal resources so that they better reflect the costs they impose on taxpayers and our planet."[12] These statements culminated in December, 2015 when the President joined with 194 other nations in recognizing "that climate change represents an urgent and potentially irreversible threat to human societies and the planet" and setting the goal of "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C."[13] The

[7] The White House, Remarks by the President at U.N. Climate Change Summit (Sept. 23, 2014), available at: https://www.whitehouse.gov/the-press-office/2014/09/23/remarks-president-un-climate-change-summit.

[8] U.S.-China Joint Announcement on Climate Change (Nov. 11, 2014), available at: https://www.whitehouse.gov/the-press-office/2014/11/11/us-china-joint-announcement-climate-change (attached as Exhibit 46).

[9] The White House, Climate Action Plan: Strategy to Reduce Methane Emissions (March 2014), available at: https://www.whitehouse.gov/blog/2014/03/28/strategy-cut-methane-emissions (attached as Exhibit 1).

[10] Environmental Protection Agency, Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64662 (Oct. 23, 2015).

[11] The White House, Statement by the President on the Keystone XL Pipeline (Nov. 6, 2015), available at: https://www.whitehouse.gov/the-press-office/2015/11/06/statement-president-keystone-xl-pipeline.

[12] President Barack Obama, State of the Union (Jan. 12, 2016), available at: https://www.whitehouse.gov/sotu.

[13] United Nations Framework Convention on Climate Change, Conference of the Parties (Nov 30-Dec. 11, 2015), Adoption of the Paris Agreement, Art. 2, U.N. Doc. FCCC/CP/2015/L.9 (Dec. 12, 2015), available at: http://unfccc.int/resource/docs/2015/cop21/eng/l09.pdf ("Paris Agreement") (attached as Exhibit 2).

President ratified the Paris Agreement, along with China, on September 3, 2016.[14] The President has also recognized that "the Paris Agreement alone will not solve the climate crisis. Even if we meet every target embodied in the agreement, we'll only get to part of where we need to go."[15]

Although national policy and statements addressing climate change have accelerated in recent years—as they should given the narrowing window of time to take meaningful action—the federal government's recognition of climate change is not new. The Secretary of the United States Department of the Interior stated, in Secretarial Order 3226, *Evaluating Climate Change Impacts in Management Planning* (January 19, 2001), that "[t]here is a consensus in the international community that global climate change is occurring and that it should be addressed in governmental decision making." Order 3226 established the responsibility of agencies to "consider and analyze potential climate change impacts when undertaking long-range planning exercises, when setting priorities for scientific research and investigations, when developing multi-year management plans, and/or when making major decisions regarding potential utilization of resources under the Department's purview."

In a 2007 report entitled *Climate Change: Agencies Should Develop Guidance for Addressing the Effects on Federal Land and Water Resources,* the GAO concluded that the Department of the Interior had not provided specific guidance to implement Secretarial Order 3226, that officials were not even aware of Secretarial Order 3226, and that Secretarial Order 3226 had effectively been ignored. This report led to Secretarial Order 3289, *Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources* (September 14, 2009), which reinstated the provisions of Order 3226, and recognized that "the realities of climate change require us to change how we manage land, water, fish and wildlife, and cultural heritage and tribal lands and resources we oversee," and acknowledged that the Department of the Interior is "responsible for helping protect the nation from the impacts of climate change." A month later, in Executive Order No. 13514, *Federal Leadership in Environmental, Energy, and Economic Performance* (Oct. 5, 2009), President Obama called on all federal agencies to "measure, report, and reduce their greenhouse gas emissions from direct and indirect activities." 74 Fed. Reg. 52,117 (Oct. 8, 2009). This directive was followed by Executive Order No. 13693, *Planning for Federal Sustainability in the Next Decade* (March 25, 2015), which reaffirmed the federal government's commitment to reducing GHG emissions. 80 Fed. Reg. 15,871 (March 25, 2015).

In 2009, the Environmental Protection Agency ("EPA") issued a finding that the changes in our climate caused by elevated concentrations of greenhouse gases in the atmosphere are reasonably anticipated to endanger the public health and welfare of current and future generations. 74 Fed. Reg. 66496 (Dec. 15, 2009). In 2015, EPA acknowledged more recent

[14] The White House, President Obama: The United States Formally Enters the Paris Agreement (Sept. 3, 2016), available at: https://www.whitehouse.gov/blog/2016/09/03/president-obama-united-states-formally-enters-paris-agreement.

[15] The White House, Office of the Press Secretary, Remarks by the President on the Paris Agreement (Oct. 5, 2016), available at: https://www.whitehouse.gov/the-press-office/2016/10/05/remarks-president-paris-agreement ((attached as Exhibit 3).

scientific assessments that "highlight the urgency of addressing the rising concentrations of CO_2 in the atmosphere." 80 Fed. Reg. 64661 (Oct. 23, 2015).

Earlier this year, the White House Council on Environmental Quality ("CEQ")—the federal agency tasked with managing the federal government's implementation of NEPA—recognized the unique nature of climate change and the challenges it imposed on NEPA compliance. On August 1, 2016, CEQ released *Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* (hereafter, "Final Climate Guidance") (attached as Exhibit 4). The Final Guidance applies to all proposed federal agency actions, "including land and resource management actions." *Id*. at 9. Notably, while CEQ's final guidance post-dates the initiation of BLM's NEPA process, (draft guidance was published December 18, 2014), it is intended to "facilitate compliance with existing NEPA requirements." *Id.* at 1. In other words, the Final Guidance is meant to underscore BLM's existing legal obligations to disclose and consider the foreseeable effects that, for example, coal, oil and gas leasing and development has on climate change. BLM still has ample time to incorporate this Guidance into the Final RMP and EIS. In its Final Guidance, the CEQ recognized that:

> Climate change results from the incremental addition of GHG emissions from millions of individual sources, which collectively have a large impact on a global scale. CEQ recognizes that the totality of climate change impacts is not attributable to any single action, but are exacerbated by a series of actions including actions taken pursuant to decisions of the Federal Government. Therefore, a statement that emissions from a proposed Federal action represent only a small fraction of global emissions is essentially a statement about the nature of the climate change challenge, and is not an appropriate basis for deciding whether or to what extent to consider climate change impacts under NEPA. Moreover, these comparisons are also not an appropriate method for characterizing the potential impacts associated with a proposed action and its alternatives and mitigations because this approach does not reveal anything beyond the nature of the climate change challenge itself: the fact that diverse individual sources of emissions each make a relatively small addition to global atmospheric GHG concentrations that collectively have a large impact.

Id. at 10-11. CEQ's Final Guidance also explains the application of NEPA principles and practices to the analysis of GHG emissions and climate change, including: (1) that agencies quantify a proposed action's projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools; (2) that agencies use projected GHG emissions as a proxy for assessing potential climate change effects when preparing a NEPA analysis; (3) where GHG emission tools, methodologies, or data inputs are not reasonably available, that agencies include a qualitative analysis in the NEPA document and explain the basis for determining that quantification is not reasonably available; (4) that agencies analyze foreseeable direct, indirect, and cumulative GHG emissions and climate effects; (5) that agencies consider reasonable alternatives and the short- and long-term effect and benefits in the alternatives and mitigation analysis; (6) that agencies consider alternatives that would make the actions and affected

communities more resilient to the effects of a changing climate; and (7) that agencies assess the broad-scale effects of GHG emissions and climate change, either to inform programmatic decisions, or at both the programmatic and project-level. *See id.* at 4-6.

A. BLM Failed to Consider Recent Climate Science and Carbon Budgeting.

Since the dawn of the industrial revolution a century ago, the average global temperature has risen some 1.6 degrees Fahrenheit. Most climatologists agree that, while the warming to date is already causing environmental problems, another 0.4 degree Fahrenheit rise in temperature, representing a global average atmospheric concentration of carbon dioxide ("CO_2") of 450 parts per million ("ppm"), could set in motion unprecedented changes in global climate and a significant increase in the severity of natural disasters—and could represent the point of no return.[16] In August 2016, the atmospheric concentration of CO_2 was approximately 402.25 ppm, up from 398.93 ppm the same month a year earlier.[17]

Climate change has been intensively studied and acknowledged at the global, national, and regional scales. Climate change is being fueled by the human-caused release of greenhouse gas emissions, in particular carbon dioxide and methane. The Intergovernmental Panel on Climate Change ("IPCC") is a Nobel Prize-winning scientific body within the United Nations that reviews and assesses the most recent scientific, technical, and socio-economic information relevant to our understanding of climate change. In its most recent report to policymakers in 2014, the IPCC provided a summary of our understanding of human-caused climate change. Among other things, the IPCC summarized:[18]

- Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems.

- Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen.

- Anthropogenic greenhouse gas emissions have increased since the pre-industrial era, driven largely by economic and population growth, and are now higher than ever. This has led to atmospheric concentrations of carbon dioxide, methane, and

[16] *See* David Johnston, *Have We Passed the Point of No Return on Climate Change?*, Scientific American (April 2015), available at: http://www.scientificamerican.com/article/have-we-passed-the-point-of-no-return-on-climate-change/.
[17] NOAA, Earth System Research Laboratory, *Trends in Atmospheric Carbon Dioxide*, available at: http://www.esrl.noaa.gov/gmd/ccgg/trends/.
[18] IPCC AR5*, Summary for Policymakers* (March 2014) available at: http://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf (attached as Exhibit 5).

nitrous oxide that are unprecedented in at least the last 800,000 years. Their effects, together with those of other anthropogenic drivers, have been detected throughout the climate system and are extremely likely to have been the dominant cause of the observed warming since the mid-20th century.

- In recent decades, changes in climate have caused impacts on natural and human systems on all continents and across the oceans. Impacts are due to observed climate change, irrespective of its cause, indicating the sensitivity of natural and human systems to changing climate.

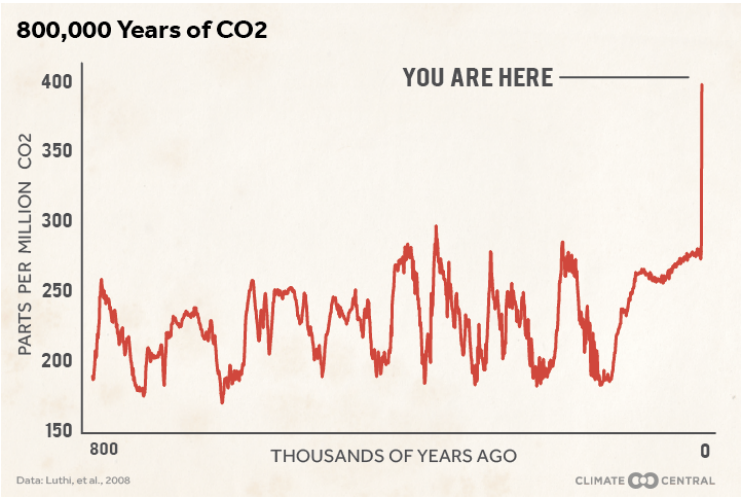
- Continued emission of greenhouse gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive, and irreversible impacts for people and ecosystems. Limiting climate change would require substantial and sustained reductions in greenhouse gas emissions which, together with adaptation, can limit climate change risks.

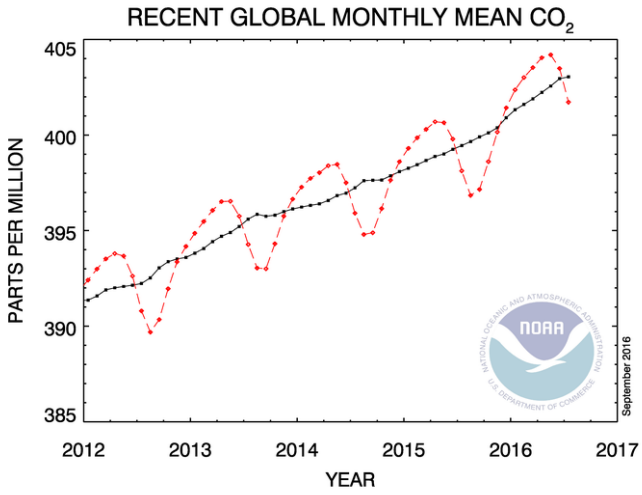
- Surface temperature is projected to rise over the 21st century under all assessed emission scenarios. It is very likely that heat waves will occur more often and last longer, and that extreme precipitation events will become more intense and frequent in many regions. The ocean will continue to warm and acidify, and global mean sea level to rise.

Carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are recognized as the key greenhouse gases contributing to climate change. In 2009, the EPA found that these "six greenhouse gases taken in combination endanger both the public health and the public welfare of current and future generations."[19] The D.C. Circuit has upheld this decision as supported by the vast body of scientific evidence on the subject. *See Coal. for Responsible Regulation, Inc. v. EPA.*, 684 F.3d 102, 120-22 (D.C. Cir. 2012).

According to the National Oceanic and Atmospheric Administration ("NOAA"), "[t]he combined average temperature over global land and ocean surfaces for August 2016 was the highest for August in the 137-year period of record, marking the 16th consecutive month of record warmth for the globe."[20] The global climate crisis is happening and it may well be accelerating quickly.

[19] Environmental Protection Agency, *Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act* 74 Fed. Reg. 66,496 (Dec. 15, 2009).
[20] NOAA, Global Analysis – August 2016, available at: https://www.ncdc.noaa.gov/sotc/global/201608.





The graphs show globally averaged historic and monthly mean carbon dioxide.

The IPCC in 2013 affirmed: "Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased" causing "widespread impacts on human and natural systems."[21] This is consistent with the findings of the United States' 2014 Third National Climate Assessment, stating: "That the planet has warmed is 'unequivocal,' and is corroborated through multiple lines of evidence, as is the conclusion that the causes are very likely human in origin."[22] With particular regard to the Southwest Region—which includes Colorado, New Mexico, Utah, Arizona, Nevada, and California—the National Climate Assessment included in the following overview:[23]

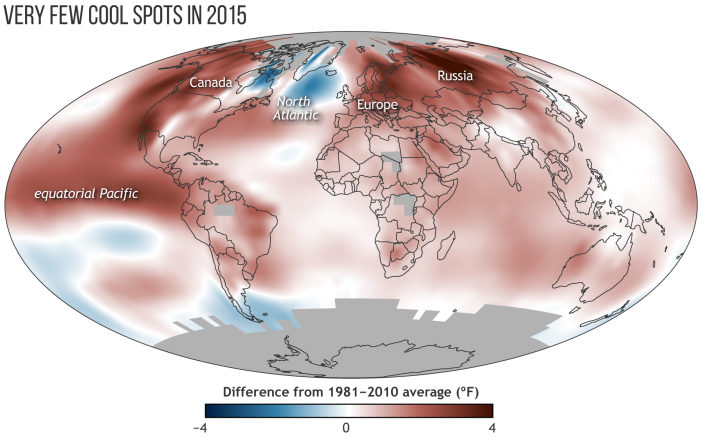
- Snowpack and streamflow amounts are projected to decline in parts of the Southwest, decreasing surface water supply reliability for cities, agriculture, and ecosystems.
- The Southwest produces more than half of the nation's high-value specialty crops, which are irrigation-dependent and particularly vulnerable to extremes of moisture, cold, and heat. Reduced yields from increasing temperatures and increasing competition for scarce water supplies will displace jobs in some rural communities.
- Increased warming, drought, and insect outbreaks, all caused by or linked to climate change, have increased wildfires and impacts to people and ecosystems in the Southwest. Fire models project more wildfire and increased

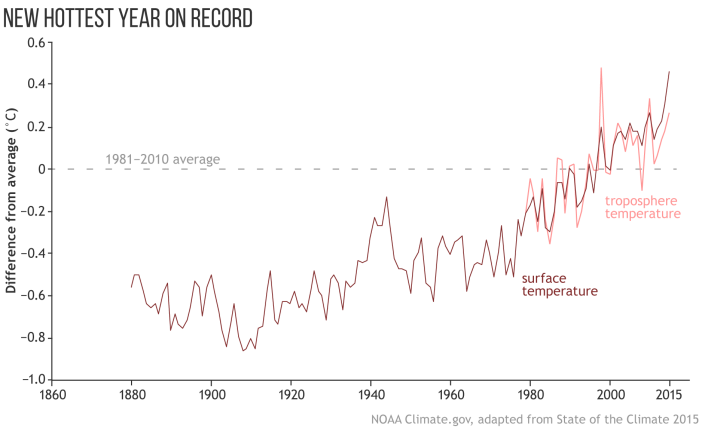
[21] IPCC AR5 Synthesis Report at 2 (attached as Exhibit 5).
[22] Jerry M. Melillo, *et al.*, Climate Change Impacts in the United States: The Third National Climate Assessment (2014) at 61, available at: http://nca2014.globalchange.gov (attached as Exhibit 6).
[23] *See id.* at 463-86.

risks to communities across extensive areas.

- Flooding and erosion in coastal areas are already occurring even at existing sea levels and damaging some California coastal areas during storms and extreme high tides. Sea level rise is projected to increase as Earth continues to warm, resulting in major damage as wind-driven waves ride upon higher seas and reach farther inland.
- Projected regional temperature increases, combined with the way cities amplify heat, will pose increased threats and costs to public health in southwestern cities, which are home to more than 90% of the region's population. Disruptions to urban electricity and water supplies will exacerbate these health problems.

Immediate and substantial greenhouse gas reductions are required to avoid catastrophic impacts to people and communities. "Following the warmest year on record in 2014 according to most estimates, 2015 reached record warmth yet again, surpassing the previous record by more than 0.1°C."[24]





[24] American Meteorological Society, *State of the Climate in 2015*, Vol.97, No.8 (Aug. 2016), at S7 (attached as Exhibit 7).

As noted above, the Paris Agreement commits all signatories—including the United States—to a target holding long-term global average temperature "to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels."[25] As articulated by a team of international climate scientists, including Dr. James Hansen, in a 2013 report: "The widely accepted target of limiting human-made global warming to 2 degrees Celsius (3.6 degrees Fahrenheit) above preindustrial level is too high and would subject young people, future generations and nature to irreparable harm…. Observational data reveal that some climate extremes are already increasing in response to warming of several tenths of a degree in recent decades; these extremes would likely be much enhanced with warming of 2°C or more."[26] "Runaway climate change—in which feedback loops drive ever-worsening climate change, regardless of human activities—are now seen as a risk even at 2°C of warming."[27] Indeed, the impacts of 2°C temperature rise have been "revised upwards, sufficiently so that 2°C now more appropriately represents the threshold between 'dangerous' and 'extremely dangerous' climate change."[28]

Although the Paris Agreement has underscored that immediate action is needed to avoid 'extremely dangerous' warming, meeting the voluntary commitments adopted in Paris alone will be insufficient to meet goal of limiting temperature change to between 1.5°C and 2.0°C above pre-industrial levels. As noted by a 2015 UNEP technical report:

> The emissions gap between what the full implementation of the unconditional [intended nationally determined contributions (INDCs)] contribute and the least-cost emission level for a pathway to stay below 2°C, is estimated to be 14 $GtCO_2e$ (range: 12-17) in 2030 and 7 $GtCO_2e$ (range: 5-10) in 2025. When conditional INDCs are included as fully implemented, the emissions gap in 2030 is estimated to be 12 GtCO2e (range: 10-15) and 5 $GtCO_2e$ (range: 4-8) in 2025.[29]

---

[25] Paris Agreement at Art. 2 (attached as Exhibit 2).

[26] James Hansen, *et al., Assessing "Dangerous Climate Change": Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature,* 8 PLoS ONE 8 e81648 (2013) (attached as Exhibit 8).

[27] Greg Muttitt, *et al.*, *The Sky's Limit: Why the Paris Climate Goals Require a Managed Decline of Fossil Fuel Production*, Oil Change International (Sept. 2016) at 6 (attached as Exhibit 9); *see also* David Spratt, *Climate Reality Check: After Paris, Counting the Cost* (March 2016) at 8 (attached as Exhibit 10) ("there is an unacceptable risk that before 2°C of warming, significant "long-term" feedbacks will be triggered, in which warming produces conditions that generate more warming, so that carbon sinks such as the oceans and forests become less efficient in storing carbon, and polar warming triggers the release of significant permafrost and clathrate carbon stores. Such an outcome could render ineffective human efforts to control the level of future warming to manageable proportions.").

[28] Kevin Anderson and Alice Bows, *Beyond 'Dangerous' Climate Change: Emission Scenarios for a New World*, Phil. Trans. R. Soc. (2011) (attached as Exhibit 11).

[29] United Nations Environment Programme (UNEP), *The Emissions Gap Report 2015: A UNEP Synthesis Report* (Nov. 2015) at xviii (attached as Exhibit 12).

In other words, far greater emissions reductions are necessary to stay below and 2.0°C, let alone aspire to 1.5°C of warming. If no further progress were made beyond the Paris Agreement, expected warming by 2100 would be 3.5°C.[30] In the alternative, if no action is taken and the status quo is maintained—a position reflected in BLM's draft EIS—estimated warming by 2100 is upwards of 4.5°C.[31]

With specific regard to United States commitments under the Paris Agreement, the U.S. INDC set specific greenhouse gas emissions reduction target for 2025 of a 26% to 28% reduction below the 2005 emission levels, producing a range in 2005 net GHG emissions from 6,323 to 7,403 $MTCO_2e$.[32] The difference between this target and the estimated 2025 emissions without INDC policies results in an 'emissions gap' ranging from 896 to 2,121 $MTCO_2e$.[33]

Both the IPCC and National Climate Assessment recognize the dominant role of fossil fuels in driving climate change:

> While scientists continue to refine projections of the future, observations unequivocally show that climate is changing and that the warming of the past 50 years is primarily due to human-induced emissions of heat-trapping gases. These emissions come mainly from burning coal, oil, and gas, with additional contributions from forest clearing and some agricultural practices.[34]
>
> ***
>
> CO_2 emissions from fossil fuel combustion and industrial processes contributed about 78% to the total GHG emission increase between 1970 and 2010, with a contribution of similar percentage over the 2000–2010 period (*high confidence*).[35]

As summarized in a recent report:

> The Paris Agreement aims to help the world avoid the worst effects of climate change and respond to its already substantial impacts. The basic climate science

---

[30] Spratt, *Climate Reality Check* at 2 (attached as Exhibit 10).
[31] *See* Climate Interactive, Climate Scorecard, available at: https://www.climateinteractive.org/programs/scoreboard/*; see also,* Andrew P. Schurer, *et al., Separating Forced from Chaotic Climate Variability over the Past Millennium*, Journal of Climate, Vol. 26 (March 2013) (attached as Exhibit 13).
[32] Jeffery Greenblatt & Max Wei, *Assessment of the climate commitments and additional mitigation policies of the Unites States*, Nature Climate Change (Sept. 2016), available at: http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate3125.html (attached as Exhibit 14).
[33] *Id.* at 2; *see also* UNEP, Emissions Gap Report (attached as Exhibit 12).
[34] Third National Climate Assessment at 2 (attached as Exhibit 6).
[35] IPCC AR5 Synthesis Report at 46 (attached as Exhibit 5).

> involved is simple: cumulative carbon dioxide (CO_2) emissions over time are the key determinant of how much global warming occurs. This gives us a finite *carbon budget* of how much may be emitted in total without surpassing dangerous temperature limits.[36]

According to the IPCC, as of 2011, the remaining carbon budget of cumulative CO_2 emissions from all anthropogenic sources must remain below 1,000 $GtCO_2$ to provide a 66% probability of limiting warming to 2°C above pre-industrial levels.[37] For years 2012-2014, approximately 107 $GtCO_2$ was emitted, averaging approximately 36 $GtCO_2$ per year, which left us at the start of 2016 with a carbon budget of only 850 $GtCO_2$.[38] These emissions were the highest in human history and 60% higher than in 1990 (the Kyoto Protocol reference year). Of course, the Paris Agreement aim of limiting global warming to 1.5°C requires adherence to a more stringent carbon budget of only 400 $GtCO_2$ from 2011 onward, of which about 250 $GtCO_2$ remained at the start of 2016.[39] "With global annual emissions amounting to 36 $GtCO_2$ in 2015, scientists predict that at current rates global emissions will exceed the carbon budgets necessary to stay under the 1.5°C target by 2021 and the 2°C target by 2036.[40]

The potential carbon emissions from *existing* fossil fuel reserves—the known belowground stock of extractable fossil fuels—considerably exceed both 2°C and 1.5°C of warming. "Estimated total fossil carbon reserves exceed this remaining [carbon budget] by a factor of 4 to 7."[41] "For the 2°C or 1.5°C limits, respectively 68% or 85% of reserves must remain in the ground."[42] The reserves in currently operating oil and gas field alone, even with no

---

[36] *The Sky's Limit* at 6 (attached as Exhibit 9).
[37] IPCC AR5 Synthesis Report at 63-64 & Table 2.2 (attached as Exhibit 5). For an 80% probability of staying below 2°C, the budget from 2000 is 890 $GtCO_2$, with less than 430 $GtCO_2$ remaining. Malte Meinshausen *et al., Greenhouse-gas emission targets for limiting global warming to 2°C*, Nature (2009) at 1159 (attached as Exhibit 15).
[38] *See* Annual Global Carbon Emissions, available at: https://www.co2.earth/global-co2-emissions; *see also* C. Le Quéré, *et al., Global Carbon Budget 2015*, Earth Syst. Sci. Data (Dec. 2015) (attached as Exhibit 16).
[39] Dustin Mulvaney, *et al.*, *Over-Leased: How Production Horizons of Already Leased Federal Fossil Fuels Outlast Global Carbon Budgets,* EcoShift Consulting (July 2016) (attached as Exhibit 17) at 2 (citing Joeri Rogelj, *et al., Difference between carbon budget estimates unraveled*, Nature Climate Change (2016) (attached as Exhibit 18).
[40] Mulvaney at 2 (citing Oak Ridge National Laboratories, Carbon Dioxide Information Analysis Center (2015), available at: http://cdiac.ornl.gov/GCP/).
[41] IPCC AR5 Synthesis Report at 63 (attached as Exhibit 5).
[42] The Sky's Limit at 6 (attached as Exhibit 9); *see also* Kevin Anderson and Alice Bows, *Reframing the climate change challenge in light of post-2000 emission trends*, Phil. Trans. R. Soc. (2008) (attached as Exhibit 19) ("to provide a 93% mid-value probability of not exceeding 2°C, the concentration (of atmospheric greenhouse gases) would need to be stabilized at or below 350 parts per million carbon dioxide equivalent (ppm CO_2e)" compared to the current level of ~485 ppm CO_2e.).

coal, would take the world beyond 1.5°C.[43]

In order for the world to stay within a carbon budget consistent with Paris Agreement goals—"holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C"[44]—significant fossil fuel resources must remain in the ground. More specifically, to meet the target of 2°C, globally "a third of oil reserves, half of gas reserves and over 80 percent of current coal reserves should remain unused from 2010-2050."[45] Studies estimate that global coal, oil and gas resources considered currently economically recoverable contain potential greenhouse gas emissions of 4,196 $GtCO_2$,[46] with other estimates as high as 7,120 $GtCO_2$.[47]

Critically, the United States carbon quota—equivalent to 11% of the global carbon budget needed for a 50% chance of limiting warming to 2°C—allocates approximately 158 $GtCO_2$ to the United States as of 2011.[48] By way of comparison, federal and non-federal fossil fuel emissions together would produce between 697 and 1,070 $GtCO_2$.[49] Regarding just federal fossil fuel resources, the United States contains enough recoverable coal, oil and gas that, if extracted and burned, would result in as much as 492 $GtCO_2$, far surpassing the entire global carbon budget for a 1.5°C target and nearly eclipsing the 2°C target—to say nothing of the United States 'share' of global emissions.[50] Unleased federal fossil fuels comprise 91% of these potential emissions, with already leased federal fossil fuels accounting for as much as 43 $GtCO_2$.[51]

In 2012, "the GHG emissions resulting from the extraction of fossil fuels from federal lands by private leaseholders totaled approximately 1,344 $MMTCO_2e$."[52] Between 2003 and 2014, approximately 25% of all United States and 3-4% of global fossil fuel greenhouse gas emissions are attributable to federal minerals leased and developed by the Department of the

[43] The Sky's Limit at 5, 17 (attached as Exhibit 9).
[44] Paris Agreement at Art. 2 (attached as Exhibit 2).
[45] Christophe McGlade & Paul Ekins, *The geographical distribution of fossil fuels unused when limiting global warming to 2°C*, Nature (Jan 2015) (attached as Exhibit 20).
[46] Michael Raupach, *et al., Sharing a quota on cumulative carbon emissions*, Nature Climate Change (Sept. 2014) (attached as Exhibit 21).
[47] IPCC AR5, Mitigation of Climate Change, Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (2014) at Table 7.2 (attached as Exhibit 22).
[48] Raupach at 875 (attached as Exhibit 21).
[49] Dustin Mulvaney, *et al.*, *The Potential Greenhouse Gas Emissions from U.S. Federal Fossil Fuels*, EcoShift Consulting (Aug. 2015) at 16 (attached as Exhibit 23).
[50] *Id.*
[51] *Id.*
[52] Stratus Consulting, *Greenhouse Gas Emissions from Fossil Energy Extracted from Federal Lands and Waters: An Update* (Dec. 2014) at 9 (attached as Exhibit 24).

Interior.[53] Continued leasing and development of federal fossil fuel resources commits the world to 'extremely dangerous' warming well beyond the 2°C threshold. As one study put it, "the disparity between what resources and reserves exist and what can be emitted while avoiding a temperature rise greater than the agreed 2°C limit is therefore stark."[54] In short, *any* new leasing of federal fossil fuel resources is inconsistent with a carbon budget that would seek to avoid catastrophic climate change.

The production horizons for already leased federal fossil fuel resources underscore how unwarranted any additional leasing is, and in turn the reasonableness of the no action alternative. Comparing these production horizons to dates at which carbon budgets would be exceeded if current emission levels continue:

- Federal crude oil already leased will continue producing for 34 years beyond the 1.5°C threshold and 19 years beyond the 2°C threshold;
- Federal natural gas already leased will continue producing 23 years beyond the 1.5°C threshold and 8 years beyond the 2°C threshold;
- Federal coal already leased will continue producing 20 years beyond the 1.5°C threshold and 5 years beyond the 2°C threshold.[55]

Opportunities to reduce GHG emissions through the cessation of new leasing and non-renewal of non-producing leases must be prioritized by BLM.

If new leasing and renewal of existing non-producing leases continues, by 2040 it will contribute about two-thirds of expected federal fossil fuel production (forecast based on EIA and other sources).[56] On the other hand, if new leasing ceases and existing non-producing leases are not renewed, 40% of forecast coal production could be avoided in 2025 and 74% of coal production could be avoided in 2040. As for oil and gas, 12% of oil production could be avoided in 2025 and 65% could be avoided by 2040 while 6% of natural gas production could be avoided in 2025 and 59% could be avoided by 2040.[57]

This avoided production would significantly reduce future U.S. emissions. Cessation of new and renewed leases for federal fossil fuel extraction could reduce CO_2 emissions by about 100 Mt per year by 2030. Annual emission reductions could become greater than that over time as production declines on existing leases and maintaining or increasing production becomes

---

[53] *See* Energy Information Administration, *Sales of Fossil Fuels Produced from Federal and Indian Lands, FY 2003 through FY 2014* (July 2015) (attached as Exhibit 25); *see also* Stratus Consulting (attached as Exhibit 24).
[54] McGlade at 188 (attached as Exhibit 20).
[55] Mulvaney (2016) at 5 (attached as Exhibit 17).
[56] Peter Erickson and Michael Lazarus, *How Would Phasing Out U.S. Federal Leases for Fossil Fuel Extraction Affect CO2 Emissions and 2°C Goals?,* Stockholm Environmental Institute (2016) at 12 (attached as Exhibit 323).
[57] Erickson and Lazarus at 16.

dependent on yet-to-be issued leases.[58]

A comparison with other measures shows that "no leasing" could be a very significant part of U.S. efforts to address climate change. The 100 Mt CO_2 emissions savings that could result from no leasing in 2030 compares favorably with EPA standards for light- and medium-vehicles that are expected to yield 200 Mt in CO_2 savings in 2030, and with standards for heavy-duty vehicles that are expected to yield 70 Mt in CO_2 savings in the same year. The 100 Mt CO_2 emissions reduction from leasing restrictions would be greater than either the emission reductions that the EPA expects to achieve through its existing regulation of oil and gas industry emissions or reductions the BLM expects to achieve from its proposed methane waste standards on oil and gas operations on federal land. Clearly, cessation of new and renewed leases could make an important contribution to U.S. climate change mitigation efforts.[59]

Also, importantly, avoided production through no new leasing and non-renewal of existing non-producing leases could help avoid further carbon lock-in in terms of investment in both fossil fuel-producing and fossil fuel-using infrastructure.[60]

Simply put, the timeframe to avoid catastrophic climate change is short, and the management of our federal minerals is dangerously out of step with this reality. BLM must adopt the no action alternative for the January 2017 lease sale.

VII. BLM Failed to Take a "Hard Look" by Predetermining its NEPA Analysis.

As detailed below, NEPA "requires ... that an agency give a 'hard look' to the environmental impact of any project or action it authorizes." *Morris v. U.S. Nuclear Regulatory Commission,* 598 F.3d 677, 681 (10th Cir. 2010). This examination "must be taken objectively and in good faith, not as an exercise in form over substance, and not as a subterfuge designed to rationalize a decision already made." *Forest Guardians,* 611 F.3d at 712 (quoting *Metcalf v. Daley,* 214 F.3d 1135, 1142 (9th Cir. 2000)); *see also* 40 C.F.R. § 1502.2(g) ("Environmental impact statements shall serve as the means of assessing the environmental impact of proposed agency actions, rather than justifying decisions already made."); *id.* § 1502.5 ("The statement shall be prepared early enough so that it can serve practically as an important contribution to the decision-making process and will not be used to rationalize or justify decisions already made.").

By failing to perform the necessary analysis, the agency, in effect, is presupposing that any site-specific impacts from oil and gas development can be mitigated without significant, unacceptable impacts at the APD stage before even knowing what those site-specific impacts are. The agency is also presupposing that oil and gas resources, if developed, outweigh non-oil and gas resources, like wildlife habitat, air quality, water quality protection, and human communities in the planning area.

---

[58] *Id.* at 26.
[59] *Id.* at 27.
[60] *Id.* at 30.

As soon as BLM issues an oil and gas lease, that sale confers a guaranteed right to the leaseholder, which includes the right of occupancy. *See* EA at 11 ("the lease purchaser has the exclusive right to use as much of the leased lands as is necessary to explore and drill oil and gas within the lease boundaries."). Without analyzing impacts from the lease sale itself, any subsequent analysis intrinsically shifts from *preventing* impacts (and managing lands for other resource values) to merely *mitigating* impacts (and allowing oil and gas lessees to exercise their surface use rights to the lease at the expense of other resource values). This approach is fundamentally incongruous with NEPA's mandate. In *Northern Plains* the Ninth Circuit warned: "In a way, reliance on mitigation measures presupposes approval. It assumes that—regardless of what effects construction may have on resources—there are mitigation measures that might counteract the effect without first understanding the extent of the problem. This is inconsistent with what NEPA requires." *Northern Plains,* 668 F.3d at 1084-85. In the present case, this presupposition is precisely what BLM has done in determining that actual NEPA analysis can wait until some future date while relying on generic lease stipulations and future mitigation to avoid a finding of significance.

BLM, in making this predetermined conclusion, creates an un-level playing field that benefits oil and gas leasing and drilling at the expense of other multiple use resources. There is a long line of cases that warn agencies against making a predetermined decision with respect to NEPA analysis. The Tenth Circuit has cautioned: "[I]f an agency predetermines the NEPA analysis by committing itself to an outcome, the agency likely has failed to take a hard look at the environmental consequences of its actions due to its bias in favor of that outcome and, therefore, has acted arbitrarily and capriciously." *Forest Guardians,* 611 F.3d at 713 (citing *Davis v. Mineta,* 302 F.3d 1104 (10th Cir. 2002). The Tenth Circuit further stated that "[w]e [have] held that ... predetermination [under NEPA] resulted in an environmental analysis that was tainted with bias" and was therefore not in compliance with the statute. *Id.* (citing *Davis,* 302 F.3d at 1112–13, 1118–26)).

While the threshold for finding agency predetermination is high—"occur[ing] only when an agency *irreversibly and irretrievably* commits itself to a plan of action that is dependent upon the NEPA environmental analysis producing a certain outcome, *before* the agency has completed that environmental analysis," *Forest Guardians*, 611 F.3d at 714 (emphasis in original)—here, BLM's misguided process has met that threshold. BLM made the express determination that an analysis of impacts is not necessary at the lease sale stage, which guarantees that a FONSI will be issued. That FONSI is based not on any actual analysis of impacts, but rather on the predetermined decision to perform the necessary NEPA analysis at a later stage. Indeed, by not performing any genuine analysis, it is impossible to reach any conclusion other than a FONSI. By playing this shell-game, BLM, at a minimum, creates an improper "inertial presumption" in favor of committing resources to oil and gas development before knowing the site-specific impacts. *Natl. Wildlife Fed. v. Morton*, 393 F.Supp 1286, 1292 (D.D.C. 1975).

By reaching, in effect, a predetermined decision—or at least creating a presumption in favor of oil and gas leasing and development—BLM not only violates NEPA, but also, by elevating development of oil and gas over other multiple use resources, violates the Federal Land Policy Management Act ("FLPMA"). As the Tenth Circuit has explained:

> It is past doubt that the principle of multiple use does not require BLM to prioritize development over other uses… Development is a *possible* use, which BLM must weigh against other possible uses – including conservation to protect environmental values, which are best assessed through the NEPA process.

New Mexico ex rel. Richardson, 565 F.3d at 710. BLM's presupposition of outcome is a direct affront to both NEPA and FLPMA, and cannot be sustained.

VIII. BLM Failed to Take a Hard Look at the Direct, Indirect and Cumulative Impacts of Oil and Gas Leasing and Development.

The National Environmental Policy Act ("NEPA"), 42 U.S.C. § 4321 *et seq*., and its implementing regulations, promulgated by the Council on Environmental Quality ("CEQ"), 40 C.F.R. §§ 1500.1 *et seq*., is our "basic national charter for the protection of the environment." 40 C.F.R. § 1500.1. Recognizing that "each person should enjoy a healthful environment," NEPA ensures that the federal government uses all practicable means to "assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings," and to "attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences," among other policies. 43 U.S.C. § 4331(b).

NEPA regulations explain, in 40 C.F.R. §1500.1(c), that:

> Ultimately, of course, it is not better documents but better decisions that count. NEPA's purpose is not to generate paperwork – even excellent paperwork – but to foster excellent action. The NEPA process is intended to help public officials make decisions that are based on understanding of environmental consequences, and take actions that protect, restore, and enhance the environment.

Thus, while "NEPA itself does not mandate particular results, but simply prescribes the necessary process," *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989), agency adherence to NEPA's action-forcing statutory and regulatory mandates helps federal agencies ensure that they are adhering to NEPA's noble purpose and policies. *See* 42 U.S.C. §§ 4321, 4331.

NEPA imposes "action forcing procedures … requir[ing] that agencies take a *hard look* at environmental consequences." *Methow Valley*, 490 U.S. at 350 (citations omitted) (emphasis added). These "environmental consequences" may be direct, indirect, or cumulative. 40 C.F.R. §§ 1502.16, 1508.7, 1508.8. A cumulative impact—particularly important here—is defined as:

> the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

40 C.F.R. § 1508.7.

Federal agencies determine whether direct, indirect, or cumulative impacts are significant by accounting for both the "context" and "intensity" of those impacts. 40 C.F.R. § 1508.27. Context "means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality" and "varies with the setting of the proposed action." 40 C.F.R. § 1508.27(a). Intensity "refers to the severity of the impact" and is evaluated according to several additional elements, including, for example: unique characteristics of the geographic area such as ecologically critical areas; the degree to which the effects are likely to be highly controversial; the degree to which the possible effects are highly uncertain or involve unique or unknown risks; and whether the action has cumulatively significant impacts. *Id.* §§ 1508.27(b).

Furthermore, the Federal Land Policy and Management Act ("FLPMA"), 43 U.S.C. § 1701 *et seq*., directs that "the public lands be managed in a manner that will protect the quality of [critical resource] values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use." 43 U.S.C. § 1701(a)(8). This substantive mandate requires that the agency not elevate the development of oil and gas resources above other critical resource values in the planning area. To the contrary, FLPMA requires that where oil and gas development would threaten the quality of critical resources, that conservation of these resources should be the preeminent goal. As detailed, below, for several critical resource values in the planning area, the proposed action conflicts with the BLM's mandate under FLMPA.

A. Because an irretrievable commitment of resources will occur at the lease sale stage, BLM must consider impacts prior to the sale.

BLM has stated its intent to postpone NEPA analysis to determine whether significant impacts exist until the APD stage, claiming: "The act of leasing the parcel would, by itself, have no impact on any resources in the FFO. All impacts would be linked to as yet undetermined future levels of lease development." EA at 52.

BLM has previously relied on *Park County Resource Council v. U.S. Department of Agriculture*, 817 F.2d 609 (10th Cir. 1987), to support its contention that site-specific NEPA analysis is not required until the APD stage. In *Park County*, the Court provided that "*with appropriate lease stipulations* aimed at protecting the environment, lease issuance itself, essentially a paper transaction, does not *usually* require prior preparation of an EIS." *Park County*, 817 F.2d at 621 (emphasis added). *Park County*, however, does not stand for the proposition—as BLM has implied—that there is a categorical rule exempting BLM from ever performing site-specific analysis at the lease sale stage. Indeed, the Ninth Circuit has consistently held that the sale of oil and gas leases is an irretrievable commitment of resources for which an EIS must be prepared. *See, e.g., Conner v. Burford,* 848 F.2d 1441 (9th Cir.1988); *Bob Marshall Alliance v. Hodel,* 852 F.2d 1223, 1227 (9th Cir.1988). Further, *Park County* cannot be

understood in a vacuum; as the Tenth Circuit more recently explained:

> [T]here is no bright line rule that site-specific analysis may wait until the APD stage. Instead, the inquiry is necessarily contextual. Looking to the standards set out by regulation and by statute, assessment of all 'reasonably foreseeable' impacts must occur at the earliest practicable point, and must take place before an 'irretrievable commitment of resources' is made. 42 U.S.C. § 4332(2)(C)(v); *Pennaco Energy v. U.S. Dept. of Interior*, 377 F.3d 1147, 1160 (10th Cir. 2004); *Kern v. U.S. Bureau of Land Management*, 284 F.3d 1062, 1072 (9th Cir. 2002); 40 C.F.R. §§ 1501.2, 1502.22. Each of these inquiries is tied to the existing environmental circumstances, not to the formalities of agency procedures. Thus, applying them necessarily requires a fact-specific inquiry.

New Mexico ex rel. Richardson, 565 F.3d at 717-18. The Court has unambiguously stated that "[t]he operative inquiry [is] simply whether all foreseeable impacts of leasing [are] taken into account before leasing [can] proceed." *Id.* at 717.

Indeed, in *Pennaco Energy,* the Court found: "A plan-level EIS for the area failed to address the possibility of [coal-bed methane ("CBM")] development, and a later EIS was prepared only after the leasing stage, and thus 'did not consider whether leases should have been issued in the first place.'" *New Mexico,* 565 F. 3d. at 717 (citing *Pennaco Energy,* 377 F.3d at 1152). Moreover, the Court held that "[b]ecause the issuance of leases gave lessees a right to surface use, the failure to analyze CBM development impacts before the leasing stage foreclosed NEPA analysis from affecting the agency's decision." *Id.* (citing *Pennaco Energy,* 377 F.3d at 1160).

Unlike *Park County* where site-specific impacts were difficult to anticipate, here, like in *Pennaco Energy*, the impacts of leasing parcels are reasonably foreseeable—over 90% of the FFO planning area has already been leased and expansive oil and gas development has already occurred, including in the Mancos Shale oil play. Moreover, the agency has identified the reasonably foreseeable impacts of development stemming from the lease of these parcels. *See* EA at 16. Thus, as in *Pennaco Energy*, an EIS assessing the specific effects of oil and gas development from this lease sale is required before leases are conferred to industry.

Moreover, irrespective of BLM's ultimate conclusion with regard to stipulations, an irretrievable commitment of resources will be conferred at the lease sale stage; oil and gas leases confer "the right to use so much of the leased lands as is necessary to explore for, drill for, mine, extract, remove and dispose of all the leased resource in a leasehold." 40 C.F.R. § 3101.1-2; *Sierra Club v. Hodel*, 848 F.2d 1068, 1093 (10th Cir. 1988) (agencies are to perform hard look NEPA analysis "before committing themselves irretrievably to a given course of action so that the action can be shaped to account for environmental values"); *see also* EA at n/a ("Once sold, the lease purchaser has the exclusive right to use as much of the leased lands as is necessary to explore and drill oil and gas within the lease boundaries.").

Yet, even where an NSO stipulation covering an entire parcel exists, the mere issuance of

the lease confers a right to the resources thereunder. Whether through horizontal drilling or some other method of extraction, the leaseholder has an exercisable interest as soon as the lease is conferred, which it then relies upon in proceeding with its development plan. Therefore, significant environmental impacts, based on those lease rights, may also occur once a lease is issued, including, for example, impacts to air resources, climate change, and groundwater. Although it is true that "some or all of the environmental consequences of oil and gas development may be mitigated through lease stipulations, it is equally true that the purpose of NEPA is to examine the foreseeable environmental consequences of a range of alternatives *prior* to taking an action that cannot be undone." *Montana Wilderness Ass'n*, 310 F.Sup.2d at 1145; *see also* 40 C.F.R. § 1501.2.

Here, the BLM refused to perform site-specific analysis at the lease stage, and, once lease right are conferred, BLM's authority will thereafter be limited to imposing mitigation measures consistent with the terms of the lease. Consequently, if BLM discovers significant impacts at the APD stage, it may no longer be able to prevent them. Because BLM is irretrievably committing resources at the lease sale stage, it must consider the impacts of its decision to lease parcels before it can confer public resources to a private developer in a lease—analysis which would be inherently flawed if performed without the benefit of a completed Mancos Shale RMP and EIS.

While the EA purports to evaluate the sale of oil and gas lease parcels which will allow drilling, completion, and production components, the agency also contends that consideration of impacts from development stage activity will actually occur later once APDs are submitted. This is a classic example of segmentation that is prohibited by NEPA.

As NEPA provides, to adequately assess the environmental impacts of a proposed action, BLM must assess three types of actions: (1) connected actions, (2) cumulative actions, and (3) similar actions. 40 C.F.R. § 1508.25. Connected actions "are closely related and therefore should be discussed in the same impact statement. Actions are connected if they: (i) Automatically trigger other actions which may require environmental impact statements; (ii) Cannot or will not proceed unless other actions are taken previously or simultaneously; (iii) Are interdependent parts of a larger action and depend on the larger action for their justification." *Id.* Cumulative actions are those actions that "when viewed with other proposed actions have cumulatively significant impacts and should therefore be discussed in the same impact statement." *Id.* Similar actions are those actions that "when viewed with other reasonably foreseeable or proposed agency actions, have similarities that provide a basis for evaluating their environmental consequences together, such as common timing or geography. An agency may wish to analyze these actions in the same impact statement. It should do so when the best way to assess adequately the combined impacts of similar actions or reasonable alternatives to such actions is to treat them in a single impact statement." *Id.*

There are two steps necessary to drill this area: first, BLM's proposed action to lease the subject parcels, and, second, BLM's promise of separate NEPA for the review and approval of APDs. The second cannot be accomplished without the first, and the act of drilling does not have independent utility. Instead, they are, for all intents and purposes, interdependent parts of a single action—to drill this area for oil and gas—that has been improperly segmented into two pieces.

As detailed above, BLM knows enough about current oil and gas development in the southern San Juan Basin to look at the impacts that will occur if the lease sale occurs and oil and gas development commences. Among those impacts are immense amounts of nitrogen deliveries, the need for extensive storage, the need for ancillary development for oil that does not currently exist, flaring of natural gas and industrial infrastructure delivery development in rural, undeveloped areas, among others.

B. BLM failed to analyze or take a "hard look" at cumulative impacts of the January 2017 lease sale.

A cumulative impact is the "impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." 40 C.F.R. § 1508.7. While BLM includes a "*Cumulative Impacts*" section in their EA, *see* EA at 50-52, BLM fails to actually conduct any cumulative analysis of those impacts. *See Natural Resources Defense Council v. Hodel*, 865 F.2d 288, 298 (D.C. Cir. 1988) (providing that section headings without the "requisite analysis" are insufficient); *see also* 40 C.F.R. § 1508.27(b)(7) (BLM must consider whether the proposed action is related to other actions that together may have cumulatively significant *impacts*. "Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.").

Here, the FFO's cumulative impacts analysis is remarkably insufficient. This is an area besieged by fossil fuel development. The FFO has over 23,000 active oil and gas wells, as well as two massive mine-to-mouth coal-fired power plant complexes—the Navajo Mine and Four Corners Power Plant, and the San Juan Mine and San Juan Generating Station. The impact of such development on the area's air, water, land, and human communities cannot be overstated. Yet, the FFO dismissively provides that "[c]onserving as much land as possible and applying appropriate mitigation measures will alleviate the cumulative impacts." EA at 73. Although BLM includes a cursory section of resource values cumulatively effected by the proposed action, the agency consistently avoids any actual cumulative analysis by claiming the scope of the lease sale is de minimis given the scale of the resource considered. For example, for air quality, BLM offers: "The very small increase in emissions that could result from approval of the action alternatives would not result in any county in the FFO area exceeding the NAAQS for any criteria pollutants." EA at 75. With regard to climate change, BLM states:

> The very small increase in GHG emissions that could result from approval of the Proposed Action Alternative would not produce climate change impacts that differ from the No Action Alternative. This is because climate change is a global process that is impacted by the sum total of GHGs in the Earth's atmosphere. <u>The incremental contribution to global GHGs from the proposed action cannot be translated into effects on climate change globally or in the area of this site-specific action.</u> It is currently not feasible to predict with certainty the net impacts

from the proposed action on global or regional climate.

EA at 75. As stated by the CEQ in its Final Guidance:

> Climate change results from the incremental addition of GHG emissions from millions of individual sources, which collectively have a large impact on a global scale. CEQ recognizes that the totality of climate change impacts is not attributable to any single action, but are exacerbated by a series of actions including actions taken pursuant to decisions of the Federal Government. Therefore, a statement that emissions from a proposed Federal action represent only a small fraction of global emissions is essentially a statement about the nature of the climate change challenge, and is not an appropriate basis for deciding whether or to what extent to consider climate change impacts under NEPA. Moreover, these comparisons are also not an appropriate method for characterizing the potential impacts associated with a proposed action and its alternatives and mitigations because this approach does not reveal anything beyond the nature of the climate change challenge itself: the fact that diverse individual sources of emissions each make a relatively small addition to global atmospheric GHG concentrations that collectively have a large impact.

Although BLM provides a generalized discussion of anticipated climate impacts within the region encompassing a given lease sale, the EA failed to estimated the contribution of GHG emissions from lease sale to cumulative GHG emissions from past, present, and reasonably foreseeable GHG-emitting oil and gas activities on public lands. Nor did BLM analyze the climate impacts of cumulative GHG emissions from these activities. Instead, as noted above, BLM declined to analyze cumulative impacts of GHG emissions at the leasing stage on the basis that "[i]t is currently not feasible to predict with certainty the net impacts from the proposed action on global or regional climate." EA at 75.

BLM cites state and national emissions levels to conclude emissions from this particular lease sale represents only a small fraction of these emissions, and are therefore insignificant. (Notably, BLM makes this assertion without actually estimating resulting emissions). In so doing, however, BLM is defining the cumulative impacts area with respect to GHG emissions at a state and national scale. Using this baseline, the appropriate scope of the BLM's cumulative analysis must similarly be at this scale, which would include disclosing and considering the cumulative emissions from BLM's Oil and Gas Leasing Program—including emissions from all active producible wells managed by BLM—and the incremental contribution to these emissions from the proposed lease sale. BLM must not only disclose and quantify these emissions, but also consider the effect that these emissions will have to resource values and communities across the planning area, and to our nation as a whole.

BLM's estimates the direct GHG emissions from the sale, which alone do not provide the decisionmaker or the public with a context for understanding the effects to climate from BLM's proposed sale either individually or in the aggregate. Climate data and GHG quantification tools and methodologies, such as the Social Cost of Carbon, are readily available to BLM, easy to

apply, and are already in widespread use throughout the Federal and private sectors, state and local governments, and globally. The Social Cost of Carbon estimates the cost to society of each additional ton of GHG pollution emitted into the atmosphere, thereby providing a fairly comprehensive estimate of climate change damage resulting from a project's GHG emissions.

There is no effort to identify, much less quantify, the myriad cumulative impacts that this lease sale will contribute to, as noted above. Indeed, such analysis is impossible while the Mancos RMPA and EIS remain uncompleted. As defined in the EA: "Cumulative impacts include the combined effect of past projects, specific planned projects and other reasonably foreseeable future actions." EA at 52 (emphasis added). And, as noted above, additional impacts from the shale oil play "were not anticipated in the RFD or analyzed in the current 2003 RMP/EIS." 79 Fed. Reg. 10548. Without the benefit of completed RMPA considering this new level of development, by BLM's own definition it is impossible to sufficiently determine what the cumulative impacts from the January 2017 lease sale might be.

Here, BLM attempts to satisfy their NEPA obligation for this resource solely by tiering to the Air Resources Technical Report for Oil and Gas Development ("ARTR"). Although the ARTR does broadly describe the air resource conditions and impacts for the New Mexico, Oklahoma, Texas and Kansas region, a document of this scope cannot satisfy the site-specific cumulative impacts to air resources stemming from this lease sale, which is the level of analysis NEPA demands. "Conclusory remarks," as are consistently provided throughout BLM's EA, "do not equip a decisionmaker to make an informed decision about alternative courses of action." *NRDC*, 865 F.2d at 298. "Perfunctory references do not constitute analysis useful to a decisionmaker in deciding whether, or how, to alter the program to lessen cumulative environmental impacts." *Id.* at 275. BLM's conclusory treatment of their cumulative impacts analysis fails to meet their hard look requirement under NEPA.

C. BLM failed to take a "hard look" at impacts to air quality.

The BLM failed to take a hard look at the air quality impacts from oil and gas leasing and development in the planning area, and failed to consider the Citizen Groups detailed Comments on air quality resources, incorporated herein. 40 C.F.R. § 1506.6.

The FFO's air resources analysis is tiered to the existing 2003 RMP and EIS, which, as detailed above and functionally admitted by BLM, is no longer capable of guiding agency decision-making. The 2003 RMP/EIS is also fatally flawed specifically with regards to air quality. Indeed, significant new information demonstrates that emissions associated with oil and gas development are significantly higher than what the 2003 Farmington RMP contemplated. According to recent inventory data prepared by the Western Regional Air Partnership ("WRAP"), the 2003 Farmington EIS underestimates emissions of VOCs from oil and gas operations by nearly 30-fold. In 2003, BLM estimated that within 20 years, VOC emissions would amount to 2,008.5 tons/year. According to the most recent WRAP inventory, VOC emissions from oil and gas activities in San Juan and Rio Arriba Counties were estimated to be

nearly 60,000 tons/year in 2006 and projected to be more than 55,000 tons per year by 2012.[61] The table below illustrates this discrepancy between the amount of VOC emissions projected in 2003 and the most recent estimates.

Source of Emission Inventory	VOC Emission Estimate (tons/year)
RMP 20-Year Projection (RMP EIS at J-11)	2,008.5
WRAP Phase III 2006 Inventory for San Juan/Rio Arriba Counties	59,933
WRAP Phase III 2012 Projection for San Juan/Rio Arriba Counties	55,049

This discrepancy is significant because it indicates that BLM cannot reasonably tier to the 2003 RMP/EIS to justify that air quality impacts will not be significant. If anything, BLM must either prepare an EIS to address the air quality impacts of the proposed leases, supplement the 2003 RMP/EIS prior to moving ahead with the proposed leases, or, as discussed above, defer further leasing and development until the Mancos Shale RMP and EIS are completed.

This discrepancy also indicates that the emissions data presented in the EA, which shows dramatically lower VOC emissions in San Juan and Rio Arriba Counties, is flawed. *See* EA at 50. The EA indicates that EPA emission inventory data from 2011 was utilized in reporting overall emissions in San Juan and Rio Arriba Counties. However the EPA's inventory data does not reflect the actual emission inventory data presented by the WRAP as it relies solely on point source inventory data submitted by the New Mexico Environment Department.[62] Yet, as the WRAP data indicates, the vast majority of oil and gas-related VOC emissions are non-point source emissions.

In other words, the emissions data BLM presents in the EA fails to accurately account for oil and gas emissions, raising further concerns that the EA is inadequate and fails to justify a finding of no significant impact. BLM's EA failed to analyze and assess impacts in terms of accurate emissions data for the oil and gas industry. Moreover, the agency admits that additional

[61] *See* ENVIRON, *Final Report: Development of 2012 Oil and Gas Emissions Projections for the South San Juan Basin* (Dec. 2009) (prepared for Western Regional Air Partnership) (previously included as Exhibit 3); ENVIRON, *Final Report: Development of Baseline 2006 Emissions from Oil and Gas Activity in the South San Juan Basin* (Nov. 2009) (prepared for Western Regional Air Partnership) (previously included as Exhibit 4).

[62] *See* EPA, *2011 National Emissions Inventory, version 1, Technical Support Document DRAFT* (Nov. 2013) at 160, available at: http://www.epa.gov/ttn/chief/net/2011nei/2011_neiv1_tsd_draft.pdf (previously included as Exhibit 5).

near-field air quality modeling is needed. The agency states: "Due to the close proximity of occupied buildings and residences to potential well sites on these lease parcels, information about the air quality impacts at these locations needs to be determined and disclosed as part of the NEPA analysis prior to decision making on the APDs for wells on these parcels." EA at 60. The agency later continues: "At the time of the lease sale, there is still not enough information available about how the lease will be developed to accurately determine the near-field air quality impacts." EA at 60. The agency also admits "the lease purchaser has the exclusive right to use as much of the leased lands as is necessary to explore and drill oil and gas within the lease boundaries." EA at 11. In other words, regardless of what additional modeling tells us about impacts to air quality, once leases are sold, the agency cannot prevent development. This is precisely the type of scenario that NEPA forbids.

The FFO also incorporates in the EA broad technical information related to air resources from the ARTR for New Mexico, Oklahoma, Texas and Kansas, which is too general in scope to sufficiently analyze the site-specific impacts of oil and gas leasing and development from the proposed action. These documents, as well as the agency's assertion that "leasing the subject tracts would have no direct impacts to air quality[,]" and that "[a]ny potential effects to air quality from the sale of lease parcel would occur at such time that the lease is developed[,]" is the extent of BLM's analysis of air resources. EA at 54. With no analysis, quantified data, or reference to any of NEPA's significance factors, 40 C.F.R. § 1508.27, the agency has failed to satisfy their statutory mandate. The BLM's hard look analysis "must be taken objectively and in good faith, not as an exercise in form over substance, and not as a subterfuge designed to rationalize a decision already made." *Forest Guardians,* 611 F.3d at 712. What the agency offers in one-and-a-half pages fails to satisfy this obligation.

The EA also does not actually analyze or assess the impacts of developing the proposed leases to a number of national ambient air quality standards ("NAAQS"). We are especially troubled that the EA fails to analyze the direct, indirect, and cumulative air quality impacts in the context of NAAQS promulgated since the RMP was adopted. These NAAQS include the 1-hour nitrogen dioxide NAAQS (promulgated in 2010), the 1-hour sulfur dioxide NAAQS (also promulgated in 2010), the 8-hour ozone NAAQS (promulgated in 2008), the 24-hour $PM_{2.5}$ NAAQS (promulgated in 2006), and the annual $PM_{2.5}$ NAAQS (promulgated in 2012). We are particularly concerned over the impacts to the 1-hour NO_2 NAAQS given that short-term NO_2 concentrations are linked to near-field, near ground-level emissions, including compressor engines exhaust stacks and other combustion sources. Because the RMP does not analyze or assess impacts to these air quality standards, in particular the NO_2 NAAQS, the EA cannot reasonably tier to the analysis in the 2003 RMP/EIS or otherwise reasonably conclude that the direct, indirect, and cumulative impacts of the proposed leasing will not be significant.

The failure to analyze and assess impacts to air quality is especially hard to understand because the EA acknowledges the relevant NAAQS. *See* EA at 19 (Table 2). Yet nowhere in the EA does BLM attempt to analyze what the consequences of developing the proposed leases will be in terms of future air quality concentrations. Although the BLM cites current air quality monitoring data in support of its assertion that impacts to the NAAQS will not be significant, the fact that current monitoring does not indicate the region is violating any NAAQS does not mean

that the NAAQS will never be violated. Moreover, the U.S. District Court for the District of Colorado in fact rejected a similar analysis prepared by the BLM in support of an oil and gas drilling plan in the Roan Plateau area of western Colorado. In that case, the BLM asserted that the lack of ozone violations indicated that future impacts would not be significant. In her ruling, Judge Krieger stated: "The mere fact that the area has not exceeded ozone limits in the past is of no significance when the purpose of the EIS is to attempt to predict what environmental effects are likely to occur in the future[.]" *Colo. Envtl. Coal. v. Salazar*, 875 F. Supp. 2d 1233, 1257 (D. Colo. 2012). This is particularly relevant here. BLM cites the "current design value of 0.068 ppm" for ozone as "below the attainment value of 0.070 ppm" to support a conclusion that emissions from the "proposed lease sale are not expected to impact" air quality respective to ozone. EA at 19. Notably, BLM failed to provide any site specific modeling of the cumulative effect that this sale would have to air quality in the region before reaching this conclusion.

Compounding BLM's failure in the EA to actually analyze and assess air quality impacts is that BLM entirely fails to even address emissions impacts. Although the EA discloses 2008 emission data for the San Juan Basin, there is no actual analysis or assessment as to how emission levels would be affected by development of the proposed leases. Simply disclosing the affected environment does not amount to an analysis or assessment of reasonably foreseeable impacts. Particularly when the BLM asserts that future emissions will not be significant, a lack of any actual analysis of emissions impacts is especially troublesome. The EA must be revised to include an actual analysis of how development of the proposed leases will impact emission levels.

D. BLM failed to take a "hard look" at climate change.

The BLM failed to take a hard look at the climate change impacts from oil and gas leasing and development in the planning area, and failed to consider the Citizen Groups detailed Comments on climate change and GHG emissions, incorporated herein. 40 C.F.R. § 1506.6. As detailed above, BLM failed to consider and account for significant new information and national policy dealing with GHG emissions and climate change, and failed to consider new scientific information, data, and carbon budgeting in their decisionmaking process, in violation of NEPA. Additionally, as with air quality, the FFO erroneously relies on the ARTR to satisfy the agency's NEPA obligations for climate change and GHG emissions. *See* EA at 54. As noted above, although the ARTR provides a broad overview of oil and gas emissions for a four state region, the document, in isolation, is incapable satisfying the type of site-specific NEPA analysis that is demanded here.

The agency begins with the recognition that "increasing concentrations of GHGs are likely to accelerate the rate of climate change." EA at 22. Yet, the FFO attempts to avoid performing any actual analysis and consistently ignores its obligation to consider the direct, indirect and cumulative impacts of GHG emissions, in violation of NEPA. 40 C.F.R. §§ 1502.16(a), (b); 1508.25(c). Although the agency concedes that production emissions would be a direct impact, the agency states: "[l]easing the subject tracts under the Proposed Action Alternative would have no direct impacts to climate change as a result of GHG emissions. Any potential effects to air quality from sale of a lease parcel would occur at such time that the lease

was developed." EA at 54. This type of evasive approach is inconsistent with the agency's obligations under NEPA and CEQ regulations. As noted above, this obfuscation contradicts the agency's earlier acknowledgment that full-scale oil and gas development "is reasonably foreseeable … [to] occur on leased parcels," EA at 17-18, which would otherwise compel the analysis of these reasonably foreseeable impacts. *See New Mexico ex rel. Richardson*, 565 F.3d at 718 (assessment of all "reasonably foreseeable" impacts must occur at the earliest practicable point). Perhaps more critically, however, is the scientific certainty that if we are to stem the impacts of climate change and manage for sustainable ecosystems, not only must the BLM take a hard look at GHG emissions from the proposed development, but its ultimate decision must be reflective of the challenges we face.

Here, the agency is perpetuating the inertial momentum of climate change by failing to take meaningful action on the site-specific contribution of GHG emissions from the proposed action. Although the agency does quantify the annual carbon dioxide equivalent ("CO_2e") emissions for the estimated 12 oil wells developed on lease parcels at 1,181 metric tons of CO_2e per year, the FFO attempts to diminish the significance of these emissions by comparing them on a scale to total U.S. GHG emissions, total U.S. emissions from oil and gas, and down the line to New Mexico and San Juan Basin GHG emissions from oil and gas. EA at 57.[63]

The only statement of assurance the FFO offers to mitigate these emissions is that "[t]he Field Office will work with industry to facilitate the use of the relevant BMPs for operations proposed on Federal mineral leases where such mitigation is consistent with agency policy." EA at 59. In other words, there is absolutely *no* commitment by BLM to do anything. Such a dismissive approach fails take these emissions in particular and, more broadly, the impacts climate change, seriously. These emissions contribution to climate change are precisely the type of "[cumulative] impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions" that must be considered by the agency. 40 C.F.R. § 1508.7; *Ctr. for Biological Diversity*, 538 F.3d 1172, 1217. Failure to do so would "impermissibly subject[s] the decisionmaking process contemplated by NEPA to 'the tyranny of small decisions.' " *Kern,* 284 F.3d at 1078 (citation omitted).

CEQ's Final Guidance explains the application of NEPA principals and practices to the analysis of GHG emissions and climate change, including, among others: (1) that agencies quantify a proposed action's projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools; (2) that agencies use projected GHG emissions as a proxy for assessing potential climate change effects when preparing a NEPA analysis; (3) where GHG emission tools, methodologies, or data inputs are not reasonably available, agencies include a qualitative analysis in the NEPA document and explain the basis for determining that quantification is not reasonably available; (4) analyze foreseeable direct, indirect, and cumulative GHG emissions and climate effects; (5) consider reasonable alternatives and the short- and long-term effect and benefits in the alternatives and mitigation analysis; (6) consider alternatives that

[63] However, San Juan Basin emission estimates are quantified based on 14,995 wells, which is only about 65% of the more than 23,000 current wells in the basin.

would make the actions and affected communities more resilient to the effects of a changing climate; and (7) assess the broad-scale effects of GHG emissions and climate change, either to inform programmatic decisions, or at both the programmatic and project-level. BLM falls dramatically short of this level of analysis and consideration, as required by NEPA.

a. Social cost of carbon.

An EIS must do more than merely identify impacts. An EIS must also enable the agency and other interested parties to "evaluate the severity" of the effects. *See Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 352 (1989); *see also* 40 C.F.R. § 1508.27-(b) (a factor in assessing intensity or severity, and hence significance for NEPA purposes, is "the degree to which the proposed action affects public health or safety").

BLM's EA offers estimates of the amount of GHGs that will be emitted under the lease sale, but fails to include any meaningful discussion of the impacts of these emissions. Where information relevant to foreseeable adverse impacts is unavailable, agencies must nonetheless evaluate "such impacts based upon theoretical approaches or research methods generally accepted in the scientific community." 40 C.F.R. § 1502.22(b)(4).

One widely used approach to evaluating the impact of GHG emissions is to estimate the costs of those emissions to society. The federal Interagency Working Group on the Social Cost of Carbon has developed estimates of the present value of the future costs of carbon dioxide emissions as a proxy for the magnitude and severity of those impacts. The EPA has relied on a similar peer-reviewed estimate for the social cost of methane emissions, which adjusts the social cost of carbon dioxide to account for the different effects of methane on climate change and its greater global warming potential. These tools are easy to use by agencies, easy to understand by the public, and supported by years of peer-reviewed scientific and economic research. The EPA and other federal agencies have used these social cost protocols to estimate the effects of rulemakings on climate, and certain BLM field offices have used these tools in leasing level NEPA analysis. These protocols estimate the global financial cost of each additional ton of GHG pollution emitted to the atmosphere, taking into account factors such as diminished agricultural productivity, droughts, wildfires, increased intensity and duration of storms, ocean acidification, and sea-level rise.

Here, BLM included a social cost of carbon section in its EA, but states: "The BLM finds that including monetary estimates of the social cost of GHGs (SC GHG) in its NEPA analysis for this Proposed Action would not be useful. There is no court case or existing guidance requiring the inclusion of SCC in the NEPA context." EA at 59. The agency later continued: "Given the global nature of climate change, estimating SCC of an individual decision requires assessing the impact of the project on the global market for the commodity in question. While the BLM is able to estimate the GHG emissions associated with reasonably foreseeable oil and gas development, this EA does not estimate the net effect of this action on global GHG emissions or climate change." EA at 59. Although these statements attempt to insulate the agency from including such analysis, BLM misses the fundamental NEPA obligation that employing SCC would satisfy, which is acting as a proxy for the magnitude and severity of climate impacts. And, of course,

BLM's additional quantification does not change the fundamental assumption driving the agency's analysis, that "[l]easing the subject tracts under the Proposed Action Alternative would have no direct impacts to climate change as a result of GHG emissions." EA at 54.

Simple calculations applying the SCC to GHG emissions from this lease sale offer a straightforward comparative basis for analyzing impacts, and identifying very significant costs. The agency recognizes that "Total Potential GHG Emissions from Oil and Gas Field Production at Full Development (12 wells)" is 1,181 metric tons of CO_2e. EA at 57. Applying the IWG central value of $42 per ton of CO_2 results in a SCC of $49,602 for 12 wells.[64]

Notably, BLM recognizes that "methane has a global warming potential that is *21 to 25 times* greater than the warming potential of CO_2." EA at 55. However, BLM appears unable to make up its mind with regard to which warming potential for methane to use—and fails to actually disclose and justify the warming potential actually applied to form the basis of methane emission estimates. In addition to the above statement, elsewhere BLM provides that "one ton of methane would be equal to *25 tons of CO_2 equivalent*, because it has a global warming potential (GWP) 25 times that of CO_2." EA at 22. And just a few pages later offers that "[m]ethane is *34 times more potent* at trapping greenhouse gas emissions than CO2 when considering a time horizon of 100 years (Intergovernmental Panel on Climate Change, 2013)." EA at 24.[65] Moreover, BLM offers no justification for relying on a 100-year time horizon. According to the same IPCC report (which BLM cited but failed to apply), the 20-year GWP for methane—which is the relevant timeframe for consideration if we are to stem the worst of climate change—is 87.[66] While BLM fails to quantify what percentage of stated GHG emissions from the project are from methane, EPA estimates provide that approximately 97% of emissions from oil production in the San Juan Basin are from methane. Accordingly, if the updated GWP of 87 for methane is applied, emissions of CO^2e from the project increase dramatically, to **4,745 metric tons for the 12 wells, or a SCC of $199,290.**

In the final EA, at Citizen Groups urging, BLM does include estimated indirect GHG emissions from the lease sale by applying emissions factors to estimated well production, resulting in an estimated **601,813 $MTCO^2e$ of GHG emissions per year, or a SCC of $25,276,146**. EA at 57.[67]

---

[64] It is important to note that, although the 2010 IWG SCC protocol did not address methane impacts, the 2013 IWG Technical Update explicitly addresses methane impacts. Thus, it is appropriate to calculate a SCC outcome that takes into account the full CO_2e emissions associated with the proposed leasing.

[65] It should be noted that the IPCC report cited by BLM actually identifies a GWP of 36 for methane from fossil fuel sources over a 100-year time horizon, rather than the GWP of 34 the agency cited. *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *Working Group I Contribution to the IPCC Fifth Assessment Report Climate Change 2013: The Physical Science Basis,* at 8-58 (Table 8.7) (Sept. 2013) (included previously as Scoping Exhibit 68).

[66] *See id*.

[67] Curiously, BLM reduces ultimate well recovery estimates from 245,000 barrels of oil equivalent in the draft EA at 46, to 140,000 bbls of oil per well in the final EA at 55. This change

Instead of considering these costs, the agency attempts to evade the necessary NEPA analysis of the magnitude and severity of GHG emission impacts by erroneously concluding that "[i]t is currently not feasible to predict with certainty the net impacts from the proposed action on global or regional climate" EA at 75. As noted by Judge Jackson, the SCC protocol provides such a tool. *See High Country Conservation Advocates v. U.S. Forest Service,* 52 F.Supp.3d 1174, 1190 (D.Colo. 2014). By failing to consider the costs of GHG emissions from the Proposed Action, the agency's analysis effectively assumes a price of carbon that is $0. *See id.* at 1192 (holding that although there is a "wide range of estimates about the social cost of GHG emissions[,] neither the BLM's economist nor anyone else in the record appears to suggest the cost is as low as $0 per unit. Yet by deciding not to quantify the costs as all, the agencies effectively zeroed out the cost in its quantitative analysis."). The agency's failure to consider the SCC is arbitrary and capricious, and ignores the explicit directive of EO 12866.

An agency must "consider every significant aspect of the environmental impact of a proposed action." *Baltimore Gas & Elec. Co. v. Natural Resources Defense Council*, 462 U.S. 87, 107 (1983) (quotations and citation omitted). This includes the disclosure of direct, indirect, and cumulative impacts of its actions, including climate change impacts and emissions. 40 C.F.R. § 1508.25(c). The need to evaluate such impacts is bolstered by the fact that "[t]he harms associated with climate change are serious and well recognized," and environmental changes caused by climate change "have already inflicted significant harms" to many resources around the globe. *Massachusetts v. EPA*, 549 U.S. 497, 521 (2007); *see also id.* at 525 (recognizing "the enormity of the potential consequences associated with manmade climate change."). Among other things, the agency's analysis must disclose "the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity[,]" including the "energy requirements and conservation potential of various alternatives and mitigation measures." 42 U.S.C. § 4332(c); 40 C.F.R. § 1502.16(e). As explained by CEQ, this requires agencies to "analyze total energy costs, including possible hidden or indirect costs, and total energy benefits of proposed actions." 43 Fed. Red. 55,978, 55,984 (Nov. 29, 2978); *see also* Executive Order 13514, 74 Fed. Reg. 52,117 (Oct. 5, 2009) (requiring government agencies to disclose emissions information annually from direct and indirect activities). Failing to perform such analysis undermines the agency's decisionmaking process and the assumptions made.

Moreover, BLM typically measures a project's GHG emissions against a baseline of national and/or global GHG emissions—thereby marginalizing the Proposed Actions contribution to our climate crisis while concluding the agency is powerless to avoid or mitigate such impacts. Here, the agency provides that "climate change is a global process that is impacted by the sum total of GHGs in the Earth's atmosphere. The incremental contribution to global GHGs from the proposed action cannot be translated into effects on climate change globally or in the area of this site-specific action." EA at 75. Indeed, the EPA has cautioned "against comparing GHG emissions associated with a single project to global GHG emission levels" because it erroneously leads to a conclusion that "on a global scale, emissions are not

---

is unexplained, but results in a dramatic change in lease parcel production from 2,940,000 bbls to 922,000 bbls.

likely to change" as a result of the project.[68] As noted above, CEQ has offered similar guidance, recognizing that "the totality of climate change impacts is not attributable to any single action, but are exacerbated by a series of actions including actions taken pursuant to decisions of the Federal Government. Therefore, a statement that emissions from a proposed Federal action represent only a small fraction of global emissions is essentially a statement about the nature of the climate change challenge, and is not an appropriate basis for deciding whether or to what extent to consider climate change impacts under NEPA." Applying the SCC, as provided above, takes these abstract emissions and places them in concrete, economic terms. It also allows the agency to easily perform the cost-benefit analysis mandated by EO 12866, as well as BLM's own policy. Specifically, Instruction Memorandum No. 2013-131 (Sept. 18, 2013) is reflective of the BLM's attempt to internalize the costs of such emissions:

> All BLM managers and staff are directed to utilize estimates of nonmarket environmental values in NEPA analysis supporting planning and other decision-making where relevant and feasible, in accordance with the attached guidance. At least a qualitative description of the most relevant nonmarket values should be included for the affected environment and the impacts of alternatives in NEPA analyses….
>
> Nonmarket environmental values reflect the benefits individuals attribute to experiences of the environment, uses of natural resources, or the existence of particular ecological conditions that do not involve market transactions and therefore lack prices. Examples include the perceived benefits from hiking in a wilderness or fishing for subsistence rather than commercial purposes. The economic methods described in this guidance provide monetary estimates of nonmarket values. Several non-economic, primarily qualitative methods can also be used to characterize the values attributed to places, landscapes, and other environmental features. Guidance on qualitative methods for assessing environmental values, including ethnography, interviews, and surveys, is in preparation.
>
> Ideally, economic analysis for resource management should consider all relevant values, not merely those that are easy to quantify. Utilizing nonmarket values provides a more complete picture of the consequences of a proposed activity than market data alone would allow. The BLM's Land Use Planning Handbook, Appendix D encourages inclusion of information on nonmarket values, but does not provide detail.

The agency simply cannot continue to ignore its obligation to consider the costs of GHG emissions in its decisionmaking, as it has done here.

Here, the agency violated NEPA by relying on analysis that partially disclosed the amount of GHG pollution from foreseeable oil and gas development, while also failing to take

[68] *See* Light, 87 Tul. L. Rev. 511, 546.

the essential next step required for a hard look: disclosing the costs and impacts that such pollution would have. An economic cost-benefit must be performed before the agency authorizes the proposed development. Such an analysis will reveal dramatically greater costs to people and the environment than anticipated benefits from the project, which seriously undermines the economic logic of proceeding with the proposed sale. At the very least, however, failing to provide any cost-benefit analysis is impermissible according to the agency's multiple legal obligations, including NEPA, EO 12866, as well as BLM's own policy IM No. 2013-131.

b. Methane emissions and waste.

By making absolutely no commitment on mitigation measures and BMPs to address the GHG emissions from oil and gas leasing and development, the FFO is missing a critical opportunity and, indeed, obligation, to address the serious issue of methane ("CH_4") emissions and waste. *See* EA at 59 ("The Field Office will work with industry to facilitate the use of the relevant BMPs for operations proposed on Federal mineral leases where such mitigation is consistent with agency policy."). As detailed in Comments, incorporated herein, there readily available and cost-effective mitigation technologies that can drastically reduce the amount of methane lost during production. And, as introduced above, the IPCC's best available global warming potential ("GWP") estimates for methane—of 36 over a 100-year period, and 87 over a 20-year period[69]—underscores the importance of eliminating methane waste, which is a critical step the FFO can take *now* to reduce GHG emissions in the planning area. That the FFO failed to make the use of *any* methane mitigation technology a requirement for the future development of these parcels is inexcusable. Instead of making a specific commitment to address the serious waste of a harmful climate pollutant, BLM offers that "US EPA promulgated air quality regulations controlling VOC emissions at gas wells. These rules require air pollution mitigation measures that reduce the emissions of volatile organic compounds. These same mitigation measures have a co-benefit of reducing methane emissions." EA at 20.

To the agency's credit, BLM has finally acknowledged the methane "hot spot" that exists over the San Juan Basin, citing "pioneering research using space-borne (satellite and aircraft) determination of methane concentrations have indicated anomalously large methane concentrations may occur in the Four Corners region (Kort, Frankenberg, Costigan, Lindenmaier, Dubey, & Wunch, 2014)." EA at 24. Yet, in an apparent attempt to avoid taking action on the methane hot spot, BLM continues: "While space-borne studies can determine the pollutant concentration in a column of air, these studies cannot pinpoint the specific sources of air pollution. Further study is required to determine the sources responsible for methane concentrations in the Four Corners region; however, it is known that a significant amount of methane is emitted during oil and gas well completion (Howarth, Santoro, & A. Ingraffea, 2011)." EA at 24. This uncertainty is no longer the case. This summer, NASA released a study of methane emissions in the San Juan Basin identifying 250 large methane plumes emitted from well pads, storage tanks, pipelines, gas processing plants, and venting from the San Juan coal

[69] *See* IPCC, *Fifth Assessment Report Climate Change 2013* at 8-58.

mine.[70] Together these sources make up roughly half of all basin-wide methane emissions, and all but one of these sources is from the oil and gas industry.

To comply with NEPA, the BLM must take a hard look at direct, indirect, and cumulative impacts, as discussed above. 40 C.F.R. §§ 1502.16(a), (b); 1508.25(c). In evaluating impacts, the agency must discuss "[e]nergy requirements and conservation potential of various alternatives and mitigation measures," "[n]atural or depletable resource requirements and conservation potential of various alternatives and mitigation measures," and "[m]eans to mitigate adverse environmental impacts (if not fully covered under 1502.14(f))." 40 C.F.R. §§ 1502.16(e), (f), (h). The FFO's EA fails to provide any such analysis or comparison.

We emphasize, again, the "heart" of the NEPA process: BLM's duty to consider "alternatives to the proposed action" and to "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources." 42 U.S.C. §§ 4332(2)(C)(iii), 4332(2)(E); 40 C.F.R. § 1502.14(a). Alternatives are critical because, "[c]learly, it is pointless to 'consider' environmental costs without also seriously considering action to avoid them." *Calvert Cliffs' Coordinating Comm., Inc. v. U.S. Atomic Energy Commn.*, 449 F.2d 1109, 1128 (D.C. Cir. 1971). Here, BLM considered only two alternatives: a "no action" alternative in which none of the nominated parcels would be offered for sale, and the "proposed action" where four allotment parcels covering 843 acres are offered with standard terms and conditions as well as lease stipulations dating back to the obsolete and ineffective 2003 RMP and EIS. *See* EA 9-10 (discussing alternatives). None of these existing measures or stipulations addresses GHG emissions or methane waste.

With no analysis or context, the EA includes a section on Design Features where the following statement is made:

> The FFO purchased an infrared camera designed to detect natural gas leaks on and around well pad and pipeline facilities. FFO inspection personnel have been trained to operate the camera and FFO is currently developing a strategy to implement the use of the camera in cooperation with oil and gas operators to detect and eliminate natural gas leaks in well pad and pipeline infrastructure.

EA at 12.

The infrared camera was purchased as part of the 2003 RMP settlement in 2010 by BLM and several of the organizations on this comment letter. The FFO has failed to develop a strategy to implement the infrared camera program while the infrared camera (purchased at considerable expense) is mothballed in a BLM closet. If BLM has any data that shows that the infrared camera has been used in the field, we would be interested in being apprised of how and when it has been

[70] Christian Frankenberg, et al., *Airborne methane remote measurements reveal heavy-tail flux distribution in Four Corners region*, PNAS, vol. 113 no. 25 (Aug. 30, 2016) (previously included as Exhibit 4).

utilized. In the absence of such a demonstration, the agency's reliance on an otherwise nonexistent infrared camera program, here, fails to assuage Citizens Groups' concerns regarding harmful fugitive emissions and waste from the proposed action. Without a strategy, data, and analysis demonstrating the benefits of employing this technology to address the considerable impacts and waste of methane and other pollutant emissions in the planning area, it is disingenuous at best, and deceptive at worse, to tout this as a design feature that would mitigate impacts when developing these parcels—and furthermore fails to satisfy NEPA's hard look mandate.

Moreover, the FFO's EA fails to quantify the magnitude of methane pollution from oil and gas emissions sources within the planning area—which, given the agency's admission that these parcels will be developed in a business-as-usual manner—is directly relevant to the proposed sale. Oil and natural gas systems are the biggest contributor to methane emissions in the United States, accounting for over one quarter of all methane emissions, or 129.9 million metric tons of CO_2e each year (which does not include CH_4 that has been flared, captured, or otherwise controlled).[71] However, methane emission rates can differ quite dramatically from one oil and gas field to the next, and, depending on the type of mitigation and emission controls employed, emissions can range anywhere from 1% to 12% of production.[72] In order to sufficiently understand the scope of methane emission impacts expected from the proposed action, BLM should quantify estimated emission rates and analyze alternatives that would mitigate these impacts. However, even without specific data from the proposed action, we can assume leakage somewhere between these two extremes and, even at the low end, emissions reductions would not be trivial, particularly in a region containing the largest methane plume in the country. The agency's refusal to consider any mitigation measures that would reduce these emissions fails to satisfy BLM's NEPA obligations.

Even setting aside the issue of climate change, every ton of methane emitted to the atmosphere from oil and gas development is a ton of natural gas *lost*. Every ton of methane lost to the atmosphere is therefore a ton of natural gas that cannot be used by consumers. Methane lost from federal leases will also not yield royalties otherwise shared between federal, state, and local governments. This lost gas reflects serious inefficiencies in how BLM oil and gas leases are developed. Energy lost from oil and gas production – whether avoidable or unavoidable – reduces the ability of a lease to supply energy, increasing the pressure to drill other lands to supply energy to satisfy demand. 40 C.F.R. §§ 1502.16(e)-(f). In so doing, inefficiencies create indirect and cumulative environmental impacts by increasing the pressure to satisfy demand with new drilling. 40 C.F.R. §§ 1508.7, 1508.8(b).

---

[71] *See* U.S. EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2012*, at 3-63 (April 2014) (included previously as Exhibit 12).

[72] *See, e.g.,* David T. Allen, et. al., *Measurements of methane emissions at natural gas production sites in the United States*, PNAS (Aug. 19, 2013) (finding emissions as low as 1.5% of production at select cites) (included previously as Scoping Exhibit 66); Anna Karion, et. al., *Methane emissions estimate from airborn measurements over a western United States gas field*, GEOPHYSICAL RESEARCH LETTERS (Aug. 27, 2013) (finding emissions of 6 to 12 percent, on average, in the Uintah Basin) (included previously as Scoping Exhibit 67).

c. Managing for community and ecosystem resiliency.

Critically absent from the FFO's analysis is any mention of the climate change impacts already effecting the planning area. As provided in Comments, and according to experts at the Government Accountability Office ("GAO"), federal land and water resources are vulnerable to a wide range of effects from climate change, some of which are already occurring. These effects include, among others, "(1) physical effects, such as droughts, floods, glacial melting, and sea level rise; (2) biological effects, such as increases in insect and disease infestations, shifts in species distribution, and changes in the timing of natural events; and (3) economic and social effects, such as adverse impacts on tourism, infrastructure, fishing, and other resource uses."[73] There is absolution no mention, much less analysis, in the EA of these growing impacts or the necessity to employ climate mitigation measures to ensure landscape and human resiliency and their ability to adapt and respond to climate change impacts.

Beyond mitigating climate change by reducing contributions of GHG pollution to the atmosphere, the BLM can also help promote ecological resiliency and adaptability by reducing external anthropogenic environmental stresses (like oil and gas development) as a way of best positioning public lands, and the communities that rely on those public lands, to withstand what is acknowledged ongoing and intensifying climate change degradation. It is crucial for the BLM to close the gap in their decision-making regarding the cumulative contribution of oil and gas development authorized in the proposed action, particularly given the conflict between such authorization and the agency's responsibility to manage for healthy, resilient ecosystems. Although the FFO has recognized the threat of climate change, the agency's decision-making is not reflective of this harm and the agency fails to take the many necessary and meaningful steps to ameliorate the impacts to communities, landscapes, and species. The FFO's failure to even mention the relationship between climate change and these impacts is a fundamental deficiency in the EA.

E. BLM failed to take a "hard look" at hydraulic fracturing.

The BLM failed to take a hard look at hydraulic fracturing (or "fracking") impacts from oil and gas leasing and development in the planning area, and failed to consider the Citizen Groups detailed Scoping Comments on fracking, incorporated herein. 40 C.F.R. § 1506.6.

---

[73] GAO Report, *Climate Change: Agencies Should Develop Guidance for Addressing the Effects on Federal Land and Water Resources* (2007) (included previously as Scoping Exhibit 35); *see also* Committee on Environment and Natural Resources, National Science and Technology Council, *Scientific Assessment of the Effects of Global Climate Change on the United States* (2008) (included previously as Scoping Exhibit 36); Melanie Lenart, et. al. *Global Warming in the Southwest: Projections, Observations, and Impacts* (2007) (included previously as Scoping Exhibit 37) (describing impacts from temperature rise, drought, floods and impacts to water supply on the southwest).

The agency's EA acknowledges that it is foreseeable that hydraulic fracturing will occur on leased parcels, and that "[h]ydraulic fracturing is a common process in the San Juan Basin and applied to nearly all wells drilled." *See* EA at 65. And that it is "anticipated that with more wells being drilled, there will be an increase in the amount of wells being hydraulically fractured and completed." EA at 54. In particular, the agency added in the final EA that, specifically, that the Mancos Shale in this area "has been developed by horizontal drilling and any future development is anticipated to be primarily horizontal drilling." EA at 55.

BLM also identifies general impacts from fracking, such as: "Volatile organic compounds are emitted during the completion of hydraulically fractured wells," EA at 54; "a higher probability of dust particulates in the atmosphere from the increase in vehicular traffic due to hydraulically fracturing wells," EA at 54; impacts to special status species and wildlife, EA at 69; as well as impacts to nearby residents, EA at 71. However, in each instance the FFO either relies on vague and undefined future mitigation, attempts to explain why these impacts actually aren't that big a deal, or ignores these impacts altogether—all without ever providing the hard look analysis that NEPA demands. Although BLM included additional information in Appendix 1: Phases of Oil and Gas Development, it offers little more than a factual background on the hydraulic fracturing process without actually analyzing impacts to people and resource values in the planning area. EA at 78. Critically, the agency failed to quality the types of impacts to specific resources anticipated from lease development, and in particular the greater magnitude of impacts to surface, air, and water resources from horizontal drilling and multi-stage hydraulic fracturing, which BLM admits will be the drilling technology employed on these parcels. As recognized in the attached expert declaration of petroleum engineer, Susan Harvey, the additional magnitude of impacts includes, among others, an average of 5.2 acres of land cleared per well; up to a 333% increase in air pollutant emissions, including an additional 11.88 more tons of VOCs per well and 1.13 more tons of HAPs per well; and 2,300 round trips of heavy truck traffic.[74] BLM failed to discuss altogether these and other foreseeable impacts from drilling.

With regard to VOC emissions from fracked wells, the EA cites EPA promulgated air quality regulations for completion of hydraulically fractured gas wells, and states that "[t]hese rules require air pollution mitigation measures that reduce emissions of volatile organic compounds during gas well completions." EA at 20. However, the EA fails to provide what these mitigation measures actually are, or quantify how such measures "constitute an adequate buffer against the negative impacts [and] whether the mitigation measures will render such impacts so minor as to not warrant an EIS." *National Parks*, 241 F.3d at 735.

Critically, the agency also acknowledges impacts to nearby residents, who "may be disturbed while hydraulic fracturing or other completion and stimulation operations are occurring, as these activities involve many vehicles, heavy equipment, and a workover rig." EA at 71. In response, the FFO callously provides that "[t]hese impacts would be limited to the period of time during which drilling operations associated with hydraulic fracturing occur." *Id*.

[74] Declaration of Susan L. Harvey, as submitted in *Diné CARE v. Sally Jewell*, Case No. 1:15-cv-0209 (D. N.M.) (attached as Exhibit 26).

Of course, these sensory impacts represent only some of the far broader effects that local residents will suffer from the proposed action, as detailed below. Plainly, however, the FFO cannot avoid a finding of significance simply because they allege that these impacts are limited in time, as the agency erroneously suggests. *See* 40 C.F.R. §§ 1508.8, 1508.27.

BLM does include a new lease stipulation, and provide that it was "developed to require modeling to determine 'near-field' air quality impacts (see Appendix 2). Due to the close proximity of occupied buildings and residences to potential well sites for these lease parcels, information about the air quality impacts at these locations needs to be determined and disclosed as part of the NEPA analysis prior to decision making on the APDs for wells on these parcels." EA at 71-72; Appendix 2 at 93. As noted above, however, a commitment to perform modeling at the drilling stage is too late, and a point where BLM is necessarily forced to mitigate impacts rather than preventing them altogether.

BLM and the New Mexico Oil & Gas Conservation Division's ("NMOCD") lack of inspection capacity also significantly undermines responsible oil and gas development in the state.[75] Currently, there are only 13 NMOCD field inspectors to oversee 53,000 producing wells—an impossible task.

F. BLM failed to take a "hard look" at impacts to water resources.

The BLM failed to take a hard look at water resource impacts from oil and gas leasing and development in the planning area, and failed to consider the Conservation Groups detailed Scoping Comments on both water quality and quantity, incorporated herein. 40 C.F.R. § 1506.6. In addition to the water resource concerns raised in the Comments of both the Citizen Groups and the Center for Biological Diversity, the BLM has failed to consider a significant potential impact to ground and/or surface water associated with Mancos Shale drilling. It is well established that the Mancos Shale formation, and groundwater associated with Mancos Shale beds, contains high concentrations of pollutants including nitrate, selenium, and uranium.[76] Prior to authorizing leases that will foreseeably result in Mancos Shale drilling, the BLM must analyze the potential for drilling and related operations—including produced water and frack fluid storage and disposal, drilling mud and cuttings storage and disposal, cross-contamination of aquifers from induced fractures and/or wellbore communication—to result in contamination of ground and/or surface waters with selenium, uranium, or other Mancos Shale contaminants.

a. Groundwater

BLM acknowledges: "Potential impacts to groundwater resources could occur from the proposed well bore, including groundwater depletion, contamination or cross-contamination of aquifers during drilling and completion phases." EA at 65. Nevertheless, BLM's chosen

[75] *See* Earthworks, *Enforcement Report: New Mexico Oil & Gas Conservation Division* (May 2012) (previously included as Exhibit 5).
[76] *See* U.S. Dep't of Energy, *Natural Contamination from the Mancos Shale*, LMS/S07480 (April 2011), http://energy.gov/sites/prod/files/S07480_NatContRpt.pdf.

approach is to postpone actual analysis of these impacts until the APD stage, where "a BLM geologist would identify all potential subsurface formations that would be penetrated by the wellbore. This includes all groundwater aquifers and any zones that would present potential safety or health risks that may need special protection measures during drilling, or that may require specific protective well construction measures," after which "BLM would review the company's proposed casing and cementing programs to ensure well construction design is adequate to protect the surface and subsurface environment." EA at 65-66. As with other resource values, BLM's shell-game approach to NEPA analysis fails to satisfy the agency's explicit mandate to analyze all reasonably foreseeable impacts at the earliest practicable point, which, here, clearly requires assessment prior to the January 2017 lease sale. *See New Mexico ex rel. Richardson*, 565 F.3d at 718. Unspecified mitigation and unsupported conclusions fail to demonstrate an "adequate buffer against the negative impacts" and fail to determine "whether the mitigation measures will render such impacts so minor as to not warrant an EIS." *National Parks*, 241 F.3d at 735.

The agency also states "there are no drinking water sources located in or near the proposed parcels." EA at 39. Elsewhere, however, the agency recognizes the need for additional near-field air quality modeling "[d]ue to the close proximity of occupied buildings and residences to potential well sites on these lease parcels." EA at 60. The agency fails to explain the apparent contradiction that an occupied building or residence wouldn't also require a source of drinking water. Given the agency's admission that groundwater contamination could occur—as well as a recently published study demonstrating drinking-water well contamination from fracking[77]—the agency's conclusion that there is no possibility of impacts to groundwater remains unsupported.

b. Surface Water

BLM is remarkably silent with regard to potential impacts to surface waters. Although the agency offers that "[d]uring operation, pipelines could potentially leak or rupture, which could impact groundwater quality," EA at 66, there is no mention of how such accidents would impact surface waters. In fact, all BLM offers is that, "[i]n the event of a leak or rupture, the BLM and NMOCD would work collaboratively to clean up the spill and protect groundwater." EA at 66. In other words, rather than taking steps to mitigate or avoid such accidents, BLM simply commits to cleaning it up once it happens. There is no discussion of mitigation or any other explanation of how these impacts are otherwise so insignificant as to not warrant an EIS. Such a cursory approach by the agency fails to their NEPA obligations seriously.

[77] *See* Thomas H. Darrah, et al., *Noble gasses identify the mechanisms of fugitive gas contamination in drinking-water wells overlying the Marcellus and Barnett Shales*, PNAS (Aug. 12, 2014) (previously included as Exhibit 13) (identifying "discrete clusters of fugitive gas contamination … that showed increased contamination through time" of drinking-water wells as a result of nearby hydraulic fracturing).

c. Water Quantity

The FFO's analysis of water quantity impacts is similarly devoid of detail. The limited extent of consideration in the EA provides: "The water used for hydraulic fracturing in the FFO generally comes from permitted groundwater wells, although surface water sources may occasionally be used. Because large volumes of water are needed for hydraulic fracturing, the use of groundwater for this purpose might contribute to the drawdown of groundwater aquifer levels. Groundwater use is permitted and managed by the NM OSE, and these water rights have already been designated." EA at 66. Whether or not BLM is responsible of allocation of water rights is beside the point of whether the agency has satisfied its obligations under NEPA. Here, the agency clearly has not. Notably, in an arid region already suffering from prolonged drought, substantial amounts of water—which will primarily come from groundwater sources—is required in developing these leases. "Approximately 1.02 million gallons (approximately 3.13 acre-feet) of water would be used for drilling and completions per well (Engler, et al., 2014)." EA at 66. Although BLM states that "[t]he use of groundwater for hydraulic fracturing is in compliance with all federal and state laws and regulations," EA at 66, BLM fails to take a hard look at how such water use will impact people and resources in the planning area, as NEPA requires. There is no discussion of how the groundwater drawdown from developing these oil wells will impact the land, wildlife, livestock, or human communities in the planning area, or how these impacts are further compounded in a drought-stricken southwest. There is no discussion of alternatives—such as the use of nitrogen fracking, which is already occurring in the area and which was referenced only in passing by BLM, EA at 64—or the tradeoff between water savings and air quality impacts of employing these technologies. There is no discussion of how impacts to groundwater will be mitigated, let alone with a sufficient enough buffer to avoid significance. Quite simply, the agency's EA does not satisfy the hard look NEPA demands.

G. BLM failed to take a "hard look" at induced seismic risks.

BLM arbitrarily and capriciously concluded that "there will be no induced seismic activity from the proposed action" without actually analyzing any existing subsurface conditions in the action area. EA at 40. For example, BLM did not look at whether there are active fault lines in the area, or fault lines that could be activated by wastewater injection. Instead, BLM summarily dismissed any such considerations and instead relied only on data regarding the number of past earthquakes in the area. Because there were not "any natural or induced earthquakes in the San Juan Basin from 1973-2012," EA at 39, BLM assumes that the chances of any earthquakes occurring in the action area, regardless of what activities may result directly or indirectly from the proposed action, are less than 1 percent. This assumption relies on a USGS map, Forecast for Damage from Natural and Induced Earthquakes in 2016, which merely looked at past activity rather than any site-specific existing subsurface conditions. In assuming so, BLM ignores USGS's disclaimer that "assessment of induced earthquake hazard was dependent on the assumption that past earthquake rates will remain constant over the next year of the forecast. While this assumption will not hold for areas of injection over long periods, recent studies…indicate that assessing earthquake rates observed over short time windows of a year or less are currently the best method available for forecasting the next year's rate of induced earthquakes. This model, however, does not account for increased, reduced, or new induced

activity in 2016."[78] BLM failed to consider the growing body of scientific evidence showing that increases in wastewater injections might increase seismic activity in the area.[79]

That the action area is more than 150 miles from the "three main areas in New Mexico (Dagger Draw, Raton, and Socorro) that have seismic activity," EA at 40, is irrelevant because even one new injection well could push stable faults past their tipping points and induce earthquakes.[80] Pore-pressure models have demonstrated that a combination of brine production and wastewater injection near faults in Azle, Texas, for example, generate subsurface pressures sufficient to induce earthquakes on near-critically stressed faults in the area.[81] But earthquake swarms have been observed to be associated with extraction as well, not just injection.[82] Induced seismicity is often associated with subsurface pressure changes, and extensional stresses will concentrate on the boundary of the fluid draw-down region, promoting normal faulting.[83] Contrary to BLM's assumptions, the fact that there has not yet been much seismic activity in the area does not preclude the possibility that more oil and gas activity will lead to earthquakes.

As the Center has already explained in its scoping comments, BLM is required to look at the region's fault environment by identifying and characterizing all faults in these areas based on sources including but not limited to the USGS Quaternary Fault and Fold database. In its analysis, BLM should assess its ability to identify all faults in these areas, including strike-slip faults and deep faults that can be difficult to detect. BLM should also consider the background seismicity of oil- and gas-bearing lands including the history of earthquake size and frequency, fault structure (including orientation of faults), seismicity rates, failure mechanisms, and state of stress of faults, as well as the geology of oil- and gas-bearing lands including pore pressure, formation permeability, and hydrological connectivity to deeper faults. As the Center has stated in its previous comments, BLM must analyze the potential for fracking and wastewater disposal to induce earthquakes, and the possible risks of induced seismicity in the specific areas for lease, including structures in the area that are at risk. Moreover, many of the archeological features in the region, including the delicately balanced walls of Pueblo Bonito and other Great Houses

---

[78] USGS. 2016. One-Year Seismic Hazard Forecast for the Central and Eastern United States from Induced and Natural Earthquakes, Open-File Report 2016–1035 (2016) ("USGS 2016)" at 12, available at http://pubs.usgs.gov/of/2016/1035/ofr20161035.pdf.

[79] Ellsworth, W.L. Injection-Induced Earthquakes, 341 Science 1225942 (2013) ("Ellsworth 2013"); Keranen, Katie et al., Potentially Induced Earthquakes in Oklahoma, USA: Links Between Wastewater Injection and the 2011 Mw5.7 Earthquake Sequence, Geology doi:10.1130/G34045.1 (March 26, 2013) ("Keranen 2013").

[80] Lamont-Doherty Earth Observatory, Columbia University. Distant Quakes Trigger Tremors at U.S. Waste-Injection Sites, Says Study. July 11, 2013, available at: https://www.ldeo.columbia.edu/news-events/distant-quakes-trigger-tremors-us-waste-injection-sites-says-study .

[81] Hornbach, Matthew J. et al., Causal Factors for Seismicity near Azle, Texas, Nature Communications 6:6728 (April 21, 2015), 1, available at: http://www.nature.com/ncomms/2015/150421/ncomms7728/full/ncomms7728.html.

[82] *Id*. at 5-6.

[83] *Id*.

associated with Chaco Culture National Historical Park and outlying sites, are particularly susceptible to seismic activity. Limiting its analysis to only past seismic activity in the area, which provides no information at all on the potential impacts of the proposed action, does not meet NEPA requirements.

H. BLM failed to take a "hard look" at impacts to human health.

The BLM failed to take a hard look at human health impacts from oil and gas leasing and development in the planning area, and failed to consider the Conservation Groups detailed health concerns, as raised throughout the Scoping Comments, incorporated herein. 40 C.F.R. § 1506.6.

The FFO generally identifies health impacts throughout the EA, but fails to ever offer the hard look that NEPA demands. For example, health concerns due to air quality are raised in the discussion of the Air Quality Index ("AQI") and National Air Toxics Assessment ("NATA"), EA at 20, but the agency erroneously assumes its obligations are satisfied by these references alone, and fails to acknowledge their independent responsibility to analyze these impacts under NEPA before an irretrievable commitment of resources is made.

The consideration of impacts adverse to human health are also acknowledged in the affected environment section as an obligation with regard to the agency's environmental justice review, EA at 46, but there is, typically, *no* subsequent analysis of those impacts. *See* EA at 64. As with other resource values, BLM acknowledges the potential impacts to communities and human health without ever analyzing those impacts, as NEPA demands. EA at 71 ("While the act of leasing federal minerals itself would result in no social impacts, subsequent development of a lease may generate impacts to people living near or using the area in the vicinity of the lease. Oil and gas exploration, drilling, or production could create a disruption to these people due to increased traffic and traffic delays, air pollution, noise and visual impacts."); EA at 90 ("To ensure that hydraulic fracturing is conducted in a safe and environmentally sound manner, the BLM approves and regulates all drilling and completion operations, and related surface disturbance on Federal public lands. Operators must submit Applications for Permit to Drill (APDs) to the agency. Prior to approving an APD, a BLM Field Office geologist identifies all potential subsurface formations that would be penetrated by the wellbore. This includes all groundwater aquifers and any zones that would present potential safety or health risks that may need special protection measures during drilling, or that may require specific protective well construction measures.").

None of these references to the human health impacts of oil and gas leasing and development include any actual analysis. The FFO's shell-game approach to NEPA fails to satisfy the agency's explicit mandate to analyze all reasonably foreseeable impacts at the earliest practicable point, which, here, clearly requires assessment prior to the January 2017 lease sale. *See New Mexico ex rel. Richardson*, 565 F.3d at 718.

The EA's failure to take a hard look at the potential health impacts of oil and gas activities on these leases is especially concerning given the EA's acknowledgement of the likelihood that there will be "close proximity of occupied buildings and residences to potential

well sites on these lease parcels." EA at 12. In response, the agency has imposed a lease stipulation for the four parcels requiring no surface occupancy ("NSO") within 660 feet of occupied residences. EA at 12. This setback is insufficient to ensure that health impacts will be avoided, and, critically, the agency has failed to provide any justification or data supporting this decision. For example, Colorado's oil and gas commission recently passed new rules imposing a 500-foot setback for residences, but a buffer zone setback of 1,000-feet wherein mitigation and COGCC approval is required. *See* 2 C.C.R. § 404-1. Notably, however, current Colorado ballot Initiative 88 seeks a 2,000-foot setback from the nearest occupied structure. Here, the agency has failed to justify its decision and has failed to take a hard look, in violation of NEPA.

Scientific research continues to raise concerns about the health risks of living in close proximity to oil and gas wells. In addition to the information raised in the Comments, there are at least two notable scientific papers BLM should consider in this context. First, a recent review identified 15 different components of unconventional oil and gas development, everything from trucks and tanks to chemicals and venting, which can present a chemical, physical and/or safety hazard.[84] Second, a recent study found that babies whose mothers lived in close proximity to multiple oil and gas wells were 30% more likely to be born with defects in their heart than babies born to mothers who did not live close to oil and gas wells.[85] Rather than merely noting that health impacts may occur, BLM must now take a hard look at the reasonably foreseeable health impacts of its actions.

IX. BLM failed to take a "hard look" at impacts to human communities, cultural values, and environmental justice.

The FFO attempts to avoid taking a hard look while at the same time acknowledging impacts to human communities, providing: "While the act of leasing federal minerals itself would result in no social impacts, subsequent development of a lease may generate impacts to people living near or using the area in the vicinity of the lease." EA at 71. The agency recognizes a number of different impacts to local residents, including: "Oil and gas exploration, drilling, or production could create a disruption to these people due to increased traffic and traffic delays, air pollution, noise and visual impacts[;]" and that "nearby residents may be disturbed while hydraulic fracturing or other completion and stimulation operations are occurring, as these activities involve many vehicles, heavy equipment, and a workover rig[;]" and that "[c]reation of new access roads into an area could allow increased public access and exposure of private property to vandalism." EA at 71. Yet, the agency is dismissive of all these concerns, concluding that "[f]or leases where the surface is privately owned and the subsurface is BLM managed, surface owner agreements, standard lease stipulations, and BMPs could address many of the concerns of private surface owners." EA at 71. Not only does BLM's vague reference to non-

[84] John L. Adgate *et al.*, *Potential Public Health Hazards, Exposures and Health Effects from Unconventional Natural Gas Development*, 48 ENVIRONMENTAL SCIENCE & TECHNOLOGY 8307 (Feb. 24, 2014) (previously included as Exhibit 14).
[85] Lisa M. McKenzie *et al.*, *Birth Outcomes and Maternal Resident Proximity to Natural Gas Development in Rural Colorado*, 122 ENVIRONMENTAL HEALTH PERSPECTIVES 412 (April 2014) (previously included as Exhibit 15).

specific mitigation measures fail to satisfy the agency's NEPA obligations for these identified impacts to communities, but the agency also ignores whole host of foreseeable impacts, the consideration of which should be fundamental to the agency's decision-making process for the subject lease sale—considerations that are particularly critical, here, given the Navajo allotted lands included in the sale. Critically, as noted above, occupied buildings and residences are in close proximity to well sites on these lease parcels, raising the specter impacts to human communities—not just from poor air quality, but myriad other impacts from hydraulic fracturing. Recently, on July 11, 2016, a massive fire broke out at a fracking site operated by WPX Energy that was approved by the FFO, setting off several explosions and closing Highway 550.[86] Approximately 36 storage tanks caught fire and burned, local residents were evacuated, and numerous domestic animals and livestock were killed. The massive fire took several days to burn itself out.[87]

Moreover, there are excellent sources the FFO should consider in their assessment and consideration of impacts to human communities and, particularly, native communities, many of which are outlined in a recent article in THE ATLANTIC.[88] Among the concerns and impacts to native communities raised in this article—and in particular the social and cultural impacts experienced on the Fort Berthold Indian Reservation, located in the heart of North Dakota's Bakken formation—include:

> [North Dakota's U.S. Attorney] noticed a peculiar pattern emerging from Fort Berthold. Many of his filings – a surprising number of them – involved non-Indian perpetrators. "We had five or six in a month," he told me. "Why was this? We realized it's non-enrolled folks moving to the oil patch."
>
> The immediate side-effects are the obvious ones, and they come with any boom: limited jail space, an overworked police force, a glut of men with cash in their pockets. In 2012, the tribal police department reported more murders, fatal accidents, sexual assaults, domestic disputes, drug busts, gun threats, and human trafficking cases than in any year before. The surrounding counties offer similar reports.
>
> But there is one essential difference between Fort Berthold and the rest of North Dakota: The reservation's population has more than doubled with an influx of

[86] Chow, L. Massive Fracking Explosion in New Mexico, 36 Oil Tanks Catch Fire, EcoWatch, July 13, 2016, available at http://www.ecowatch.com/massive-fracking-explosion-in-new-mexico-1919567359.html.

[87] *See* Letter from Diné CARE, *et al*., to Secretary Sally Jewell*, et al.*, RE: Mancos Shale Oil Drilling, Public Participation, and WPX Energy Explosion, July 26, 2016 (previously included as Exhibit 6).

[88] Sierra Crane-Murdoch, *On Indian Land, Criminals Can Get Away With Almost Anything*, THE ATLANTIC (Feb. 22, 2013), available at: http://www.theatlantic.com/national/archive/2013/02/on-indian-land-criminals-can-get-away-with-almost-anything/273391/ (previously included as Exhibit 16).

non-Indian oil workers – over whom the tribe has little legal control.

In 2011, the U.S. Justice Department did not prosecute 65 percent of rape cases reported on reservations. According to department records, one in three Native American women are raped during their lifetimes – two-and-a-half times the likelihood for an average American woman – and in 86 percent of these cases, the assailant is non-Indian.

Between 2009 and 2011, federal case filings on North Dakota reservations rose 70 percent.

With oil and gas industry predicting a new oil boom for the San Juan Basin[89]—with an estimated 30 billion barrels of oil trapped in the Mancos Shale—the impacts described above threaten to compound those already experienced by the native and non-native communities in the planning area. BLM's failure to articulate and analyze such impacts represents a fundamental deficiency of the EA, and overlooks critical information weighing on the conclusions reached therein, in violation of NEPA.

The BLM attempts to characterize impacts to National Forest land on the Taos Field office BLM boundary and on Navajo Allotments. These areas are rural, remote and undeveloped. The industrial activities needed to drill, operate and deliver oil and gas resources from these proposed lease parcels would fundamentally and significantly alter communities and public lands in the region. One only needs to visit the Jicarilla Ranger District of the Carson National Forest to see how oil and gas development has destroyed the forest. By necessity, these remote lease areas could be populated by man camps, itinerant workers, numerous contractors and subcontractors bound to facilitate development of the leases with unknown regard for the communities. BLM should clearly prepare an EIS to assess the significant impacts that could occur to landowners, allottees and the public if leasing for oil and gas occurs.

X. The BLM Failed to Sufficiently Analyze All Reasonable Alternatives.

Through the January 2017 lease sale NEPA process, the FFO required to "estimate and display the physical, biological, economic, and social effects of implementing each alternative considered in detail. The estimation of effects shall be guided by the planning criteria and procedures implementing [NEPA]." 43 C.F.R. § 1610.4-6. Incumbent to any NEPA process is a robust analysis of alternatives to the proposed action. Consideration of reasonable alternatives is necessary to ensure that the agency has before it and takes into account all possible approaches to, and potential environmental impacts of, a particular project. NEPA's alternatives requirement, therefore, ensures that the "most intelligent, optimally beneficial decision will

[89] Staci Matlock, *New oil boom coming to San Juan Basin*, THE NEW MEXICAN (March 13, 2014), available at: http://www.santafenewmexican.com/news/local_news/new-oil-boom-coming-to-san-juan-basin/article_665ff2f2-bd6c-54fd-9dd8-238092c73917.html (previously included as Exhibit 17).

ultimately be made." *Calvert Cliffs' Coordinating Comm., Inc. v. U.S. Atomic Energy Comm'n,* 449 F.2d 1109, 1114 (D.C. Cir. 1971).

"[T]he heart" of an environmental analysis under NEPA is the analysis of alternatives to the proposed project, and agencies must evaluate all reasonable alternatives to a proposed action." *Colorado Environmental Coalition*, 185 F.3d at 1174 (quoting 40 C.F.R. § 1502.14). An agency must gather "information sufficient to permit a reasoned choice of alternatives as far as environmental aspects are concerned." *Greater Yellowstone*, 359 F.3d at 1277 (citing *Colorado Environmental Coalition*, 185 F.3d at 1174); *see also Holy Cross Wilderness Fund v. Madigan*, 960 F.2d 1515, 1528 (10th Cir. 1992). Thus, agencies must "ensure that the statement contains sufficient discussion of the relevant issues and opposing viewpoints to enable the decisionmaker to take a 'hard look' at environmental factors, and to make a reasoned decision." *Izaak Walton League of America v. Marsh,* 655 F.2d 346, 371 (D.C. Cir.1981) (citing *Kleppe v. Sierra Club,* 427 U.S. 390, 410 n. 21 (1976)).

Here, BLM considered only two alternatives: a "no action" alternative in which none of the nominated parcels would be offered for sale, and the "proposed action" where four parcels covering 843 acres are offered with standard terms and conditions as well as lease stipulations dating back to the obsolete and ineffective 2003 RMP and EIS. *See* EA at 11 (discussing alternatives). In other words, the FFO failed to consider any alternative that would limit or mitigate the impacts of oil and gas development, or consider oil and gas development on equal footing to other multiple use values in the planning area.

FLPMA does not mandate that every use be accommodated on every piece of land; rather, delicate balancing is required. *See Norton v. S. Utah Wilderness Alliance*, 542 U.S. 55, 58 (2004). "'Multiple use' requires management of the public lands and their numerous natural resources so that they can be used for economic, recreational, and scientific purposes without the infliction of permanent damage." *Public Lands Council v. Babbitt*, 167 F.3d 1287, 1290 (10th Cir. 1999) (citing 43 U.S.C. § 1702 (c)). As held by the Tenth Circuit, "[i]f all the competing demands reflected in FLPMA were focused on one particular piece of public land, in many instances only one set of demands could be satisfied. A parcel of land cannot both be preserved in its natural character and mined." *Rocky Mtn. Oil & Gas Ass'n v. Watt,* 696 F.2d 734, 738 n. 4 (10th Cir.1982) (quoting *Utah v. Andrus,* 486 F.Supp. 995, 1003 (D.Utah 1979)); *see also* 43 U.S.C. § 1701(a)(8) (stating, as a goal of FLPMA, the necessity to "preserve and protect certain public lands in their natural condition"); *Pub. Lands Council,* 167 F.3d at 1299 (citing § 1701(a)(8)). As further provided by the Tenth Circuit:

> BLM's obligation to manage for multiple use does not mean that development *must* be allowed on [a particular piece of public lands]. Development is a *possible* use, which BLM must weigh against other possible uses – including conservation to protect environmental values, which are best assessed through the NEPA process. Thus, an alternative that closes the [proposed public lands] to development does not necessarily violate the principle of multiple use, and the multiple use provision of FLPMA is not a sufficient reason to exclude more protective alternatives from consideration.

New Mexico ex rel. Richardson, 565 F.3d at 710. This type of analysis is entirely absent from the FFO's EA, which has elevated oil and gas above the area's other multiple use resources, in violation of NEPA. *See* 43 C.F.R. § 1610.4-6.

XI. FLPMA: Unnecessary and Undue Degradation

Pursuant to the Federal Land Policy and Management Act ("FLPMA"), 43 U.S.C. § 1701 *et seq.*, "[i]n managing the public lands," the agencies "shall, by regulation or otherwise, take any action necessary to prevent unnecessary or undue degradation of the lands." 43 U.S.C. § 1732(b). Written in the disjunctive, BLM must prevent degradation that is "unnecessary" and degradation that is "undue." *Mineral Policy Ctr. v. Norton*, 292 F.Supp.2d 30, 41-43 (D. D.C. 2003). This protective mandate applies to agencies planning and management decisions, and should be considered in light of its overarching mandate that the FFO employ "principles of multiple use and sustained yield." 43 U.S.C. § 1732(a); *see also, Utah Shared Access Alliance v. Carpenter*, 463 F.3d 1125, 1136 (10th Cir. 2006) (finding that BLM's authority to prevent degradation is not limited to the RMP planning process). While these obligations are distinct, they are interrelated and highly correlated. The Bureau must balance multiple uses in its management of public lands, including "recreation, range, timber, minerals, watershed, wildlife and fish, and [uses serving] natural scenic, scientific and historical values." 43 U.S.C. § 1702(c). It must also plan for sustained yield—"control [of] depleting uses over time, so as to ensure a high level of valuable uses in the future." *Norton v. S. Utah Wilderness Alliance,* 542 U.S. 55, 58 (2004).

"Application of this standard is necessarily context-specific; the words 'unnecessary' and 'undue' are modifiers requiring nouns to give them meaning, and by the plain terms of the statute, that noun in each case must be whatever actions are causing 'degradation.' " *Theodore Roosevelt Conservation Partnership v. Salazar*, 661 F.3d 66, 76 (D.C. Cir. 2011) (citing *Utah v. Andrus,* 486 F.Supp. 995, 1005 n. 13 (D. Utah 1979) (defining "unnecessary" in the mining context as "that which is not necessary for mining"—or, in this context, "for oil and gas development"—and "undue" as "that which is excessive, improper, immoderate or unwarranted.")); *see also Colorado Env't Coalition,* 165 IBLA 221, 229 (2005) (concluding that in the oil and gas context, a finding of "unnecessary or undue degradation" requires a showing "that a lessee's operations are or were conducted in a manner that does not comply with applicable law or regulations, prudent management and practice, or reasonably available technology, such that the lessee could not undertake the action pursuant to a valid existing right.").

Here, that action is the oil and gas development authorized by the FFO through the January 2017 lease sale. The inquiry, then, is whether the agency has taken sufficient measures to prevent degradation unnecessary to, or undue in proportion to, the development the proposed action permits. *See Theodore Roosevelt Conservation Partnership*, 661 F.3d at 76. For example, methane waste and pollution may cause "undue" degradation, even if the activity causing the degradation is "necessary." Where methane waste and pollution is avoidable, even if in the

process of avoiding such emissions lessees or operators incur reasonable economic costs that are consistent with conferred lease rights, it is "unnecessary" degradation. 43 U.S.C. § 1732(b).

Therefore, drilling activities may only go forward as long as unnecessary and undue environmental degradation does not occur. This is a *substantive* requirement, and one that the BLM must define and apply in the context of oil and gas development authorized through the lease sale. In other words, the FFO must define and apply the substantive UUD requirements in the context of the specific resource values at stake.

Further, these UUD requirements are distinct from requirements under NEPA. "A finding that there will not be significant impact [under NEPA] does not mean either that the project has been reviewed for unnecessary and undue degradation or that unnecessary or undue degradation will not occur." *Ctr. for Biological Diversity,* 623 F.3d at 645 (quoting *Kendall's Concerned Area Residents,* 129 I.B.L.A. 130, 140 (1994)). In the instant case, BLM must specifically account for UUD in its NEPA analysis for the January 2017 lease sale, which is distinct from its compliance under NEPA, and is also actionable on procedural grounds.

XII. Conclusion

The Citizen Groups appreciate your consideration of the information and concerns addressed herein, as well as the information included in the attached exhibits. In general, we are alarmed at the fatal deficiencies of the EA analysis and the numerous issues overlooked and/or marginalized in the EA. The boilerplate EA continues the trend of BLM rushing oil and gas lease documents to meet prescribed lease sale schedules, rather than performing the analysis required by NEPA and its implementing regulations. These deficiencies fail to support a decision to proceed with the proposed lease sale. Accordingly, the no action alternative should be adopted.

Should you have any questions, please do not hesitate to contact me.

Sincerely,

Kyle Tisdel
WESTERN ENVIRONMENTAL LAW CENTER
208 Paseo del Pueblo Sur, Unit 602
Taos, New Mexico 87571
575.613.8050
tisdel@westernlaw.org

Along with:

Rachel Conn
AMIGOS BRAVOS
PO Box 238
Taos, NM 87571
rconn@amigosbravos.org

Anson Wight
CHACO ALLIANCE
4990 SW Hewett Blvd.
Portland, OR 97221
ansonw@comcast.net

Michael Saul
CENTER FOR BIOLOGICAL DIVERSITY
1536 Wynkoop St., Ste. 421
Denver, CO 80202
msaul@biologicaldiversity.org

Carol Davis
DINÉ CARE
Dilkon, on Navajo Nation
HRC 63 Box 272
Winslow, AZ 86047
caroljdavis.2004@gmail.com

Pete Dronkers
EATHWORKS
1612 K Street, Suite 808
Washington, DC 20006
pdronkers@earthworksaction.org

Marissa Knodel
FRIENDS OF THE EARTH
1101 15th St. NW, Floor 11
Washington, D.C.
mknodel@foe.org

Amy Mall
NATURAL RESOURCES DEFENSE COUNCIL
1152 15th Street, N.W., Suite 300
Washington, D.C. 20005
amall@nrdc.org

Mike Eisenfeld
SAN JUAN CITIZENS ALLIANCE
PO Box 6655
Farmington, NM 87499
mike@sanjuancitizens.org

Katie Schaefer
SIERRA CLUB
2101 Webster Street, Suite 1300
Oakland, CA 94612
katie.schaefer@sierraclub.org

Jeremy Nichols
WILDEARTH GUARDIANS
1536 Wynkoop St., Ste. 301
Denver, CO 80202
jnichols@wildearthguardians.org

From:	Michael Saul
To:	jbierk@blm.gov
Cc:	Michael Saul; Diana Dascalu-Joffe; "Chen, Alan"
Subject:	Proposed Supplementary Rules
Date:	Monday, December 5, 2016 5:57:45 PM
Attachments:	Center Comment on Bureau of Land Management Colorado Supplementary Rules Final 12-5-16.pdf

---

Chief Ranger Bierk,

Please find attached, in .pdf format, the comments of the Center for Biological Diversity on the BLM's "Proposed Supplementary Rules for Public Lands in Colorado," 81 Fed. reg. 69,019.

Please feel free to contact me if you have questions regarding these comments or would like to discuss further.

Sincerely,

Michael Saul

Michael Saul

Senior Attorney, Public Lands

Center for Biological Diversity

Denver, CO

phone/text 303-915-8308

msaul@biologicaldiversity.org

This email may contain material that is confidential, privileged and/or attorney work product for the sole use of the intended recipient. Any review, reliance or distribution by others or forwarding without express permission is strictly prohibited. If you are not the intended recipient, please contact the sender and delete all copies.

December 5, 2016

John Bierk
State Chief Ranger
BLM Colorado State Office
2850 Youngfield Street
Lakewood, CO 80215

Via electronic mail to: jbierk@blm.gov

Re: Proposed Supplementary Rules, 81 Fed. Reg. 69,019 (Oct. 5, 2016)

Chief Ranger Bierk:

The Center for Biological Diversity ("Center") hereby submits the following comments on the Bureau of Land Management's (BLM) proposed supplementary rules for public lands and BLM facilities in Colorado, 81 Fed. Reg. 69,019 (Oct. 5, 2016). Many of the proposed rules appear to be either (a) reasonable provisions to protect public safety (e.g., from exploding targets) or (b) duplicative of existing provisions of Colorado state law. However, the Center is concerned that certain provisions of the proposed rules, most notably elements of Prohibited Acts 2, 6, and 7, are content-based limitations on the public's constitutionally-protected right to freedom of speech and assembly in violation of the First Amendment to the U.S. Constitution and/or are unconstitutionally vague.

As the BLM is no doubt aware, content-based regulations of speech are presumptively unconstitutional and subject to the strictest constitutional scrutiny. *See Reed v. Town of Gilbert*, 135 S.Ct. 2218, 2227 (2015). Just last year in *Reed*, the Supreme Court reiterated that "it is well established that '[t]he First Amendment's hostility to content-based regulation extends not only to restrictions on particular viewpoints, but also to prohibition of public discussion of an entire topic.'" *Id.* at 2223, *quoting Consolidated Edison Co. of N. Y.* v. *Public Serv. Comm'n of N. Y.*, 447 U. S. 530, 537 (1980). Even a facially-neutral regulation is content-based and presumptively unconstitutional if it was "adopted by the government 'because of disagreement' with its message, and whether the regulation was 'justified without reference to the content of the speech.'" *Id.* at 2227, *quoting Ward v. Rock Against Racism*, 491 U.S. 781, 791 (1989). It is our view that many provisions of the proposed regulation overtly discriminate against speech based on its content and that the factual context in which the regulation has arisen suggests that at least one of BLM's underlying purposes is to restrict speech because it disagrees with the speakers' message. Furthermore, we believe that several elements of the regulation are also unconstitutionally vague.

The Center of course recognizes the BLM's legitimate public interest in ensuring the safety of its employees, the public, and the public lands. But in purporting to advance those interests, the BLM's proposed regulation sweeps far wider than necessary to regulate harmful conduct and encompasses much activity that would unequivocally count as constitutionally-protected speech. For instance, Prohibited Act 2 is drafted in such a manner as to preclude a protest or demonstration that is intended to influence not only the conduct of but also the substantive decisions at a BLM meeting, procession, or gathering. As written, BLM officials could enforce this provision against any speaker whom they deem to be intending to disrupt a lawful BLM meeting by oral protest; in contrast, a speaker who enthusiastically cheered on the BLM officials' actions would not be subject to sanction. The second clause of Prohibited Act 2 specifically prohibits pure speech ("verbal utterances") that obstructs or interferes with a meeting, again overtly regulating those who oppose BLM's actions but not those who do not. Prohibited Act 6

extends to those who might "hinder" a BLM meeting or any of its officials, which again could be construed to allow punishment of pure speech designed to persuade BLM officials to adopt or not adopt a particular policy. Finally, Prohibited Act 7 expressly regulates "demonstrations," which are pure forms of expression designed to influence public policy, even when regulating such expression would not be consistent with accepted constitutional limits. While demonstrations can surely be regulated where they present a "clear and present danger to the public health and safety," Act 7(v), they may not be prohibited because of some undifferentiated governmental interest in protecting the tranquility of "interpretive, visitor service, or other program activities," Act 7(iii).

Our concern with the content-based nature of the proposed regulation is informed not only by the regulation's explicit language, but by a disturbing pattern of recent events that creates reason to believe that certain of the proposed rules are intended to stifle protected speech based on its content, namely opposition to federal fossil fuel leasing policies. Although the proposed rules do not single out climate or environmental activism by name, the context and timing of their promulgation creates substantial concern that their purpose is to prohibit climate speech as "disruptive" simply because it criticizes BLM's policies and/or displeases representatives of the oil and gas industry. Examples of activities that raise these concerns include moving public oil and gas lease sale auctions, including those located in Colorado, online to avoid scrutiny by the public; clandestine and social media surveillance of peaceful climate activists in Colorado; and, in the case of the BLM New Mexico State Office, moving an oil and gas lease sale auction from Santa Fe to Roswell, makingattendance more difficult for demonstrators. Suspicions of content discrimination are exacerbated by the fact that several of these incidents have involved the Colorado BLM specifically. Colorado has been the site of numerous demonstrations opposing oil and gas where the Colorado BLM and demonstrators have disagreed over public access to oil and gas auctions, and that Colorado has been the site of clandestine surveillance of demonstrators. It is no mere coincidence that the proposed rule is not generally applicable to all BLM lands and facilities, but only to BLM facilities located in Colorado.

Governmental regulations constitute content-based restrictions on speech if they distinguish between permissible and impermissible speech based on the views expressed. *See Griffin v. Bryant*, 30 F. Supp.3d 1139, 1173 (D.N.M. 2014). In this case, because of a pattern of governmental activities targeting conservationists and climate activists because of the content of their message, there is substantial reason to believe that the proposed rules are content-based and therefore presumptively unconstitutional. In this context, multiple provisions of the proposed rule – including vague prohibitions on "obstruct[ing] or interfer[ing] with" meetings and gatherings (Prohibited Act 2); requirements to leave public facilities if "threaten[ing] to commit . . . any act which . . . would interfere with, or obstruct" BLM functions (Prohibited Act 6); and provisions to consign protected speech to "designated demonstration areas" (Prohibited Act 7) create a presumption that the proposed rule is intended to restrict the speech of climate activists simply because BLM does not want to be exposed to speakers' substantive messages.

Beyond the concerns about content-discrimination built into the proposed regulation's features, much of the language included is so vague as to make it impossible for the average person to understand when he or she is in violation of its provisions. Regulation of speech must be sufficiently precise as to allow regulated persons to be able to conform their conduct to the rule. An ordinance, for example, prohibiting assembly and conduct that is "annoying to persons passing by" is unconstitutional because the subjective standard of "annoying" conduct is effectively no standard at all. *Coates v. Cincinnati*, 402 U.S. 611, 614 (1971). The constitutional requirement of regulatory precision of speech is also designed to preclude the type of unfettered discretion granted to BLM officials by this proposed regulation. In effect, this regulation would permit BLM to enforce the rules in a manner that discriminates against speakers because of their viewpoint or the content of their expression. Regulation of speech is unconstitutionally vague when the law is "so standardless that it authorizes or encourages seriously discriminatory enforcement." *United States v. Williams*, 553 U.S. 285, 304 (2008) (citing *Hill v. Colorado*, 530 U.S. 703, 732 (1972)).

The regulation as written would authorize enforcement against any person who engaged in pure expression (giving a speech, holding up a protest sign, etc.) that was construed by BLM officials to "obstruct," "interfere,"

"impede," "disrupt," or "hinder" BLM meetings or the actions of its officials. Unless the terms "obstruct," "interfere," "impede," "disrupt," and "hinder," are clarified with greater precision, the proposed rule will chill speakers who are unsure of whether their protected expression runs afoul of the provisions and also creates a substantial risk of encouraging discriminatory enforcement. BLM must replace terms the "obstruct," "interfere," "impede," "disrupt," and "hinder," with specifically-identifiable conduct, and must exercise care in the application of the rule to ensure that it is not disproportionately applied on the basis of either viewpoint or subject matter. Should the BLM proceed with the rule in its current form, it should explicitly clarify that speech and assembly at BLM facilities or on public land cannot be prohibited as "disruptive" or "interfering," simply because the speech objects to or disagrees with BLM policies or actions. BLM has a legitimate interest in preventing *conduct* that *actually* interferes with its official activities, such as Prohibited Act 4, designed to protect safety and allow public officials to conduct their duties.

Should BLM proceed with the adoption of the proposed rules, several other changes are also necessary to ensure consistency with the First Amendment's protections for freedom of speech and freedom of assembly. To address the danger of discriminatory enforcement, BLM must make explicit in the rule, its implementation, and in training its personnel, that the proposed rules may not be applied or enforced disproportionately or arbitrarily based on the content of speech. Content-based regulations are unconstitutional unless the government can show that the regulation is narrowly tailored to serve a compelling government interest. *See Sable Comm'ns of Cal. v. FCC*, 492 U.S. 115 (1989). "Some facial distinctions based on a message are obvious, defining regulated speech by a particular subject matter, and others are more subtle, defining regulated speech by its function or purpose." *Reed*, 135 S. Ct. at 2227. Here, proposed Prohibited Act 2 prohibits all action "intended to prevent or disrupt" or "obstruct or interfere with" a BLM meeting, procession, or gathering. It is obviously the stated intent of many climate activists to (by lawful and peaceful means) prevent future federal fossil fuel auctions by exercising their rights of speech, assembly, and petition to lawfully and peacefully persuade the BLM to exercise its lawful authority to decline to offer federal lands and minerals for fossil fuel extraction. Under the First Amendment, BLM may not prohibit protected speech and assembly simply because its intended substantive outcome is to "prevent" fossil fuel auctions. *See Reed*, 135 S. Ct. at 2227; *Ward*, 491 U.S. at 791. The public cannot be excluded from public or limited nonpublic fora without a compelling governmental interest, s*ee Cornelius v. NAACP Legal Def. & Edu. Fund*, 473 U.S. 788, 800 (1985), and even nonpublic fora can be limited only "as long as the regulation on speech is reasonable and not an effort to suppress expression merely because public officials oppose the speaker's view." *Perry Educ. Ass'n v. Perry Local Educators' Ass'n*, 460 U.S. 37, 46 (1983).

Finally, Prohibited Act 7, restricting public speech to "designated demonstration areas," should either be eliminated entirely because it is far too broad to advance a heightened governmental interest, or, at the very least, should be clarified to ensure that any "designated demonstration area" is minimally burdensome and provides ample alternative avenues for communication. Because the public lands administered by the BLM in Colorado are so vast (8.3 million acres of federal surface), the use of "designated demonstration areas" creates enormous potential for the BLM to frustrate protected speech and expression by consigning disfavored expression to remote locations. Applying the "designated demonstration area" rule only to "public protests, assemblies, picketing, speechmaking, parades, marching, placement of signs or banners, holding vigils or religious services, and all other like forms of conduct that involve the communications or expression of views or grievances," 81 Fed. Reg. 69,022 (emphasis added) specifically targets conduct because it expresses views or grievances. Even were the rule content-neutral on its face, which it does not appear to be, given the vast federal estate covered by this regulation, it would be impermissible, for example, to prohibit demonstrators from assembling at or in the vicinity of the BLM State Office when the purpose of their speech and assembly is specifically to communicate their views regarding the policies and actions of that State Office.

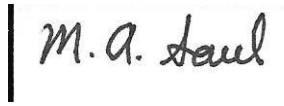
Even if the designated speech zones were construed to be content-neutral rules, they still would run the risk of violating the First Amendment. The law permits government to engage in reasonable, content neutral regulations

of the time, place, and manner of speech, but only if that regulation is (1) "narrowly tailored to serve a significant government interest" and (2) allows for "ample alternative channels for communication of the information." *Ward*, 491 U.S. at 791. Portions of Prohibited Act 7 readily appear to serve significant government interests – e.g. preventing "injury or damage to public lands," and preventing "a clear and present danger to the public health and safety." However, Prohibited Act 7(iii) in particular does not clearly identify a "significant government interest." That portion of the rule authorizes BLM to establish "designated demonstration areas" if expressive speech or conduct would "unreasonably interfere with interpretive, visitor service, or other program activities, or with the administrative activities of BLM." 81 Fed. Reg. 69,023. Although conducting "administrative activities" and "other program activities" defined broadly is certainly a government interest, shielding government officials from public viewpoints with which they disagree is emphatically not. Moreover, regulation of speech must be tailored to address the demonstrated scope of the problem the government is seeking to solve. For example, in *McCullen v. Coakley*, 134 S. Ct. 2518, 2539 (2014), the Supreme Court struck down a "buffer zone" regulation outside all abortion clinics when the State had demonstrated an issue only at one clinic. Here, BLM does not appear to have demonstrated a need for "designated demonstration areas" to prevent "unreasonable interference" at even one location, let alone across 8.3 million acres of public land.

Because it has not shown a significant governmental interest in limiting speech to "designated demonstration areas," BLM should decline to adopt Prohibited Act 7 generally, and 7(iii) in particular, in any final rule. Alternatively, however, should BLM proceed to adopt the rule, it must be clarified to ensure that any designated demonstration area complies with the final First Amendment requirement set out in *Ward v. Rock Against Racism* – that the rule provide "ample alternative avenues of communication." Where, for example, the public's speech concerns the statewide policies of the BLM State Office, designating a demonstration area out of view and/or earshot of that office would fail to provide "ample alternative avenues of communication."

Thank you for your consideration of the Center's comments on the proposed rule. The Center strongly supports the BLM's efforts to maintain the safety and integrity of the public lands, its employees, and the public. We believe that appropriate modifications and clarifications to the proposed rule would allow BLM to achieve this objective without unconstitutionally suppressing protected speech, expressive conduct, and assembly.

Sincerely,



Michael A. Saul
Senior Attorney
Center for Biological Diversity
1536 Wynkoop Street, Suite 421
Denver, CO 80202
msaul@biologicaldiversity.org

From:	Michael Saul
To:	blm_co_may_2017_lease_sale@blm.gov
Cc:	Michael Saul
Subject:	Attn: May 2017 Lease Sale
Date:	Monday, December 12, 2016 6:51:43 PM
Attachments:	Attachment A May 2017 WR Lease Sale Scoping Comment 9-7-16.pdf Attachment B CBD et al White River Protest Letter 4-27-15.pdf Attachment C Wolf 2016 CBD 16 03 10 Colorado River Basin climate impacts.pdf Center for Biological Diversity Comments May 2017 Lease Sale 12-12-16.pdf

---

Please find attached the comments of the Center for Biological Diversity regarding the Bureau of Land Management's Environmental Assessment for its proposed Colorado May 2017 oil and gas lease sale, as well as Exhibits A through C to those comments.

For your convenience, copies of additional references cited will be sent separately on CD-ROM.

Michael Saul

Michael Saul

Senior Attorney, Public Lands

Center for Biological Diversity

Denver, CO

phone/text 303-915-8308

msaul@biologicaldiversity.org

This email may contain material that is confidential, privileged and/or attorney work product for the sole use of the intended recipient. Any review, reliance or distribution by others or forwarding without express permission is strictly prohibited. If you are not the intended recipient, please contact the sender and delete all copies.

CENTER for BIOLOGICAL DIVERSITY Because life is good.

September 7, 2016

VIA ELECTRONIC MAIL AND FED EX

Bureau of Land Management
White River Field Office
220 E. Market St.,
Meeker, CO 81461
blm_co_may_2017_lease_sale@blm.gov

Re: Center for Biological Diversity's Scoping Comments on the May 2017 Competitive Oil & Gas Lease Sale

Dear Project Lead:

The Center for Biological Diversity writes to submit the following scoping comments on the proposed May 2017 Competitive Oil and Gas Lease Sale, White River Field Office.

The Bureau of Land Management ("BLM") received nominations of parcels for the aforementioned sale, which requires the BLM to prepare an Environmental Impact Statement ("EIS") under the National Environmental Policy Act ("NEPA"). The BLM Colorado State Office is proposing to offer 106 parcels encompassing approximately 101,208 acres of federal lands in Routt, Rio Blanco, Grand, Jackson, Moffat Counties (collectively, "leasing area").

The exploration and development of these parcels likely involves highly controversial and severely harmful extraction methods, including horizontal drilling and hydraulic fracturing (or "fracking"). Such extraction methods bring with them all of the harms to water quality, air quality, the climate, species, and communities associated with traditional oil and gas development, but also brings increased risks in many areas as discussed in greater detail below. Fracking has also opened up vast reserves that otherwise would not be available, increasing the potential greenhouse gas emissions that can be released into the atmosphere. BLM must consider a ban on this dangerous practice and a ban on new leasing to prevent the worst effects of climate change.

The extraction and burning of fossil fuels worsens the climate crisis; endangers water, air, wildlife, public health, and local communities; and further undermines the protection of our public lands. Because new fossil fuel leasing within the planning area will contribute to worsening the climate crisis, the vast majority of all *proven* fossil fuels must be kept in the ground to preserve any chance of averting catastrophic climate disruption. Opening up new

areas to oil and gas exploration and unlocking new sources of greenhouse gas pollution would only fuel greater warming and contravenes BLM's mandate to manage the public lands "without permanent impairment of the productivity of the land and the quality of the environment."[1] Full compliance with the spirit and objectives of NEPA and other federal environmental laws and regulations allows, and even requires, BLM to avoid these dangers by ending all new leasing in the planning area and all other areas that it manages in order to limit the climate change effects of its actions; at a minimum, it should defer any such leasing until such time as it can conduct a comprehensive review of the climate consequences of its leasing activities, at the national and regional scale.

Although BLM's existing land use plans discuss some of the potential impacts of oil and gas leasing in very general terms, BLM must also publicly disclose its analyses of all foreseeable *site-specific* impacts. This includes a re-evaluation of conservation needs and objectives for increasingly scarce and/or fragile natural resources in the areas to be leased. Given the likelihood that fracking and other similarly harmful techniques would be employed in the exploration and development of the parcels, BLM must analyze and disclose the potential impacts resulting from such frequently used practices, including impacts of leasing on climate change, at the lease-parcel scale and across the planning areas. Proceeding with new leasing and fracking proposals *ad hoc* in the absence of a comprehensive plan that addresses these changed conditions is premature and risks irreversible damage before the agency and public have had the opportunity to weigh the full costs of oil and gas extraction and consider necessary limits on fracking.

For the reasons set forth in this letter, we insist that BLM: (1) cease all new leasing of fossil fuels in the planning area, including oil and natural gas; or, at a minimum (2) defer the proposed May 2017 Sale pending a programmatic review of all federal fossil fuel leasing which must consider a "no leasing" and "no fracking" plan amendments. Should BLM proceed with the sale, BLM must: (1) initiate formal consultation with the Fish and Wildlife Service, as required by the Endangered Species Act ("ESA"); and (2) prepare a full EIS for the proposed lease sale in consideration of significant unexamined impacts from the consequences of leasing. Any such EIS must consider a full range of alternatives, including an alternative that bans new unconventional well stimulation activities, such as hydraulic fracturing, and require strict controls on natural gas emissions and leakage.

I. BLM Must End All New Fossil Fuel Leasing and Hydraulic Fracturing.

Expansion of fossil fuel production will substantially increase the volume of greenhouse gases emitted into the atmosphere and jeopardize the environment and the health and well being of future generations. BLM's mandate to ensure "harmonious and coordinated management of the various resources *without permanent impairment of the productivity of the land and the quality of the environment*" requires BLM to limit the climate change effects of its actions.[2] Keeping all unleased fossil fuels in the ground and banning fracking and other unconventional

[1] *See* 43 U.S.C. §§ 1701(a)(7), 1702(c), 1712(c)(1), 1732(a) (emphasis added); *see also id*. § 1732(b) (directing Secretary to take any action to "prevent unnecessary or undue degradation" of the public lands).
[2] *See* 43 U.S.C. §§ 1701(a)(7), 1702(c), 1712(c)(1), 1732(a) (emphasis added); *see also id*. § 1732(b) (directing Secretary to take any action to "prevent unnecessary or undue degradation" of the public lands).

well stimulation methods would lock away millions of tons of greenhouse gas pollution and limit the destructive effects of these practices.

a. The Dangers of Hydraulic Fracturing Necessitate a Ban

The proposed leasing action is part of a dramatic recent increase in oil and gas leasing in the region, and reflects increased industry interest in developing Colorado's fossil fuel resources. The entire basis for this surge of interest is the possibility that hydraulic fracturing and other advanced recovery techniques will allow the profitable exploitation of geologic formations previously perceived as insufficiently valuable for development. Elements of these technologies have been used individually for decades. However, the combination of practices employed by industry recently is new: "Modern formation stimulation practices have become more complex and the process has developed into a sophisticated, engineered process in which production companies strive to design a hydraulic fracturing treatment to emplace fracture networks in specific areas."[3]

Hydraulic fracturing brings with it all of the harms to water quality, air quality, the climate, species, and communities associated with traditional oil and gas development, but also brings increased risks in many areas. Hydraulic fracturing, a dangerous practice in which operators inject toxic fluid underground under extreme pressure to release oil and gas, has greatly increased industry interest in developing tightly held oil and gas deposits such as those in the proposed lease area. The first aspect of this technique is the hydraulic fracturing of the rock. When the rock is fractured, the resulting cracks in the rock serve as passages through which gas and liquids can flow, increasing the permeability of the fractured area. To fracture the rock, the well operator injects hydraulic fracturing fluid at tremendous pressure. The composition of fracturing fluid has changed over time. Halliburton developed the practice of injecting fluids into wells under high pressure in the late 1940s[4]; however, companies now use permutations of "slick-water" fracturing fluid developed in the mid-1990s.[5] The main ingredient in modern fracturing fluid (or "frack fluid") is generally water, although liquefied petroleum has also been used as a base fluid for modern fracking.[6] The second ingredient is a "proppant," typically sand, that becomes wedged in the fractures and holds them open so that passages remain after pressure is relieved.[7] In addition to the base fluid and proppant, a mixture of chemicals are used, for purposes such as increasing the viscosity of the fluid, keeping proppants suspended, impeding bacterial growth or mineral deposition.[8]

---

[3] Arthur, J. Daniel et al., Hydraulic Fracturing Considerations for Natural Gas Wells of the Marcellus Shale at 2 (Sep. 2008) ("Arthur") at 9.
[4] Tompkins, How will High-Volume (Slick-water) Hydraulic Fracturing of the Marcellus (or Utica) Shale Differ from Traditional Hydraulic Fracturing? Marcellus Accountability Project at 1 (Feb. 2011).
[5] New York State Department of Environmental Conservation, *Final Supplemental Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program, Well Permit Issuance for Horizontal Drilling and High-Volume Hydraulic Fracturing to Develop the Marcellus Shale and Other Low-Permeability Gas Reservoirs* (2015) ("NYDEC SGEIS") at 5-5.
[6] *Id.*; Arthur at 10; United States House of Representatives, Committee on Energy and Commerce, Minority Staff, Chemicals Used in Hydraulic Fracturing (Apr. 2011) ("Waxman 2011b").
[7] Arthur at 10.
[8] Arthur at 10.

Frack fluid is hazardous to human health, although industry's resistance to disclosing the full list of ingredients in frack fluid formulations makes it difficult for the public to know exactly how dangerous.[9] A congressional report sampling incomplete industry self-reports found that "[t]he oil and gas service companies used hydraulic fracturing products containing 29 chemicals that are (1) known or possible human carcinogens, (2) regulated under the Safe Drinking Water Act for their risks to human health, or (3) listed as hazardous air pollutants under the Clean Air Act."[10] Recently published scientific papers also describe the harmfulness of the chemicals often in fracking fluid. One study reviewed a list of 944 fracking fluid products containing 632 chemicals, 353 of which could be identified with Chemical Abstract Service numbers.[11] The study concluded that more than 75 percent of the chemicals could affect the skin, eyes, and other sensory organs, and the respiratory and gastrointestinal systems; approximately 40 to 50 percent could affect the brain/nervous system, immune and cardiovascular systems, and the kidneys; 37 percent could affect the endocrine system; and 25 percent could cause cancer and mutations.[12] Another study showed prenatal exposures to the chemicals used in hydraulic fracturing could disrupt hormonal development in female mice, linking 23 of 24 commonly used hydraulic fracturing chemicals to lower pituitary hormone concentrations, increased body weight, altered uterine and ovary weight, increased heart weight, and other effects.[13]

The impacts associated with the fracking-induced oil and gas development boom has caused some jurisdictions to place a moratorium or ban on fracking. For instance, in 2011 France became the first country to ban the practice.[14] In May, Vermont became the first state to ban fracking. Vermont's governor called the ban "a big deal" and stated that the bill "will ensure that we do not inject chemicals into groundwater in a desperate pursuit for energy."[15] New York State halted fracking within its borders in 2008, continued the moratorium in 2014 and banned the practice in 2015. The state's seven-year review concluded that fracking posed risks to land, water, natural resources and public health.[16] [17] Also, New Jersey's legislature recently passed a bill that would prevent fracking waste, like toxic wastewater and drill cuttings, from entering its borders,[18] and Pennsylvania, ground zero for the fracking debate, has banned "natural-gas

---

[9] Waxman 2011b; *see also* Colborn, Theo et al., *Natural Gas Operations for a Public Health Perspective*, 17 Human and Ecological Risk Assessment 1039 (2011) ("Colborn 2011"); McKenzie, Lisa et al., *Human Health Risk Assessment of Air Emissions form Development of Unconventional Natural Gas Resources*, Sci Total Environ (2012), doi:10.1016/j.scitotenv.2012.02.018 ("McKenzie 2012").
[10] Waxman 2011b at 8.
[11] Colborn 2011 at 1.
[12] Colborn 2011 at 1.
[13] Kassotis, C., et al, Adverse Reproductive and Developmental Health Outcomes Following Prenatal Exposure to a Hydraulic Fracturing Chemical Mixture in Female C57BI/6 Mice, Endocrinology, July 19, 2016.
[14] Castelvecchi, Davide, *France becomes first country to ban extraction of natural gas by fracking*, Scientific American (Jun. 30, 2011).
[15] CNN Staff Writer, *Vermont first state to ban fracking*, CNN U.S. (May 17, 2012).
[16] Public News Service - NY, *Cuomo Declares: No Fracking for Now in NY.* See: http://www.publicnewsservice.org/2014-12-18/health-issues/cuomo-declares-no-fracking-for-now-in-ny/a43579-1 .
[17] RT Network. June 30, 2015. *It's official: New York bans fracking.* https://www rt.com/usa/270562-new-york-fracking-ban/ .
[18] Tittel, Jeff, *Opinion: Stop fracking waste from entering New Jersey's borders* (Jul 14, 2012) *available at* http://www.nj.com/times-opinion/index.ssf/2012/07/opinion_stop_fracking_waste_fr html .

exploration across a swath of suburban Philadelphia . . . ."[19] Numerous cities and communities, like Buffalo, Pittsburgh, Raleigh, Woodstock, and Morgantown have banned fracking.[20]

Separate from hydraulic fracturing, the second technological development underlying the recent shale boom is the use of horizontal drilling. Shale oil and shale gas formations are typically located far below the surface, and as such, the cost of drilling a vertical well to access the layer is high.[21] The shale formation itself is typically a thin layer; however, such that a vertical well only provides access to a small volume of shale—the cylinder of permeability surrounding the well bore.[22] Although hydraulic fracturing increases the radius of this cylinder of shale, this effect is often itself insufficient to allow profitable extraction of shale resources.[23] Horizontal drilling solves this economic problem: by drilling sideways along the shale formation once it is reached, a company can extract resources from a much higher volume of shale for the same amount of drilling through the overburden, drastically increasing the fraction of total well length that passes through producing zones.[24] The practice of combining horizontal drilling with hydraulic fracturing was developed in the early 1990s.[25]

A third technological development is the use of "multi-stage" fracking. In the 1990s industry began drilling longer and longer horizontal well segments. The difficulty of hydraulic fracturing increases with the length of the well bore to be fractured, however, both because longer well segments are more likely to pass through varied conditions in the rock and because it becomes difficult to create the high pressures required in a larger volume.[26] In 2002 industry began to address these problems by employing multi-stage fracking. In multi-stage fracking, the operator treats only part of the wellbore at a time, typically 300 to 500 feet.[27] Each stage "may require 300,000 to 600,000 gallons of water," and consequently, a frack job that is two or more stages can contaminate and pump into the ground over a million gallons of water.[28]

Notwithstanding the grave impacts that these practices have on the environment, this new combination of multi-stage slickwater hydraulic fracturing and horizontal drilling has made it possible to profitably extract oil and gas from formations that only a few years ago were

---

[19] Philly.com, *Fracking ban is about our water*, The Inquirer (Jul. 11, 2012).
[20] *CBS, Pittsburgh Bans Natural Gas Drilling,* CBS/AP (Dec 8, 2010)*;* Wooten, Michael *City of Buffalo Bans Fracking* (Feb. 9, 2011); The Raleigh Telegram, *Raleigh City Council Bans Fracking Within City Limits* (Jul. 11, 2012); Kemble, William, *Woodstock bans activities tied to fracking*, Daily Freeman (Jul. 19, 2012); MetroNews.com, *Morgantown Bans Fracking* (June 22, 2011), *available at* http://www.wvmetronews.com/news.cfm?func=displayfullstory&storyid=46214.
[21] CITI, Resurging North American Oil Production and the Death of the Peak Oil Hypothesis at 9 (Feb.15, 2012) ("CITI"); United States Energy Information Administration, Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays at 4 (Jul. 2011) ("USEIA 2011"); Orszag, Peter, Fracking Boom Could Finally Cap Myth of Peak Oil (Jan. 31, 2011) ("Orszag").
[22] *Id.*
[23] *Id.*; Arthur at 8 (Figure 4).
[24] Venoco, Inc., Monterey Shale Focused Analyst Day Slide Show at 23 (May 26, 2010) ("Venoco Slide Show"), USEIA 2012a at 63.
[25] *Id.*
[26] NYDEC SGEIS at 5-93.
[27] *Id.*
[28] *Id.*

generally viewed as uneconomical to develop.[29] The effect of hydraulic fracturing on the oil and gas markets has been tremendous, with many reports documenting the boom in domestic energy production. A recent congressional report notes that "[a]s a result of hydraulic fracturing and advances in horizontal drilling technology, natural gas production in 2010 reached the highest level in decades."[30] A 2011 U.S. EIA report notes how recently these changes have occurred, stating that "only in the past 5 years has shale gas been recognized as a 'game changer' for the U.S. natural gas market."[31] With respect to oil, the EIA notes that oil production has been increasing, with the production of shale oil resources pushing levels even higher over the next decade:

> Domestic crude oil production has increased over the past few years, reversing a decline that began in 1986. U.S. crude oil production increased from 5.0 million barrels per day in 2008 to 5.5 million barrels per day in 2010. Over the next 10 years, continued development of tight oil, in combination with the ongoing development of offshore resources in the Gulf of Mexico, pushes domestic crude oil production higher.[32]

Thus, it is evident that fracking, including fracking with the most recent techniques that have been associated with serious adverse impacts in other areas of the country, is poised to expand; it is further evident that the oil and gas industry is still exploring new locations to develop, and the nation has not yet seen the full extent of fracking's impact on oil and gas development and production.

In large part through the use of fracking, the oil and gas sector is now producing huge amounts of oil and gas throughout the United States, rapidly transforming the domestic energy outlook. Fracking is occurring in the absence of any adequate federal or state oversight. The current informational and regulatory void on the state level makes it even more critical that the BLM perform its legal obligations to review, analyze, disclose, and avoid and mitigate the impacts of its oil and gas leasing decisions.

b. BLM Must Limit Greenhouse Gas Emissions by Keeping Federal Fossil Fuels in the Ground

A ban on new fossil fuel leasing and fracking is necessary to meet the U.S.'s greenhouse gas reduction commitments. On December 12, 2015, 197 nation-state and supra-national organization parties meeting in Paris at the 2015 United Nations Framework Convention on Climate Change Conference of the Parties consented to an agreement (Paris Agreement) committing its parties to take action so as to avoid dangerous climate change. [33] As the United

[29] *See* CITI at 9 ; USEIA 2011 at 4; Orszag, Peter, *Fracking Boom Could Finally Cap Myth of Peak Oil* (Jan. 31, 2011) ("Orszag").
[30] Waxman 2011b at 1.
[31] USEIA 2011 at 4.
[32] USEIA 2012a at 2
[33] United Nations Framework Convention on Climate Change, Adoption of the Paris Agreement, Proposal by the President, Draft decision -/CP.21 (2015) ("Paris Agreement") at Art. 2.

States signed the treaty on April 22, 2016[34] as a legally binding instrument through executive agreement,[35] the Paris Agreement commits the United States to critical goals—both binding and aspirational—that mandate bold action on the United States' domestic policy to rapidly reduce greenhouse gas emissions.[36]

The United States and other parties to the Paris Agreement recognized "the need for an effective and progressive response to the urgent threat of climate change on the basis of the best available scientific knowledge."[37] The Paris Agreement articulates the practical steps necessary to obtain its goals: parties including the United States have to "reach global peaking of greenhouse gas emissions *as soon as possible* . . . and to *undertake rapid reductions* thereafter in accordance *with best available science*,"[38] imperatively commanding that developed countries specifically "should continue taking the lead by undertaking economy-wide absolute emission reduction targets"[39] and that such actions reflect the "highest possible ambition."[40]

The Paris Agreement codifies the international consensus that climate change is an "urgent threat" of global concern,[41] and commits all signatories to achieving a set of global goals. Importantly, the Paris Agreement commits all signatories to an articulated target to hold the long-term global average temperature "to *well below 2°C* above pre-industrial levels and to *pursue efforts to limit the temperature increase to 1.5°C* above pre-industrial levels"[42] (emphasis added).

In light of the severe threats posed by even limited global warming, the Paris Agreement established the international goal of limiting global warming to 1.5°C above pre-industrial levels in order to "prevent dangerous anthropogenic interference with the climate system," as set forth in the UNFCCC, a treaty which the United States has ratified and to which it is bound.[43] The Paris consensus on a 1.5°C warming goal reflects the findings of the IPCC and numerous scientific studies that indicate that 2°C warming would exceed thresholds for severe, extremely

---

[34] For purposes of this Petition, the term "treaty" refers to its international law definition, whereby a treaty is "an international law agreement concluded between states in written form and governed by international law" pursuant to article 2(a) of the Vienna Convention on the Law of Treaties, 1155 U.N.T.S. 331, 8 I.L.M. 679 (Jan. 27, 1980).
[35] *See* United Nations Treaty Collection, Chapter XXVII, 7.d Paris Agreement, List of Signatories; U.S. Department of State, Background Briefing on the Paris Climate Agreement, (Dec. 12, 2015), http://www. state.gov/ r/pa/prs/ps/2015/12/250592 htm.
[36] Although not every provision in the Paris Agreement is legally binding or enforceable, the U.S. and all parties are committed to perform the treaty commitments in good faith under the international legal principle of *pacta sunt servanda* ("agreements must be kept"). Vienna Convention on the Law of Treaties, Art. 26.
[37] *Id.*, Recitals.
[38] *Id.*, Art. 4(1).
[39] *Id.*, Art. 4(4).
[40] *Id.*, Art. 4(3).
[41] *Id.*, Recitals.
[42] *Id.*, Art. 2.
[43] *See* U.N. Framework Convention on Climate Change, Cancun Agreement (2011), *available at* http://cancun.unfccc.int/ (last visited Jan 7, 2015); United Nations Framework Convention on Climate Change, Copenhagen Accord (2009), *available at* http://unfccc.int/meetings/copenhagen_dec_2009/items/5262.php (last accessed Jan 7, 2015). The United States Senate ratified the UNFCC on October 7, 1992. *See* U.S. Congress, Ratification of Treaty Document titled The United Nations Framework Convention on Climate Change, adopted May 9, 1992 *available at* https://www.congress.gov/treaty-document/102nd-congress/38.

dangerous, and potentially irreversible impacts.[44] Those impacts include increased global food and water insecurity, the inundation of coastal regions and small island nations by sea level rise and increasing storm surge, complete loss of Arctic summer sea ice, irreversible melting of the Greenland ice sheet, increased extinction risk for at least 20-30% of species on Earth, dieback of the Amazon rainforest, and "rapid and terminal" declines of coral reefs worldwide.[45] As scientists noted, the impacts associated with 2°C temperature rise have been "revised upwards, sufficiently so that 2°C now more appropriately represents the threshold between 'dangerous' and 'extremely dangerous' climate change."[46] Consequently, a target of 1.5 ºC or less temperature rise is now seen as essential to avoid dangerous climate change and has largely supplanted the 2°C target that had been the focus of most climate literature until recently.

Immediate and aggressive greenhouse gas emissions reductions are necessary to keep warming below a 1.5º or 2°C rise above pre-industrial levels. Put simply, there is only a finite amount of CO_2 that can be released into the atmosphere without rendering the goal of meeting the 1.5°C target virtually impossible. A slightly larger amount could be burned before meeting a 2°C became an impossibility. Globally, extracting and burning all proven fossil fuel reserves would release enough CO_2 to exceed this limit many times over.[47] This is before accounting for unproven resources, such as would be targeted under any new BLM leasing.

The question of what amount of fossil fuels can be extracted and burned without negating a realistic chance of meeting a 1.5 or 2°C target is relatively easy to answer, even if the answer is framed in probabilities and ranges. The IPCC Fifth Assessment Report and other expert assessments have established global carbon budgets, or the total amount of remaining carbon that can be burned while maintaining some probability of staying below a given temperature target. According to the IPCC, total cumulative anthropogenic emissions of CO_2 must remain below about 1,000 gigatonnes ($GtCO_2$) from 2011 onward for a 66% probability of limiting warming to 2°C above pre-industrial levels.[48] Given more than 100 $GtCO_2$ have been emitted since 2011,[49]

---

[44] *See* Paris Agreement, Art. 2(1)(a); U); United Nations Framework Convention on Climate Change, Subsidiary Body for Scientific and Technical Advice, Report on the structured expert dialogue on the 2013-15 review, No. FCCC/SB/2015/INF.1 at 15-16 (June 2015); Intergovernmental Panel on Climate Change, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change at 64 & Table 2.2 [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)] ("IPCC AR5 Synthesis Report") at 65 & Box 2.4.

[45] *See* Jones, C. et al, Committed Terrestrial Ecosystem Changes due to Climate Change, 2 Nature Geoscience 484: 484–487 (2009); Smith, J. B. et al., Assessing Dangerous Climate Change Through an Update of the Intergovernmental Panel on Climate Change (IPCC) 'Reasons for Concern', 106 Proceedings of the National Academy of Sciences of the United States of America 4133 (2009); Veron, J. E. N. *et al.*, The Coral Reef Crisis: The Critical Importance of <350 ppm CO2, 58 Marine Pollution Bulletin 1428, (2009); Warren, R. J. *et al.*, Increasing Impacts of Climate Change Upon Ecosystems with Increasing Global Mean Temperature Rise, 106 Climatic Change 141 (2011); Hare, W. W. *et al.*, Climate Hotspots: Key Vulnerable Regions, Climate Change and Limits to Warming, 11 Regional Environmental Change 1 (2011); Frieler, K. M. *et al.*, Limiting Global Warming to 2ºC is Unlikely to Save Most Coral Reefs, Nature Climate Change, Published Online (2013) doi: 10.1038/NCLIMATE1674; Schaeffer, M. *et al.*, Adequacy and Feasibility of the 1.5°C Long-Term Global Limit, Climate Analytics (2013).

[46] Anderson, K. and A. Bows, Beyond 'Dangerous' Climate Change: Emission Scenarios for a New World, 369 Philosophical Transactions, Series A, Mathematical, Physical, and Engineering Sciences 20 (2011).

[47] Cimons, Marlene, Keep It In the Ground 6, Sierra Club *et al.* (Jan. 25, 2016).

[48] IPCC, 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change; Summary for Policymakers (2013) at 27; IPCC AR5 Synthesis Report.

the remaining portion of the budget under this scenario is well below 900 $GtCO_2$. To have an 80% probability of staying below the 2°C target, the budget from 2000 is 890 $GtCO_2$, with less than 430 $GtCO_2$ remaining.[50]

To have even a 50% probability of achieving the Paris Agreement goal of limiting warming to 1.5°C above pre-industrial levels equates to a carbon budget of 550-600 $GtCO_2$ from 2011 onward, [51] of which more than 100 $GtCO_2$ has already been emitted. To achieve a 66% probability of limiting warming to 1.5°C requires adherence to a more stringent carbon budget of only 400 $GtCO_2$ from 2011 onward, [52] of which less than 300 $GtCO_2$ remained at the start of 2015.[53] An 80% probability budget for 1.5°C would have far less that 300 $GtCO_2$ remaining. Given that global CO_2 emissions in 2014 alone totaled 36 $GtCO_2$,[54] humanity is rapidly consuming the remaining burnable carbon budget needed to have even a 50/50 chance of meeting the 1.5°C temperature goal.[55]

According to a recent report[56] by EcoShift Consulting commissioned by the Center and Friends of the Earth, unleased (and thus unproven and unburnable) federal fossil fuels represent a significant source of potential greenhouse gas emissions:

- Potential GHG emissions of federal fossil fuels (leased and unleased) if developed would release up to 492 gigatons (Gt) (one gigaton equals 1 billion tons) of carbon dioxide equivalent pollution (CO2e); representing 46 percent to 50 percent of potential emissions from all remaining U.S. fossil fuels.
- Of that amount, up to 450 Gt CO2e have not yet been leased to private industry for extraction;

---

[49] From 2012-2014, 107 GtCO2 was emitted (*see* Annual Global Carbon Emissions at http://co2now.org/Current-CO2/CO2-Now/global-carbon-emissions.html (accessed May 20, 2016)).

[50] Carbon Tracker Initiative, Unburnable Carbon – Are the world's financial markets carrying a carbon bubble? http://www.carbontracker.org/wp-content/uploads/2014/09/Unburnable-Carbon-Full-rev2-1.pdf (accessed May 20, 2016); Meinshausen, M. *et al.*, Greenhouse gas emission targets for limiting global warming to 2 degrees Celsius, 458 Nature 1158, 1159 (2009).

[51] IPCC AR5 Synthesis Report at 64 & Table 2.2.

[52] *Id*.

[53] See CarbonBrief, Carbon Countdown: How Many Years of Current Emissions Would Use up the IPCC's Carbon Budgets for Different Levels of Warming, http://www.carbonbrief.org/analysis-only-five-years-left-before-one-point-five-c-budget-is-blown (accessed May 20, 2016).

[54] *See* Global Carbon Emissions, http://co2now.org/Current-CO2/CO2-Now/global-carbon-emissions html

[55] In addition to limits on the *amount* of fossil fuels that can be utilized, emissions pathways compatible with a 1.5 or 2°C target also have a significant temporal element. Leading studies make clear that to reach a reasonable likelihood of stopping warming at 1.5° or even 2°C, global CO2 emissions must be phased out by mid-century and likely as early as 2040-2045. *See, e.g.* Rogelj, Joeri *et al.*, Energy system transformations for limiting end-of-century warming to below 1.5°C, 5 Nature Climate Change 519, 522 (2015). United States focused studies indicate that we must phase out fossil fuel CO2 emissions even earlier—between 2025 and 2040—for a reasonable chance of staying below 2ºC. *See, e.g.* Climate Action Tracker, http://climateactiontracker.org/countries/usa. Issuing new legal entitlements to explore for and extract federal fossil fuels for decades to come is wholly incompatible with such a transition.

[56] Ecoshift Consulting, et al., The Potential Greenhouse Gas Emissions of U.S. Federal Fossil Fuels. Prepared for Center for Biological Diversity & Friends of the Earth. 2015. Available at http://www.ecoshiftconsulting.com/wpcontent/uploads/Potential-Greenhouse-Gas-Emissions-U-S-Federal-Fossil-Fuels.pdf

- Releasing those 450 Gt CO2e (the equivalent annual pollution of more than 118,000 coal-fired power plants) would be greater than any proposed U.S. share of global carbon limits that would keep emissions below scientifically advised levels.

Fracking has also opened up vast resources that otherwise would not be available, increasing the potential for future greenhouse gas emissions. In recognition of established climate science, and global carbon budgeting, BLM must consider a ban on fracking and a ban on new leasing.

Beginning the phase-out of public fossil fuel production by ceasing new onshore leases would have a significant effect on U.S. contributions to greenhouse gas emissions, allowing us to meet targets under the Paris Agreement. The first systematic quantitative assessment of the emissions consequences of a cessation of federal leasing (both onshore and offshore) found that:

> [U]nder such a policy, U.S. coal production would steadily decline, moving closer to a pathway consistent with a global 2°C temperature limit. Oil and gas extraction would drop as well, but more gradually, as federal lands and waters represent a smaller fraction of national production, and these resources take longer to develop. Phasing out federal leases for fossil fuel extraction could reduce global CO2 emissions by 100 million tonnes per year by 2030, and by greater amounts thereafter.[57]

II. BLM Must Consider Alternatives that Ban New Oil and Gas Leasing and Fracking in a Programmatic Review and Halt All New Leasing and Fracking in the Meantime

Development of unleased oil and gas resources will not only worsen climate disruption, it will undercut the needed transition to a clean energy economy. As BLM has not yet had a chance to consider no-leasing and no-fracking alternatives as part of any of its RMP planning processes or a comprehensive review of its federal oil and gas leasing program, BLM should suspend new leasing until it properly considers these alternatives in updated RMPs or a Programmatic EIS (or "PEIS") for the entire leasing program. BLM demonstrably has tools available to consider the climate consequences of its leasing programs, and alternatives available to mitigate those consequences, at either a regional or national scale.[58]

BLM would be remiss to continue leasing when it has never stepped back and taken a hard look at this problem at the programmatic scale. Before allowing more oil and gas extraction in the planning area, BLM must: (1) comprehensively analyze the total greenhouse gas emissions which result from past, present, and potential future fossil fuel leasing and all other activities across all BLM lands and within the various planning areas at issue here, (2) consider their

[57] Erickson, Peter and Michael Lazarus, How Would Phasing Out U.S. Federal Leases for Fossil Fuel Extraction Affect CO_2 Emissions and 2°C Goals? 1, 31-32, Stockholm Environment Institute Working Paper 2016-02 (May 2016).

[58] *See, e.g.,* U.S. Bureau of Land Management Montana, North Dakota and South Dakota, Climate Change Supplementary Information Report (updated Oct. 2010) (conducting GHG inventory for BLM leasing in Montana, North Dakota and South Dakota); U.S. Bureau of Land Management, Proposed Rule: Waste Prevention, Production Subject to Royalties, and Resource Conservation, 81 Fed. Reg. 6615 (Feb. 8, 2016) (proposing BLM-wide rule for prevention of methane waste).

cumulative significance in the context of global climate change, carbon budgets, and other greenhouse gas pollution sources outside BLM lands and the planning area, and (3) formulate measures that avoid or limit their climate change effects. By continuing leasing and allowing new fracking in the absence of any overall plan addressing climate change BLM is effectively burying its head in the sand.

A programmatic review and moratorium on new leasing would be consistent with the Secretary of Interior's recent order to conduct a comprehensive, Programmatic EIS (PEIS) on its coal leasing program, in light of the need to take into account the program's impacts on climate change, among other issues, and "the lack of any recent analysis of the Federal coal program as a whole."[59] Specifically, the Secretary directed that the PEIS "should examine how best to assess the climate impacts of continued Federal coal production and combustion and how to address those impacts in the management of the program to meet both the Nation's energy needs and its climate goals, as well as how best to protect the public lands from climate change impacts." [60]

The Secretary also ordered a moratorium on new coal leasing while such a review is being conducted. The Secretary reasoned:

> Lease sales and lease modifications result in lease terms of 20 years and for so long thereafter as coal is produced in commercial quantities. Continuing to conduct lease sales or approve lease modifications during this programmatic review risks locking in for decades the future development of large quantities of coal under current rates and terms that the PEIS may ultimately determine to be less than optimal. This risk is why, during the previous two programmatic reviews, the Department halted most lease sales with limited exceptions…. Considering these factors and given the extensive recoverable reserves of Federal coal currently under lease, I have decided that a similar policy is warranted here. A pause on leasing, with limited exceptions, will allow future leasing decisions to benefit from the recommendations that result from the PEIS while minimizing any economic hardship during that review.[61]

The Secretary's reasoning is also apt here. A programmatic review assessing the climate change effects of public fossil fuels is long overdue. And there is no shortage of oil and gas supply that would preclude a moratorium while such a review is conducted, as evidenced by very low natural oil and gas prices, and by all time high rates of oil and gas production on federal lands. More importantly, BLM should not "risk[] locking in for decades the future development of large quantities of [fossil fuels] under current…terms that a [programmatic review] may ultimately determine to be less than optimal." [62] BLM should cancel the sale and halt all new leasing and fracking until a programmatic review is completed.

III. BLM Must Take a Hard Look at Site-Specific Impacts Before Leasing

[59] *See* Secretary of Interior, Order No. 3338, § 4 (Jan. 15, 2016).
[60] *Id*. § 4(c).
[61] *Id*. § 5.
[62] *Id*.

When site-specific impacts are reasonably foreseeable at the leasing stage, NEPA requires the analysis and disclosure of such reasonably foreseeable site-specific impacts. *N.M. ex rel. Richardson v. BLM*, 565 F.3d 683, 716 (10th Cir. 2009). BLM is required to analyze, for example, potential resource conflicts, necessary mitigation measures, and potential specific development scenarios. NEPA and the CEQ regulations provide that assessment of a given environmental impact must occur as soon as that impact is "reasonably foreseeable," *id.*, (citing 40 C.F.R. § 1502.22), and must take place before an "irretrievable commitment of resources" occurs, *id.,* (citing 42 U.S.C. § 4332(2)(C)(v)). *See also Pennaco Energy, Inc. v. United States DOI*, 377 F.3d 1147, 1160 (10th Cir. 2004) (Agencies are required to satisfy NEPA before committing themselves irretrievably to a given course of action, so that the action can be shaped to account for environmental values.). Because a lessee has certain, defined surface use rights, see e.g. 43 C.F.R. § 3101.1-2 ("[a] lessee shall have the right to use so much of the leased lands as is necessary to explore for, drill for, mine, extract, remove, and dispose of all the leased resource in a leasehold . . ."), the point of irretrievable and irreversible commitment occurs at the point of lease issuance. *S. Utah Wilderness All. v. Norton*, 457 F. Supp. 2d 1253, 1256 (D. Utah 2006). Therefore all foreseeable site-specific impacts must be publicly disclosed in BLM's NEPA review before lease issuance.

Oil and gas development and hydraulic fracturing are a reasonably foreseeable consequence of leasing the proposed parcels, and therefore an analysis of site-specific impacts from new oil and gas development is required. *See* section IV(a) below (describing tools available to perform site-specific analysis). Indeed, BLM Instruction Manual 2010-117 specifically directs BLM to conduct site-specific analysis of lease parcels in NEPA documentation.[63] *See, e.g.*, IM 2010-117 § III(E) ("The IPDR Team will complete site-specific NEPA compliance documentation for all BLM surface and split estate lease sale parcels..."); *id*. ("Most parcels that the field office determines should be available for lease will require site-specific NEPA analysis."). IM 2010-117 also calls upon BLM to consider a host of factors in deciding whether to propose parcels for lease, each of which calls for site-specific analysis. For example, BLM must consider whether "[c]onstruction and use of new access roads or upgrading existing access roads to an isolated parcel would have unacceptable impacts to important resource values."[64] Another consideration is whether "[p]arcel configurations would lead to unacceptable impacts to resources on the parcels or on surrounding lands and cannot be remedied by reconfiguring."[65] Moreover, IM 2010-117 directs BLM to "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources."[66] Such an evaluation would necessarily require a consideration of site-specific resource uses.[67]

In sum, BLM must perform the requisite "hard look" of site-specific impacts to support its decision to lease, including consideration of all factors set forth in IM 2010-117 and consideration of alternatives that would allow BLM to meaningfully examine unresolved resource use conflicts. *See S. Utah Wilderness All. v. United States DOI*, 2016 U.S. Dist. LEXIS

[63] Bureau of Land Management, IM 2010-117, Oil and Gas Leasing Use Planning and Lease Parcel Reviews (2010).
[64] IM 2010-117 § III(C)(4).
[65] *Id*.
[66] *Id*. § III(E).
[67] *Id*.

42696, 14-15 (D. Utah Mar. 30, 2016) (failure to comply with IM 2010-117 can result in NEPA violation); *see also Cotton Petroleum Corp.* 870 F.2d 1515, 1527 (10th Cir. 1989) (failure to follow internal guidance document can constitute arbitrary and capricious decisionmaking). The following sections describe numerous issues such an analysis must address.

IV. BLM Must Take a Hard Look at the Greenhouse Gas Impacts of New Leasing on Climate Change

Oil and gas operations are a major cause of climate change; this is due to emissions from the operations themselves, and emissions from the combustion of the oil and gas produced. Under NEPA's requirement to analyze *indirect* as well as direct impacts, BLM's environmental review must therefore include not only emissions from drilling operations, but the "downstream" emissions from the combustion (and leakage) of the oil and gas produced.[68]

The EIS should calculate the amount of greenhouse gas emissions that will result on an annual basis from (1) each of the fossil fuels that can be developed within the planning area, (2) each of the well stimulation or other extraction methods that can be used, including, but not limited to, fracking, acidization, acid fracking, and gravel packing, and (3) cumulative greenhouse gas emissions expected over the long term (expressed in global warming potential of each greenhouse pollutant as well as CO2 equivalent), including emissions throughout the entire fossil fuel lifecycle discussed above. The EIS must then weigh the no-leasing and no-fracking alternatives' climate-change benefits against the impacts of allowing new leasing and fracking.

a. BLM Must Quantify Potential Emissions Related to the Proposed Action

The CEQ's recently finalized climate change guidance ("CEQ Guidance") "[r]ecommends that agencies quantify a proposed agency action's projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools that are suitable for the proposed agency action."[69] Furthermore, the CEQ Guidance notes that "[q]uantification tools are widely available, and are already in broad use in the Federal and private sectors, by state and local governments, and globally."[70] BLM indeed has considerable data points and access to several widely used quantification tools, and therefore must quantify the amount of

[68] *See High Country Conservation Advocates v. United States Forest Serv.*, 52 F. Supp. 3d 1174 (D. Colo. 2014); *Dine Citizens Against Ruining Our Env't v. United States Office of Surface Mining Reclamation & Enf't*, 82 F. Supp. 3d 1201 (D. Colo. 2015); *WildEarth Guardians v. United States Office of Surface Mining, Reclamation & Enf't*, 104 F. Supp. 3d 1208, 1230 (D. Colo. 2015); *Wildearth Guardians v. U.S. Office of Surface Mining, Reclamation & Enf't*, No. CV 14-103-BLG-SPW, 2015 WL 6442724 (D. Mont. Oct. 23, 2015) report and recommendation adopted in part, rejected in part sub nom. *Guardians v. U.S. Office of Surface Mining, Reclamation & Enf't*, No. CV 14-103-BLG-SPW, 2016 WL 259285 (D. Mont. Jan. 21, 2016); *see also* Council on Environmental Quality, Revised Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts 11 (Dec. 18, 2014), *available at* https://www.whitehouse.gov/administration/eop/ceq/initiatives/nepa/ghg-guidance ("emissions from activities that have a reasonably close causal relationship to the Federal action, such as those that may occur as a predicate for the agency action (often referred to as upstream emissions) and as a consequence of the agency action (often referred to as downstream emissions) should be accounted for in the NEPA analysis."

[69] CEQ, Final Guidance on the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in NEPA Reviews ("CEQ Guidance"), p. 4 (2016), 81 Fed. Reg. 51,866 (Aug. 5, 2016).

[70] CEQ Guidance, p. 12 (citing https://ceq.doe.gov/current_developments/GHG-accounting-tools.html).

greenhouse gas (e.g. CO_2e) emissions that are likely to result, even if indirectly, from the proposed action.

NEPA requires "reasonable forecasting," which includes the consideration of "reasonably foreseeable future actions…even if they are not specific proposals."[71] It is reasonably foreseeable that opening this acreage to oil and gas leasing would result in the commercial production of oil and gas. BLM has ample information to inform a greenhouse gas emissions analysis, including figures for total wells and well pads, average length of gathering lines, and compressor stations. That BLM cannot precisely calculate the total emissions anticipated is not a rational basis for cutting off its analysis: "Reasonable forecasting and speculation is … implicit in NEPA, and[courts] reject any attempt by agencies to shirk their responsibilities under NEPA by labeling any and all discussion of future environmental effects as 'crystal ball inquiry.'"[72] BLM should therefore quantify the potential lifetime CO2e emissions from all phases of oil and gas development. This quantification should include emissions from the associated drilling, completion, production, transportation, and ultimate consumption phases.[73] Emissions from "connected actions," e.g., from development of private subsurface and private minerals opened up by federal oil and gas leasing, and from the construction and operation of gathering and transmission infrastructure should also be quantified.[74]

In performing a full analysis of climate impacts, BLM must consider all potential sources of greenhouse gas emissions. For example, every step of the lifecycle process for development of oil and gas results in significant carbon emissions, including but not limited to:

> *End-user oil and gas combustion emissions*. The combustion of extracted oil and gas will add vast amounts of carbon dioxide to the atmosphere, further heating the climate and moving the Earth closer to catastrophic and irreversible climate change. Though much of the oil is used as gasoline to fuel the transportation sector, the produced oil may also be used in other types of products. The EIS should study all end-uses as contributors to climate change. According to the CEQ Guidance, "[f]or actions such as a Federal lease sale of coal for energy production, the impacts associated with the end-use of the fossil fuel being extracted would be the reasonably foreseeable combustion of that coal."[75] This logic should hold with equal force for oil and gas leasing, and thus these combustion emissions should be quantified.

---

[71] *N. Plains Res. Council, Inc. v. Surface Transp. Bd.*, 668 F.3d 1067, 1079 (9th Cir. 2011) (citation omitted).
[72] *Save Our Ecosystems v. Clark*, 747 F.2d 1240, 1246 n.9 (9th Cir. 1984 (quoting *Scientists' Inst. for Pub. Info., Inc. v. Atomic Energy Comm.*, 481 F.2d 1079, 1092 (D.C. Cir. 1973)); *see also*, *High Country Conservation Advocates v. United States Forest Serv.*, 52 F. Supp. 3d 1174, 1196 (D. Colo. 2014) (decision to forgo calculating mine's reasonably foreseeable GHG emissions was arbitrary "in light of the agencies' apparent ability to perform such calculations"); *Ctr. for Biological Diversity v. NHTSA*, 538 F.3d 1172, 1217 (9th Cir. 2008) ("The impact of greenhouse gas emissions on climate change is precisely the kind of cumulative impacts analysis that NEPA requires agencies to conduct.").
[73] CEQ Guidance, p. 14.:

> "NEPA reviews for proposed resource extraction and development projects typically include the reasonably foreseeable effects of various phases in the process, such as clearing land for the project, building access roads, extraction, transport, refining, processing, using the resource, disassembly, disposal, and reclamation."

[74] See CEQ Guidance, page 13; Id. at 16 n. 42 page 13.
[75] *Id*. at 16 n.42.

Combustion in the distribution of product. To the extent that distribution of raw and end-use products will rely on rail or trucks, the combustion of gasoline or diesel to transport these products will emit significant greenhouse gas emissions.

Emissions from Refineries and Production. Oil and gas must undergo intensive refinery and production processes before the product is ready for consumption. Refineries and their auxiliary activities constitute a significant source of emissions.

Vented emissions. Oil and gas wells may vent gas that flows to the surface at times where the gas cannot otherwise be captured and sold. Vented gas is a significant source of greenhouse gas emissions and can also pose a safety hazard.

Combustion during construction and extraction operations. Operators rely on both mobile and stationary sources of power to construct and run their sites. The engines of drilling or excavation equipment, pumps, trucks, conveyors, and other types of equipment burn large amounts of fuel to operate (e.g. greenhouse gas emissions generated by transporting large amounts of water for fracking). Carbon dioxide, methane, and nitrous oxide (another potent greenhouse gas) are emitted from oxidized fuel during the combustion process. Engines emit greenhouse gases during all stages of oil and gas recovery, including drilling rig mobilization, site preparation and demobilization, completion rig mobilization and demobilization, well drilling, well completion (including fracking and other unconventional extraction techniques), and well production. Transportation of equipment and chemicals to and from the site is an integral part of the production process and contributes to greenhouse gas emissions. Gas flaring is another important source of carbon dioxide emissions. Significant sources of emissions in oil production include pneumatic devices, dehydrators and pumps, and compressors, and system upsets.[76]

Fugitive emissions. Potent greenhouse gases can leak as fugitive emissions at many different points in the production process, especially in the production of gas wells. Recent studies suggest that previous estimates significantly underestimate leakage rates.[77] New research shows methane leakage from some gas wells may be as high as 17.3 percent.[78] Another study identified more than 250 sources of methane plumes from fossil fuel harvesting, processing, and distributing infrastructures in the Four Corners region,

---

[76] U.S. Environmental Protection Agency, National Gas STAR Program, Basic Information, Major Methane Emission Sources and Opportunities to Reduce Methane Emissions ("USEPA, Basic Information").

[77] Brandt, A. R. *et al., Methane leaks from North American natural gas systems, 343* Science 733 *(2014);* Miller, S. M. et al. Anthropogenic Emissions of Methane in the United States, Proc. Natl. Acad. Sci. Early Edition, DOI: 10.1073/pnas.1314392110 (2013) ("Miller 2013").

[78] Caulton, Dana R. et al., *Toward a Better Understanding and Quantification of Methane Emissions from Shale Gas Development*, 111 Proc. Natl. Acad. Sciences 17 (2014); Schneising, Oliver, et al., Remote Sensing of Fugitive Methane Emissions from Oil and Gas Production in North American Tight Geologic Formations, Earth's Future 2, doi:10.1002/2014EF000265 (2014); Allen, D. T. *et al., (2013), Measurements of Methane Emissions at Natural Gas Production Sites in the United States, 110* Proc. Natl. Acad. Sci. 44 *(2013) ("Allen 2013"); Zavala-Araizaa, Daniel et al., Reconciling divergent estimates of oil and gas methane emissions, 112 Proc. Natl. Acad. Sciences 51 (2015), available at* www.pnas.org/cgi/doi/10.1073/pnas.1522126112 *(leakage rate 1.5% of production in Barnett shale or twice EPA's estimate); Vaidyanathan, G, Bad news for the climate as methane leaks far surpass previous estimates,E&E News (Dec. 8, 2015) (leakage rate in Barnett shale equal to annual emissions of 8,000 cars).*

including leakages of up to 5,000 kilograms per hour.[79] Moreover, new research has shown that unconventional gas wells are up to 2.7 times more likely than a conventional well to have a cement or casing impairment, which can lead to methane leaks.[80] The intersection of new fractures with nearby abandoned wells can also result in methane migration to the surface.[81] Leakage can also occur during storage, processing, and distribution to customers.[82]

Natural gas emissions are generally about 84 percent methane.[83] Methane is a potent greenhouse gas that contributes substantially to global climate change. Its global warming potential is approximately 34 times that of carbon dioxide over a 100 year time frame and at least 86 times that of carbon dioxide over a 20 year time frame.[84] Oil and gas operations release large amounts of methane; while the exact amount is not clear, EPA has estimated that "oil and gas systems are the largest human-made source of methane emissions and account for 37 percent of methane emissions in the United States and is expected to be one of the most rapidly growing sources of anthropogenic methane emissions in the coming decades."[85] That proportion is based on an estimated calculation of methane emissions, rather than measured actual emissions, which indicate that methane emissions may be much greater in volume than calculated.[86] Fracked wells leak an especially large amount of methane, with some evidence indicating that the leakage rate is so high that shale gas is worse for the climate than coal.[87] In fact, a research team associated with the National Oceanic and Atmospheric Administration recently reported that preliminary results from a field study in the Uintah Basin of Utah suggest that the field leaked methane at an eye-popping rate of nine percent of total production.[88]

b. BLM Must Provide a Meaningful Qualitative Analysis

[79] Frankenberg, C., et al., Airborne Methane Remote Measurements Reveal Heavy-Tail Flux Distribution in Four Corners Region, June 17, 2016, available at http://www.eenews net/assets/2016/08/16/document_ew_01.pdf
[80] Ingraffea, Anthony R, et al., *Assessment and Risk Analysis of Casing and Cement Impairment in Oil and Gas Wells in Pennsylvania, 2000 – 2012*, 111 Proc. Natl. Acad. Sciences 30 (2014).
[81] King, Pamela. *'Frack hits' provide pathways for methane migration study* , E&E News (Oct. 21, 2015).
[82] Howarth, R. W. A bridge to nowhere: methane emissions and the greenhouse gas footprint of natural gas, Energy Science and Engineering 2014; 2(2): 47–60, 49 ("Howarth 2014").
[83] Brown Memo to EPA at 3; Power, Thomas, The Local Impacts of Natural Gas Development in Valle Vidal, New Mexico, University of Montana (2005) ("Power").
[84] Intergovernmental Panel on Climate Change, Chapter 8: Anthropogenic and Natural Radiative Forcing in Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Table 8.7 (2013); Howarth, Robert, et al., Methane and the greenhouse-gas footprint of natural gas from shale formations, Climactic Change (Mar. 31, 2011) ("Howarth 2011"); Shindell, Drew, *Improved Attribution of Climate Forcing to Emissions*, 326 Science 716 (2009).
[85] USEPA, Basic Information; *see also* Petron, Gabrielle, et al., *Hydrocarbon emissions characterization in the Colorado Front Range: A pilot study*, 117 Journal of Geophysical Research (2012).
[86] Miller, S. M. et al*., Anthropogenic Emissions of Methane in the United States*, Proc. Natl. Acad. Sci. Early Edition, DOI: 10.1073/pnas.1314392110 (2013).
[87] Howarth 2011; Brune, Michael, Statement of Sierra Club Executive Director Michael Brune Before the Committee on Oversight & Government Reform (May 31, 2012); Wang, Jinsheng, et al., Reducing the Greenhouse Gas Footprint of Shale (2011); Alvarez, Ramon et al., *Greater focus needed on methane leakage from natural gas infrastructure*, Proc. Nat'l. Acad. Sci. Early Edition (Feb 13, 2012) at 3; *see also* Howarth, Robert, et al., Venting and Leaking of Methane from Shale Gas Development: Response to Cathles et al., (2012); Hou, Deyi, et al., Shale gas can be a double-edged sword for climate change, Nature Climate Change at 386 (2012)
[88] Tollefson, Jeff, *Methane leaks erode green credentials of natural gas*, Nature News (Jan 2, 2013).

Greenhouse gas emissions from leasing and development of unconventional wells could exact extraordinary financial costs to communities and future generations, setting aside the immeasurable loss of irreplaceable, natural values that can never be recovered. BLM must provide an accounting of these potential costs in an EIS. The NEPA analysis should therefore put the proposed action's emissions into context using an evaluation of the proposed action's social cost of carbon ("SCC"). The Federal social cost of carbon, which multiple Federal agencies have developed and used to assess the costs and benefits of alternatives in rulemakings, offers a harmonized, interagency metric that can provide decisionmakers and the public with some context for meaningful NEPA review.[89] The SCC evaluation is a simple tool that contextualizes emissions by translating tons of carbon into estimates of the costs to society of emitting that carbon.

The effects of cumulative greenhouse gas emissions will have far-reaching impacts on and inflict extraordinary harm to natural and social systems. BLM must provide meaningful analysis of the proposed action's contribution to these effects. The Paris Agreement codified the international consensus that the climate crisis is an urgent threat to human societies and the planet, with the parties recognizing that:

> Climate change represents an *urgent and potentially irreversible threat to human societies and the planet* and thus requires the widest possible cooperation by all countries, and their participation in an effective and appropriate international response, with a view to accelerating the reduction of global greenhouse gas emissions (emphasis added).[90]

Numerous authoritative scientific assessments have established that climate change is causing grave harms to human society and natural systems, and these threats are becoming increasingly dangerous. The Intergovernmental Panel on Climate Change (IPCC), in its 2014 Fifth Assessment Report, stated that: "Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased" and that "[r]ecent climate changes have had widespread impacts on human and natural systems."[91]

The 2014 Third National Climate Assessment, prepared by a panel of non-governmental experts and reviewed by the National Academy of Sciences and multiple federal agencies similarly stated that "[t]hat the planet has warmed is 'unequivocal,' and is corroborated though multiple lines of evidence, as is the conclusion that the causes are very likely human in origin,"[92]

---

[89] See "Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis," (November 2013), available at www.WhiteHouse.gov/sites/default/files/omb/assets/inforeg/technical-update-social-cost-of-carbon-forregulator-impact-analysis.pdf.

[90] Paris Agreement, Decision, Recitals.

[91] IPCC AR5 Synthesis Report at 2.

[92] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., Climate Change Impacts in the United States: The Third National Climate Assessment (U.S. Global Change Research Program), doi:10.7930/J0Z31WJ2 (2014) ("Third National Climate Assessment") at 61 (quoting IPCC, Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate

and "[i]mpacts related to climate change are already evident in many regions and are expected to become increasingly disruptive across the nation throughout this century and beyond."[93] The United States National Research Council similarly concluded that: "[c]limate change is occurring, is caused largely by human activities, and poses significant risks for—and in many cases is already affecting—a broad range of human and natural systems."[94]

The IPCC and National Climate Assessment further decisively recognize the dominant role of fossil fuels in driving climate change:

> While scientists continue to refine projections of the future, observations unequivocally show that climate is changing and that the warming of the past 50 years is primarily due to human-induced emissions of heat-trapping gases. These emissions come mainly from burning coal, oil, and gas, with additional contributions from forest clearing and some agricultural practices.[95]
> ***
> CO_2 emissions from fossil fuel combustion and industrial processes contributed about 78% to the total GHG emission increase between 1970 and 2010, with a contribution of similar percentage over the 2000–2010 period (*high confidence*).[96]

These impacts ultimately emanating from the extraction and combustion of fossil fuels are harming the United States in myriad ways, with the impacts certain to worsen over the coming decades absent deep reductions in domestic and global GHG emissions. EPA recognized these threats in its 2009 Final Endangerment Finding under Clean Air Act Section 202(a), concluding that greenhouse gases from fossil fuel combustion endanger public health and welfare: "the body of scientific evidence compellingly supports [the] finding" that "greenhouse gases in the atmosphere may reasonably be anticipated both to endanger public health and to endanger public welfare."[97] In finding that climate change endangers public health and welfare, EPA has acknowledged the overwhelming evidence of the documented and projected effects of climate change upon the nation:

*Effects on air quality: "*The evidence concerning adverse air quality impacts provides strong and clear support for an endangerment finding. Increases in ambient ozone are expected to occur over broad areas of the country, and they are expected to increase serious adverse health effects in large population areas that are and may continue to be in nonattainment. The evaluation of the potential risks associated with increases in ozone in attainment areas also

---

Change, S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, and H. L. Miller, Eds., Cambridge University Press (2007).

[93] Third National Climate Assessment at 10.

[94] National Research Council, Advancing the Science of Climate Change (2010), available at www.nap.edu. ("Advancing the Science of Climate Change") at 2.

[95] Third National Climate Assessment at 2.

[96] IPCC AR5 Synthesis Report at 46.

[97] U.S. Environmental Protection Agency, Endangerment and Cause or Contribute Findings for Greenhouse Gas Unders Section 202(a) of the Clean Air Act, 74 Fed. Reg. at 66,497 (Dec 15, 2009) ("Final Endangerment Finding").

supports such a finding."[98]

Effects on health from increased temperatures: "The impact on mortality and morbidity associated with increases in average temperatures, which increase the likelihood of heat waves, also provides support for a public health endangerment finding."[99]

Increased chance of extreme weather events: "The evidence concerning how human induced climate change may alter extreme weather events also clearly supports a finding of endangerment, given the serious adverse impacts that can result from such events and the increase in risk, even if small, of the occurrence and intensity of events such as hurricanes and floods. Additionally, public health is expected to be adversely affected by an increase in the severity of coastal storm events due to rising sea levels."[100]

Impacts to water resources: "Water resources across large areas of the country are at serious risk from climate change, with effects on water supplies, water quality, and adverse effects from extreme events such as floods and droughts. Even areas of the country where an increase in water flow is projected could face water resource problems from the supply and water quality problems associated with temperature increases and precipitation variability, as well as the increased risk of serious adverse effects from extreme events, such as floods and drought. The severity of risks and impacts is likely to increase over time with accumulating greenhouse gas concentrations and associated temperature increases."[101]

Impacts from sea level rise: "The most serious potential adverse effects are the increased risk of storm surge and flooding in coastal areas from sea level rise and more intense storms. Observed sea level rise is already increasing the risk of storm surge and flooding in some coastal areas. The conclusion in the assessment literature that there is the potential for hurricanes to become more intense (and even some evidence that Atlantic hurricanes have already become more intense) reinforces the judgment that coastal communities are now endangered by human-induced climate change, and may face substantially greater risk in the future. Even if there is a low probability of raising the destructive power of hurricanes, this threat is enough to support a finding that coastal communities are endangered by greenhouse gas air pollution. In addition, coastal areas face other adverse impacts from sea level rise such as land loss due to inundation, erosion, wetland submergence, and habitat loss. The increased risk associated with these adverse impacts also endangers public welfare, with an increasing risk of greater adverse impacts in the future."[102]

Impacts to energy, infrastructure, and settlements: "Changes in extreme weather events threaten energy, transportation, and water resource infrastructure. Vulnerabilities of industry, infrastructure, and settlements to climate change are generally greater in high-risk locations, particularly coastal and riverine areas, and areas whose economies are closely linked with climate-sensitive resources. Climate change will likely interact with and possibly exacerbate

[98] *Id.*
[99] *Id.*
[100] *Id.* at 66,497-98.
[101] *Id.* at 66,498.
[102] *Id.*

ongoing environmental change and environmental pressures in settlements, particularly in Alaska where indigenous communities are facing major environmental and cultural impacts on their historic lifestyles."[103]

Impacts to wildlife: "Over the 21st century, changes in climate will cause some species to shift north and to higher elevations and fundamentally rearrange U.S. ecosystems. Differential capacities for range shifts and constraints from development, habitat fragmentation, invasive species, and broken ecological connections will likely alter ecosystem structure, function, and services, leading to predominantly negative consequences for biodiversity and the provision of ecosystem goods and services."[104]

In addition to these acknowledged impacts on public health and welfare more generally, climate change is causing and will continue to cause serious impacts on natural resources that the Department of Interior is specifically charged with safeguarding.[105]

Impacts to Public Lands: Climate change is causing and will continue to cause specific impacts to public lands ecosystem services. Although public lands provide a variety of difficult-to-quantify public benefits, one recent Forest Service attempt at quantification estimates the public land ecosystem services at risk from climate change at between $14.5 and $36.1 billion annually.[106] In addition to the general loss of ecosystem services, irreplaceable species and aesthetic and recreational treasures are at risk of permanent destruction. High temperatures are causing loss of glaciers in Glacier National Park; the Park's glaciers are expected to disappear entirely by 2030, with ensuing warming of stream temperatures and adverse effects to aquatic ecosystems.[107] With effects of warming more pronounced at higher latitudes, tundra ecosystems on Alaska public lands face serious declines, with potentially serious additional climate feedbacks from melting permafrost.[108] In Florida, the Everglades face severe ecosystem disruption from already-occurring saltwater incursion.[109] Sea level rise will further damage freshwater ecosystems and the endangered species that rely on them.

Impacts to Biodiversity and Ecosystems: Across the United States ecosystems and biodiversity, including those on public lands, are directly under siege from climate change—leading to the loss of iconic species and landscapes, negative effects on food chains, disrupted

---

[103] *Id.*

[104] *Id.*; *see also* Third National Climate Assessment at 195-219.

[105] *See* Federal Land Policy and Management Act of 1976, 43 U.S.C. §§ 1701(a)(8), 1712(c)(1); Multiple-Use Sustained Yield Act of 1960, 16 U.S.C. § 528; National Environmental Policy Act of 1969, 42 U.S.C. §§ 4331-4332.

[106] Esposito, Valerie et al., Climate Change and Ecosystem Services: The Contribution and Impacts on Federal Public Lands in the United States, USDA Forest Service Proceedings RMRS-P-64 at 155-164 (2011).

[107] U.S. Environmental Protection Agency, Climate Change and Public Lands (1999).

[108] *See* National Climate Assessment at 48; Collins, M. et al., Long-term Climate Change: Projections, Commitments and Irreversibility, Ch 12 at 1096-7 in *Climate Change 2013: The Physical Science Basis, Contribution of Working Group 1 to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (2013); MacDougall, A. H., et al., Significant contribution to climate warming from the permafrost carbon feedback, 5 Nature Geoscience 719-721 (2012), doi:10.1038/ngeo1573.

[109] *See* National Climate Assessment at 592; Foti, Romano et al., Signs of critical transition in the Everglades wetlands in response to climate and anthropogenic changes, 110 Proceedings of the National Academy of Sciences6296-6300, (2013), doi:10.1073/pnas.1302558110.

migrations, and the degradation of whole ecosystems.[110] Specifically, scientific evidence shows that climate change is already causing changes in distribution, phenology, physiology, genetics, species interactions, ecosystem services, demographic rates, and population viability: many animals and plants are moving poleward and upward in elevation, shifting their timing of breeding and migration, and experiencing population declines and extirpations.[111] Because climate change is occurring at an unprecedented pace with multiple synergistic impacts, climate change is predicted to result in catastrophic species losses during this century. For example, the IPCC concluded that 20% to 30% of plant and animal species will face an increased risk of extinction if global average temperature rise exceeds 1.5°C to 2.5°C relative to 1980-1999, with an increased risk of extinction for up to 70% of species worldwide if global average temperature exceeds 3.5°C relative to 1980-1999. [112]

Although cost-benefit analysis is not necessarily the ideal or exclusive method for assessing contributions to an adverse effect as enormous, uncertain, and potentially catastrophic as climate change, BLM does have tools available to provide one approximation of external costs and has previously performed a "social cost of carbon" analysis in prior environmental reviews.[113] Its own internal memo identifies one available analytical tool: "For federal agencies the authoritative estimates of [social cost of carbon] are provided by the 2013 technical report of the Interagency Working Group on Social Cost of Carbon, which was convened by the Council of Economic Advisers and the Office of Management and Budget."[114] As explained in that report:

---

[110] National Climate Assessment at 13.

[111] *See* Parmesan, C. and G. Yohe, A globally coherent fingerprint of climate change impacts across natural systems, 421 Nature 37–42 (2003); Root, T. et al., Fingerprints of global warming on wild animals and plants, 421 Nature 57–60 (2003); Chen, I. et al., Rapid range shifts of species associated with high levels of climate warming, 333 Science 1024–1026 (2011).

[112] Intergovernmental Panel on Climate Change, Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, and H. L. Miller, Eds., Cambridge University Press (2007). Other studies have predicted similarly severe losses: 15%-37% of the world's plants and animals committed to extinction by 2050 under a mid-level emissions scenario, s*ee* Thomas et al., Extinction risk from climate change, 427 Nature 145–8 (2004)); the potential extinction of 10% to 14% of species by 2100 if climate change continues unabated, *see* Maclean, I. M. D. and R. J. Wilson, Recent ecological responses to climate change support predictions of high extinction risk, 108 Proceedings of the National Academy of Sciences of the United States of America 12337-12342 (2011); and the loss of more than half of the present climatic range for 58% of plants and 35% of animals by the 2080s under the current emissions pathway, in a sample of 48,786 species, *see* Warren, R. J. et al., Increasing Impacts of Climate Change Upon Ecosystems with Increasing Global Mean Temperature Rise, 106 Climatic Change 141–77 (2011)..

[113] *See High Country Conserv'n Advocates v. United States Forest Serv.*, 2014 U.S. Dist. Lexis 87820 (D. Colo. 2014) (invalidating environmental assessment ["EA"] for improperly omitting social cost of carbon analysis, where BLM had included it in preliminary analysis); Taylor, P. "BLM crafting guidance on social cost of carbon -- internal memo," Greenwire, April 15, 2015, available at http://www.eenews net/greenwire/stories/1060016810/; BLM Internal Memo from Assistant Director of Resources and Planning Ed Roberson ("Roberson Internal Memo"), April 2015, available at http://www.eenews net/assets/2015/04/15/document_gw_01.pdf (noting "some BLM field offices have included estimates of the [social cost of carbon] in project-level NEPA documents") (accessed July 29, 2015); *see also* Council on Environmental Quality, Revised Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts, p. 18, available at www.whitehouse.gov/administration/eop/ceq/initiatives/nepa/ghg-guidance (accessed Jul 29, 2015) (quantitative analysis required if GHGs > 25k tons/yr).

[114] BLM, Roberson Internal Memo.

> The purpose of the "social cost of carbon" (SCC) estimates presented here is to allow agencies to incorporate the social benefits of reducing carbon dioxide (CO_2) emissions into cost-benefit analyses of regulatory actions that impact cumulative global emissions. The SCC is an estimate of the monetized damages associated with an incremental increase in carbon emissions in a given year. It is intended to include (but is not limited to) changes in net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services due to climate change.[115]

Further, other analytical tools exist to evaluate the cost of methane emissions.[116] EPA has peer reviewed and employed such a tool in its "Regulatory Impact Analysis of the Proposed Emission Standards for New and Modified Sources in the Oil and Natural Gas Sector."[117]

In sum, climate change, driven primarily by the combustion of fossil fuels, poses a severe and immediate threat to the health, welfare, ecosystems and economy of the United States. These impacts are felt across the nation, including upon the public lands the Secretary of the Interior is charged with safeguarding. Social cost of carbon analysis is an appropriate tool for analyzing the cumulative impacts of greenhouse gas emissions, and a rapid and deep reduction of emissions generated from fossil fuels is essential if such threats are to be minimized and their impacts mitigated.

V. BLM Must Take a Hard Look at Impacts to Water Resources

BLM must consider the impacts that oil and gas operations, including hydraulic fracturing and other unconventional stimulation methods, on the water resources in the areas to be leased. For example, BLM must consider the increased risk of spills and leaks that will result from new leasing within the planning area. Spills within the Colorado River sub-basin could be particularly detrimental to the endangered fish and their critical habitat.

The likelihood that the sale will result in fracking raises several issues that BLM must address:

- Where will the water come from and what are the impacts of extracting it?

---

[115] *See* Interagency Working Group on Social Cost of Carbon, United States Government, Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis - Under Executive Order 12866, May 2013, available at https://www.whitehouse.gov/sites/default/files/omb/inforeg/social_cost_of_carbon_for_ria_2013_update.pdf (accessed July 29, 2015).

[116] *See* Marten A.L., Kopits K.A., Griffiths C.W., Newbold S.C., Wolverton A. 2014, online publication (2015, print publication). "Incremental CH4 and N2O mitigation benefits consistent with the US Government's SC-CO2 estimates," Climate Policy 15(2):272-298, abstract available at http://www.tandfonline.com/doi/abs/10.1080/14693062.2014.912981.

[117] *See* U.S. Environmental Protection Agency, Social Cost of Carbon, *available at* http://www3.epa.gov/climatechange/EPAactivities/economics/scc html (noting application of social cost of methane supported by peer review); USEPA, Regulatory Impact Analysis of the Proposed Emission Standards for New and Modified Sources in the Oil and Natural Gas Sector, Ch. 4, available at http://www3.epa.gov/airquality/oilandgas/pdfs/og_prop_ria_081815.pdf.

- What chemicals will be used in the drilling and fracking process?
- How will BLM ensure the collection and disclosure of that information?
- What limitations will BLM place on the chemicals used in order to protect public health and the environment?
- What measures will BLM require to ensure adequate monitoring of water impacts, both during and after drilling?
- What baseline data is available to ensure that monitoring of impacts can be carried out effectively? How will BLM collect baseline data that is not currently available?
- Much of the fracking fluid return to the surface as toxic waste. Where will the discharge go?
- Is there the potential for subsurface migration of fracking fluids, or the potential for those fluids to escape into the groundwater by way of a faulty casing?
- What kinds of treatment will be required?
- What is the potential footprint and impact of the necessary treatment facilities?

BLM's analysis of potential impacts to water must take account of all significant and "foreseeable" impacts to water that may arise from the sale, including the following issues.

a. Contamination

Across the U.S., in states where fracking or other types of unconventional oil and gas recovery has occurred, surface water and groundwater have been contaminated. Recent studies have concluded that water contamination attributed to unconventional oil and gas activity has occurred in several states, including Colorado,[118] Wyoming,[119] Texas,[120] Pennsylvania,[121] Ohio,[122] and West Virginia.[123] Surface waters can be contaminated in many ways from unconventional well stimulation. In addition to storm water runoff, surface water contamination

[118] Trowbridge, A., *Colorado Floods Spur Fracking Concerns*, CBS News, Sept. 17, 2013, *available at* http://www.cbsnews.com/8301-201_162-57603336/colorado-floods-spur-fracking-concerns/ ("Trowbridge 2013") (accessed July 30, 2015).
[119] U.S. Environmental Protection Agency, Draft Investigation of Ground Water Contamination near Pavillion, Wyoming (2011) ("USEPA Draft Pavillion Investigation"); See also DiGiulio, D. and Jackson, R., *Impact to Underground Sources of Drinking Water and Domestic Wells from Production Well Stimulation and Completion Practices in the Pavillion, Wyoming, Field*. Environ. Sci. Technol., Pp 4524-4536 (2016) ("DiGiulio, 2016").
[120] Fontenot, Brian et al., An evaluation of water quality in private drinking water wells near natural gas extraction sites in the Barnett Shale Formation, Environ. Sco. Technol., DOI: 10.1021/es4011724 (published online July 25, 2013) ("Fontenot 2013").
[121] Jackson, Robert et al., Increased Stray Gas Abundance in a Subset of Drinking Water Wells near Marcellus Shale Gas Extraction, Proc. Natl. Acad. of Sciences Early Edition, doi: 10.1073/pnas.1221635110/-/DCSupplemental (2013) ("Jackson 2013").
[122] Shulman, Seth, *Ohio Wake-Up Call On Fracking Disclosure Laws*, Union of Concerned Scientists, August 2014, *available at* http://www.ucsusa.org/publications/got-science/2014/got-science-august-2014.html#.V0NKhvkrK2w.
[123] Begos, K., *Four States Confirm Water Pollution*, Associated Press (January 5, 2014), *available at* http://www.usatoday.com/story/money/business/2014/01/05/some-states-confirm-water-pollution-from-drilling/4328859/ (accessed July 29, 2015); *see also* U.S. EPA, Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources, External Review Draft (June 2015) ("EPA 2015"), *available at* http://ofmpub.epa.gov/eims/eimscomm.getfile?p_download_id=523539 (accessed July 30, 2015).

may also occur from chemical and waste transport, chemical storage leaks, and breaches in pit liners.[124]

The potential for spills to move from tributaries into endangered fish critical habitat within main-stem rivers was shown by a 2014 spill into the Green River. On the night of May 20, 2014 an oil well operated by SW Energy on lands administered by BLM "blew out," leaking an estimated 100 barrels per hour of crude oil and production water into Salt Wash which leads to the Green River. SW Energy did not shut-in the well until 1:20 p.m. on May 22, at least 36 hours later. On May 24, flooding from a thunderstorm "overcame prevention measures" washing an unknown quantity of oil and produced water 1.5 miles from Salt Wash into the Green River and critical habitat for endangered fish.[125] The U.S. Fish and Wildlife Service's recent Biological Opinion for the Gasco Energy Inc. Field Development Project anticipates these events and the potential for more frequent spills given expanded drilling:

> There is a greater potential for impacts from pollutants, if a pipeline, well pit, or other source were to inadvertently release contaminated fluids into waterways at points near the Green and White Rivers. Through direct or indirect discharge, these pollutants could reach the Green River and negatively impact water quality to the point of affecting native fish populations. Direct impacts will result from a discharge from a pipeline or well pit reaching the Green River in its original form or within a single release event. Indirect effects occur when discharges are released to the ground and are later released to the river after being carried by an erosion event or carried by rain or snowmelt runoff. As more well and pipeline development occurs in the project area the chance of pollutants reaching the Green River increases, thus increasing the potential of harm to native fish populations.[126]

Like the above Green River incident, some spills or leaks are not detected until long after they have started.[127]

---

[124] Vengosh, Avner et al., A Critical Review of the Risks to Water Resources from Unconventional Shale Gas Development and Hydraulic Fracturing in the United States, Environ. Sci. Technol., DOI: 10.1021/es405118y (2014) ("Vengosh 2014").

[125] BLM. 2014. Update: Salt Wash Oil Spill, available at http://www.blm.gov/ut/st/en/fo/moab/SaltWashSpill.html.

[126] Fish and Wildlife Service, Biological Opinion for the Gasco Energy Inc. Field Development Project ("Gasco BO"), Dec. 2011, p. 26, available at http://www.blm.gov/style/medialib/blm/ut/vernal_fo/planning/gasco_eis/gasco_rod.Par.56176.File.dat/Gasco%20ROD%20Attachment%205%20BO.pdf.

[127] *See* MacPherson, James, "ND wants answers on ruptured pipeline inspections," AP, Oct. 16, 2013, available at http://bigstory.ap.org/article/experts-question-north-dakota-oil-spill-estimates (spill released from quarter-inch pipeline hole contaminated wheat field the size of seven football fields); Vanderklippe, Nathan. "Spill sends 22,000 barrels of oil mix into Alberta muskeg," *The Globe and Mail*, May 30, 2012, available at http://www.theglobeandmail.com/globe-investor/spill-sends-22000-barrels-of-oil-mix-into-alberta-muskeg/article4219809/ (22,000-barrel wastewater pipeline spill not detected until after it had reached surface waters and was spotted by aircraft); Vanderklippe, "Toxic waste spill in northern Alberta biggest of recent disasters in North America," *The Globe and Mail*, June 12, 2013, available at http://www.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/apache-pipeline-leaks-60000-barrels-of-salty-water-in-northwest-

The spilling or leaking of fracking fluids, flowback, or produced water is a serious problem. Harmful chemicals present in these fluids can include volatile organic compounds ("VOCs"), such as benzene, toluene, xylenes, and acetone.[128] As much as 25 percent of fracking chemicals are carcinogens,[129] and flowback can even be radioactive.[130] As described below, contaminated surface water can result in many adverse effects to wildlife, agriculture, and human health and safety. It may make waters unsafe for drinking, fishing, swimming and other activities, and may be infeasible to restore the original water quality once surface water is contaminated. BLM should consider these impacts in the EIS.

1) Groundwater Contamination

Contamination of groundwater is a significant concern that is important for BLM to analyze. Many groundwater wells are likely present within the vicinity of the lease sale parcels for sale in this auction. BLM must specifically identify the presence of groundwater wells in the areas for lease.

Contamination of groundwater of these drinking water sources is a real risk, as evidenced by recent studies showing that groundwater contamination in the Barnett Shale region is likely a result of unconventional well development activities.[131] One report showed that for decades, Texas oil and gas regulators ignored federal requirements governing injection of wastewater into underground sources of drinking water.[132] Another study detected "multiple volatile organic carbon compounds throughout the region, including various alcohols, the BTEX family of compounds, and several chlorinated compounds" in private and public drinking water well samples drawn from aquifers overlying the Barnett shale formation."[133] Another study found that "arsenic, selenium, strontium and total dissolved solids (TDS) exceeded the Environmental Protection Agency's Drinking Water Maximum Contaminant Limit (MCL) in some samples from private water wells located within 3 km of active natural gas wells," while lower levels of these contaminants were found at sites outside the Barnett Shale region, as well as sites within the Barnett Shale region located more than 3 km from active natural gas wells.[134] Many of the detected compounds were associated with unconventional oil and gas extraction.[135]

---

alberta/article12494371/ (9.5 million liter spill of produced water from pipeline suspected to be "longstanding" given the extent of damage over 42 hectares).

[128] U.S. Environmental Protection Agency, Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources (Nov. 2011) ("EPA Plan to Study Fracking Impacts").

[129] Colborn 2011.

[130] EPA Plan to Study Fracking Impacts; White, Ivan E., Consideration of radiation in hazardous waste produced from horizontal hydrofracking, National Council on Radiation Protection (2012).

[131] Hildenbrand, Zacariah, A Comprehensive Analysis of Groundwater Quality in The Barnett Shale Region, Environ. Sci. Technol. (June 16, 2015), available at http://pubs.acs.org/doi/abs/10.1021/acs.est.5b01526.

[132] Clean Water Action, Texas Aquifer Exemptions: Ignoring Federal Law to Fast Track Oil & Gas Drilling, August 2016.

[133] *Id*.

[134] Fontenot, Brian et al., An Evaluation of Water Quality in Private Drinking Water Wells Near Natural Gas Extraction Sites in the Barnett Shale Formation, Environ. Sci. Technol., 47 (17), 10032–10040 DOI: 10.1021/es4011724, available at http://pubs.acs.org/doi/abs/10.1021/es4011724 ("Fontenot 2013").

[135] *Id*.

Once groundwater is contaminated, it is very difficult, if not impossible, to restore the original quality of the water. As a result, in communities that rely on groundwater drinking water supplies, groundwater contamination can deprive communities of usable drinking water. Such long-term contamination necessitates the costly importation of drinking water supplies. According to the EPA, "evidence of any fracturing-related fluid migration affecting drinking water resources…could take years to discover."[136] Another study based on modeling found that advective transport of fracking fluid from a fracked well to an aquifer could occur in less than 10 years.[137] Unfiltered drinking water supplies, such as drinking water wells, are especially at risk because they have no readily available means of removing contaminants from the water. Even water wells with filtration systems are not designed to handle the kind of contaminants that result from unconventional oil and gas extraction.[138] In some areas hydraulic fracturing may occur at shallower depths or within the same formation as drinking water resources, resulting in direct aquifer contamination.[139] The EIS must disclose where the potential for such drilling exists.

Groundwater contamination can occur in a number of ways, and the contamination may persist for many years,[140] including surface spills and leaks; methane and fracking fluid migration via abandoned wells, natural faults, or intentionally created fractures; failed or degraded casings; and improperly constructed wells. For example, fluids and hydrocarbons may contaminate groundwater by migrating through newly created or natural fractures.[141] Many unconventional techniques intentionally fracture the formation to increase the flow of gas or oil. New cracks and fissures can allow the additives or naturally occurring elements such as natural gas to migrate to groundwater. "[T]he increased deployment of hydraulic fracturing associated with oil and gas production activities, including techniques such as horizontal drilling and multi-well pads, may increase the likelihood that these pathways could develop," which, "in turn, could lead to increased opportunities for impacts on drinking water sources."[142] Fluids can also migrate through pre-existing and natural faults and fractures that may become pathways once the fracking or other method has been used.

A well in which stimulation operations are being conducted may also "communicate" with nearby wells, which may lead to groundwater and surface contamination, particularly if the nearby wells are improperly constructed or abandoned.[143] In the last 150 years, as many as 12

---

[136] EPA 2015 at 6-56 – 6-57.
[137] Myers, Tom, Potential Contaminant Pathways from Hydraulically Fractured Shale to Aquifers, Ground Water 50, no. 6, p. 1 (2012).
[138] Physicians, Scientist & Engineers for Healthy Energy, Letter from Robert Howarth Ph.D. and 58 other scientists to Andrew M. Cuomo, Governor of New York State re: municipal drinking water filtration systems and hydraulic fracturing fluid (Sept 15, 2011), *available at* http://www.psehealthyenergy.org/data/Cuomo_ScientistsLetter_15Sep20112.pdf (accessed July 29, 2015).
[139] EPA 2015 at ES-15.
[140] Myers, Tom, Potential Contamination Pathways from Hydraulically Fractured Shale to Aquifers, National Groundwater Association (2012).
[141] EPA Draft Pavillion Investigation; Warner, Nathaniel R., et al., Geochemical Evidence for Possible Natural Migration of Marcellus Formation Brine to Shallow Aquifers in Pennsylvania, PNAS Early Edition (2012).
[142] EPA 2015 at 6-55.
[143] *See* Detrow, Scott. (2012) *Perilous Pathways: How Drilling Near An Abandoned Well Produced a Methane Geyser,* StateImpact Pennsylvania, National Public Radio (October 9, 2012), *available at* https://stateimpact.npr.org/pennsylvania/2012/10/09/perilous-pathways-how-drilling-near-an-abandoned-well-produced-a-methane-geyser/ (accessed July 29, 2015); Alberta Energy Board, Directive 083: Hydraulic Fracturing –

million "holes" have been drilled across the United States in search of oil and gas, many of which are old and decaying, or are in unknown locations.[144] Fracking can contaminate water resources by intersecting one of those wells. For instance, one study found at least nineteen instances of fluid communication in British Columbia and Western Alberta.[145] Wells as far away as 1.8 miles away have provided pathways for surface contamination.[146] And given that a substantial portion of wells experience well barrier or integrity failure—6.3% in the Marcellus shale between 2005 and 2013—the threat of groundwater contamination is not at all hypothetical.[147] Dr. Ingraffea of Cornell has noted an 8.9 percent failure rate for wells in the Marcellus Shale.[148] Improper well construction and surface spills are cited as a confirmed or potential cause of groundwater contamination in numerous incidents at locations across the U.S. including but not limited to Colorado,[149] Wyoming,[150] Pennsylvania,[151] Ohio,[152] West Virginia,[153] and Texas.[154]

The Draft EPA Investigation of Ground Water Contamination near Pavillion, Wyoming, found that chemicals found in samples of groundwater were from fracked wells.[155] These results have been confirmed with follow-up analyses.[156] Another study based on modeling found that advective transport of fracking fluid from a fracked well to an aquifer could occur in less than 10

Subsurface Integrity, Alberta Energy Regulator (2013), *available at* http://www.aer.ca/documents/directives/Directive083.pdf.

[144] Kusnetz, Nicholas, *Deteriorating Oil and Gas Wells Threaten Drinking Water, Homes Across the Country*, ProPublica (April 4, 2011).

[145] BC Oil & Gas Commission, Safety Advisory 2010-03, Communication During Fracture Stimulation (2010).

[146] King, Pamela, *'Frack hits' provide pathways for methane migration study*, E&E News (Oct. 21, 2015).

[147] Davies, Richard J. et al. Oil and gas wells and their integrity: Implications for shale and unconventional resource exploitation, Marine and Petroleum Geology 56 (2014) 239e254, available at http://ac.els-cdn.com/S0264817214000609/1-s2.0-S0264817214000609-main.pdf?_tid=7344676e-d5f1-11e5-9200-00000aab0f02&acdnat=1455767050_bdf90f64ecdb607187778614024039c4.

[148] Ingraffea, Anthony R., Some Scientific Failings within High Volume Hydraulic Fracturing Proposed Regulations 6 NYCRR Parts 550-556, 560, Comments and Recommendations Submitted to the NYS Dept. of Environmental Conservation (Jan 8, 2013).

[149] Gross, Sherilyn A. et al., Abstract: Analysis of BTEX groundwater concentrations from surface spills associated with hydraulic fracturing operations, 63 J. Air and Waste Mgmt. Assoc. 4, 424 doi: 10.1080/10962247.2012.759166 (2013).

[150] U.S. Environmental Protection Agency, Draft Investigation of Ground Water Contamination Near Pavillion, Wyoming (2011) ("EPA Draft Pavillion Investigation").

[151] Darrah, Thomas H. et al., Noble Gases Identify the Mechanisms of Fugitive Gas Contamination in Drinking-Water Wells Overlying the Marcellus and Barnett Shales, Proc. Natl. Acad. Of Sciences Early Edition, doi: 10.1073/pnas.1322107111 (2014) ("Darrah 2014").

[152] Begos, Kevin, *Some States Confirm Water Pollution from Oil, Gas Drilling*, Seattle Times, Jan. 6, 2014, http://www.seattletimes.com/business/some-states-confirm-water-pollution-from-oil-gas-drilling/ (accessed July 29, 2015) ("Begos, Seattle Times, Jan 6, 2014"); *see also* Ohio Department of Natural Resources, *Report on the Investigation of the Natural Gas Invasion of Aquifers in Bainbridge Township of Geauga County, Ohio* (Sep. 2008) ("ODNR 2008").

[153] Begos, Seattle Times, Jan 6. 2014.

[154] Darrah 2014.

[155] EPA Draft Pavillion Investigation.

[156] DiGiulio, 2016; Drajem, Mark, *Wyoming Water Tests in Line with EPA Finding on Fracking*, Bloomberg (Oct. 11, 2012); U.S. Environmental Protection Agency, Investigation of Ground Water Contamination near Pavillion, Wyoming Phase V Sampling Event - Summary of Methods and Results (September 2012); Myers, Tom, Review of DRAFT: Investigation of Ground Water Contamination near Pavillion Wyoming Prepared by the Environmental Protection Agency, Ada OK (Apr. 30, 2012).

years.[157] The injection of fracking waste underground can also lead to leaks and spills.[158] Massive volumes of chemicals and wastewater are used or produced in oil and gas operations. Between 2,600 to 18,000 gallons of chemicals are injected per hydraulically fracked well depending on the number of chemicals injected.[159] This waste can reach fresh water aquifers and drinking water.

BLM must analyze mitigation measures beyond setbacks and buffers, or consider greater setbacks, as existing requirements may not be adequate to protect groundwater from potential fracking fluid contamination. A recent study by the University of Colorado at Boulder suggests that setbacks of even up to 300-feet may not prevent contamination of drinking water resources.[160] The study found that 15 organic compounds found in hydraulic fracturing fluids may be of concern as groundwater contaminants based on their toxicity, mobility, persistence in the environment, and frequency of use. These chemicals could have 10 percent or more of their initial concentrations remaining at a transport distance of 300 feet, the average "setback" distance in the U.S. It is not enough to merely require an arbitrary setback. The effectiveness and feasibility of any proposed setbacks must be evaluated.

2) Contamination from Chemical and Waste Transport

Produced waters that fracking operations force to the surface from deep underground can contain high levels of total dissolved solids, salts, metals, and naturally occurring radioactive materials.[161] If spilled, the effects of produced water or brine can be more severe and longer-lasting than oil spills, because salts do not biodegrade or break down over time.[162] The only way to deal with them is to remove them.[163] The accumulation of long-lived isotopes of radium has been observed in the sediments and soils of produced-water spill sites.[164] Due to its relatively long half-life, radium contamination could remain in the soil for thousands of years.[165]

---

[157] Myers, Tom, Potential Contaminant Pathways from Hydraulically Fractured Shale to Aquifers, Ground Water 50, no. 6, p. 1 (2012).
[158] Kusnetz, Nicholas, North Dakota's Oil Boom Brings Damage Along with Prosperity at 4, ProPublica (June 7, 2012); Lustgarten, Abraham, Polluted Water Fuels a Battle for Answers, ProPublica (2012); Lustgarten, Abraham, Injection Wells: The Poison Beneath Us, ProPublica at 2 (2012); Lustgarten, Abraham, Whiff of Phenol Spells Trouble, ProPublica (2012).
[159] EPA 2015 at ES-12.
[160] University of Colorado--Boulder, New study identifies organic compounds of potential concern in fracking Fluids (July 1, 2015), *available at* http://www.colorado.edu/news/releases/2015/06/30/newstudyidentifiesorganiccompoundspotentialconcernfrackingfluids (accessed July 29, 2015).
[161] Brittingham, Margaret C. et al., Ecological Risks of Shale Oil and Gas Development to Wildlife, Aquatic Resources and their Habitats, Environ. Sci. Technol. 2014, 48, 11034-11047, p. 11039; Lauer, Nancy E. Brine Spills Associated with Unconventional Oil Development in North Dakota. Environmental Science & Technology Article ASAP, DOI: 10.1021/acs.est.5b06349 (April 27, 2016), available at http://pubs.acs.org/doi/abs/10.1021/acs.est.5b06349 (finding contaminants such as ammonium, selenium, and lead at produced-water spill sites in North Dakota, and contamination in violation of national water quality regulations
[162] *Id*. at G (observing contamination from produced water "is remarkably persistent in the environment" and "elevated levels of salts and trace elements…can be preserved in spill sites for at least months to years"); King, Pamela, *Limited study supports findings on bigger brine spill risks*, E&E News (Nov. 4, 2015) ("King 2015")
[163] *Id*.
[164] Lauer 2016 at G.
[165] *Id*.

Flowback waters (i.e., fracturing fluids that return to the surface) may also contain similar constituents along with fracturing fluid additives such as surfactants and hydrocarbons.[166] Given the massive volumes of chemicals and wastewater produced, their potentially harmful constituents, and their persistence in the environment, the potential for environmental disaster is real.

Fluids must be transported to and/or from the well, which presents opportunities for spills.[167] Unconventional well stimulation relies on numerous trucks to transport chemicals to the site as well as collect and carry disposal fluid from the site to processing facilities. A U.S. Government Accountability Office (GAO) study found that up to 1,365 truck loads can be required just for the drilling and fracturing of a single well pad[168] while the New York Department of Conservation estimated the number of "heavy truck" trips to be about 3,950 per horizontal well (including unloaded and loaded trucks).[169] Accidents during transit may cause leaks and spills that result in the transported chemicals and fluids reaching surface waters. Chemicals and waste transported by pipeline can also leak or spill. There are also multiple reports of truckers dumping waste uncontained into the environment.[170]

The EIS should evaluate how often accidents can be expected to occur, and the effect of chemical and fluid spills on present resources. Such analysis should also include identification of the particular harms faced by communities near oil and gas fields. The EIS must include specific mitigation measures and alternatives based on a cumulative impacts assessment, and the particular vulnerabilities of environmental justice communities in both urban and rural settings.

3) Contamination from On-site Chemical Storage and Processing

Thousands of gallons of chemicals can be potentially stored on-site and used during hydraulic fracturing and other unconventional well stimulation activities.[171] These chemicals can be susceptible to accidental spills and leaks. Natural occurrences such as storms and earthquakes may cause accidents, as can negligent operator practices.

Some sites may also use on-site wastewater treatment facilities. Improper use or maintenance of the processing equipment used for these facilities may result in discharges of contaminants. Other causes of spills include equipment failure (most commonly, blowout

---

[166] King 2015.
[167] Warco, Kathy, *Fracking truck runs off road; contents spill*, Observer Reporter (Oct 21, 2010).
[168] U.S. Government Accountability Office, Oil and Gas: Information on Shale Resources, Development, and Environmental and Public Health Risks, GAO 12-732 (2012) at 33.
[169] NYDEC SGEIS at Ch. 6 Potential Environmental Impacts (2015) at 6-306 –*available at* http://www.dec ny.gov/docs/materials_minerals_pdf/fsgeis2015.pdf.
[170] Kusnetz, Nicholas, *North Dakota's Oil Boom Brings Damage Along with Prosperity* at 4, ProPublica (June 7, 2012) ("Kusnetz North Dakota"); E&E News, *Ohio man pleads not guilty to brine dumping* (Feb. 15, 2013); Ohio Department of Natural Resources ("ODNR"), *Ohio Pursues Action Against Companies for Illegal Brine Dumping*, June 4, 2013, *available at* http://ohiodnr.gov/news/post/ohio-pursues-action-against-companies-for-illegal-brine-dumping.
[171] EPA 2015 at ES-10.

preventer failure, corrosion and failed valves) and failure of container integrity.[172] Spills can result from accidents, negligence, or intentional dumping.

The EIS should examine and quantify the risks to human health and the environment associated with on-site chemical and wastewater storage, including risks from natural events and negligent operator practices. Again, such analysis must also include an analysis of potential impacts faced by environmental justice communities in both rural and urban settings.

4) Disposal of Drilling and Fracking Wastes

Disposal of wastes from oil and gas operations can also lead to contamination of water resources. Potential sources of contamination include:

- leaching from landfills that receive drilling and fracking solid wastes;
- spreading of drilling and fracking wastes over large areas of land;
- wastewaters discharged from treatment facilities without advanced "total dissolved solids" removal processes, or inadequate capacity to remove radioactive material removal; and
- breaches in underground injection disposal wells.[173]

U.S. EPA has found that California's Class II underground injection well program to be insufficiently protective of groundwater resources.[174]

The EIS must evaluate the potential for contamination from each of these disposal methods.

5) Contamination from Storm Water Runoff

Oil and gas operations require land clearance for access roads, pipelines, well pads, drilling equipment, chemical storage, and waste disposal pits. As a result, new oil and gas development will cause short-term disturbance as well as long-term disturbance within the areas for lease. While undisturbed land can retain greater amounts of water through plants and pervious soil, land that has been disturbed or developed may be unable to retain as much water, thereby increasing the volume of runoff. The area of land that is able to retain water will be significantly decreased if unconventional oil and gas extraction methods are permitted to expand.

Water from precipitation and snowmelt can serve as an avenue through which contaminants travel from an operation site to sensitive areas, including population centers.

---

[172] EPA 2015 at ES-11.
[173] EPA 2015, 8-20, 8-36, 8-48, 8-65, 8-70; U.S. Geologic Society, Indication of Unconventional Oil and Gas Wastewaters Found in Local Surface Waters, available at http://toxics.usgs.gov/highlights/2016-05-09-uog_wastes_in_streams.html.
[174] Walker, James, California Class II UIC Program Review, Report submitted to Ground Water Office USEPA Region 9 at 119 (Jun. 2011); U.S. Environmental Protection Agency Region IX, Letter from David Albright, Manager Ground Water, to Elena Miller, State Oil and Gas Supervisor Dept of Conservation re California Class II Underground Injection Control (UIC) Program Review final report (July 18, 2011).

Contaminated water runoff may seep into residential areas, polluting streets, sidewalks, soil, and vegetation in urban areas, adversely affecting human health. Thus, not only do these oil and gas activities create pollution, they create greater conduits for storm water runoff to carry those pollutants from the operation site, into areas in which significant harm can be caused.

Rapid runoff, even without contaminants, can harm the environment by changing water flow patterns and causing erosion, habitat loss, and flooding. Greater runoff volumes may also increase the amount of sediment that is carried to lakes and streams, affecting the turbidity and chemical content of surface waters. Because a National Pollutant Discharge Elimination System permit is not required for oil and gas operations,[175] it is particularly important that the impact of runoff is considered as part of the NEPA process.

b. Water Depletion

Some unconventional extraction techniques, most notably fracking, require the use of tremendous amounts of freshwater. Typically between 2 and 5.6 million gallons of water are required to frack each well.[176] These volumes far exceed the amounts used in conventional natural gas development.[177] Water used in large quantities may lead to several kinds of harmful environmental impacts. The extraction of water for fracking can, for example, lower the water table, affect biodiversity, harm local ecosystems, and reduce water available to communities.[178]

Withdrawal of large quantities of freshwater from streams and other surface waters will undoubtedly have an impact on the environment.[179] Withdrawing water from streams will decrease the supply for downstream users, such as farmers or municipalities, compounding existing shortages, which will only worsen with climate change. A Bureau of Reclamation report looks at how climate change will affect water supplies in the West and finds that warming weather will increase the likelihood of shortages, particularly for farmers.[180] More "extreme variations" in climate will make it difficult for Reclamation to meet competing demands for water. Building on a 2011 report that analyzed eight river basins, the new version analyzes nine: the Klamath, Truckee, Sacramento, San Joaquin, Lower Colorado, Rio Grande, Colorado, Columbia and Missouri. The rivers supply Reclamation with 10 trillion gallons of water per year for cities, as well as water for 10 million acres of irrigated farmland that supply more than half of U.S. vegetable production and more than a quarter of fruit and nut production.[181] The Bureau of Reclamation notes that the basins have already warmed by about 2 degrees Fahrenheit since

---

[175] 33 U.S.C. § 1342(l)(2).
[176] U.S. Government Accountability Office 2012 at 17.
[177] *See* Clark, Corrie E. et al., Life Cycle Water Consumption for Shale Gas and Conventional Natural Gas, Environ. Sci. Technol., 2013, 47 (20), pp 11829–11836, abstract *available at* http://pubs.acs.org/doi/abs/10.1021/es4013855.
[178] International Energy Agency, Golden Rules for the Golden Age of Gas at 31-32 (2012).
[179] *See* Entrekin, Sally et al., *Rapid Expansion of Natural Gas Development Poses a Threat to Surface Waters*, 9 Front Ecol. Environ. 9, 503 (2011); EPA 2015 at 4-16.
[180] U.S. Department of the Interior Bureau of Reclamation. Secure Water Act Section 9503(c) – Reclamation Climate Change and Water, at 10-13, March 2016.
[181] Kahn, Debra. 'Climate change bodes ill for Western supplies.' E&E Reporter: The Politics and Business of Climate Change. March 2016.

1895, which is only slightly more than the nationwide average of 1.3 to 1.9 F.[182] The report finds that more of the West's precipitation will fall as rain rather than snow, and predicts reductions in runoff entering rivers in the South. All areas are expected to see big changes in the timing of snowmelt, which will shift peak river flows earlier and earlier.[183]

Runoff and demand for irrigation will rise. In addition to runoff changes, increased temperatures are expected to increase the demand for irrigation water and for Reclamation's hydroelectricity, as well as for water dedicated to maintaining habitat for fish and other river species.[184] Collectively, the impacts of climate change to water resources give rise to difficult questions about how best to operate Reclamation facilities to address growing demands for water and hydropower now and how to upgrade and maintain infrastructure to optimize operations in the future.[185]

Rising demand from oil and gas operators has already led to increased competition for water between farmers and oil and gas operators. In some regions of Colorado, farmers have had to fallow fields due to astronomical water prices.[186] For example, in prior years, farmers in Colorado have paid at most $100 per acre-feet of water in auctions held by cities with excess supplies, but in 2013 energy companies paid $1200 to $2,900 per acre-feet.[187] Reductions in stream flows may also lead to downstream water quality problems by diminishing the water bodies' capacity for dilution and degradation.

Furthermore, withdrawing large quantities of water from subsurface waters to supply oil and gas production will likely deplete and harm aquifers. Removing water from surface water or directly from underground sources of water faster than the rate that aquifers can be replenished will lower the volume of water available for other uses. Depletion can also lead to compaction of the rock formation serving as an aquifer, after which the original level of water volume can never be restored.[188] Depleted aquifer water resources may also adversely affect agriculture, species habitat and ecosystems, and human health.

The freshwater in the planning areas therefore would be greatly affected by the increased demand for water if fracking and other unconventional oil and gas extraction are permitted. A no-fracking alternative would preserve scarce water resources and keep critical sources of drinking water in the planning area safe and clean. The EIS must analyze where water will be sourced, how much, and the effects on water sources under different alternatives. All of these

---

[182] Id.
[183] Id.
[184] Id.
[185] U.S. Department of the Interior Bureau of Reclamation. Secure Water Act Section 9503(c) – Reclamation Climate Change and Water at 1-10.
[186] Healy, Jack. For Farmers in the West, Oil Wells are Thirsty Rivals, The New York Times (Sept. 5,2012), available at http://www nytimes.com/2012/09/06/us/struggle-for-water-in-colorado-with-rise-in-fracking.html?_r=0 (accessed July 29, 2015); Burke, Garance. Fracking fuels water fights in nation's dry spots, Associated Press (June 17, 2013), available at http://news.yahoo.com/fracking-fuels-water-fights-nations-dry-spots-133742770.html.
[187] *Id*.
[188] Freyman, Monika and Ryan Salmon, Hydraulic Fracturing and Water Stress: Growing Competitive Pressures for Water, CERES, 9 (2013) ("Freyman 2013"), *available at* http://www.ceres.org/resources/reports/hydraulic-fracturing-water-stress-water-demand-by-the-numbers.

effects must be analyzed in the context of increasing water scarcity in the planning area due to climate change, drought, and increasing population growth.

c. Harm to Aquatic Life and Habitat

The areas at stake in this lease sale are known to support a number of native fish regarded as BLM-sensitive, including Colorado River cutthroat trout (CRCT). When streams and other surface waters are depleted, the habitat for countless plants and animals will be harmed, and the depletion places tremendous pressure on species that depend on having a constant and ample stream of water. Oil and gas activities could also increase the risk of toxic spills and leaks, harming aquatic species that inhabit areas downstream from spill sites. A pair of studies that compared water quality downstream from a wastewater injection site in West Virginia to that of upstream areas found (1) downstream sites had elevated levels of endocrine-disrupting chemicals at levels known to adversely affect aquatic organisms; and (2) microbial communities in downstream sediments had lower diversity and shifts in community composition, altering microbial activity and potentially impacting nutrient cycling.[189] Such impacts must (a) be adequately analyzed in an EIS and (b) undergo full and up-to-date consultation with the Fish and Wildlife Service under Section 7 of the Endangered Species Act, using the best and most recent scientific data regarding Colorado River flows and the status of the four endangered fishes.

Physical habitats such as banks, pools, runs, and glides (low gradient river sections) are important yet susceptible to disturbance with changing stream flows.[190] Altering the volume of water can also change the water's temperature and oxygen content, harming some species that require a certain level of oxygenated water. Decreasing the volume of streamflow and stream channels by diverting water to fracking would have a negative impact on the environment.

Furthermore, BLM must take into consideration the impacts of climate change on these water resources, such as the decline in stream flows. Numerous climate change models show anthropogenic climate change is profoundly impacting water resources such as the Colorado River in ways that are altering temperature[191], streamflow[192], and the hydrologic cycle.[193]

---

[189] Akob, D.M., et al., 2016, Wastewater disposal from unconventional oil and gas development degrades stream quality at a West Virginia injection facility: Environmental Science and Technology, doi:10.1021/acs.est.6b00428 (Advanced Web release); Kassotis, C.D., et al., 2016, Endocrine disrupting activities of surface water associated with a West Virginia oil and gas Industry wastewater disposal site: Science of the Total Environment, v. 557–558, p. 901910, doi:10.1016/j.scitotenv.2016.03.113. The two studies are summarized at: http://toxics.usgs.gov/highlights/2016-05-09-uog_wastes_in_streams.html.

[190] Barnett, T. P., et al. 2008. Human-induced changes in the hydrology of the western United States. Science 319: 1080–1083 ("Barnett et al. 2008"); Woodhouse, C. A., et al. 2016. Increasing influence of air temperature on upper Colorado River streamflow. Geophys. Res. Lett. 43, doi:10.1002/2015GL067613 ("Woodhouse et al. 2016")

[191] Hoerling, M. P., et al. 2013. Evolving weather and climate conditions of the Southwest United States. Pages 74–100 in G. Garfin, A. Jardine, M. Black, R. Merideth, J. Overpeck, and A. Ray, editors. Assessment of climate change in the Southwest United States: a report prepared for the National Climate Assessment. Island Press, Washington, D.C., USA ("Hoerling, 2013")

[192] Hoerling, 2013; Hamlet, A., et al. 2005. Effects of temperature and precipitation variability on snowpack trends in the western United States. Journal of Climate 18: 4545-4561; Stewart, I. T., et al. 2004. Changes in snowmelt runoff timing in western North America under a 'Business as Usual' climate change scenario. Climatic Change 62: 217-232; Garfin, G., et al., 2014: Ch. 20: Southwest. Climate Change Impacts in the United States: The Third

Changes observed to date include rising temperatures, earlier snowmelt and streamflow, decreasing snowpack, and declining runoff and streamflow.[194] Modeling studies project that these changes will only worsen, including continued declines in streamflow and intensification of drought.[195]

The physical equipment itself that is designed to intake and divert water may also pose a threat to certain wildlife. If not properly designed, such equipment and intake points may be a risk to wildlife.

d. Harm to Wetlands

High volume removal of surface or groundwater can result in damage to wetlands, which rely on ample water supplies to maintain the fragile dynamics of a wetland habitat. Damage can also occur from spills of chemicals or wastewater, filling operations, and sediment runoff.[196] BLM in its environmental document must fully vet the impacts from every potential aspect of the proposed sale.

Many plant and animal species depend on wetland habitats, and even small changes can lead to significant impacts. Wetlands provide a variety of "eco-service" functions, including water purification, protection from floods, and functioning as carbon sinks.[197] The ecological importance of wetlands is unquestionable, and their full protection is paramount. The EIS must analyze these potential impacts to wetlands, and the related, potential indirect impacts that may stem from such impacts.

VI. BLM Must Look at Impacts to Air Quality

Permitting fracking and other well stimulation techniques will greatly increase the release of harmful air emissions in these and other regions. BLM should disallow new leasing, or else adopt a no-fracking alternative, which would prevent further degradation of local air quality, respiratory illnesses, premature deaths, hospital visits, as well as missed school and work days.

National Climate Assessment, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 462-486.

[193] *Id*.

[194] *Id*.

[195] Stewart, I. T., et al. 2004. Changes in snowmelt runoff timing in western North America under a 'Business as Usual' climate change scenario. Climatic Change 62: 217-232; Rauscher, S. A., et al. 2008. Future changes in snowmelt-driven runoff timing over the western US. Geophysical Research Letters 35: L16703, doi:10.1029/2008GL034424 ("Rauscher, 2008"); Dettinger, M., B. Udall, and A. Georgakakos. 2015. Western water and climate change. Ecological Applications 25: 2069-2093 ("Dettinger, 2015").

[196] U.S. Department of Justice, *Trans Energy Inc. to Restore Streams and Wetland Damaged by Natural Gas Extraction Activities in West Virginia* (Sep. 2, 2014), http://www.justice.gov/opa/pr/trans-energy-inc-restore-streams-and-wetland-damaged-natural-gas-extraction-activities-west (accessed July 29, 2015); *See also,* Pennsylvania Department of Environmental Protection, Commonwealth of Pennsylvania, DEP Fines Seneca Resources Corp. $40,000 for Violations at Marcellus Operation in Tioga County (Jul. 10, 2010), http://www.portal.state.pa.us/portal/server.pt/community/newsroom/14287?id=14655&typeid=1 (accessed July 29, 2015).

[197] U.S. Environmental Protection Agency, Wetlands and People, http://water.epa.gov/type/wetlands/people.cfm (accessed July 29, 2015).

a. Sources of Air Emissions

Harmful air pollutants are emitted during every stage of unconventional oil and gas recovery, including drilling, completion, well stimulation, production, and disposal. Drilling and casing the wellbore require substantial power from large equipment. The engines used typically run on diesel fuel, which emits particularly harmful types of air pollutants when burned. Similarly, high-powered pump engines are used in the fracturing and completion phase. This too can result in large volumes of air pollution. Flaring, venting, and fugitive emissions of gas are also a potential source of air emissions. Gas flaring and venting can occur in both oil and gas recovery processes when underground gas rises to the surface and is not captured as part of production. Fugitive emissions can occur at every stage of extraction and production, often leading to high volumes of gas being released into the air. Methane emissions from oil and gas production is as much as 270 percent greater than previously estimated by calculation.[198] Recent studies show that emissions from pneumatic valves (which control routine operations at the well pad by venting methane during normal operation) and fugitive emissions are higher than EPA estimates.[199]

Evaporation from pits can also contribute to air pollution. Pits that store drilling waste, produced water, and other waste fluid may be exposed to the open air. Chemicals mixed with the wastewater—including the additives used to make fracking fluids, as well as volatile hydrocarbons, such as benzene and toluene, brought to the surface with the waste—can escape into the air through evaporation. Some pits are equipped with pumps that spray effluents into the air to hasten the evaporation process. Even where waste fluid is stored in so-called "closed loop" storage tanks, fugitive emissions can escape from tanks.

As mentioned above, increased truck traffic will lead to more air emissions. Trucks capable of transporting large volumes of chemicals and waste fluid typically use large engines that run on diesel fuel. Air pollutants from truck engines will be emitted not only at the well site, but also along truck routes to and from the site.

b. Impact of Increased Air Pollution

Oil and gas operations emit large amounts and numerous types of air pollutants, including volatile organic compounds (VOCs), Nitrogen oxides (NOx), particulate matter, hydrogen sulfide, and methane. Unconventional oil and gas operations, such as fracking, are particularly harmful, emitting large amounts of toxic air pollutants,[200] also referred to as Hazardous Air Pollutants, which are known or suspected to cause cancer or other serious health effects, such as

---

[198] Miller, S. M. et al. Anthropogenic Emissions of Methane in the United States, Proc. Natl. Acad. Sci. Early Edition, DOI: 10.1073/pnas.1314392110 (2013) ("Miller 2013").

[199] Allen, D. T. *et al., (2013), Measurements of Methane Emissions at Natural Gas Production Sites in the United States*, 110 *Proc*. Natl. Acad. Sci. 44 (2013) ("Allen 2013"); Harriss, Robert et al., Using Multi-Scale Measurements to Improve Methane Emission Estimates from Oil and Gas Operations in the Barnett Shale Region, Texas, Environ. Sci. Technol., 2015, 49 (13), pp 7524–7526.

[200] Sierra Club et al. comments on New Source Performance Standards: Oil and Natural Gas Sector; Review and Proposed Rule for Subpart OOOO (Nov. 30, 2011) ("Sierra Club Comments") at 13.

reproductive effects or birth defects, or adverse environmental effects.[201] A report from the Clean Air Task Force shows more than 200 counties across 21 states face elevated cancer risks from toxic emissions stemming from oil and gas production in the United States.[202] There is also a growing body of scientific evidence showing that exposure to ambient air pollution increases the risk of stillbirth.[203]

The reporting requirements recently implemented by the California South Coast Air Quality Management District ("SCAQMD") have shown that at least 44 chemicals known to be air toxics have been used in fracking and other types of unconventional oil and gas recovery in California.[204] Through the implementation of these new reporting requirements, it is now known that operators have been using several types of air toxics in California, including crystalline silica, methanol, hydrochloric acid, hydrofluoric acid, 2-butoxyethanol, ethyl glycol monobutyl ether, xylene, amorphous silica fume, aluminum oxide, acrylic polymer, acetophenone, and ethylbenzene. Many of these chemicals also appear on the U.S. EPA's list of hazardous air pollutants.[205] EPA has also identified six "criteria" air pollutants that must be regulated under the National Ambient Air Quality Standards (NAAQS) due to their potential to cause primary and secondary health effects. Concentrations of these pollutants—ozone, particulate matter, carbon monoxide, nitrogen oxides, sulfur dioxide and lead—will likely increase in regions where unconventional oil and gas recovery techniques are permitted.

The potential harms resulting from increased exposure to the dangerous air pollutants described above are serious and wide ranging. The negative effects of criteria pollutants are well documented and are summarized by the U.S. EPA's website:

> *Nitrogen oxides* (NOx) react with ammonia, moisture, and other compounds to form small particles. These small particles penetrate deeply into sensitive parts of the lungs and can cause or worsen respiratory disease, such as emphysema and bronchitis, and can aggravate existing heart disease, leading to increased hospital admissions and premature death. NO_x and volatile organic compounds react in the presence of heat and sunlight to form ozone.
>
> *Particulate matter* (PM) – especially fine particles – contains microscopic solids or liquid droplets that are so small that they can get deep into the lungs and cause serious health problems. Numerous scientific studies have linked particle pollution exposure to a variety of problems, including: premature death in people with heart or lung disease, increased mortality, nonfatal heart attacks, irregular heartbeat, aggravated asthma,

---

[201] U.S. EPA, Hazardous Air Pollutants, *available at* http://www.epa.gov/haps (accessed Jan. 10, 2016).
[202] Fleischman, L., Fossil Fumes: A Public Health Analysis of Toxic Air Pollution from the Oil and Gas Industry, June 2016, *available* at http://www.catf.us/resources/publications/files/FossilFumes.pdf
[203] *See* Siddika N, Balogun HA, Amegah AK, Jaakkola JJ. *Prenatal ambient air pollution exposure and the risk of stillbirth: systematic review and meta-analysis of the empirical evidence.* Occup Environ Med. 2016 May 24. pii: oemed-2015-103086. doi: 10.1136/oemed-2015-103086; *see also* Annie Knox, "At Vernal forum, questions about air pollution, pregnancies, research," Salt Lake Tribune (April 19, 2015); Paul Solotaroff, "What's Killing the Babies of Vernal, Utah?" Rolling Stone (July 2, 2015).
[204] Center for Biological Diversity, Air Toxics One Year Report, p. 1 (June 2014).
[205] U.S. Environmental Protection Agency, The Clean Air Act Amendments of 1990 List of Hazardous Air Pollutants, Technology Transfer Network Air Toxics Web Site, http://www.epa.gov/ttnatw01/orig189 html (accessed July 29, 2015).

decreased lung function, and increased respiratory symptoms, such as irritation of the airways, coughing or difficulty breathing.[206]

Sulfur Dioxide (SO_2) has been shown to cause an array of adverse respiratory effects including bronchoconstriction and increased asthma symptoms.[207] Studies also show a connection between short-term exposure and increased visits to emergency departments and hospital admissions for respiratory illnesses, particularly in at-risk populations including children, the elderly, and asthmatics.[208]

Carbon Monoxide (CO) can cause harmful health effects by reducing oxygen delivery to the body's organs (like the heart and brain) and tissues. At extremely high levels, CO can cause death.[209] Exposure to CO can reduce the oxygen-carrying capacity of the blood. People with several types of heart disease already have a reduced capacity for pumping oxygenated blood to the heart, which can cause them to experience myocardial ischemia (reduced oxygen to the heart), often accompanied by chest pain (angina), when exercising or under increased stress.[210] For these people, short-term CO exposure further affects their body's already compromised ability to respond to the increased oxygen demands of exercise or exertion.[211]

Ozone (O_3) can trigger or worsen asthma and other respiratory ailments.[212] Ground level ozone can have harmful effects on sensitive vegetation and ecosystems. Ozone may also lead to loss of species diversity and changes to habitat quality, water cycles, and nutrient cycles.

VOCs, from car and truck engines as well as the drilling and completion stages of oil and gas production, make up about 3.5 percent of the gases emitted by oil or gas operations.[213] The VOCs emitted include the BTEX compounds – benzene, toluene, ethyl benzene, and xylene – which are listed as Hazardous Air Pollutants.[214] There is substantial evidence showing the grave harm from these pollutants.[215] Recent studies and reports confirm the pervasive and extensive amount of VOCs emitted by unconventional oil and gas extraction.[216] In particular, a study

---

[206] U.S. Environmental Protection Agency, Particulate Matter, (PM) http://www.epa.gov/airquality/particlepollution/health html (accessed July 30, 2015); Ostro, Bart et al., Long-term Exposure to Constituents of Fine Particulate Air Pollution and Mortality: Results from the California Teachers Study, 118 Environmental Health Perspectives 3 (2010).
[207] U.S. Environmental Protection Agency, Sulfur Dioxide http://www.epa.gov/airquality/sulfurdioxide/health.html, *available at* (accessed July 29, 2015).
[208] *Id.*
[209] U.S. Environmental Protection Agency, Carbon Monoxide, *available at* http://www.epa.gov/airquality/carbonmonoxide/health html (accessed July 29, 2015).
[210] *Id.*
[211] *Id.*
[212] U.S. Environmental Protection Agency, Ground Level Ozone, *available at* http://www.epa.gov/airquality/ozonepollution/health.html (accessed July 29, 2015).
[213] Brown, Heather, Memorandum to Bruce Moore, U.S.EPA/OAQPS/SPPD re Composition of Natural Gas for use in the Oil and Natural Gas Sector Rulemaking, July 28, 2011 ("Brown Memo") at 3.
[214] 42 U.S.C. § 7412(b).
[215] Colborn 2011; McKenzie 2012; Food & Water Watch 2011.
[216] McCawley, M., Air, Noise, and Light Monitoring Plan for Assessing Environmental Impacts of Horizontal Gas Well Drilling Operations (ETD-10 Project), West Virginia University School of Public Health, Morgantown, WV (2013) ("McCawley 2013"), *available at* http://www.dep.wv.gov/oil-and-gas/Horizontal-

covering sites near oil and gas wells in five different states found that concentrations of eight volatile chemicals, including benzene, formaldehyde and hydrogen sulfide, exceeded risk-based comparison values under several operational circumstances.[217] Another study determined that vehicle traffic and engine exhaust were likely the sources of intermittently high dust and benzene concentrations observed near well pads.[218] Recent studies have found that oil and gas operations are likely responsible for elevated levels of hydrocarbons such as benzene downwind of the Denver-Julesburg Fossil Fuel Basin, north of Denver.[219] Another study found that oil and gas operations in this area emit approximately 55% of the VOCs in northeastern Colorado.[220]

VOCs can form ground-level (tropospheric) ozone when combined with nitrogen oxides ("NO_X"), from compressor engines, turbines, other engines used in drilling, and flaring,[221] and sunlight. This reaction can diminish visibility and air quality and harm vegetation. Tropospheric ozone can also be caused by methane, which is leaked and vented at various stages of unconventional oil and gas development, as it interacts with nitrogen oxides and sunlight.[222] In addition to its role as a greenhouse gas, methane contributes to increased concentrations of ground-level ozone, the primary component of smog, because it is an ozone precursor.[223] Methane's effect on ozone concentrations can be substantial. One paper modeled reductions in various anthropogenic ozone precursor emissions and found that "[r]educing anthropogenic CH_4 emissions by 50% nearly halves the incidence of U.S. high-O_3 events . . . ."[224] Like methane, VOCs and NO_X are also ozone precursors; therefore, many regions around the country with substantial oil and gas operations are now suffering from extreme ozone levels due to heavy emissions of these pollutants.[225] Ozone can result in serious health conditions, including heart

---

Permits/legislativestudies/Documents/WVU%20Final%20Air%20Noise%20Light%20Protocol.pdf; Center for Biological Diversity, Dirty Dozen: The 12 Most Commonly Used Air Toxics in Unconventional Oil Development in the Los Angeles Basin (Sept. 2013).

[217] Macey, G.P. et al., Air Concentrations of Volatile Compounds Near Oil and Gas Production: A Community-Based Exploratory Study, 13 Environmental Health 82 (2014) at 1.

[218] McCawley 2013.

[219] Pétron, G. et al., Hydrocarbon Emissions Characterization in the Colorado Front Range – A Pilot Study, 117 J. Geophysical research D04304 (2012), at 8, 13 ("Pétron 2012").

[220] Gilman, J.B. et al., *Source Signature of Volatile Organic Compounds from Oil and Natural Gas Operations in Northeastern Colorado*, 47 Envtl. Sci & Tech. 1297, 1303 (2013).

[221] *See, e.g.*, U.S. Environmental Protection Agency, Oil and Gas Sector: Standards of Performance for Crude Oil and Natural Gas Production, Transmission, and Distribution: Background Technical Support Document for Proposed Standards at 3-6 (July 2011); Armendariz, Al, Emissions for Natural Gas Production in the Barnett Shale Area and Opportunities for Cost-Effective Improvements (2009) ("Armendariz") at 24.

[222] Fiore, Arlene et al., Linking Ozone Pollution and Climate Change: The Case for Controlling Methane, 29 Geophys. Res Letters 19 (2002).

[223] U.S. Environmental Protection Agency, Oil and Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews Proposed Rule, 76 Fed. Reg 52,738 (Aug 23, 2011).

[224] Fiore, Arlene et al., Linking ozone pollution and climate change: The case for controlling methane, 29 Geophys. Res Letters 19 (2002); *see also* Martin, Randal et al., Final Report: Uinta Basin Winter Ozone and Air Quality Study Dec 2010 - March 2011 (2011) at 7.

[225] Armendariz at 1, 3, 25-26; Wendy Koch, *Wyoming's Smog Exceeds Los Angeles' Due to Gas Drilling*, USA Today (May 9, 2011); Craft, Elena, Environmental Defense Fund, Do Shale Gas Activities Play a Role in Rising Ozone Levels? (2012); Colorado Dept. of Public Health and Environment, Conservation Commission, Colorado Weekly and Monthly Oil and Gas Statistics (July 6, 2012) at 12.

and lung disease and mortality.[226] A recent study of ozone pollution in the Uintah Basin of northeastern Utah, a rural area that experiences hazardous tropospheric ozone concentrations, found that oil and gas operations were responsible for 98 to 99 percent of VOCs and 57 to 61 percent of NO_X emitted from sources within the Basin considered in the study's inventory.[227] Another study released by the University of Colorado, Boulder, shows that oil and gas operations are directly contributing to summertime ozone problems in Colorado's populous northern Front Range area.[228] According to the study the rapid changes in the oil and gas sector and urban population growth suggest the potential for year-to-year changes in photochemical (ozone) sensitivities and emissions of VOC and NOx.

Oil and gas operations can also emit hydrogen sulfide. The hydrogen sulfide is contained in the natural gas and makes that gas "sour."[229] Hydrogen sulfide may be emitted during all stages of operation, including exploration, extraction, treatment and storage, transportation, and refining. Long-term exposure to hydrogen sulfide is linked to respiratory infections, eye, nose, and throat irritation, breathlessness, nausea, dizziness, confusion, and headaches.[230]

The oil and gas industry is also a major source of particulate matter. The heavy equipment regularly used in the industry burns diesel fuel, generating fine particulate matter[231] that is especially harmful.[232] Vehicles traveling on unpaved roads also kick up fugitive dust, which is particulate matter.[233] Further, both NO_X and VOCs, which as discussed above are heavily emitted by the oil and gas industry, are also particulate matter precursors.[234] Some of the health effects associated with particulate matter exposure are "premature mortality, increased hospital admissions and development of chronic respiratory disease."[235]

Natural gas drilling operations result in the emissions of numerous non-methane hydrocarbons (NMHCs) that have been linked to numerous adverse health effects. A recent study that analyzed air samples taken during drilling operations near natural gas wells and

---

[226] U.S. Environmental Protection Agency, Integrated Science Assessment (ISA) for Ozone (O3) and Related Photochemical Oxidants (2013).
[227] Lyman, Seth and Howard Shorthill, Final Report: 2012 Uintah Basin Winter Ozone & Air Quality Study, Utah Department of Environmental Quality (2013); *see also* Gilman, Jessica et al., Source signature of colatile organic compounds from oil and natural gas operations in northeastern Colorado, Environ Sci and Technology (Jan 14, 2013), DOI: 10.1021/es304119a.
[228] McDuffie, E., et al., Influence of Oil and Gas Emissions on Summertime Ozone in the Colorado Northern Front Range, AGU Publications, July 2016.
[229] Sierra Club Comments.
[230] U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Report to Congress on Hydrogen Sulfide Air Emissions Associated with the Extraction of Oil and Natural Gas (EPA-453/R-93-045) at i (Oct. 1993) ("USEPA 1993").
[231] Earthworks, Sources of Oil and Gas Pollution (2011).
[232] Bay Area Air Quality Management District, Particulate Matter Overview, Particulate Matter and Human Health (2012).
[233] U.S. Environmental Protection Agency, Regulatory Impact Analysis for the Proposed Revisions to the National Ambient Air Quality Standards for Particulate Matter (June 2012), http://www.epa.gov/ttnecas1/regdata/RIAs/PMRIACombinedFile_Bookmarked.pdfat 2-2, ("EPA RIA").
[234] EPA RIA at 2-2.
[235] U.S. Environmental Protection Agency, National Ambient Air Quality Standards for Particulate Matter Proposed Rule, 77 Fed. Reg. 38,890, 38,893 (June 29, 2012).

residential areas in Garfield County, Colorado, detected 57 chemicals between July 2010 and October 2011, including 44 with reported health effects.[236] For example:

> Thirty-five chemicals were found to affect the brain/nervous system, 33 the liver/metabolism, and 30 the endocrine system, which includes reproductive and developmental effects. The categories with the next highest numbers of effects were the immune system (28), cardiovascular/blood (27), and the sensory and respiratory systems (25 each). Eight chemicals had health effects in all 12 categories. There were also several chemicals for which no health effect data could be found.[237]

The study found extremely high levels of methylene chloride, which may be used as cleaning solvents to remove waxy paraffin that is commonly deposited by raw natural gas in the region. These deposits solidify at ambient temperatures and build up on equipment.[238] While none of the detected chemicals exceeded governmental safety thresholds of exposure, the study noted that such thresholds are typically based on "exposure of a grown man encountering relatively high concentrations of a chemical over a brief time period, for example, during occupational exposure."[239] Consequently, such thresholds may not apply to individuals experiencing "chronic, sporadic, low-level exposure," including sensitive populations such as children, the elderly, and pregnant women.[240] For example, the study detected polycyclic aromatic hydrocarbon (PAH) levels that could be of "clinical significance," as recent studies have linked low levels of exposure to lower mental development in children who were prenatally exposed.[241] In addition, government safety standards do not take into account "the kinds of effects found from low-level exposure to endocrine disrupting chemicals…, which can be particularly harmful during prenatal development and childhood.[242]

Another study reviewed exposures to emissions from unconventional natural gas development and noted that trimethylbenzenes are among the largest contributors to non-cancer threats for people living within a half mile of a well, while benzene is the largest contributor to cumulative cancer risk for people, regardless of the distance from the wells.

Fracking results in additional air pollution that can create a severe threat to human health. One analysis found that 37 percent of the chemicals found at fracked gas wells were volatile, and that of those volatile chemicals, 81 percent can harm the brain and nervous system, 71 percent can harm the cardiovascular system and blood, and 66 percent can harm the kidneys.[243] Also, the SCAQMD has identified three areas of dangerous and unregulated air emissions from

---

[236] Colborn et al., An Exploratory Study of Air Quality Near Natural Gas Operations, 20 Human and Ecological Risk Assessment: An International Journal. 1, 21-22 (2012) (pages refer to page numbers in attached manuscript and not journal pages) ("Colborn 2012"), *available at* http://www.tandfonline.com/doi/full/10.1080/10807039.2012.749447.
[237] Colborn 2012, p. 11.
[238] *Id*., p. 10.
[239] *Id*., pp. 11-12.
[240] *Id*. p. 12.
[241] *Id*., p. 10-11.
[242] *Id*., p. 12.
[243] Colborn 2011 at 8.

fracking: (1) the mixing of the fracking chemicals; (2) the use of the silica, or sand, as a proppant, which causes the deadly disease silicosis; and (3) the storage of fracking fluid once it comes back to the surface.[244] Preparation of the fluids used for well completion often involves onsite mixing of gravel or proppants with fluid, a process which potentially results in major amounts of particulate matter emissions.[245] Further, these proppants often include silica sand, which increases the risk of lung disease and silicosis when inhaled.[246] Finally, as flowback returns to the surface and is deposited in pits or tanks that are open to the atmosphere, there is the potential for organic compounds and toxic air pollutants to be emitted, which are harmful to human health as described above.[247]

The EIS should study the potential for oil and gas operations sites in the planning area to emit such air toxics and any other pollutants that may pose a risk to human health, paying particular attention to the impacts of air pollution on environmental justice communities that already bear the burden of disproportionately high levels of air pollution. The EIS should rely on the most up-to-date information regarding the contribution of oil and gas operations to VOC and air toxics levels.

VII. BLM Must Take a Hard Look at Impacts to Wildlife Resources

The expansion of oil and gas development activities will harm wildlife through habitat destruction and fragmentation, stress and displacement caused by development-related activities (e.g., construction and operation activities, truck traffic, noise and light pollution), surface water depletion leading to low stream flows, water and air contamination, introduction of invasive species, and climate change. These harms can result in negative health effects and population declines. Studies and reports of observed impacts to wildlife from unconventional oil and gas extraction activities are summarized in the Center's "Review of Impacts of Oil and Gas Exploration and Development on Wildlife," submitted herewith.[248] Because the allowance of destructive oil and gas extraction runs contrary to BLM's policy of managing resources in a manner that will "protect the quality of…ecological…values" and "provide…habitat for wildlife,"[249] no-fracking and no-leasing alternatives minimizing industrial development and its harmful effects on wildlife must be considered.

a. Habitat Loss

Oil and gas development creates a network of well pads, roads, pipelines, and other infrastructure that lead to direct habitat loss and fragmentation, as well as displacement of

[244] South Coast Air Quality Management District, Draft Staff Report on Proposed Rule 1148.2 - Notification and Reporting Requirements for Oil and Gas Wells and Chemical Suppliers (January 2013).at 15 ("SCAQMD Revised Draft Staff Report PR1148-2").
[245] *Id.*
[246] South Coast Air Quality Management District, Response to Questions re Air Quality Risks of Hydraulic Fracturing in California, Submission to Joint Senate Hearing (2013) at 3.
[247] SCAQMD Revised Draft Staff Report PR1148-2 at 15.
[248] *See* Center for Biological Diversity, Review of Impacts of Oil and Gas Exploration and Development on Wildlife (June 20, 2015). This review presents the findings of numerous studies and reports on the impacts of hydraulic fracturing on wildlife.
[249] 43 U.S. Code § 1701(a)(8).

wildlife from these areas due to increased human disturbance. Habitat loss occurs as a result of a reduction in the total area of the habitat, the decrease of the interior-to-edge ratio, isolation of one habitat fragment from another, breaking up of one habitat into several smaller patches of habitat, and decreasing the average size of a habitat patch. New research has revealed the extent of this habitat loss. For example, in the western United States, the amount of high-quality habitat for the pronghorn has shrunk drastically due to oil and gas development.[250]

The indirect effects from unconventional oil and gas development can often be far greater than the direct disturbances to habitat. The impacts from the well site—including noise, light, and pollution—extend beyond the borders of the operation site and will consequently render even greater areas uninhabitable for some wildlife. Species dependent on having an "interior" habitat will lose their habitat as operation sites or other infrastructure fragment previously buffered and secluded areas. These and other indirect effects can be far greater than the direct disturbances to land. In the Marcellus shale of Pennsylvania, for instance, research shows that 8.8 acres of forest on average are cleared for each drilling pad along with associated infrastructure, but after accounting for ecological edge effects, each drilling station actually affected 30 acres of forest.[251]

While individual well sites may cause some disturbance and destruction, the cumulative impacts of oil and gas production using unconventional methods must receive attention as well. While the actual well pads may only occupy a small proportion of a particular habitat, their impact can be much greater when their aggregate impact is considered. As discussed above, interior habitats will be destroyed by removing the buffer between the interior habitat and the operation site. For example, one study found that grassland bird species' habitat have been degraded by oil development in the Bakken shale region, as evidenced by their avoidance of these areas. Grassland birds avoided areas within 150 meters of roads, 267 meters of single-bore well pads, and 150 meters of multi-bore well pads.[252] In areas of dense development, these habitat effects are greatly multiplied for sensitive species, such as the Sprague's pipit (*Anthus spragueii*), which avoided areas within 350 meters of single-bore well pads. The EIS must quantify the potential cumulative loss of habitat for wildlife.[253]

b. Water Depletion

Water depletion also affects species whose habitats are far removed from the actual well site. BLM must take into consideration how fracking could impact the population and habitat of wildlife on and surrounding the parcels that are being offered for lease sale. Because of the high volume of water required for even a single well that uses unconventional extraction methods, the cumulative water depletion has a significant impact on species that rely on water sources that

[250] Beckmann, J.P. et al. Human-mediated shifts in animal habitat use: Sequential changes in pronghorn use of a natural gas field in Greater Yellowstone, 147 Biological Conservation 1:222 (2012).
[251] Johnson, N., Pennsylvania energy impacts assessment: Report 1: Marcellus shale natural gas and wind, Nature Conservancy – Pennsylvania Chapter (2010) at 10.
[252] Thomas, Sarah J. et al. Avoidance of unconventional oil wells and roads exacerbates habitat loss for grassland birds in the North American great plains, Biological Conservation 192 (2015) 82–90, *available at* https://www.researchgate net/publication/282292567_Avoidance_of_unconventional_oil_wells_and_roads_exacerbates_habitat_loss_for_grassland_birds_in_the_North_American_great_plains.
[253] *Id.*

serve to supply oil and gas operations. In addition, water depletion adversely impacts water temperature and chemistry, as well as amplifies the effects of harmful pollutants on wildlife that would otherwise be diluted without the depletion.

c. Water Contamination

Accidental spills or intentional dumping of wastewater contaminate surface water and cause large-scale harm to wildlife. BLM must take a hard look at the impacts that this would have on wildlife on and surrounding the action area, and account for the sources of such contamination. For example, numerous incidents of wastewater contamination from pipelines, equipment blowouts, and truck accidents have been reported, and have resulted in kills of fish, aquatic invertebrates, and trees and shrubs, as well as negative health effects for wildlife and domestic animals. In 2013, a company admitted to dumping wastewater from fracking operations into the Acorn Fork Creek in Kentucky, causing a massive fish kill.[254] Among the species harmed was the blackside dace, a threatened minnow species.[255] An analysis of water quality of Acorn Creek and fish tissues taken shortly after the incident was exposed showed the fish displayed general signs of stress and had a higher rate of gill lesions, than fish in areas not affected by the dumping.[256] The discharge of fracking wastewater into the Susquehanna River in Pennsylvania is suspected to be the cause of fish abnormalities, including high rates of spots, lesions, and intersex.[257] In West Virginia, the permitted application of hydrofracturing fluid to an area of mixed hardwood forest caused extensive tree mortality and a 50-fold increase in surface soil concentrations of sodium and chloride.[258]

In addition, open air pits that store waste fluid pose risks for wildlife that may come into contact with the chemicals stored in the pits. Already, there have been several documented cases of animal mortality resulting from contact with pits. A field inspection of open pits in Wyoming found 269 bird carcasses, the likely cause of death being exposure to toxic chemicals stored in the open pits.[259] Open pits can also serve as breeding grounds for mosquitoes, which serve as a vector for West Nile virus, a threat to humans and animals alike. In Wyoming, an increase of ponds led to an increase of West Nile virus among greater sage-grouse populations.[260] Recently, new information has come to light that operators in California have been dumping wastewater

[254] Vaidyanathan, Gayathri, *Fracking Spills Cause Massive Ky. Fish Kill*, E&E News, Aug. 29. 2013, http://www.eenews.net/greenwire/2013/08/29/stories/1059986559 (accessed July 30, 2015).
[255] *Id.*
[256] Papoulias, D.M. and A.L. Velasco. Histopathological analysis of fish from Acorn Fork Creek, Kentucky, exposed to hydraulic fracturing fluid releases, 12 Southwestern Naturalist (Special Issue 4):92 (2013).
[257] Piette, Betsy, BP Oil Spill, Fracking Cause Wildlife Abnormalities, Workers World (April 27, 2012) available at http://www.workers.org/2012/us/bp_oil_spill_fracking_0503/; Pennsylvania Fish & Boat Commission, Ongoing Problems with the Susquehanna River smallmouth bass, a Case for Impairment (May 23, 2012), www.fish.state.pa.us/newsreleases/2012press/senate_susq/SMB_ConservationIssuesForum_Lycoming.pdf
[258] Adams, Mary Beth, Land Application of Hydrofracturing Fluids Damages a Deciduous Forest Stand in West Virginia, 40 Journal of Environmental Quality 1340 (2011).
[259] *See, e.g.,* Ramirez, P. Jr., Bird Mortality in Oil Field Wastewater Disposal Facilities, 46 Environ Mgmt 5: 820 (2010).
[260] Zou, Li et al., Mosquito Larval Habitat Mapping Using Remote Sensing and GIS: Implications of Coalbed Methane Development and West Nile Virus, 43 J. Med. Entomol. 5:1034 (2006) ("Zou 2006").

into hundreds of unpermitted open pits.[261] The EIS must take into account the impact of both unpermitted, illegal waste pits as well as those that are regulated.

Contaminants from spills not only directly harm species exposed to these contaminants but can enter the food chain and harm predators. A recent study found that in watersheds where hydraulic fracturing occurs, a top predator, riparian songbird in headwater systems, the Louisiana Waterthrush (*Parkesia motacilla*), accumulated metals associated with the fracking process. "In both the Marcellus and Fayetteville shale regions, barium and strontium were found at significantly higher levels in feathers of birds in sites with fracking activity than at sites without fracking."[262] While the study did not resolve the pathway for these metals entering the food chain, their findings suggested that "hydraulic fracturing may be contaminating surface waters and underscores the need for additional monitoring and study to further assess ecological and human health risks posed by the increasingly widespread development of unconventional sources of natural gas around the world."[263]

d. Invasive Species

Invasive species may be introduced through a variety of pathways that would be increasingly common if oil and gas activity is allowed to expand. Machinery, equipment, and trucks moved from site to site can carry invasive plant species to new areas. In addition, materials such as crushed stone or gravel transported to the site from other locations may serve as a conduit for invasive species to migrate to the well site or other areas en route.

Aquatic invasive species may also spread more easily given the large amounts of freshwater that must be transported to accommodate new drilling and extraction techniques. These species may be inadvertently introduced to new habitats when water is discharged at the surface. Alternatively, hoses, trucks, tanks, and other water use equipment may function as conduits for aquatic invasive species to access new habitats.

e. Climate Change

Anthropogenic climate change poses a significant threat to biodiversity.[264] Climate disruption is already causing changes in distribution, phenology, physiology, genetics, species interactions, ecosystem services, demographic rates, and population viability: many animals and plants are moving poleward and upward in elevation, shifting their timing of breeding and migration, and experiencing population declines and extinctions.[265] See, for example, the

---

[261] Cart, Julie. *Hundreds of Illicit Oil Wastewater Pits Found in Kern County*, (Feb. 26, 2015), *available at* http://www.latimes.com/local/lanow/la-me-ln-pits-oil-wastewater-20150226-story.html.

[262] Latta, Steven C., et al., Evidence from two shale regions that a riparian songbird accumulates metals associated with hydraulic fracturing," *Ecosphere* vol. 6(9), Article 144 (September 2015), *available at* http://www.esajournals.org/doi/pdf/10.1890/ES14-00406.1.

[263] *Id*.

[264] Warren, R. et al.,Quantifying the benefit of early climate change mitigation in avoiding biodiversity loss, 3 Nature Climate Change 678 (2013) ("Warren 2013").

[265] Cahill, A.E. et al., How Does Climate Change Cause Extinction? Proceedings of the Royal Society B, doi:10.1098/rspb.2012.1890 (2012); Chen, I. et al., Rapid range shifts of species associated with high levels of climate warming, 333 Science 1024 (2011); Maclean, I.M.D., and R.J. Wilson, Recent ecological responses to

discussion above in section "V" subsection "c" regarding the impacts of climate change on stream flows. Because climate change is occurring at an unprecedented pace with multiple synergistic impacts, climate change is predicted to significantly increase extinction risk for many species. The IPCC concludes that it is extremely likely that climate change at or above 4°C will result in substantial species extinction.[266] Other studies have predicted similarly severe losses: 15-37 percent of the world's plants and animals committed to extinction by 2050 under a mid-level emissions scenario[267]; the extinction of 10 to 14 percent of species by 2100 if climate change continues unabated.[268] Another recent study predicts the loss of more than half of the present climatic range for 58 percent of plants and 35 percent of animals by the 2080s under the current emissions pathway, in a sample of 48,786 species.[269] Because expansion of oil and gas production in the planning area will substantially increase the emissions of greenhouse gases, this activity will further contribute to the harms from climate change to wildlife and ecosystems.

f. Population-level Impacts

Oil and gas development has been linked to population-level impacts on wildlife, including lower reproductive success of sage grouse and declines in the abundance of songbirds and aquatic species. For example, young greater-sage grouse avoided mating near infrastructure of natural-gas fields, and those that were reared near infrastructure had lower annual survival rates and were less successful at establishing breeding territories compared to those reared away from infrastructure.[270] In Wyoming, an increasing density of wells was associated with decreased numbers of Brewer's sparrows, sage sparrows, and vesper sparrows.[271] In the Fayetteville Shale of central Arkansas, the proportional abundance of sensitive aquatic taxa, including darters, was negatively correlated with gas well density.[272] The EIS must consider the population-level impacts that oil and gas development may have on wildlife in the planning areas.

g. Endangered, Threatened, and Sensitive Species

---

climate change support predictions of high extinction risk, 108 Proc. Natl. Acad. Sci. Early Edition 12337 (2011) ("Maclean and Wilson 2011"); Parmesan, C., Ecological and Evolutionary Responses to Recent Climate Change, 37 Annual Review of Ecology Evolution & Systematics 637 (2006); Parmesan, C., and G. Yohe, A globally coherent fingerprint of climate change impacts across natural systems, 421 Nature 37 (2003); Root, T.L. et al., Fingerprints of Global Warming on Wild Animals and Plants, 421 Nature 57 (2003); Warren, Rachel et al., Increasing Impacts of Climate Change Upon Ecosystems with Increasing Global Mean Temperature Rise, 106 Climatic Change 141 (2011). ("Warren 2011").

[266] Intergovernmental Panel on Climate Change, *Climate Change 2014: Synthesis Report, Summary for Policy Makers IPCC Fifth Assessment Synthesis Report*, 18 (2014).

[267] Thomas, C.D. et al., Extinction Risk from Climate Change, 427 Nature 8:145 (2004).

[268] Maclean and Wilson 2011.

[269] Warren 2013.

[270] Holloran, M.J. et al., Yearling Greater Sage-Grouse Response to Energy Development in Wyoming, 74 Journal of Wildlife Management 1:65 (2010).

[271] Gilbert, Michelle M. & Anna D. Chalfoun, Energy Development Affects Populations of Sagebrush Songbirds in Wyoming, 75 The Journal of Wildlife Management 4:816 (2011).

[272] Green, Jessie J. et al., Abstract: Examining Community Level Variables of Fishes in Relation to Natural Gas Development, Southeastern Fishes Council, Annual Meeting Program, November 8 - 9, 2012, New Orleans, Louisiana (2012).

BLM must use the existing readily available data to identify which sensitive species that are of critical concern with regards to the lands included in, or in immediate proximity to, the proposed sale parcels. BLM's EIS must discuss any impacts to such species, including but not limited to the Columbian Sharp-Tailed Grouse (or "CSTG"), Greater Sage-Grouse (or "GRSG"), Colorado River Cutthroat Trout ("CRCT"), and White-Tailed Prairie-Dog ("WTPD"). Several of the parcels are within range of GRSG and CSTG as well as sensitive habitat including lek sites, production areas, and winter range. BLM must either (1) provide detailed analysis of potential direct and indirect impacts on local populations, cumulative effects on regional populations, and full consideration of BLM's obligations under its sensitive species policy, including a thorough assessment of mitigation measures; or (2) refrain from leasing sensitive habitat, including winter, nesting, and brood-rearing habitat.

In addition, BLM must consult with the Fish and Wildlife Service regarding the impacts of the lease sale on affected listed species, in compliance with its section 7 obligations under the ESA. To the extent that BLM relies on its section 7 programmatic consultations for resource management plans governing the lease sale, that reliance is not proper for any of the listed species affected by BLM's action. The potential for fracking and horizontal drilling and its associated impacts within the planning area constitutes "new information reveal[ing] effects of the [RMPs] that may affect listed species or critical habitat in a manner or to an extent not previously considered [in the prior section 7 programmatic consultations]." 50 CFR § 402.16(b). BLM must therefore reinitiate consultation on all of the planning documents for these areas. In any case, it must formally consult over the lease sale's potential adverse effects on listed species and consider the full scope of fracking and other drilling activities that could affect these species.

1. *BLM Must Analyze the Impacts of New Drilling on Endangered Fish and Reinitiate Consultation Under ESA Section 7*

The leasing and development of these parcels would have significant effects on survival and recovery of the endangered Colorado pikeminnow, razorback sucker, humpback chub, and bonytail (collectively, "endangered fish"). The parcels at issue are located near the White River and the Yampa River, both of which are tributaries to the Green River which flows into the Colorado River. The loss of adequate flows in the endangered fishes' habitat within the Upper Colorado River Basin is so serious that the Service has determined that *any* depletion of Upper Basin stream flows adversely affects and jeopardizes the endangered fish.[273] Therefore, any depletion is subject to section 7 consultation. Specifically, new information about (a) the potential for increased horizontal well development and Mancos shale play development within these areas; (b) climate change effects on stream flows (which is not even acknowledged in the PBO), (c) long-term drought and increased water demand which has drastically reduced water supplies, and (d) declining razorback sucker and Colorado pikeminnow populations, reveal effects of the action that may affect the species in a manner or to an extent not previously considered, and therefore trigger reinitiation of consultation.

(a) Horizontal wells will require greater water depletions than previously anticipated

Under section 7 of the Endangered Species Act, BLM must consult with Fish and Wildlife Service regarding the tremendous water depletion effects of horizontal drilling on the endangered fish. Leasing of the parcels at issue and deployment of these new drilling technologies would foreseeably entail significant water depletions and adversely affect endangered fish that inhabit areas downstream of the lease areas. While the 2008 "Programmatic Biological Opinion for Water Depletions Associated with Bureau of Land Management's Fluid Mineral Program within the Upper Colorado River Basin in Colorado" (PBO) is designed to address any depletions resulting from oil and gas development within the White River Field Office and other western Colorado field offices, BLM can no longer rely on that consultation for its section 7 compliance. The PBO did not consider the likely increase in horizontal drilling and other unconventional drilling practices that deplete enormous amounts of water to develop the Mancos/Mowry and Niobrara shale plays (collectively "Mancos shale play"). Nor did it consider the use of these water-intensive practices throughout the rest of the programmatic action area,

---

[273] U.S. Bureau of Land Management, White River FEIS at 3-71 (2015) ("The FWS has determined that any federally authorized depletion from the Upper Colorado River Basin has an adverse effect on listed Colorado River fishes."); Biological Opinion for BLM Resource Management Plan (RMP), Price Field Office (PFO), 138 (Oct. 27, 2008) ("The USFWS determined that any depletion will jeopardize their continued existence and will likely contribute to the destruction or adverse modification of their critical habitat (citing USDI, Fish and Wildlife Service, Region 6 Memorandum, dated July 8, 1997), available at http://www.blm.gov/style/medialib/blm/ut/price_fo/Planning/rod_approved_rmp.Par.2742.File.dat/Price%20Biological%20Opinion.pdf; Biological Opinion for BLM Resource Management Plan (RMP), Vernal Field Office (VFO), 113 (Oct. 23, 2008)(same), available at http://www.blm.gov/style/medialib/blm/ut/vernal_fo/planning/rod_approved_rmp.Par.4719.File.dat/VernalBiologicalOpinion.pdf.

including the Grand Junction, Little Snake, Tres Rios, and Colorado River Valley Field Offices.[274]

For example, in the White River planning area, the PBO projects that new vertical wells would consume 2.62 acre-feet per well, but BLM water depletion logs indicate that between FY2011 and FY2015, the average depletion for horizontal wells in BLM's western Colorado field offices was 24.47 acre-feet per well. [275] The drastic increase in the use of this water-intensive drilling technique was not considered in the PBO, nor in BLM's consultations over the recent White River, Kremmling, and Little Snake RMP amendments or revisions, which only relied on the PBO regarding the RMPs' water depletion effects. Further, increased water use from horizontal drilling within other parts of the upper Colorado River Basin (e.g., the Grand Junction planning area, where horizontal drilling has been most active recently) could alter the Service's analysis of the lease sale's effects on the endangered fish, as all BLM-authorized fluid mineral development activity within the Basin is part of a single programmatic action that impacts the endangered fish.

Moreover, recently, on June 8, 2016, the U.S. Geological Survey published a report re-assessing the total technically recoverable reserves in the Mancos shale play in the Piceance Basin, including the Niobrara strata of the play.[276] According to the report, the Mancos shale play's total technically recoverable natural gas reserves are over 40 times greater than the USGS's 2003 estimate and is the second-largest in the U.S., behind the Marcellus shale.[277] Specifically, 66.3 trillion cubic feet of natural gas, 74 million barrels of oil and 45 million barrels of natural gas liquids are potentially recoverable.[278] While tight gas in the younger, shallower Mancos shale intervals is produced primarily from vertical and directional wells in which the reservoirs have been hydraulically fractured, the tight gas and continuous oil and gas in the older and deeper intervals of the Mancos shale are produced mostly from horizontal wells that have been hydraulically fractured.[279] These reserves underlie large areas of the Grand Junction, White River, Colorado River Valley, Uncompahgre, and Gunnison Field Offices, all of which fall under the PBO.

Increasing interest in the Piceance Basin's Mancos shale play should therefore be expected in the White River and these other field offices, given its enormous production potential. Indeed, since the 2003 USGS assessment, more than 2,000 wells have already been drilled and completed in one or more intervals of the study area.[280] A review of BLM oil and gas

---

[274] BLM Instruction Memorandum CO-2011-022 (April 11, 2011) ("All of the estimates in the PBO were based on using conventional vertical drilling technology.").
[275] *See id*.
[276] USGS, Assessment of Continuous (Unconventional) Oil and Gas Resources in the Late Cretaceous Mancos Shale of the Piceance Basin, Uinta-Piceance Province, Colorado and Utah (2016) ("USGS 2016"), available at http://pubs.usgs.gov/fs/2016/3030/fs20163030.pdf.
[277] *See id*.
[278] *Id*.
[279] *Id*.
[280] *Id.*

projects in western Colorado indicates that operators are planning a number of projects involving horizontal drilling, which would most likely target the Mancos shale.[281]

Accordingly, Mancos shale drilling projects are likely to increase within the Upper Basin, including the areas for lease in the White River RMP, but the PBO does not take into account this expansion in new development potential. Because the RMPs for the White River Field Office and other Piceance Basin field offices overlapping the Mancos shale play do not limit total new wells that may be drilled, the greater amount and availability of technically recoverable oil and gas reserves could result in the development of many more new wells in the Upper Basin than assumed in the RMPs and the PBO. For example, the RFDs for the Colorado River Valley and White River RMPs did not take into account Mancos shale drilling (other than exploratory wells) and thus such drilling is not considered in the PBO.[282] Further, a substantial portion of new wells would be horizontal wells, as the lower strata of the Mancos formation would likely be accessed via horizontal drilling, but again, the PBO does not take into account the extraordinarily higher water use for horizontal wells. Water depletions in the White River sub-basin and throughout the entire Upper Colorado River Basin could therefore exceed projected water use estimates in the PBO.

To the extent that approval of the lease sale would rely on the PBO, such reliance is arbitrary and cannot constitute BLM's section 7 compliance. BLM must either reinitiate consultation on the PBO or initiate section 7 consultation on the lease sale.

(b) Climate Change is Reducing Stream Flows in the Colorado River Basin

BLM must analyze climate change effects on reducing Colorado River Basin stream flows and how such reductions could impact the endangered fish. As detailed below, changes observed to date include rising temperatures, earlier snowmelt and streamflow, decreasing snowpack, and declining runoff and streamflow. Modeling studies project that these changes will only worsen, including continued declines in streamflow and intensification of drought. Climate change is likely to have significant effects on the endangered fish species in the Colorado River basin and the Colorado River ecosystem.

Rising temperatures

[281] *See* Center for Biological Diversity, Spreadsheet of Horizontal Well Projects in Colorado (listing horizontal well projects listed in BLM's NEPA register and projected water use).

[282] *See* White River RMP FEIS at K-358 ("Development of the Mancos and Niobrara outside the Rangely Field in Rio Blanco County in the WRFO are not [] currently well defined and are exploratory in nature. This development is in the initial stages of the exploration phase to determine of the maturity of the reservoir and the potential viability of the Niobrara within the WRFO."); *see also* Colorado River Valley RMP FEIS at 4-576 ("To date, use of horizontal drilling in relation to the deep marine shales [i.e., Niobrara, Mancos, and Eagle Basin formations] has been limited and is considered experimental. As a result, the development intensity, timing, and location of development of the deep marine shales was considered too speculative for quantitative impact analysis in connection with this planning process.").

The Colorado River basin has warmed significantly during the past century, with average increases in surface temperature of 1.6°F (0.9°C) over the Southwest during 1901-2010.[283] The greatest warming has occurred in spring and summer, and in daytime high temperatures and nighttime low temperatures.[284] Surface temperatures in the Southwest are projected to increase steeply in this century by an average of 4.5 to 7.9° F depending on the emissions scenario, with an average of 2.5 to 3°F of warming projected for 2021-2050 alone.[285] As explained below, warming temperatures are having significant effects on streamflow, drought severity, and the hydrologic cycle in the Southwest.[286]

Earlier snowmelt and streamflow

In much of the Colorado River basin, snowmelt, snowmelt runoff, and streamflow timing have trended earlier since the mid-1950s, in parallel with warming temperatures.[287] The Colorado River basin's spring pulse from 1978-2004 shifted to two weeks earlier compared to flows before 1978.[288] Although there are both natural and human influences on these hydrologic trends, studies indicate that anthropogenic greenhouse gases began to impact snow-fed streamflow timing during 1950-1999.[289] Modeling studies have projected that snowmelt, spring runoff, and streamflow timing will continue to shift earlier across much of the Southwest.[290]

Decreasing snowpack

The Colorado River receives most of its water from winter snowpack from the Rocky Mountains, where 15% of the total basin areas generates 85% of the river flow.[291] Across much of the Colorado River basin, the spring snowpack is decreasing and more winter precipitation is

[283] Hoerling 2013.
[284] Bonfils, C., et al. 2008. Detection and attribution of temperature changes in the mountainous western United States. Journal of Climate 21: 6404–6424 ("Bonfils 2008"); Hoerling 2013.
[285] Cayan, D. et al. 2013. Future climate: projected average. Pages 101–125 in G. Garfin, A. Jardine, R. Merideth, M. Black, and S. LeRoy, editors. Assessment of climate change in the southwest United States: a report prepared for the National Climate Assessment. A report by the Southwest Climate Alliance. Island Press, Washington, D.C., USA ("Cayan 2013").
[286] Barnett, T.P. and D.W. Pierce. 2008. When will Lake Mead go dry? Water Resources Research 44: W03201 ("Barnett, et al. 2008"); Woodhouse et al. 2016
[287] Hamlet, A., et al. 2005. Effects of temperature and precipitation variability on snowpack trends in the western United States. Journal of Climate 18: 4545-4561 ("Hamlet 2005"), Stewart, I. T., et al. 2004. Changes in snowmelt runoff timing in western North America under a 'Business as Usual' climate change scenario. Climatic Change 62: 217-232 ("Stewart et al. 2005"); Garfin, G., et al, 2014: Ch. 20: Southwest. Climate Change Impacts in the United States: The Third National Climate Assessment, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 462-486 ("Garfin et al. 2014"); Barnett et al. 2008; Hoerling et al. 2013;
[288] Ray, A.J., Barsugli, et al. 2008. Climate change in Colorado: a synthesis to support water resources management and adaptation. Report for the Colorado Water Conservation Board. University of Colorado, Boulder ("Ray et al. 2008")
[289] Barnett et al. 2008; Hidalgo, H. G., et al. 2009 Detection and attribution of streamflow timing changes to climate change in the western United States. Journal of Climate 22: 3838-3855 ("Hidalgo et al. 2009"); Hoerling et al. 2013
[290] Stewart et al. 2004; Rauscher, S. A., J. S. Pal, N. S. Diffenbaugh, and M. M. Benedetti. 2008. Future changes in snowmelt-driven runoff timing over the western US. Geophysical Research Letters 35: L16703, doi:10.1029/2008GL034424 ("Rauscher et al. 2008"); Dettinger, M., B. Udall, and A. Georgakakos. 2015. Western water and climate change. Ecological Applications 25: 2069-2093 ("Dettinger et al. 2015").
[291] Dettinger et al. 2015

falling as rain instead of snow.[292] Approximately half of the observed decline in snowpack in the western United States during 1950-1999 has been attributed to the effects of anthropogenic greenhouse gases, ozone and aerosols.[293] Modeling studies project a continued reduction of Southwest mountain snowpack during February through May during this century, largely due to the effects of rising temperatures.[294]

Declining Runoff and Streamflow

Annual runoff in the Colorado River basin appears to be declining,[295] with significant consequences for reduced streamflow. During 2001–2010, warm temperatures and dry conditions reduced average naturalized flows in the Colorado River (measured at Lees Ferry) to the second-lowest-flow decade since 1901, to12.6 million acre-feet per year compared to the 1901–2000 average of 15.0 million acre-feet per year.[296]

Modeling studies project that runoff and streamflow will continue to decrease substantially in the Colorado River basin during this century.[297] Barnett and Pierce (2009) concluded that anthropogenic climate change is likely to reduce runoff in the Colorado River basin by 10-30% by 2050. Projected reductions in runoff range from 6-7% (Christensen and Lettenmaier 2007) to 45% (Hoerling and Eischeid 2007) depending on the models and methods used in each study (see Barnett and Pierce 2009 at Table 2). In the short term, Hoerling and Eischeid (2007) predict streamflow to decrease by 25% during 2006-2030, and by 45% during 2035-2060.

Importantly, numerous studies show that warming temperatures alone will cause runoff and streamflow declines in the Colorado River basin. For example, a recent review[298] researchers estimated that future streamflow in the Colorado River basin will be reduced by 5% to 35% due to rising temperature alone. When precipitation change is considered, a 5% decrease in precipitation would further reduce streamflow by 10% to 15%.[299]

Moreover, warming temperatures will play an increasingly important role in causing runoff to decline in the Colorado River basin, and must be factored into streamflow forecasts.[300] An empirical study of the influence of precipitation, temperature, and soil moisture on upper

[292] Hamlet et al. 2005; Pierce, D. W., et al. 2008. Attribution of declining western U.S. snowpack to human effects. Journal of Climate 21: 6425-6444 ("Pierce et al. 2008"); Das, T., et al. 2009. Structure and detectability of trends in hydrological measures over the western United States. Journal of Climate 10: 871-892 ("Das et al. 2009")
[293] Pierce et al. 2008
[294] Cayan et al. 2013, Dettinger et al. 2015
[295] USBR 2011.
[296] Hoerling et al. 2013
[297] Ray et al. 2008; Das et al. 2011; USBR 2011; Cayan et al. 2013; Georgakakos, A., et al. 2014. Water resources. Pages 69–112 in J. M. Melillo, T. C. Richmond, and G. W. Yohe, editors. Climate change impacts in the United States: the third National Climate Assessment. U.S. Global Change Research Program, Washington, D.C., USA ("Georgakakos et al. 2014"); Dettinger et al. 2015.
[298] Vano, J. A., et al. 2014. Understanding uncertainties in future Colorado River streamflow. Bulletin of the American Meteorological Society 95: 59-78 ("Vano et al. 2014")
[299] Vano et al. 2014
[300] Woodhouse et al. 2016

Colorado River basin streamflow over the past century found that warmer temperatures have already resulted in flows less than expected based on precipitation levels.[301] Consistent with past research, the study found that cool season precipitation explains most of the variability in annual streamflow. However, temperature was highly influential in determining streamflow under certain conditions. The study concluded that "[s]ince 1988, a marked increase in the frequency of warm years with lower flows than expected, given precipitation, suggests continued warming temperatures will be an increasingly important influence in reducing future UCRB water supplies." The researchers warned that "streamflow forecasts run the risk of overprediction if warming spring and early summer temperatures are not adequately considered."

According to the study's press release it is the "first to examine the instrumental historical record to see if a temperature effect [on stream flows] could be detected."[302] The study's lead author highlighted its significance: "If we have a warmer spring, we can anticipate that the flows will be less relative to the amount of snowpack[.]….What we're seeing is not just the future – it's actually now. That's not something I say lightly."[303]

Increasing Drought Severity

Historically, droughts in the Colorado River basin were primarily driven by precipitation deficits. However, studies indicate that rising temperatures have begun to play a more important role in driving droughts.[304] Importantly, rising temperature superimposed on natural drought variability is expected to exacerbate the impacts of droughts.[305] Modeling studies project that droughts in Southwest will intensify due to longer periods of dry weather and more extreme heat, leading to higher evapotranspiration and moisture loss.[306] In the Colorado River basin, future droughts are projected to be substantially hotter, and drought is projected to become more frequent, intense, and longer lasting than in the historical record.[307]

Reduced reservoir levels and unsustainable demand for water

Of the more than 90 reservoirs on the river and its tributaries, the two largest are Lake Mead and Lake Powell which together can store up to 85% of the total flow for the basin

[301] Woodhouse et al. 2016
[302] American Geophysical Union, Colorado River Flows Reduced by Warmer Spring Temperatures (March 9, 2016), available at http://news.agu.org/press-release/colorado-river-flows-reduced-by-warmer-spring-temperatures/.
[303] *Id*.
[304] Hoerling et al. 2013, Vano et al. 2014
[305] Seager, R., et al. 2012. Projections of declining surface-water availability for the southwestern United States. Nature Climate Change doi:10.1038/NCLIMATE1787 ("Seager et al. 2012"); Cook, B.I., et al. 2015. Unprecedented 21st century drought risk in the American Southwest and Central Plains. Sci. Adv. 1: e1400082–e1400082 ("Cook et al. 2015").
[306] Seager, R., et al. 2007. Model projections of an imminent transition to a more arid climate in southwestern North America. Science 316: 1181-1184 ("Seager et al. 2007"); Cayan, D.R., et al. 2010. Future dryness in the southwest US and the hydrology of the early 21st century drought. PNAS 107: 21227-21276 ("Cayan et al. 2010"); Trenberth, K.E., A. Dai, G. van der Schrier, P.D. Jones, J. Barichivich, K.R. Briffa, and J. Sheffield. 2013. Global warming and changes in drought. Nature Climate Change 4: 17-22 ("Trenberth et al. 2013").
[307] Garfin et al. 2014.

combined.[308] Reservoirs in the Colorado River basin are highly vulnerable to climate change, particularly because the amount of storage in reservoirs is sensitive to runoff changes.[309] Even small decreases in runoff have caused average reservoir levels to markedly decrease.[310] Christensen et al. (2004) predicted that climate change impacts on the hydrology of the Colorado River system would result in water demand (deliveries and evaporation) exceeding reservoir inflows (which would also be decreased), resulting in a degraded system. Likewise, Barnett and Pierce (2008) projected that a 10% reduction in runoff would result in requested water deliveries surpassing sustainable deliveries by 2040, while a 20% reduction in runoff would cause unsustainable water demands by 2025. A greater demand than supply makes the system more prone to long-term sustained droughts, as reservoirs will not have sufficient time to be naturally replenished and more water will be extracted from a dwindling supply than is sustainable.[311] Reservoirs would spend additional time in a depleted state, weakening the system's buffering ability in years where there is low precipitation.[312] Further, as discussed above in section "V" subsection "b," the Bureau of Reclamation has noted that extreme variations in climate will make it difficult to meet competing demands for water. Increased temperatures are expected to increase the demand for irrigation water and for Reclamation's hydroelectricity, as well as for water dedicated to maintaining habitat for fish and other river species.[313]

In addition to reducing the overall amount of water in the Upper Colorado River Basin, these climate change effects would worsen effects from toxic spills by increasing the concentration of pollutants and toxic contaminants. Climate change is also likely to exacerbate mercury and selenium pollution effects on the Colorado pikeminnow. Mercury deposited into soil from coal burning and selenium will increasingly run off into streams with increased heavy rainfall events.[314] More frequent and severe wildfire events will result in increased charring of soil, releasing mercury and selenium that can wash off into streams.[315] Warmer water conditions will hasten the conversion of mercury into toxic methylmercury.[316]

Ample evidence, including empirical research, demonstrates that climate change is already reducing stream flows in the Colorado River Basin and that flows will continue to dwindle as Colorado Basin temperatures rise. BLM and the Service must reinitiate consultation over the leasing of these parcels and take into account these climate change effects on the endangered fish, in connection with its evaluation of the proposed lease sale's water depletion effects.

---

[308] Christensen, N.S., et al. 2004. The effects of climate change on the hydrology and water resources of the Colorado River basin. Climatic change 62: 337-363 ("Christensen et al. 2004").
[309] Barnett and Pierce 2008.
[310] Christensen et al. 2004.
[311] Christensen, N.S. and D.P. Lettenmaier. 2007. A multimodel ensemble approach to assessment of climate change impacts on the hydrology and water resources of the Colorado River basin. Hydrology and Earth System Sciences 11: 417-1434 ("Christensen and Lettenmaier 2007").
[312] Barnett and Pierce 2009
[313] U.S. Department of the Interior Bureau of Reclamation. Secure Water Act Section 9503(c) – Reclamation Climate Change and Water. March 2016.
[314] National Wildlife Federation, Swimming Upstream: Freshwater Fish in a Warming World, 19 (2013), available at http://www.nwf.org/~/media/PDFs/Global-Warming/Reports/NWF-Swimming%20Upstream-082813-B.ashx.
[315] *Id*.
[316] *Id*.

(c) Persistent Drought Conditions and Increasing Water Demand Have Reduced Water Supply

Compounding this threat to the endangered fish are persistent drought conditions that have diminished natural flows in the Colorado River Basin and reduced water storage that is needed to supplement Upper Basin flows. The period from 2000 to 2015 was the lowest 16-year period for natural flow in the last century, and one of the lowest 16-year periods for natural flow in the past 1,200 years, according to paleorecords.[317] As a result, water storage in the Colorado River system reservoirs have declined "from nearly full to about half of capacity," and led to local shortages in the Upper Colorado's sub-basins.[318]

Further, population growth will increase water demand for agriculture and municipal uses, making it increasingly difficult to ensure sufficient water availability for the endangered fish, which rely on the release of stored water, especially in dry years.[319] An ever widening gap between water supply and water demand is weakening the Colorado River water supply system's reliability and ability to buffer the system in dry years.[320] According to the U.S. Geological Survey, "increased water demand and declining water availability make the restoration of endangered fish habitat extremely challenging."[321] This growing gap between supply and demand in the Upper Colorado River Basin must be taken into account in a reinitiated consultation.

(d) Population Numbers of the Endangered Fish are Declining

Colorado pikeminnow populations are in decline throughout the Green River and Colorado River Basin, indicating that the Recovery Plan for the endangered fish has not been effective and that the impacts of water depletions may be more severe than previously anticipated.

According to the Fish and Wildlife Service, the latest 2014 Colorado River sub-basin population number of 501 is "cause for great concern," and catch of sub-adults and adults in 2013 and 2014 "were near lowest observed in the history of the project."[322] 2015 catch numbers are within the same range, which suggests that the population estimate for 2015 will be similar to the 2014 estimate.[323] Preliminary data show that the Green River sub-population is "in decline

---

[317] Bureau of Reclamation, Managing Water in the West: SECURE Water Act Section 9503(c) Report to Congress, Chapter 3, Colorado River Basin at 3-64 (2016).
[318] *Id*.
[319] *See id*. at 3-7 , 3-8.
[320] *Id*. at 3-10, 3-12.
[321] USGS, Effects of Climate Change and Land Use on Water Resources in the Upper Colorado River Basin, 5 (2010), available at https://pubs.usgs.gov/fs/2010/3123/pdf/FS10-3123.pdf.
[322] USFWS 2015 Sufficient Progress Memo at 23, 36 (Oct. 7, 2015) ("Sufficient Progress Memo") (noting average monthly flows significantly below 810 cfs in 15-mile reach in 2012 and 2013), available at.
[323] *See* USFWS, Monitoring the Colorado Pikeminnow Population in the Mainstem Colorado River via Periodic Population Estimates, p. 3 (Nov. 2015), available at http://www.coloradoriverrecovery.org/documents-publications/work-plan-documents/arpts/2015/rsch/127.pdf (showing similar capture rates of pikeminnow in 2014 and 2015).

throughout the entire Green River Subbasin" and has fallen under 2,000, below the minimum viable population of 2,600 adults.[324] The Yampa River portion of the sub-basin population also "remains low and may be in further decline."[325] Recent studies show that Colorado pikeminnow declines in the Yampa River are linked to "persistent high densities of nonnative predators (e.g., smallmouth bass and northern pike [])," and that northern pike are outnumbering Colorado pikeminnow by three to one.[326] The weakening of the Yampa River portion of the sub-basin population makes it even more critical to ensure that habitat for the Green River portion of the Green River sub-basin population is not degraded and remains a stronghold for the species. Humpback chub numbers are also low. Fish and Wildlife Service is "concerned that wild populations of humpback chub in Black Rocks and Westwater Canyon of the Colorado River (near the Colorado-Utah state line) have not recovered from declines detected in the late 1990's. The reason for those population declines is uncertain."[327] After this steep reduction, the Black Rocks/Westwater population continued to decline.[328] In 2008, the population "dropped below the population size downlist criterion (MVP = 2,100 adults) for the first time."[329] In 2011 and 2012, the core population estimates were 1,846 and 1,718, respectively.[330]

The Desolation/Gray Canyons population—which inhabits the Green River directly downstream of the project area—has also not met the population-size downlist criterion, and was observed to be "trending downward" based on 2006-2007 population estimates.[331] This trend has been attributed to "increased nonnative fish abundance and habitat changes associated with dry weather and low river flows."[332] The project's water depletions within the Green River sub-basin, in connection with climate change effects and shrinking water supply, could exacerbate these declines. The 2014 estimate is 1,863 adults, substantially below the 2,100-adults recovery criterion.[333]

These declining numbers not only show that the endangered fish may be more sensitive to water depletion and other oil and gas development effects than previously assumed, but they strongly suggest that the Endangered Fish Recovery Program is not achieving recovery targets nor adequately offsetting water depletion effects as intended.

2. The EIS Must Analyze the Impacts of Oil and Gas Development on Greater Sage-Grouse ("GRSG")

Many of the parcels are located within the current range of GRSG and sensitive GRSG habitat. The GRSG is a BLM sensitive species. BLM must either withdraw these parcels within sage-grouse habitat or prepare an EIS addressing the impacts of new leasing on the species. Given the significance of the potential impacts that oil and gas development could have on the

[324] Sufficient Progress Memo at 7.
[325] *Id*.
[326] *Id*. at 8.
[327] *Id*. at 36.
[328] *Id*. at 13.
[329] *Id*.
[330] *Id*. at 13-14.
[331] *Id*. at 12.
[332] *Id*. at 23.
[333] *Id*. at 12.

species, proper investigation here is crucial. BLM is required under NEPA to collect data particular to the region affected by the leases.[334]

On September 1, 2016, BLM's Washington, D.C. office issued Instruction Memorandum 2016-143, *Implementation of Greater Sage-Grouse Resource Management Plan Revisions or Amendments -Oil & Gas Leasing and Development Sequential Prioritization* (September 1, 2016) ("IM 2016-143"), to the BLM's State Directors, providing "guidance on prioritizing implementation decisions for . . . BLM oil and gas leasing and development" to be consistent with the Greater Sage-Grouse plan amendments. The IM, which does not amend the plans but provides implementation guidance, is "effective immediately," IM 2016-143 at 11, and therefore applies to the White River Field Office's proposed May 2017 sale. BLM's lease sale decision must comport with BLM's own new prioritization guidance: BLM must (1) assess site-specific impacts to GRSG and to nesting, wintering, and/or breeding habitat prior to leasing and (2) prioritize leasing outside of Priority and General Habitat Management Areas (PHMAs and GHMAs).[335] IM 2016-143's purpose is to provide consistency across the agency when leasing decisions impact Greater Sage-Grouse habitat. It provides a "prioritization sequence" for BLM state offices to follow when choosing to lease areas near or in Greater Sage-Grouse habitats. BLM must adequately review proposed leases within sage-grouse habitat for compliance with the Sage-Grouse Resource Plan Amendments[336] and the "prioritization sequence" implementing those plans set forth in Instruction Memorandum 2016-143.

h. Metrics

BLM should conduct a full assessment of the direct and indirect impacts of unconventional oil and gas development activities on wildlife and ecosystems through a suite of comprehensive studies on all species and ecosystems that could be affected. The studies should be particularly detailed for federally and state listed species, federal and state candidates for listing, and state species of special concern. The studies should address the following impacts: (1) habitat loss, degradation, and fragmentation, including edge effects; (2) water depletion; (3) air and water contamination; (4) introduction of invasive species; (5) climate change impacts; (6) health and behavioral effects such as increased stress and changes in life history behaviors; (7) changes in demographic rates such as reproductive success and survival; and (8) potential for population-level impacts such as declines and extirpations. These studies should consider these harms individually and cumulatively.

VIII. BLM Must Look at Significant Human Health and Safety Risks

In addition to climate change effects, oil and gas leasing and fracking entail significant public health risks that should compel BLM to consider a ban on these practices in a

---

[334] See Center. for Biological Diversity, 937 F. Supp. 2d at 1159 (Preparation of an EIS "is mandated where uncertainty may be resolved by further collection of data, or where collection of such data may prevent speculation on potential effects.").
[335] IM 2016-143 at 4.
[336] *See* U.S. Bureau of Land Management, Northwest Colorado Greater Sage-Grouse Approved Resource Management Plan Amendment, September 2015, available at https://eplanning.blm.gov/epl-front-office/projects/lup/36511/63221/68470/Northwest_Colorado_ARMPA_508.pdf

programmatic review and in the current leasing proposal. Ample scientific evidence indicates that well development and well stimulation activities have been linked to an array of adverse human health effects, including carcinogenic, developmental, reproductive, and endocrine disruption effects. This is all the more alarming when considering how close wells may be developed to schools, residences, and businesses under BLM's proposed leasing decision.[337] Just as troubling, is how much is *unknown* about the chemicals used in well stimulation activities.[338] The potential human health dangers and the precautionary principle should further compel BLM to consider not allowing further development of oil and gas minerals in the area for lease. In comparing the no-leasing and no-fracking alternatives to leasing and continued unconventional well development scenarios, BLM should include a health impact assessment, or equivalent, of the aggregate impact that unconventional extraction techniques, including fracking, will have on human health and nearby communities.

There are numerous studies that have found the chemicals used in oil and gas drilling operations to have serious health consequences for humans exposed to even minimal amounts. The range of illnesses that can result are summarized in a study by Dr. Theo Colburn, which charts which chemicals have been shown to be linked to certain illnesses.[339]

Due to the heavy and frequent use of chemicals, proximity to fracked wells is associated with higher rates of cancer, birth defects, poor infant health, and acute health effects for nearby residents who must endure long-term exposure:

- In one study, residents living within one-half mile of a fracked well were significantly more likely to develop cancer than those who live more than one-half mile away, with exposure to benzene being the most significant risk.[340]

- Another study found that pregnant women living within 10 miles of a fracked well were more likely to bear children with congenital heart defects and possibly neural tube defects.[341] A separate study independently found the same pattern; infants born near fracked gas wells had more health problems than infants born near sites that had not yet conducted fracking.[342, 343]

---

[337] ORC 1509.021(H) & (L) (allowing wells within 100 feet of occupied dwellings and public buildings in non-urbanized areas; allowing wells within 50 feet of surface waters).
[338] *See, e.g.* EPA 2015 at 5-73, 10-7.
[339] Colborn, Theo et al., Natural Gas Operations from a Public Health Perspective, 17 Human and Ecological Risk Assessment 1039 (2011) ("Colborn 2011"); Colborn, Theo, et al., An Exploratory Study of Air Quality near Natural Gas Operations, Human and Ecological Risk Assessment: An International Journal doi:10.1080/10807039.2012.749447 (2012) ("Colborn 2012); *see* note 120 & accompanying text below.
[340] McKenzie, L. et al., Human Health Risk Assessment of Air Emissions from Development of Unconventional Natural Gas Resources, 424 Science of the Total Environment 79 (2012) ("McKenzie 2012").
[341] McKenzie, L. et al., Birth Outcomes and Maternal Residential Proximity to Natural Gas Development in Rural Colorado, Advance Publication Environmental Health Perspectives (Jan. 28, 2014), http://dx.doi.org/10.1289/ehp.1306722 ("McKenzie 2014").
[342] Hill, Elaine L., Unconventional Natural Gas Development and Infant Health: Evidence from Pennsylvania, Cornell University (2012).
[343] Whitehouse, Mark, *Study Shows Fracking is Bad for Babies*, Bloomberg View, Jan. 4, 2014, *available at* http://www.bloombergview.com/articles/2014-01-04/study-shows-fracking-is-bad-for-babies.

- A recent study assessed the effect of prenatal ambient air pollution exposure on the risks of stillbirth and found a connection between exposure to ambient air pollution, including nitrogen dioxide and particulate matter, and the increased risks of stillbirth.[344]

- A study analyzed Pennsylvania birth records from 2004 to 2011 to assess the health of infants born within a 2.5-kilometer radius of natural-gas fracking sites. Proximity to fracking increased the likelihood of low birth weight by more than half, from about 5.6 percent to more than 9 percent.[345] The chances of a low Apgar score, a summary measure of the health of newborn children, roughly doubled, to more than 5 percent.[346] Another recent Pennsylvania study found a correlation between proximity to unconventional gas drilling and higher incidence of lower birth weight and small-for-gestational-age babies.[347]

- A recent study found increased rates of cardiology-patient hospitalizations in zip codes with greater number of unconventional oil and gas wells and higher well density in Pennsylvania.[348] The results suggested that if a zip code went from having zero wells to well density greater than 0.79 wells/km^2, the number of cardiology-patient hospitalizations per 100 people (or "cardiology inpatient prevalence rate") in that zip code would increase by 27%. If a zip code went from having zero wells to a well density of 0.17 to 0.79 wells/km^2, a 14% increase in cardiology inpatient prevalence rates would be expected. Further, higher rates of neurology-patient hospitalizations were correlated with zip codes with higher well density.

- Recently published reports indicate that people living in proximity to fracked gas wells commonly report skin rashes and irritation, nausea or vomiting, headache, dizziness, eye irritation and throat irritation.[349] Another recent study conducted in Pennsylvania provides evidence that unconventional natural gas development is associated with nasal and sinus, migraine headache, and fatique symptoms.[350]

---

[344] *See Siddika N, Balogun HA, Amegah AK, Jaakkola JJ. Prenatal ambient air pollution exposure and the risk of stillbirth: systematic review and meta-analysis of the empirical evidence. Occup Environ Med. 2016 May 24. pii: oemed-2015-103086. doi: 10.1136/oemed-2015-103086.*

[345] *Id*., citing Janet Currie of Princeton University, Katherine Meckel of Columbia University, and John Deutch and Michael Greenstone of the Massachusetts Institute of Technology.

[346] *Id.*

[347] Stacy, Shaina L. et al. (2015) Perinatal Outcomes and Unconventional Natural Gas Operations in Southwest Pennsylvania. PLoS ONE 10(6): e0126425. doi:10.1371/journal.pone.0126425, *available at* http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0126425.

[348] Jemielital, T. et al. Unconventional Gas and Oil Drilling Is Associated with Increased Hospital Utilization Rates. PLoS ONE 10(7): e0131093, *available at* http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0131093.

[349] Rabinowitz, P.M. et al., Proximity to Natural Gas Wells and Reported Health Status: Results of a Household Survey in Washington County, Pennsylvania. Environmental Health Perspectives Advance Publication (2014); Bamberger, Michelle and R.E. Oswald, Impacts of Gas Drilling on Human and Animal Health, 22 New Solutions 51 (2012); Steinzor, N. et al., Gas Patch Roulette: How Shale Development Risks Public Health in Pennsylvania, Earthworks Gas & Oil Accountability Project (2012).

[350] Tustin, A. W., et al., Associations between Unconventional Natural Gas Development and Nasal and Sinus, Migraine Headache, and Fatigue Symptoms in Pennsylvania, ENVIRONMENTAL HEALTH PERSPECTIVES, August 2016.

- A survey found agreement among experts that a minimum setback of a quarter mile from oil and gas development is necessary to protect public health. [351] Half of the experts recommended a 1 to 1 ¼ mile setback. The panel also agreed that additional protections are necessary for vulnerable populations such as children and the elderly.[352]

- In Texas, a jury awarded nearly $3 million to a family who lived near a well that was hydraulically fractured.[353] The family complained that they experienced migraines, rashes, dizziness, nausea and chronic nosebleeds. Medical tests showed one of the plaintiffs had more than 20 toxic chemicals in her bloodstream.[354] Air samples around their home also showed the presence of BTEX — benzene, toluene, ethylbenzene and xylene —colorless but toxic chemicals typically found in petroleum products.[355]

Chemicals used for fracking also put nearby residents at risk of endocrine disruption effects. A study that sampled water near active wells and known spill sites in Garfield County Colorado found alarming levels of estrogenic, antiestrogenic, androgenic, and antiandrogenic activities, indicating that endocrine system disrupting chemicals (EDC) threaten to contaminate surface and groundwater sources for nearby residents.[356] The study concluded:

> [M]ost water samples from sites with known drilling-related incidents in a drilling-dense region of Colorado exhibited more estrogenic, antiestrogenic, and/or antiandrogenic activities than the water samples collected from reference sites[,] and 12 chemicals used in drilling operations exhibited similar activities. Taken together, the following support an association between natural gas drilling operations and EDC activity in surface and ground water: [1] hormonal activities in Garfield County spill sites and the Colorado River are higher than those in reference sites in Garfield County and in Missouri, [2] selected drilling chemicals displayed activities similar to those measured in water samples collected from a drilling-dense region, [3] several of these chemicals and similar compounds were detected by other researchers at our sample collection sites, and [4] known spills of natural gas fluids occurred at these spill sites.

The study also noted a linkage between EDCs and "negative health outcomes in laboratory animals, wildlife, and humans":

---

[351] Brown, David et al. The Problem of Setback Distance for Unconventional Oil & Gas Development: An analysis of expert opinions. Southwest Pennsylvania Environmental Health Project Technical Reports, Issue 2 (May 9, 2016).
[352] *Id*.; *see also* Webb, Ellen et al. Potential hazards of air pollutant emissions from unconventional oil and natural gas operations on the respiratory health of children and infants, Review Envtl. Health 2016, available at http://ecowatch.com/wp-content/uploads/2016/05/fracking_study.pdf (suggesting greater protection from unconventional oil and gas development necessary for children and infants).
[353] *Parr v. Aruba Petroleum, Inc*., Case No. 11-01650-E (Dallas Cty., filed Sept.13, 2013).
[354] Deam, Jenny, *Jury Awards Texas family Nearly $3 million in Fracking Case*, Los Angeles Times (Apr. 3, 2014) http://www.latimes.com/nation/la-na-fracking-lawsuit-20140424-story html.
[355] *Id*.
[356] Kassotis, Christopher D. et al., Estrogen and Androgen Receptor Activities of Hydraulic Fracturing Chemicals and Surface and Ground Water in a Drilling-Dense Region. Endocrinology, March 2014, 155(3):897–907, pp. 905-906, *available at* http://press.endocrine.org/doi/full/10.1210/en.2013-1697.

> Despite an understanding of adverse health outcomes associated with exposure to EDCs, research on the potential health implications of exposure to chemicals used in hydraulic fracturing is lacking. Bamberger and Oswald (26) analyzed the health consequences associated with exposure to chemicals used in natural gas operations and found respiratory, gastrointestinal, dermatologic, neurologic, immunologic, endocrine, reproductive, and other negative health outcomes in humans, pets, livestock, and wildlife species.
>
> Of note, site 4 in the current study was used as a small-scale ranch before the produced water spill in 2004. This use had to be discontinued because the animals no longer produced live offspring, perhaps because of the high antiestrogenic activity observed at this site. There is evidence that hydraulic fracturing fluids are associated with negative health outcomes, and there is a critical need to quickly and thoroughly evaluate the overall human and environmental health impact of this process. It should be noted that although this study focused on only estrogen and androgen receptors, there is a need for evaluation of other hormone receptor activities to provide a more complete endocrine-disrupting profile associated with natural gas drilling.[357]

Operational accidents also pose a significant threat to public health. For example in August 2008, Newsweek reported that an employee of an energy-services company got caught in a fracking fluid spill and was taken to the emergency room, complaining of nausea and headaches.[358] The fracking fluid was so toxic that it ended up harming not only the worker, but also the emergency room nurse who treated him. Several days later, after she began vomiting and retaining fluid, her skin turned yellow and she was diagnosed with chemical poisoning.[359]

Harmful chemicals are also found in the flowback fluid after well stimulation events. Flowback fluid is a key component of oil-industry wastewater from stimulated wells. A survey of chemical analyses of flowback fluid dating back to April 2014 in California revealed that concentrations of benzene, a known carcinogen, were detected at levels over 1,500 times the federal limits for drinking water.[360] Of the 329 available tests that measured for benzene, the chemical was detected at levels in excess of federal limits in 320 tests (97 percent).[361] On average, benzene levels were around 700 times the federal limit for drinking water.[362] Among other carcinogenic or otherwise dangerous chemicals found in flowback fluid from fracked wells

---

[357] *Id*., p. 905.
[358] Wiserman, Hannah, Untested Waters: the Rise of Hydraulic Fracturing in Oil and Gas Production and the Need to Revisit Regulation, Fordham Envtl. Law Rev. 115 (2009),138-39.
[359] *Id*.
[360] California Department of Conservation Division of Oil, Gas, & Geothermal Resources, California Well Stimulation Public Disclosure Report, *available at* http://www.conservation.ca.gov/dog/Pages/WellStimulationTreatmentDisclosure.aspx. The highest concentration was 7,700 parts per billion (ppb) for a well with API number 03052587. The US EPA's maximum contaminant level for benzene is 5 ppb.
[361] *Id*.
[362] *Id*., *see also* Cart, J., High Levels of Benzene Found in Fracking Wastewater, Los Angeles Times, Feb. 11, 2015, http://www.latimes.com/local/california/la-me-fracking-20150211-story html#page=1.

are toluene and chromium-6.[363] These hazardous substances were detected in excess of federal limits for drinking water in over one hundred tests. This dangerous fluid is commonly disposed of in injection wells, which often feed into aquifers, including some that could be used for drinking water and irrigation.

Acidizing presents similarly alarming risks to public health and safety. In acidizing operations, large volumes of hydrochloric and hydrofluoric acid are transported to the site and injected underground. These chemicals are highly dangerous due to their corrosive properties and ability to trigger tissue corrosion and damage to sensory organs through contact.

While many risks are known, much more is unknown about the hundreds of chemicals used in fracking. The identity and effects of many of these additives is unknown, due to operators' claims of confidential business information. But, as the EPA recognizes, chemical identities are "necessary to understand their chemical, physical, and toxicological properties, which determine how they might move through the environment to drinking water resources and any resulting effects."[364] Compounds in mixtures can have synergistic or antagonistic effects, but again, it is impossible to know these effects without full disclosure.[365] The lack of this information also precludes effective remediation: "Knowing their identities would also help inform what chemicals to test for in the event of suspected drinking water impacts and, in the case of wastewater, may help predict whether current treatment systems are effective at removing them."[366]

Even where chemical identities are known, chemical safety data may be limited. In EPA's study of the hazards of fracking chemicals to drinking water, EPA found that "[o]ral reference values and oral slope factors meeting the criteria used in this assessment were not available for the majority of chemicals used in hydraulic fracturing fluids [87%], representing a significant data gap for hazard identification."[367] Without this data, EPA could not adequately assess potential impacts on drinking water resources and human health.[368] Further, of 1,076 hydraulic fracturing fluid chemicals identified by the EPA, 623 did not have estimated physiochemical properties reported in EPA's toxics database, although this information is "essential to predicting how and where it will travel in the environment."[369] The data gaps are actually much larger, because EPA excluded 35% of fracking chemicals reported to FracFocus from its analysis because it could not assign them standardized chemical names.[370]

BLM must analyze the human health and safety impacts of noise pollution, light pollution, and traffic accidents resulting from oil and gas development. A recent study found

---

[363] *Id.*; *see also* Center for Biological Diversity, Cancer-causing Chemicals Found in Fracking Flowback from California Oil Wells (2015) Feb. 11, 2015, *available at* http://www.biologicaldiversity.org/news/press_releases/2015/fracking-02-11-2015.html.
[364] EPA 2015 at 10-18.
[365] Souther, Sara et al. Biotic Impacts of Energy Development from Shale: Research Priorities and Knowledge Gaps, Front Ecol Environ 2014; 12(6): p. 334.
[366] EPA 2015 at 10-18.
[367] *Id*. at 10-7, 9-7.
[368] *Id*. at 9-37-38.
[369] *Id*. at 5-73.
[370] *Id*. at 9-38.

that automobile and truck accident rates in counties in Pennsylvania with heavy unconventional oil and gas extraction activity were between 15 and 65 percent higher than accident rates in counties without unconventional oil and gas extraction activities.[371] Rates of traffic fatalities and major injuries may be higher in areas with heavy drilling activity than areas without. [372]

IX. BLM Must Defer All Parcels Containing GRSG, CSTG, CRCT, and WTPD Suitable and Occupied Habitat and Take a Hard Look at Impacts to the Population and Habitat on and Surrounding the Parcels at Issue

The parcels at issue contain suitable and occupied habitat for various species that are listed on the BLM Colorado State Director's Sensitive Species List, including Greater Sage-Grouse, Columbian Sharp-Tailed Grouse, Colorado River Cutthroat Trout, and White Tailed Prairie Dog. BLM Manual 6840 provides that it is the BLM's Policy to promote "conservation and to minimize the likelihood and need for listing" Bureau sensitive species.[373] The Objective of Manual 6840 is "[t]o initiate proactive conservation measures that reduce or eliminate threats to Bureau sensitive species to minimize the likelihood of and need for listing of these species under the ESA."[374]

Furthermore, pursuant to Manual 6840 it is the responsibility of State Directors to not only inventory BLM lands to determine the occurrence of BLM special status species, but also to determine "the condition of the populations and their habitats, and how discretionary BLM actions affect those species and their habitats."[375] The leasing of federal lands for oil and gas extraction is a discretionary BLM action that has the potential to adversely affect lesser prairie-chicken habitat and prospects for recovery. Therefore BLM must analyze the potential effects of selling oil and gas leases before leasing.

Bureau sensitive species are considered BLM special status species, and Section 2 of the Manual provides specific measures that BLM is required to undertake in order to "conserve these species and their habitats."[376] To implement this section, BLM "shall... minimize or eliminate threats" affecting Bureau sensitive species, by determining their current threats and habitat needs, and ensuring that BLM activities "are carried out in a way that is consistent with its objectives for managing those species and their habitats at the appropriate spatial scale."[377] Due to the potential harms from habitat loss and fragmentation, the appropriate spatial scale for determining threats to the aforementioned sensitive species from oil and gas development is the entire area subject to lease sales. The need for a broader analysis to assess the threats to this species from the lease sale itself is further supported by Manual 6840's requirement that BLM work with partners and stakeholders to "develop species-specific or ecosystem-based

[371] Graham, J., Irving et al., Increased Traffic Accident Rates Associated with Shale Gas Drilling in Pennsylvania. 74 Accident Analysis and Prevention 203 (2015).
[372] *Id.*
[373] *Id.* at § .06.
[374] *Id*. at § .02 (emphasis added).
[375] *Id.* at § .04.
[376] *Id.* at § .2 ("All federally designated candidate species, proposed species, and delisted species in the 5 years following their delisting shall be conserved as Bureau sensitive species.").
[377] *Id*. at § .2(C) (emphasis added).

conservation strategies," and in the absence of such strategies, to incorporate standard operating procedures and other conservation measures "to mitigate specific threats to Bureau sensitive species *during the planning of activities and projects*."[378] Moreover, the development of species-specific and ecosystem-based conservation strategies implicitly necessitates a more holistic review of the cumulative impacts of the proposed lease sale, which cannot be accomplished through site-specific APD-stage analysis alone. And, piecemeal analyses of individual lease sales do not provide the appropriate perspective for examining the cumulative effects of hydraulic fracturing and climate change impacts at the regional and landscape scale and for making land management decisions.

Where activities have the potential to adversely impact species of concern, the general practice is to consider those impacts and address them "at the earliest possible time," in order to avoid delay, ensure that impacts are avoided and opportunities for mitigation are not overlooked.[379] This is likewise true in the context of even more general environmental review, such as under NEPA.[380] Furthermore, it is general practice to evaluate the impacts of several related projects with cumulative impacts proposed or reasonably foreseeable in the same geographic region in a single, comprehensive, analysis.[381] Likewise, under the ESA an analysis of the effects of an action must consider actions that are interrelated or interdependent.[382] This suggests that BLM should consider the effects of oil and gas extraction activities at the lease sale stage, since those actions are inherent in leasing land for such purposes. It is therefore evident that in order to effectuate the policy of protecting Bureau sensitive species set forth in Manual 6840,[383] and consistent with the established practice of early, comprehensive review of potential impacts to sensitive species, BLM must consider impacts to the aforementioned species before leasing.

Given the significance of the potential impacts that oil and gas development could have on the species, proper investigation here is crucial. BLM is required under NEPA to collect data particular to the region affected by the leases.[384] BLM must include discussion of the impacts of oil and gas development on the species, its behavior, survival, and persistence, in addition to the impacts of noise to courtship interaction and reproduction.

---

[378] *Id.* (emphasis added).
[379] *See i.e.* 50 C.F.R. §§ 402.14(a), (g)(8).
[380] *See* 40 C.F.R. § 1501.2 ("Agencies shall integrate the NEPA process with other planning at the earliest possible time to insure that planning and decisions reflect environmental values, to avoid delays later in the process, and to head off potential conflicts.").
[381] *See Kleppe v. Sierra Club*, 427 U.S. 390, 410 (1976) ("when several proposals for . . . actions that will have cumulative or synergistic environmental impact upon a region are pending concurrently before an agency, their environmental consequences must be considered together.").
[382] 50 C.F.R. §§ 402.14 and 402.02.
[383] *See* BLM Manual 6840 at .06 ("Bureau sensitive species will be managed consistent with species and habitat management objectives in land use and implementation plans to promote their conservation and to minimize the likelihood and need for listing under the ESA.").
[384] See *Center for Biological Diversity v. Bureau of Land Management*, 937 F. Supp. 2d (2013) at 1159 (Preparation of an EIS "is mandated where uncertainty may be resolved by further collection of data, or where collection of such data may prevent speculation on potential effects.").

X. Unconventional Extraction Techniques and Underground Wastewater Disposal Pose Seismic Risks and Other Geological Hazards

Increased unconventional oil and gas extraction and underground waste injection will increase the risk of induced seismicity. A no-fracking alternative would minimize these risks, while continued leasing and unconventional well development would increase them.

Research has shown that in regions of the central and eastern United States where unconventional oil and gas development has proliferated in recent years, earthquake activity has increased dramatically.[385] More than 300 earthquakes with magnitude (M) ≥ 3 occurred between 2010 through 2012, compared with an average of 21 per year between 1967 and 2000.[386] Moreover, although earthquakes with magnitude (M) ≥ 5.0 are very uncommon east of the Rocky Mountains, the number per year recorded in the midcontinent increased 11-fold between 2008 and 2011, compared to 1976 to 2007.[387] Mid-continent states experiencing elevated levels of seismic activity include Arkansas, Colorado, New Mexico, Ohio, Oklahoma, Texas, and Virginia.[388]

Research has linked much of the increased earthquake activity and several of the largest earthquakes in the U.S. midcontinent in recent years to the disposal of wastewater into deep injection wells, which is well-established to pose a significant seismic risk.[389] Much of the fracking wastewater is a byproduct of oil and gas production and is routinely disposed of by injection into wells specifically designed and approved for this purpose. The injected fluids push stable faults past their tipping points, and thereby induce earthquakes.[390] In 2015, a study published in *Science* found that the unprecedented increase in earthquakes in the U.S. mid-continent that began in 2009 has been caused solely by the instability caused by fluid injection wells associated with fracking waste disposal.[391] To put an exclamation point on this finding, a 4.7 magnitude earthquake struck northern Oklahoma that was felt in 7 additional states, leading the Oklahoma Geological Survey to reiterate the connection between disposal wells and earthquakes and to shut down the most high risk wells.[392] Earthquakes at magnitudes (M) that are felt (M3 and M4) or destructive (M4 and M5) have been attributed to wastewater injection wells in at least five states - Arkansas, Colorado, Ohio, Oklahoma, and Texas. The largest of these was a M5.7 earthquake in Prague, Oklahoma, which was the biggest in the state's history,

---

[385] Ellsworth, W.L. Injection-Induced Earthquakes, 341 Science 1225942 (2013) ("Ellsworth 2013"); Keranen, Katie et al., Potentially Induced Earthquakes in Oklahoma, USA: Links Between Wastewater Injection and the 2011 Mw5.7 Earthquake Sequence, Geology doi:10.1130/G34045.1 (March 26, 2013) ("Keranen 2013").
[386] Ellsworth 2013.
[387] Keranen 2013.
[388] Ellsworth 2013.
[389] *Id*.
[390] Lamont-Doherty Earth Observatory, Columbia University. Distant Quakes Trigger Tremors at U.S. Waste-Injection Sites, Says Study. July 11, 2013. *Available at*: https://www.ldeo.columbia.edu/news-events/distant-quakes-trigger-tremors-us-waste-injection-sites-says-study .
[391] M. Weingarten, S. Ge, J. W. Godt, B. A. Bekins, and J. L. Rubinstein. June 19, 2015. High-rate injection is associated with the increase in U.S. mid-continent seismicity. Science, VOL 348 ISSUE 6241, pages 1336-1340.
[392] Chow, Lorraine. November 19, 2015. Strong Earthquake Rattles Oklahoma, Felt in 7 Other States. https://ecowatch.com/2015/11/19/oklahoma-earthquake-fracking/

destroying 14 homes and injuring two people.[393] Other large earthquakes attributed to wastewater injection include an M5.3 in Colorado,[394] M4.9 in Texas,[395] M4.7 in Arkansas,[396] and M3.9 in Ohio.[397]

As the National Research Council notes, however, these seismic risks are rarely accounted for before wastewater injection occurs, and are poorly understood:

> Class II injection wells used only for the purpose of water disposal normally do not have a detailed geologic review performed and often data are not available to make such a review. Thus, although fluid pressure in the injection zone and the fracturing pressure of the injection zone can be measured after the disposal well is drilled, the location of possible faults is often not known as part of standard well siting and drilling procedures. Importantly, the mere presence of a fault does not always correlate to increased potential for induced seismicity.[398]

A recent study linked earthquake activity near Azle, Texas to brine production resulting from hydraulic fracturing in the Barnett Shale, as well as underground wastewater injection. The study's authors noted:

> [P]ore-pressure models demonstrate that a *combination of brine production and wastewater injection* near the fault generated subsurface pressures sufficient to induce earthquakes on near-critically stressed faults. On the basis of modeling results and the absence of historical earthquakes near Azle, brine production combined with wastewater disposal represent the most likely cause of recent seismicity near Azle.[399] [emphasis added]

Further, the authors noted "[i]t is notable that we observe earthquake swarms in the Ellenburger [i.e., the area of study] apparently associated with extraction, not just injection."[400] In other words, brine production adjacent to faults—a common phenomena that results from fracking—is associated with seismic activity. The authors explained:

---

[393] Ellsworth 2013, Keranen 2013.
[394] Rubinstein, J.L. et al., The 2001–present triggered seismicity sequence in the Raton Basin of southern Colorado/northern New Mexico, 104 Bull. Seismol. Soc'y of America 5 (2014).
[395] Brown, W.A. et al. Abstract: Investigating the cause of the 17 May 2012 M4.8 earthquake near Timpson, East Texas, Abstract 84 Seismol. Res. Lett 374 (2013).
[396] Horton, S., Disposal of Hydrofracking Waste Fluid by Injection into Subsurface Aquifers Triggers Earthquake Swarm in Central Arkansas with Potential for Damaging Earthquake, 83 Seismol. Res. Lett. 2 (2012).
[397] Kim, Won-Young, Induced Seismicity Associated with Fluid Injection into a Deep Well in Youngstown, Ohio, 118 J. of Geophys. Res.: Solid Earth 3506 (February 1, 2013); *see also* USGS, 2016 One-Year Seismic Hazard Forecast for the Central and Eastern United States from Induced and Natural Earthquakes, p. 11 (March 2016), *available at* http://dx.doi.org/10.3133/ofr20161035 (identifying Ohio counties, including Washington county, as regions of induced seismicity to consider in future analysis).
[398] NRC 2015 at 81.
[399] Hornbach, Matthew J. et al., Causal Factors for Seismicity near Azle, Texas, Nature Communications 6:6728 (April 21, 2015), 1, available at http://www.nature.com/ncomms/2015/150421/ncomms7728/full/ncomms7728 html.
[400] *Id*. at 5-6.

> Earthquakes caused by fluid extraction near faults are not a new phenomenon in the United States or even Texas. Induced seismicity is often associated with subsurface pressure changes, and extensional stresses will concentrate on the boundary of the fluid draw-down region, promoting normal faulting. It is therefore perhaps no coincidence that we observe swarms of normal-faulting events in regions where more significant near fault stress changes occur.[401]

Another study examining induced seismicity in the Eagle Ford shale region (in which the Choke Canyon Reservoir parcels are found) found that "the majority of small earthquakes may be triggered/induced by human activity" in this region and "are more often associated with fluid extraction than with injection."[402] The study noticed several examples of increased fluid extraction (i.e., oil and water) preceding earthquakes of substantial magnitude (3.4 to 4.8), suggesting a link between the two.[403]

The National Resource Council's review of human induced seismicity notes the well-documented causes of induced seismicity resulting from fluid extraction:

> Fluid extraction from a reservoir can cause declines in the pore pressure that can reach hundreds of bars. The declining pore pressure causes large contraction of the reservoir, which itself induces stress changes in the surrounding rock (Segall, 1989), in particular increasing horizontal stresses above and below the reservoir that could lead to reverse faulting (Figure 2.2). *Grasso (1992) estimates that volume contraction of reservoirs from fluid withdrawal can cause earthquakes up to M 5.0.*
>
> Several examples of induced seismicity associated with fluid withdrawal and associated pore pressure decrease have been reported, notably at the Lacq gas field in France (Box 2.5). A study of induced seismicity associated with natural gas extraction in the Netherlands (Van Eijs et al., 2006) indicates that the three most important factors in producing seismicity are the pore pressure drop from pumping, the density of existing faults overlying the gas field, and the contrast in crustal stiffness between the reservoir rock and the surrounding rock.
>
> Another proposed mechanism for initiating slip on pre-existing faults is linked to the reduction of the vertical stress on the layers underlying the reservoir from which a large mass of hydrocarbons has been extracted (McGarr, 1991). In this mechanism, the buoyancy force of the Earth's lithosphere will cause an upward movement in the part of the crust that has been unloaded, thereby inducing slip on pre-existing faults at depth.[404]

---

[401] *Id*.
[402] Frohlich, Cliff and Michael Brunt, Two-year survey of earthquakes and injection/production wells in the Eagle Ford Shale, Texas, prior to the MW4.8 20, Earth and Planetary Science Letters, 402:15, 257 (Sept. 2014), available at http://www.sciencedirect.com/science/article/pii/S0012821X14003835.
[403] *Id*. at 263.
[404] National Research Council, Induced Seismicity Potential in Energy Technologies, 44-45 (2013) ("NRC 2013"), available at

An EIS must fully assess the risk of induced seismicity caused by all unconventional oil and gas extraction and injection activities, including wastewater injection wells. The analysis should assess the following issues based on guidance from the scientific literature, the National Research Council,[405] and the Department of Energy[406]:

(1) whether existing oil and gas wells and wastewater injection wells in the areas for lease have induced seismic activity, using earthquake catalogs (which provide an inventory of earthquakes of differing magnitudes) and fluid extraction and injection data collected by industry;

(2) the region's fault environment by identifying and characterizing all faults in these areas based on sources including but not limited to the USGS Quaternary Fault and Fold database. In its analysis, BLM should assess its ability to identify all faults in these areas, including strike-slip faults and deep faults that can be difficult to detect;

(3) the background seismicity of oil- and gas-bearing lands including the history of earthquake size and frequency, fault structure (including orientation of faults), seismicity rates, failure mechanisms, and state of stress of faults;

(4) the geology of oil- and gas-bearing lands including pore pressure, formation permeability, and hydrological connectivity to deeper faults;

(5) the hazards to human communities and infrastructure from induced seismic activity; and

(6) the current state of knowledge on important questions related to the risk and hazards of induced seismicity from oil and gas development activities, including:

  (a) how the distance from a well to a fault affects seismic risk (i.e., locating wells in close proximity to faults can increase the risk of inducing earthquakes);

  (b) how fluid injection and extraction volumes, rates, and pressures affect seismic risk;

  (c) how the density of wells affects seismic risk (i.e., a greater density of wells affects a greater volume of the subsurface and potentially contacts more areas of a single fault or a greater number of faults);

  (d) the time period following the initiation of injection or extraction activities over which earthquakes can be induced (i.e., studies indicate that induced

---

http://www.nap.edu/login.php?record_id=13355&page=http%3A%2F%2Fwww.nap.edu%2Fdownload.php%3Frecord_id%3D13355.

[405]National Research Council, *Induced Seismicity Potential in Energy Technologies*. National Academies Press (2012).

[406]U.S. Department of Energy, *Protocol for Addressing Induced Seismicity Associated with Enhanced Geothermal Systems*, DOE/EE-0662 (2012); U.S. Department of Energy, *Best Practices for Addressing Induced Seismicity Associated with Enhanced Geothermal Systems - Draft* (2013).

seismicity often occurs within months of initiation of extraction or injection although there are cases demonstrating multi-year delays);

(e) how stopping extraction or injection activities affects induced seismicity (i.e., can induced seismicity be turned off by stopping extraction and injection and over what period, since studies indicate that there are often delays—sometimes more than a year—between the termination of extraction and injection activities and the cessation of induced earthquake activity);

(f) the largest earthquake that could be induced by unconventional oil and gas development activities in areas for lease, including earthquakes caused by wastewater injection; and

(g) whether active and abandoned wells are safe from damage from earthquake activity over the short and long-term.

XI. BLM Must Analyze How Fossil Fuel Development Will Impact Land Use

Increased oil and gas extraction and production have the potential to dramatically and permanently change the landscape of the areas for lease, which are relatively pristine and are unspoiled by oil and gas development. Countless acres of land will likely be leveled to allow for the construction and operation of well pads and related facilities such as wastewater pits. Roads may have to be constructed or expanded to accommodate trucks transporting chemicals and the large quantities of water needed for some recovery methods. Transmission lines and other utilities may also be required. The need for new distribution, refining, or waste treatment facilities will expand industrial land use. With new roads and other industrial infrastructure, certain areas could open up to new industrial or extractive activities, permanently changing the character and use of the land.

The conversion of substantial acreages from rural or natural landscapes to industrial sites will also mar scenic views throughout the planning area. Given BLM's failure to ensure full reclamation of idle wells and the difficulty of restoring sites to their original condition, scenic resources may be permanently impaired.

XII. BLM Must Prepare an Environmental Impact Statement ("EIS")

NEPA demands that a federal agency prepare an EIS before taking a "'major [f]ederal action[] *significantly* affecting the quality' of the environment."[407] In order to determine whether a project's impacts may be "significant," an agency may first prepare an Environmental Assessment ("EA").[408] If the EA reveals that "the agency's action may have a significant effect upon the . . . environment, an EIS must be prepared."[409]

[407] *Kern v. U.S. Bureau of Land Mgmt.*, 284 F.3d 1062, 1067 (9th Cir. 2002) (emphasis added).
[408] 40 C.F.R. §§ 1501.4, 1508.9.
[409] *Nat'l Parks & Conservation Ass'n v. Babbitt*, 241 F.3d 722, 730 (9th Cir. 2001) (internal quotations omitted).

The issues discussed above show that the potential impacts that the proposed action could have on the environment are indeed significant, which compels the preparation of an EIS.

An EIS must be prepared if substantial "questions are raised as to whether a project . . . may cause significant degradation of some human environmental factor."[410] It is not necessary to show that significant effects will in fact occur; raising substantial questions about whether a project *may* have a significant effect is enough to trigger BLM's obligation to prepare an EIS.[411] Because the aforementioned impacts are likely to have a significant effect on the environment, BLM is legally required under NEPA to prepare an EIS. This is especially true in light of the likelihood that fracking would occur on the leases.

In considering whether the proposed oil and gas leasing would have significant effects on the environment, NEPA's regulations require BLM to evaluate ten factors regarding the "intensity" of the impacts. [412] The existence of any "one of these factors may be sufficient to require preparation of an EIS."[413] Several of these "significance factors" are implicated in this proposed action and clearly warrant the preparation of an EIS:

> The degree to which the effects on the quality of the human environment are likely to be highly controversial.
>
> The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.
>
> The degree to which the proposed action affects public health or safety.
>
> The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.[414]

Here, individually and considered as a whole, there is no doubt that significant effects may result from this proposal; thus, NEPA requires that BLM must prepared an EIS for the action.

a. The effects on the human environment will be highly controversial

---

[410] *Ocean Advocates v. United States Army Corps of Eng'rs*, 402 F.3d 846, 864-65 (9th Cir. 2005) (internal quotes omitted).
[411] *Id*.
[412] 40 C.F.R. § 1508.27(b); *see also Center for Biological Diversity, et al. v. Bureau of Land Management, et al.*, 937 F. Supp. 2d 1140, 1155-59 (holding that oil and gas leases were issued in violation of NEPA where BLM failed to prepare an EIS and failed to properly address the significance factors for context and intensity in 40 C.F.R. § 1508.27).
[413] *Ocean Advocates*, 402 F.3d at 865; *Nat'l Parks & Conservation Ass'n*, 241 F.3d at 731.
[414] 40 C.F.R. § 1508.27(b)(4), (5), (2) & (9); *See Center for Biological Diversity*, 937 F. Supp. 2d at 1158-59 (holding that BLM failed to properly address the significance factors regarding controversy and uncertainty that may have been resolved by further data collection (citing *Native Ecosystems Council v. U.S. Forest Serv*., 428 F.3d 1233, 1240 (9th Cir. 2005)).

A proposal is highly controversial when "substantial questions are raised as to whether a project . . . may cause significant degradation" of a resource, *Nw. Envtl. Def. Ctr. v. Bonneville Power Admin.*, 117 F.3d 1520, 1536 (9th Cir. 1997), or when there is a "substantial dispute [about] the size, nature, or effect of the" action. *Blue Mtns. Biodiversity*, 161 F.3d at 1212. A "substantial dispute exists when evidence, raised prior to the preparation of [a] . . . FONSI, casts serious doubt upon the reasonableness of an agency's conclusions." *Nat'l Parks & Conserv. Ass'n*, 241 F.3d at 736. When such a doubt is raised, "NEPA then places the burden on the agency to come forward with a 'well-reasoned explanation' demonstrating why those responses disputing the EA's conclusions 'do not . . . create a public controversy.'" *Id.* See *CBD*, 937 F. Supp. 2d 1140.

This comment letter provides abundant evidence that oil and gas operations can cause significant impacts to human health, water resources, air quality, imperiled species, and seismicity. The potential for these significant impacts to occur is particularly clear in light of the potential for fracking to result from the lease sale. Fracking is among the top, if not the single most controversial energy issue facing America today. The controversy spans the public arena, scientific discourse, local governments, and the halls of Congress. At the request of Congress, EPA is conducting a study into the effects of fracking on drinking and ground water.[415] Similarly, the New York Draft DEC concluded that the health and environmental risks from fracking supports it ban in New York State. In Nevada, several anti-fracking grassroots groups have emerged along with petitions to ban the practice in Nevada, which to date have garnered more than 3200 signatures.[416] However, in addition to the presence of controversy, it is already evident, as discussed above, that fracking is harmful. Clearly, the level of controversy associated with fracking and its expansion in Nevada in association with the lease sale is sufficient to trigger the need for an EIS. 40 C.F.R. § 1508.27(b)(4)

b. The lease sale presents highly uncertain or unknown risks

An EIS must also be prepared when an action's effects are "highly uncertain or involve unique or unknown risks." 40 C.F.R. § 1508.27(b)(5). Preparation of an EIS is "mandated where uncertainty may be resolved by further collection of data, or where the collection of such data may prevent speculation on potential . . . effects."[417] As one court recently explained regarding oil and gas leasing that may facilitate fracking, "BLM erroneously discounted the uncertainty from fracking that may be resolved by further data collection."[418] There is also great uncertainty, for example, in the contributions of this action to the resulting effects of climate change, which are potentially catastrophic. While it is clear that oil and gas activities can cause great harm, there remains much to be learned about the specific pathways through which harm may occur and the potential degree of harm that may result. Additional information is needed,

[415] U.S. Environmental Protection Agency, Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources (November 2011).
[416] http://petitions.moveon.org/sign/nevadas-public-health.fb28?source=c.fb&r_by=5006637
http://org.credoaction.com/petitions/nevada-s-public-health-is-at-risk-we-want-a-moratorium-on-hydraulic-fracturing
http://petitions.moveon.org/sign/prevent-fracking-in-nevada/?source=search
http://org.credoaction.com/petitions/ban-fracing-in-nevada?source=facebook-share-button&time=1374605460
[417] *Native Ecosystems Council v. U.S. Forest Serv.*, 428 F.3d 1233, 1240 (9th Cir. 2005) (internal citations omitted).
[418] *Center for Biological Diversity*, 937 F. Supp. 2d at 1159.

for example, about possible rates of natural gas leakage, the potential for fluids to migrate through the ground in and around the parcels, and the potential for drilling to affect local faults. NEPA dictates that the way to address such uncertainties is through the preparation of an EIS

c. The lease sale poses threats to public health and safety

As discussed in great detail above, the oil and gas activities that may occur as a result of the lease sale could cause significant impacts to public health and safety. 40 C.F.R. § 1508.27(b)(2). Fracking would pose a grave threat to the region's water resources, harm air quality, pose seismic risks, negatively affect wildlife, and fuel climate change.

As a congressional report noted, oil and gas companies have used fracking products containing at least 29 products that are known as possible carcinogens, regulated for their human health risk, or listed as hazardous air pollutants.[419] The public's exposure to these harmful pollutants alone would plainly constitute a significant impact. Furthermore, and as previously discussed, information continues to emerge on the risk of earthquakes induced by wastewater injected into areas near faults. It is undeniable that these earthquakes pose risks to the residents of the area and points beyond.

The use of fracking fluid, which is likely to occur as a result of the lease sale, poses a major threat to public health and safety and therefore constitutes a significant impact. BLM therefore must evaluate such impacts in an EIS.

d. The action may adversely affect candidate and agency sensitive species and their habitat

An EIS may also be required when an action "may adversely affect an endangered or threatened species or its habitat." 40 C.F.R. § 1508.27(b)(9). Although a finding that a project has "some negative effects does not mandate a finding of significant impact," an agency must nonetheless fully and closely evaluate the effects on listed species and issue an EIS if those impacts are significant. *Klamath-Siskiyou Wildlands Ctr. v. U.S. Forest Serv.*, 373 F. Supp. 2d 1069, 1081 (E.D. Cal. 2004) (finding agency's conclusion that action "may affect, is likely to adversely affect" species due to "disturbance and disruption of breeding" and "degradation" of habitat is "[a]t a minimum, . . . an important factor supporting the need for an EIS").

Impacts to some of the BLM sensitive and other rare species threatened by the proposed lease have been highlighted in section "IX" of these comments.

XIII. BLM Must Ensure That the Federal Land Policy and Management Act and the Mineral Leasing Act Are Not Violated

The Mineral Leasing Act ("MLA") requires BLM to demand lessees take all reasonable measures to prevent the waste of natural gas. The MLA states:

[419] Waxman, Henry et al., United States House of Representatives, Committee on Energy and Commerce, Minority Staff, Chemicals Used in Hydraulic Fracturing (Apr. 2011) ("Waxman 2011")

> All leases of lands containing oil or gas, made or issued under the provisions of this chapter, shall be subject to the condition that the lessee will, in conducting his explorations and mining operations, use all reasonable precautions to prevent waste of oil or gas developed in the land, or the entrance of water through wells drilled by him to the oil sands or oil-bearing strata, to the destruction or injury of the oil deposits.

30 U.S.C. § 225; *see also id.* § 187 (stating that for the assignment or subletting of leases that "[e]ach lease shall contain . . . a provision . . . for the prevention of undue waste"). This statutory mandate is unambiguous and must be enforced. *Tenn. Valley Auth. v. Hill*, 437 U.S. 153, 184 n.29 (1978) (stating that "[w]hen confronted with a statute which is plain and unambiguous on its face," "it is not necessary to look beyond the words of the statute."). As already discussed in previous sections, oil and gas operations emit significant amounts of natural gases, including methane and carbon dioxide, which can be easily prevented. [420]

Pursuant to the Federal Land Policy and Management Act ("FLPMA"), BLM must "take any action necessary to prevent unnecessary or undue degradation of the [public] lands." 43 U.S.C. § 1732(b). Written in the disjunctive, BLM must prevent degradation that is "unnecessary" and degradation that is "undue." *Mineral Policy Ctr. v. Norton*, 292 F.Supp.2d 30, 41-43 (D. D.C. 2003). The protective mandate applies to BLM's planning and management decisions. *See Utah Shared Access Alliance v. Carpenter*, 463 F.3d 1125, 1136 (10th Cir. 2006) (finding that BLM's authority to prevent degradation is not limited to the RMP planning process). Greenhouse gas pollution for example causes "undue" degradation. Even if the activity causing the degradation may be "necessary," where greenhouse gas pollution is avoidable, it is still "unnecessary" degradation. 43 U.S.C. § 1732(b).

In addition to being harmful to human health and the environment, the emissions from oil and gas operations are also an undue and unnecessary waste and degredation of public lands. Consequently, BLM's proposed gas and oil lease sale violates FLPMA. *See* 43 U.S.C. § 1732(b)

Conclusion

Unconventional oil and gas development not only fuels the climate crisis but entails significant public health risks and harms to the environment. Accordingly, BLM should end all new leasing and fracking on BLM lands. Should BLM proceed with the lease sale it must thoroughly analyze the alternatives of no new leasing (or no action), and no fracking or other unconventional well stimulation methods in an EIS. Oil and gas leasing is an irrevocable commitment to convey rights to use of federal land – a commitment with readily predictable environmental consequences that BLM is required to address. These include the specific geological formations, surface and ground water resources, seismic potential, or human, animal,

[420] *See* U.S. Government Accountability Office, Federal Oil and Gas Leases, Opportunities Exist to Capture Vented and Flared Natural Gas, Which Would Increase Royalty Payments and Reduce Greenhouse Gases 20(2010)

and plant health and safety concerns present in the area to be leased. BLM should thoroughly analyze impacts to each of these resources in an EIS.

Thank you for your consideration of these comments. We look forward to reviewing a legally adequate EIS for this proposed oil and gas leasing action.

Sincerely,

My-Linh Le
Legal Fellow
Center for Biological Diversity

April 27, 2015

Via U.S. Mail & E-mail

Director (210)
Attention: Protest Coordinator, WO-210
P.O. Box 71383
Washington, D.C. 20024-1383
Email: protest@blm.gov

Dear Director Kornze:

This Resource Management Plan Amendment Protest is submitted on behalf of the Center for Biological Diversity ("Center") regarding the Bureau of Land Management's (BLM) Proposed Resource Management Plan Amendment (RMPA) and Final Environmental Impact Statement (FEIS) for the White River Field Office (WRFO). The Notice of Availability of the RMPA and FEIS was published by the Environmental Protection Agency (EPA) in the Federal Register on March 27, 2015 (80 FR 16424); therefore this Protest is being timely filed in accordance with 43 C.F.R § 1601.5-2. Pursuant to the instructions contained in BLM's "Dear Reader" letter accompanying the RMPA, this protest is being provided via email with a timely postmarked copy sent via U.S. Mail to the address above.

PROTEST

1. Protesting Parties: Contact Information and Interests:

This Protest is filed on behalf of the Center for Biological Diversity, Rocky Mountain Wild, and their boards and members by:

Wendy Park
Staff Attorney
Center for Biological Diversity
351 California St. #600
San Francisco, CA 94104
wpark@biologicaldiversity.org

Megan Mueller
Senior Conservation Biologist

Rocky Mountain Wild
1536 Wynkoop St., Ste. 900
Denver, CO 80202
(303) 704-9760
megan@rockymountainwild.org

John Weisheit, Conservation Director
Living Rivers
PO Box 466
Moab, UT 84532
(435) 259-1063
john@livingrivers.org

Zach Frankel, Executive Director
Utah Rivers Council
1055 East 2100 South, Suite 204
Salt Lake City, UT 84106
(801) 486-4776
zach@utahrivers.org

The Center is a non-profit environmental organization with 50,400 member activists, including members who live and recreate in the areas in and affected by actions taken within the areas governed by the White River Field Office planning area in Colorado. The Center uses science, policy and law to advocate for the conservation and recovery of species on the brink of extinction and the habitats they need to survive. The Center has and continues to actively advocate for increased protections for species and habitats in the planning area on lands managed by the BLM. The lands and waters that will be affected by the decision include habitat for many listed, rare, and imperiled species that the Center has worked to protect including the Colorado pikeminnow, humpback chub, bonytail, razorback sucker, Colorado cutthroat trout, and greater sage-grouse, and many other species which will be affected by actions authorized or allowed under the RMPA. The Center's board, staff, and members use the lands and waters within the planning area, including the lands and waters that would be affected by actions under the RMPA, for quiet recreation (including hiking and camping), scientific research, aesthetic pursuits, and spiritual renewal.

Rocky Mountain Wild (formerly Center for Native Ecosystems) has a longstanding interest in the management of BLM lands in Colorado and engages frequently in the decision-making processes for land use planning and project proposals that could adversely affect biodiversity, wildlife populations, rare and imperiled species, and natural areas. Rocky Mountain Wild's staff and members enjoy a wide variety of recreational activities on BLM-managed public lands, including viewing wildlife and plants (including rare and imperiled species), wildlife and nature photography, hiking, biking, rafting, and enjoying solitude. The planning area includes key habitat for a wide variety of animal and plant species that Rocky Mountain Wild has worked to protect, including elk, mule deer, pronghorn, greater sage-grouse, black footed ferret, white tailed prairie dog, graham's penstemon, white river penstemon, narrowleaf evening

primrose, and many other species that will be adversely affected by actions authorized or allowed under the RMPA.

Living Rivers is a nonprofit organization based in Moab, Utah that promotes river restoration through mobilization. By articulating conservation and alternative management strategies to the public, Living Rivers seeks to revive the natural habitat and spirit of rivers by undoing the extensive damage done by dams, and water-intensive energy development on the Colorado Plateau. Living Rivers has approximately 1,200 members in Utah, Colorado and other states.

Utah Rivers Council is a grassroots organization dedicated to the conservation and stewardship of Utah's rivers and sustainable clean water sources for Utah's people and wildlife. Founded in 1995, Utah Rivers Council works to protect Utah's rivers and clean water sources for today's citizens, future generations and healthy, sustainable natural ecosystems. It implements its mission through grassroots organizing, direct advocacy, research, education, community leadership, and litigation.

The Center and Rocky Mountain Wild participated in the planning process to the degree required by law. On January 28, 2013 Michael Saul submitted comments on the Draft Environmental Impact Statement (DEIS) and the draft proposed RMPA on behalf of the Colorado and National Wildlife Federations. This comment is included in Attachment A and is incorporated by reference herein. Mr. Saul is now a member and employee of the Center, and the Center now submits this protest on behalf of its members, including Mr. Saul. Thus, the Center properly has associational administrative standing to file this protest based on Mr. Saul's standing to file this protest. Mr. Saul has administrative standing, because he previously participated in the planning process and has an interest in the area affected by the RMPA. Mr. Saul has hiked and viewed wildlife on BLM lands within the planning area, and will visit the area again to view wildlife, including greater sage-grouse.

Rocky Mountain Wild participated in all stages of the planning process through the submission of scoping comments, comments on the DEIS, and various letters submitted to BLM regarding the impacts of plan activities on threatened and endangered species and other resources of the plan area. Its comments addressing numerous issues with the RMPA are attached as Attachment A and incorporated by reference herein. Rocky Mountain Wild submitted scoping comments on September 29, 2006, and March 9, 2007, including nominations for several Areas of Critical Environmental Concern (ACECs). It also submitted comments on the Draft Plan Amendment on January 28, 2013, including a Master Leasing Plan Proposal for the Dinosaur Lowlands Area. Rocky Mountain Wild will continue to participate in the RMPA process and other opportunities to ensure protection of key habitat and natural areas within the White River Field Office.

As detailed in those comment and others, and as explained below, the Center, Rocky Mountain Wild, Living Rivers, and Utah Rivers Council, believe that the RMPA and accompanying FEIS are inadequate to ensure compliance with the procedural and substantive mandates of the Federal Land Policy and Management Act (FLPMA), the National

Environmental Policy Act (NEPA), and the Endangered Species Act (ESA) and other federal and state laws and policies.

If the Director finds that none of the parties to this letter has administrative standing to file this protest, we request that BLM still consider these comments on the FEIS and RMPA and include them in the administrative record, as required by the Council on Environmental Quality (CEQ) regulations. *See* 40 CFR § 1503.1(b) ("An agency may request comments on a final environmental impact statement before the decision is finally made. In any case other agencies or persons may make comments before the final decision….")

2. Issues and Parts of the RMPA Protested:

The Center protests the proposed adoption of the BLM's preferred alternative which, absent modification, provides for continued and expanded oil leasing and development on BLM lands and mineral estate without adequate analysis of, or mitigation for, the direct, indirect and cumulative impacts of such activities on air and water quality, wildlife and climate. As outlined below, by adopting the preferred alternative, BLM would find itself in violation of the ESA, NEPA, and FLPMA. BLM should therefore withdraw the RMPA and FEIS, prepare a Supplemental Environmental Impact Statement (SEIS) that addresses the deficiencies in the FEIS, and issue a new RMPA that complies with applicable statutory mandates and better protects the resources BLM is entrusted to manage.

3. Statement of Reasons as to Why the Proposed Decision to Adopt the RMPA Is Unlawful:

As noted above, BLM's proposed decision to adopt the RMPA is substantively and procedurally flawed. A concise statement of those reasons is provided below.

I. <u>BLM and Fish and Wildlife Service Must Formally Consult Regarding the Impacts of Water Depletion and Spills and Leaks Resulting from Oil and Gas Development.</u>

The Service's failure to complete formal consultation regarding the effects of the RMPA on the ESA-listed Colorado pikeminnow, humpback chub, bonytail, and razorback sucker (collectively "endangered fish") violates the ESA. BLM determined that "implementation of the WRFO RMPA may affect, but is not likely to adversely affect any of the endangered fish or their critical habitats beyond the effects of water depletions, which have undergone separate section 7 consultation." The Service's determination and BLM's reliance on it are improper because the Service and BLM cannot reasonably rely on the "separate section 7 consultation," i.e., the 2008 Programmatic Biological Opinion for Water Depletions Associated with Bureau of Land Management's Fluid Mineral Program within the Upper Colorado River."[1] This is because the Programmatic Biological Opinion ("PBO") did not anticipate the full scope of water use required by the RMPA. The Service also erroneously failed to complete formal consultation regarding the heightened risk of spills and leaks that the RMPA poses to endangered fish and their habitat in

[1] *See* Fish and Wildlife Service, "Programmatic Biological Opinion for Water Depletions Associated with Bureau of Land Management's Fluid Mineral Program within the Upper Colorado River," Dec. 19, 2008 (Ex. A).

the Upper Colorado Basin. Before approving the RMPA, the Service and BLM must (1) formally consult or reinitiate formal consultation regarding the RMPA's water depletion effects on the endangered fish; and (2) complete formal consultation regarding the increased risk of spills and leaks from oil and gas development on the endangered fish.

No public comments previously commented on the adequacy of the Biological Assessment for the RMPA and the Service's concurrence, because these documents were not available at the time the draft EIS was published.

A. The Service's Determination Regarding the RMPA's Water Depletion Effects on Endangered Fish Is Flawed.

The Service cannot reasonably rely on the PBO regarding the RMPA's water depletion effects on the endangered fish. In its concurrence letter to BLM regarding the RMPA, the Service concluded that "implementation of the WRFO RMPA may affect, but is not likely to adversely affect any of the endangered fish or their critical habitats beyond the effects of water depletions, which have undergone separate section 7 consultation."[2] But that prior section 7 consultation – the PBO – did not fully take into account water depletion of hydraulic fracturing; nor did it anticipate the potential for horizontal drilling and its enormous water depletion effects.

In 2008, the Service issued the PBO regarding the water depletion effects of fluid mineral development in the WRFO and other Upper Colorado Basin planning areas. The PBO determined that BLM's water depletions from the Colorado River Basin are likely to adversely affect the endangered fish and their designated critical habitats. PBO, p. 1. However, the PBO concluded that the water depletions are not likely to jeopardize the continued existence of the endangered fish and not likely to destroy or adversely modify the endangered fishes' designated critical habitat. *Id*., p. 50.

The PBO's water depletion projections for the WRFO is based on BLM's 2007 Reasonably Foreseeable Future Development ("RFD") report for the WRFO planning area ("RFD," available at FEIS, Appendix R). While the RFD predicts that new technologies in hydraulic fracturing will allow operators to tap into unconventional reserves that were not previously accessible,[3] the PBO does not appear to account for the water depletion required by such technologies.

Based on the development scenario contemplated in the RFD, the PBO finds that the average water depletion amount per well in the WRFO would be 2.62 acre-feet per well. PBO, p.

[2] Letter from Fish & Wildlife Service to White River Field Office, BLM re Section 7 Consultation on the Oil and Gas Amendment to the Resource Management Plan (RMP), March 11, 2015 ("FWS Concurrence Letter"), p. 4 (Ex. B).

[3] *See* RFD, p. 22 ("The emerging interest in the Mesaverde basin-centered play in the central part of the WRFO is principally related to the development of new completion technology (i.e. modern hydraulic fracturing techniques) coupled with the sustained elevation in gas prices (>$5.00/thousand cubic feet of gas) over the past few years."); RFD, p. 1 (noting "past conventional drilling and extraction technologies have not been successful in producing the unique geologic traps containing the gas" in the area covering much of the WRFO, but that "new technology" recently developed allow them to be tapped).

5. This figure includes water use required for drilling and completion (2.41 acre-feet), dust abatement (0.10 acre-feet), and hydrostatic pipeline testing (0.11 acre-feet). *Id.* It is unclear, however, whether this figure accounts at all for water use required for hydraulic fracturing. The PBO relied on the 2008 Programmatic Biological Assessment ("PBA") prepared by BLM for its water use estimate.[4] The PBA states that its projections for "drilling and completion" water use account for "fracing," PBA p. 5, pp. 6-7; on the other hand, the PBA states that these projections apply to water use required for "*Primarily Conventional* Natural Gas Development with some Limited Coalbed Methane Activity." (PBA, p. 8). "Primarily conventional natural gas development" is undefined, and has no precise meaning, but in recent years "*unconventional* natural gas development" has typically been used to denote the development of unconventional, "tight" gas reserves that require fracking, like those in the Mesaverde Play Area covered by the RMPA.[5] It is thus entirely unclear to what extent the PBA took into account the freshwater needs of hydraulic fracturing for unconventional natural gas reserves other than coalbed methane development.

This is especially troubling, because hydraulic fracturing requires water volumes that far exceed the amounts used in conventional natural gas development.[6] Indeed, considering that these estimates did not account for the potential for water reuse and recycling, *see* PBA, p. 9, these estimates are remarkably low. According to FracFocus, a database reporting fracking fluid composition for individual wells, from January 2011 through February 2013, the median "total volume of water" use to frack an individual well in Rio Blanco County (which covers most of the WRFO area) was 2,248,291 gallons of water or 6.9 acre feet.[7] The FracFocus figure only represents the volume of water used in fracking fluids, and thus does not include the amount of water needed to also drill and complete the well.[8] But that figure (6.9 acre feet) is almost three

---

[4] Programmatic Biological Assessment for BLM's Fluid Minerals Program in Western Colorado re: Water Depletions and effects on the Four Endangered Big River Fishes: Colorado pikeminnow (Ptychocheilus lucius), humpback chub (Gila cypha), bonytail chub (Gila elegans), and razorback sucker (Xyrauchen texanus), November 3, 2008 (Ex. C).

[5] NaturalGas.org, Unconventional Oil and Gas, available at "http://naturalgas.org/overview/unconventional-ng-resources/ (Ex. E); Alberta Energy Regulator, "What is Unconventional Oil and Gas?," available at, https://www.aer.ca/about-aer/spotlight-on/unconventional-regulatory-framework/what-is-unconventional-oil-and-gas (Ex. F); RFD, p. 15, 17 ("Mesaverde continuous, basin-centered, tight sand gas accumulation… contains the bulk of the technically recoverable reserve in the Basin").

[6] *See* Clark, Corrie E. et al., Life Cycle Water Consumption for Shale Gas and Conventional Natural Gas, Environ. Sci. Technol., 2013, 47 (20), pp 11829–11836, abstract available at http://pubs.acs.org/doi/abs/10.1021/es4013855 (Ex. G).

[7] EPA, State-level Summaries of FracFocus 1.0 Hydraulic Fracturing Data, March 2015, pp. 1-2, 4, 14, available at http://www2.epa.gov/sites/production/files/2015-03/documents/ff_statesummarysheets_final_508.pdf (Ex. H).

[8] "Drilling and completion" are separate steps from "hydraulic fracturing" of a well. "Drilling" refers to drilling the borehole into the earth; "fracking" refers to the process of injecting fracking fluids into the well to create high pressure that fractures underground formations and forces trapped hydrocarbons to the surface once the pressure is released; and "well completion" refers to isolating the well from the surrounding environment and turning it into an actively producing well. *See* Jiang, Mohan, et al. Life Cycle Water Consumption and Wastewater Generation Impacts of a Marcellus Shale Gas Well. Environ Sci Technol. 2014 Feb 4; 48(3): 1911–1920, p. 1912, available at

times the PBO's and EIS's estimate of the amount of water needed for "drilling and completion," plus fracking (2.41 acre feet).

While the Biological Assessment for the RMPA notes that water depletion per well "is expected to decline over time as BMPs involving water recycling and treatment are more fully integrated into standard drilling and completions operations," the integration of those technologies is entirely speculative and not required by any provision of the PBO or RMPA.[9] RMPA Biological Assessment (or "BA"), PDF 67.

The EIS similarly brushes aside the potential for higher levels of water use, noting "typically fresh water is only needed for surface drilling operations and for cementing requirements for all casing strings that are run. For hydraulic fracturing, recycled produced water and/or flow back water can be used which helps cumulatively by reducing the overall amounts of water used for oil and gas operations." FEIS, Appendix K, PDF 20; *see also id*., PDF 92 (noting "majority of water and chemicals are recovered after stimulation" without citing any reference or data). No data, however, reveals what proportion of water use is "recycled produced water and/or flow back water" and what proportion is non-recycled fresh water. In the Marcellus Shale, only 20-40% of fracking fluids are recovered as flowback,[10] suggesting that the majority of fracking fluids are *not* recoverable. Further, no data reveals the extent to which operators recycle, or that recycling is technically feasible in the WRFO, or how soon operators will be relying on such technology. Indeed, the PBA's water use projections previously noted that "sophisticated water treatment, holding, reuse, and associated transmission facilities are not in place. Thus *limited water reuse* is occurring in this region…." PBA, p. 9 [emphasis added]; *see also* FEIS Chapter 4, pdf 140, 160 (noting "freshwater use volume of 2.62 acre-feet per well with limited reuse and recycling of freshwater"). One 2013 report notes that in Colorado only 2% of water used for oil and gas production is reused or recycled.[11] This is because readily available underground wastewater disposal sites and cheap sources of freshwater have reduced incentives to recycle.[12]

Nor does the PBO take into account the much higher fresh water requirements of horizontal drilling. The PBO's and PBA's water depletion projections make no mention of this technique or its freshwater requirements. Indeed, water depletion logs submitted by BLM to Fish and Wildlife Service report on the water use of horizontal drilling separately from the water

---

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3915742/ (describing steps of drilling, fracking, and completing a well) (Ex. I); Kargbo, David M., et al. Natural Gas Plays in the Marcellus Shale: Challenges and Potential Opportunities, Environ. Sci. Technol. 2010, 44, 5679–5684, pp. 5680-81, available at http://pubs.acs.org/doi/pdf/10.1021/es903811p (same) (Ex. J); "How Does Well Completion Work?" Rigzone.com, available at http://www.rigzone.com/training/insight.asp?i_id=326 (describing well completion process) (Ex. K).

[9] U.S. BLM, White River Field Office Oil and Gas Development Proposed RMP Amendment and Final EIS Revised Biological Assessment, February 2015 (Ex. D).

[10] Schramm, E. 2011. What is flowback, and how does it differ from produced water? Institute for Energy and Environmental Research of Northeastern Pennsylvania Clearinghouse website, available at http://energy.wilkes.edu/pages/205.asp (Ex. L).

[11] Lynn, Steve. "Frack-water recycling lacking in Northern Colorado," BizWest.com, Oct. 16, 2013, available at http://bizwest.com/frack-water-recycling-lacking-in-northern-colorado-2/. (Ex. M.)

[12] *Id*.

depletion of vertical wells. While vertical wells are assumed to require 2.62 acre feet of water (as estimated in the PBO) and BLM reports total number of vertical wells multiplied by this standard depletion factor, BLM's logs report actual water use for horizontal drilling.[13] Those logs show that horizontal drilling typically entails fresh water depletion much greater than 2.62 acre feet per well. The average water use of horizontal drilling projects from 2011-2014 in the Field Offices covered by the PBO (White River, Grand Junction, Kremmling, Colorado River Valley, Gunnison, Uncompahgre, San Juan Public Lands, and Little Snake) was 11.6 acre feet of water.[14] Recent horizontal drilling projects in the Grand Junction Field Office in 2014 depleted 68.3 and 70.8 acre feet of freshwater.[15] The use of this technique is likely to increase. FEIS, Appendix K, PDF 367, 374, 380 (energy companies noting EIS's failure to consider advancements in this "widespread" technique).

The EIS itself seems to admit that the water depletion of horizontal drilling was not accounted for in the PBO, noting that additional consultation may be needed for projects that exceed an unspecified water depletion estimate – likely that provided in the PBO:

> The water depletion process also requires an annual estimate of freshwater use. Exploratory wells outside the [Mesaverde Play Area], particularly horizontal completions, may result in water use *significantly above the estimate*. Each drilling proposal is considered and impacts of freshwater use analyzed in environmental assessments during the consideration of APDs. If freshwater use increases dramatically, additional consultation with FWS would most likely be required.

FEIS, Ch. 4, PDF 134 (emphasis added). But this piecemeal approach masks the collective impact of horizontal drilling projects in the WRFO area in connection with other projects, and its overall impact on sensitive species including the endangered fish. Moreover, the trigger for additional consultation is unclear. The EIS does not specify what counts as a "dramatic[]" increase and relative to what standard – possibly, an increase above the "annual estimate of freshwater use" made in the 2008 PBO (3,227 acre feet in the White River Basin), or above some other annual estimate made by BLM would trigger consultation, but the reader is left guessing.

High-volume fracking or "massive fracs" requiring millions of gallons of water may even be performed on vertical wells and directional non-horizontal wells in the WRFO.[16] ("Although many horizontal wells are given massive fracs, many vertical wells and directional non-horizontal wells, such as those in the Williams Fork formation of western Colorado, are also given massive fracs."); RFD, p. 30 (geology, drilling depth, and drilling practices can "vary significantly from wellbore to wellbore" in the Mesaverde/Williams Fork formation). Again, the

[13] BLM Water Depletion Logs Reported to Fish and Wildlife Service, 2009-2014 (Ex. N).
[14] Table Summarizing Average Water Depletions for Horizontal Drilling Projects, 2009-2014. (Ex. O.)
[15] BLM, 2014 Water Depletion Log.
[16] Getches-Wilkinson Center for Natural Resources, Energy, and the Environment, Intermountain Oil and Gas BMP Project: Hydraulic Fracturing, available at http://www.oilandgasbmps.org/resources/fracing.php. (Ex. P.)

PBO erroneously assumes an average of 2.62 acre feet of water per well, although water use could far exceed this amount.

In addition, the water depletion logs disclose other oil and gas activities that have occurred over the past several years that are likely to continue and significantly impact water use in the Colorado River Basin. These activities were not accounted for in the PBO, although they are reasonably foreseeable as part of the RMPA. Infrastructure development projects, including pipeline and road improvement projects require high amounts of water (up to 29.1 and 9 acre feet of water in 2011, respectively),[17] but the PBO only accounts for water use associated with well production. Because new pipelines and roads are expected to be constructed under the RMPA, *see* EIS, Ch. 4, PDF 74, 84, the PBO must take into account the water depletion of these projects as well.

In sum, because the PBO does not assess the full scope of anticipated fluid mineral development activities on endangered fish in the Upper Colorado Basin, the Service cannot reasonably rely on the PBO to assess the RMPA's impacts on the endangered fish and its critical habitat. Further, because the Service has determined that any water depletion in the Upper Colorado River Basin may adversely affect the endangered fish, PBA, p. 1, the Service must complete formal consultation regarding the RMPA's water depletions.

In the alternative, the Service and BLM must reinitiate formal consultation regarding the RMPA's water depletion impacts on the endangered fish. "Reinitiation of formal consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and…[i]f new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered." 50 CFR § 402.16(b). New information reveals that horizontal drilling, hydraulic fracturing, and other related infrastructure projects in the WRFO planning area will require water depletions "to an extent not previously considered." *Id*.

In a reinitiated consultation, BLM and the Service must reevaluate not just the water depletion effects of fluid mineral development under the RMPA, but it must do so with respect to *all* fluid mineral development projected to occur throughout the entire western Colorado planning area. The PBO's water use projections for these other planning areas neither take into account increased water use due to hydraulic fracturing, horizontal drilling, and infrastructure projects, although these activities are also occurring in these areas and are expected to increase.[18]

Finally, BLM is not complying with the terms of the PBO, because it has failed to report to the Service actual water depletions of vertical and directional non-horizontal wells in the WRFO and other field offices covered by the PBO. *See* pp. 7-8 above; *see also* FWS Concurrence Letter, p. 4 ("All water depletions from the Colorado River Basin involved with

[17] BLM, 2011 Water Depletion Log.
[18] *See* 2011-2014 Water Depletion Logs (water depletion logs showing water use due to horizontal drilling in other field offices); PBA, p. 5 (projecting thousands of new drilling projects throughout Upper Colorado Basin).

fluid mineral extraction from BLM administered lands must be reported to the BLM state office annually so that they can be included in the annual water depletion report submitted to our Ecological Services Office in Grand Junction."). Instead it is reporting the number of vertical and directional wells drilled annually multiplied by a standard depletion factor that does not accurately reflect actual water use. This is despite the PBO's clear intent that actual water use should be monitored. *See* PBO, p. 5 ("The BLM State Office will track all projects that result in water depletions from the upper Colorado River Basin. The BLM will complete and submit a log of all water depleting projects by river sub-basin to the Service by October 31 of each year. *The logs showing depletion amounts resulting from wells drilled will be used to track compliance with the threshold depletion amount.*" [emphasis added].) Reporting of actual water use would ensure that water depletions are not exceeding the annual water depletion threshold. In a reinitiated consultation, the Service should require BLM to collect such data from operators and report actual water depletions (or the RMPA should include these measures), given the inherent uncertainties in predicting future water use.

B. The Service Must Initiate Formal Consultation Regarding the Impacts of Spills on Endangered Fish.

The Service erroneously declined to initiate formal consultation regarding the effects of the RMPA on endangered fish, when it determined that implementation of the RMPA other than water depletion activities "may affect but is not likely to adversely affect" the endangered fish. "Formal" consultation is required when a proposed action is "likely to adversely affect" a species or its critical habitat. *See* 50 C.F.R. §§ 402.13(a), 402.14(b)(1). The Service's determination that RMPA implementation "is not likely to adversely affect" the endangered fish fails to take into account the increased risk of leaks and spills that will occur with increased fluid mineral development. These leaks and spills will pollute nearby streams, rivers, and stream-connected groundwater, exposing endangered fish to toxic pollutants and degrading their habitat.

1. Accidental Spills and Leaks Are Foreseeable and Likely to Increase Under the RMPA.

As earlier comments pointed out, fluid mineral development activities within the Upper Colorado River Basin have resulted in nearly 500 spills in Rio Blanco County between 2000 and 2012, including a 90% increase in spills since 2000. FEIS, Appendix K, PDF 234. An analysis of spills reports within the Basin between January 1, 2008 and July 31, 2014 revealed 12 self-reported spills in the WRFO planning area that resulted in contamination of surface waters or groundwater, or an average of two spills per year.[19] The number could actually be higher, as spills commonly go unreported.[20] Currently, the number of actively producing wells in the

[19] *See* Upper Colorado River Basin Spills (Ex. Q, hereinafter "Spills Data"). This document consists of data reporting spills in the Upper Colorado River Basin that we compiled from the following sources: Colorado: Colorado Oil and Gas Conservation Commission, http://cogcc.state.co.us ("inspection/incident" database for "spill/release"); Utah: Utah Department of Environmental Quality, http://eqspillsps.deq.utah.gov/Search_Public.aspx; New Mexico: State of New Mexico Oil Conservation Division, https://wwwapps.emnrd.state.nm.us/ocd/ocdpermitting//Data/Incidents/Spills.aspx. The analysis does not include data from Wyoming or Arizona.

[20] Souther, Sara, et al. Biotic Impacts of Energy Development from Shale: Research Priorities and

WRFO planning area is a little over 1,800 wells. FEIS, Ch. 3, PDF 118. With the number of producing wells expected to increase over nine-fold over the next 20 years (15,040 new wells, plus the 1,800 existing wells), the risk of spills contaminating surface waters or groundwater could likewise increase proportionally to over 18 spills per year in the WRFO planning area. This risk could be even higher since the WRFO contains no limits on the rate or number of wells drilled. *See* FEIS, Ch. 2, PDF 11, 12.

Some of these spills could result in the release of large quantities of flowback, produced water (or brine water), fracking chemicals, or hydrocarbons. For example:

- In 2010, 1,750 barrels of produced water (over 55,000 gallons) released due to a tear in a pit liner, contaminating Little Creek, which was 1000 feet away from the pit.

- In 2011, 2,028 barrels of brine water (over 63,000 gallons) leaked from an injection line, some of which may have contaminated the White River.

- In 2011, 230 barrels of drill cuttings (over 7,200 gallons) were washed away from a well pad into an ephemeral drainage, none of which was recovered.

All the above incidents occurred within the WRFO planning area.[21] And just within the last six months, at least three incidents occurred within Rio Blanco County that resulted in the release of produced water to "waters of the state" – in two of them, over 100 barrels of produced water leaked, some of which reached erosion channels presumably connected to surface waters.[22] A number of spills in the WRFO planning area and Upper Colorado Basin were of "unknown" quantity and/or substance but could potentially be quite large, given their belated discovery.[23]

The potential for spills to move from tributaries into endangered fish critical habitat within main-stem rivers was shown by a 2014 spill into the Green River. On the night of May 20, 2014 an oil well operated by SW Energy on lands administered by BLM "blew out," leaking estimated 100 barrels per hour of crude oil and production water into Salt Wash which leads to the Green River. SW Energy did not shut-in the well until 1:20 p.m. on May 22, at least 36 hours later. On May 24, flooding from a thunderstorm "overcame prevention measures" washing an

---

Knowledge Gaps, Front Ecol Environ 2014; 12(6): 330-338, p. 332 (noting that companies routinely violated Pennsylvania's spill reporting requirement; only 59% of documented spills were reported by the drilling company) (Ex. R); Gulf Monitoring Consortium Report on Activities from April 2011 to October 20, pp. 3-6, available at http://skytruth.org/gmc/wp-content/uploads/2012/05/Gulf-Monitoring-Consortium-Report.pdf (Ex. S) (uncovering evidence of non-reporting and chronic under-reporting of oil spills in Gulf of Mexico 2012, using analysis of National Response Center reports and comparison with satellite imagery); Samira Daneshgar Asl, John Amos, Paul Woods, Oscar Garcia-Pineda, Ian R. MacDonald, Chronic, Anthropogenic Hydrocarbon Discharges in the Gulf of Mexico, Deep-Sea Research II, available at http://www.sciencedirect.com/science/article/pii/S0967064514003725 (Ex. T) (peer-reviewed study by scientists at Florida State University validating previous report's analysis).

[21] *See* Spills Data (WRFO tab); Spills Data Incident Reports (Ex. U – 2008-2014 WRFO incidents for Berry, Chevron, and Williams Production).

[22] *Id*. (2014-15 surface water incidents).

[23] *Id*. (2014-15 "unknown" incidents); Spills Data (All Upper Basin tab, columns J-L).

unknown quantity of oil and produced water 1.5 miles from Salt Wash into the Green River and critical habitat for endangered fish.[24] The U.S. Fish and Wildlife Service's recent Biological Opinion for the Gasco Energy Inc. Field Development Project anticipates these events and the potential for more frequent spills given expanded drilling:

> There is a greater potential for impacts from pollutants, if a pipeline, well pit, or other source were to inadvertently release contaminated fluids into waterways at points near the Green and White Rivers. Through direct or indirect discharge, these pollutants could reach the Green River and negatively impact water quality to the point of affecting native fish populations. Direct impacts will result from a discharge from a pipeline or well pit reaching the Green River in its original form or within a single release event. Indirect effects occur when discharges are released to the ground and are later released to the river after being carried by an erosion event or carried by rain or snowmelt runoff. As more well and pipeline development occurs in the project area the chance of pollutants reaching the Green River increases, thus increasing the potential of harm to native fish populations.[25]

Like the above Green River incident, some spills or leaks are not detected until long after they have started.[26] Thus, it is quite possible that large volumes of chemical substances escape undetected until reaching surface sediments or waters. The Gasco Biological Opinion explains that this is especially possible with smaller leaks:

> The effects of smaller leaks that may cause chronic, sub-lethal effects to fish populations may be more prevalent. While the oil and gas industry has a wide variety of methods available to detect substantial leaks or integrity breeches, the technology for detection of small "pinhole" leaks is not as advanced. This creates a significant problem in that the current available methodology may allow small

---

[24] Bureau of Land Management. 2014. Update: Salt Wash Oil Spill, available at http://www.blm.gov/ut/st/en/fo/moab/SaltWashSpill.html (Ex. QQ).

[25] Fish and Wildlife Service, Biological Opinion for the Gasco Energy Inc. Field Development Project ("Gasco BO"), Dec. 2011, p. 26, available at http://www.blm.gov/style/medialib/blm/ut/vernal_fo/planning/gasco_eis/gasco_rod.Par.56176.File.dat/Gasco%20ROD%20Attachment%205%20BO.pdf (Ex.V).

[26] *See also* MacPherson, James, "ND wants answers on ruptured pipeline inspections," AP, Oct. 16, 2013, available at http://bigstory.ap.org/article/experts-question-north-dakota-oil-spill-estimates (spill released from quarter-inch pipeline hole contaminated wheat field the size of seven football fields); Vanderklippe, Natha. "Spill sends 22,000 barrels of oil mix into Alberta muskeg," *The Globe and Mail*, May 30, 2012, available at http://www.theglobeandmail.com/globe-investor/spill-sends-22000-barrels-of-oil-mix-into-alberta-muskeg/article4219809/ (22,000-barrel wastewater pipeline spill not detected until after it had reached surface waters and was spotted by aircraft); Vanderklippe, "Toxic waste spill in northern Alberta biggest of recent disasters in North America," *The Globe and Mail*, June 12, 2013, available at http://www.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/apache-pipeline-leaks-60000-barrels-of-salty-water-in-northwest-alberta/article12494371/ (9.5 million liter spill of produced water from pipeline suspected to be "longstanding" given the extent of damage over 42 hectares). (Ex.W.)

leaks to go undetected for extended periods of time often evading detection until they are manifested on the surface sediments or water.[27]

Spills and leaks from oil and gas development routinely occur not just in the WRFO but also throughout the Upper Colorado Basin. Between January 2008 and July 2014, at least 135 spills or leaks resulted in releases to surface or groundwater in the Upper Basin – many of these from facilities under BLM's jurisdiction.[28] With increasing oil and gas development expected to occur throughout the upper Basin, *see* PBA p. 5, it is entirely foreseeable that the risk of spills in this region will only increase. Moreover, a substantial portion of these spills have occurred upstream from the confluence of the Colorado River and the Green River, in the Green River Subbasin, where some of the most conducive habitat for endangered fish conservation and recovery exists, including the only known spawning bar for razorback sucker in the Upper Colorado River Basin.[29] The cumulative effects of this increased risk of spills on endangered fish in the region must also be accounted for in the Service's analysis of the RMPA's effects on the endangered fish.

The Service's determination also fails to take into account the unprecedented sheer volume of chemicals and wastewaters that will be generated by increased hydraulic fracturing in the WRFO. Millions of pounds of fracking chemicals will be transported to the WRFO planning area, injected into the ground, and either reinjected underground or transported offsite for disposal.[30] Currently, over a hundred million gallons of fracking wastewaters are produced annually in the WRFO, *see* EIS, Ch. 3, PDF 118, and that number is likely to increase with increasing rates of hydraulic fracturing.[31]

2. Spills and Leaks under the RMPA Are Likey to Adversely Affect the Endangered Fish.

Fracking chemicals and fracking wastewaters can be highly toxic to fish. Produced waters that fracking operations force to the surface from deep underground can contain high levels of total dissolved solids, salts, metals, and naturally occurring radioactive materials.[32] Flowback waters (i.e., fracturing fluids that return to the surface) may also contain similar

---

[27] Gasco BO, p. 27.
[28] Spills Data (all Upper Basin tab).
[29] Valdez, R.A. and P. Nelson. 2004. Green River Subbasin Floodplain Management Plan. Upper Colorado River Endangered Fish Recovery Program, Project Number C-6, Denver, CO., available at http://www.coloradoriverrecovery.org/documents-publications/technical-reports/hab/GreenFMP.pdf. (Ex. X.)
[30] *See* EPA, "Analysis of Hydraulic Fracturing Fluid Data from the FracFocus Chemical Disclosure Registry 1.0 ," Webinar Presentation, March 2015, p. 14, available at http://www2.epa.gov/sites/production/files/2015-04/documents/fracfocus_public_webinars_508_0.pdf (noting that hundreds or thousands of pounds may be brought to, stored, and mixed on the well pad). (Ex. Y.)
[31] Souther, p. 332 (noting 570% increase in wastewater production since 2004 from development of the Marcellus Shale).
[32] Brittingham, Margaret C., et al. Ecological Risks of Shale Oil and Gas Development to Wildlife, Aquatic Resources and their Habitats. *Environ. Sci. Technol.* 2014, 48, 11034-11047, p. 11039. (Ex. Z.)

constituents along with fracturing fluid additives such as surfactants and hydrocarbons.[33] The identity and effects of many of these additives is unknown, due to operators' claims of confidential business information. Compounds in mixtures can have synergistic or antagonistic effects, but it is impossible to know these effects without full disclosure.[34]

Nonetheless, accidental spills and intentional dumping of fracking fluids and wastewaters can cause large-scale harm to aquatic life. Numerous incidents of fracking wastewater contamination from pipelines, equipment blowouts, and truck accidents have been reported, and have resulted in kills of fish.[35] In 2013, a company admitted to dumping wastewater from fracking operations into the Acorn Fork Creek in Kentucky, causing a massive fish kill.[36] Among the species harmed was the blackside dace, a threatened minnow species.[37] An analysis of water quality of Acorn Creek and fish tissues taken shortly after the incident was exposed showed the fish displayed general signs of stress and had a higher rate of gill lesions than fish in areas not affected by the dumping.[38] The lead author (a scientist at USGS) noted that the "study is a precautionary tale of how entire populations could be put at risk even with small-scale fluid spills," "especially…if the species is threatened or is only found in limited areas, like the Blackside dace is in the Cumberland."[39]

---

[33] *Id*.
[34] Souther, p. 334.
[35] *See, e.g.*, Department of Environmental Protection, Commonwealth of Pennsylvania, Inspection Report, May 27, 2009, www.marcellus-shale.us/pdf/CC-Spill_DEP-Insp-Rpt.pdf (pipeline accidentally discharged an estimated 4,200 gallons of wastewater, as well as sediments and state investigation report concluded, "The creek was impacted by sediments all the way down to the lake and there was evidence of a fish kill as invertebrates and fish were observed lying dead in the creek."); Kathie O. Warco, "Fracking truck runs off road; contents spill", The Observer-Reporter, October 21, 2010, available at http://www.uppermon.org/news/Other/OR-Frac_Truck_Spill-21Oct10.html (tanker truck hauling fracking liquid ran off a road and spilled almost 5,000 gallons of liquid spill, resulting in the contamination of a stream and several dead minnows); Michaels, C., J.L. Simpson, and W. Wegner. 2010. "Fracture Communities, Case studies of the environmental impacts of industrial gas drilling," Riverkeeper, p. 6, available at www.riverkeeper.org/wp-content/uploads/2010/09/Fractured-Communities-FINAL-September-2010.pdf (blowout released nearly 1 million gallons of wastewater into nearby creeks, resulting in uncontrolled discharge of wastewater into a tributary of Little Laurel Run, a high-quality coldwater fishery); Department of Environmental Protection, Commonwealth of Pennsylvania, DEP Fines Talisman Energy USA for Bradford County Drilling Wastewater Spill, Polluting Nearby Water Resource," August 2, 2010, available at http://www.portal.state.pa.us/portal/server.pt/community/newsroom/14287?id=13249&typeid=1 (spill of used natural gas drilling fluids in Bradford County, PA, sent 4,200-6,300 gallons of fluids into a wetland and a tributary of Webier Creek, which drains into a coldwater fishery). (Ex. AA.)
[36] Vaidyanathan, Gayathri, *Fracking Spills Cause Massive Ky. Fish Kill*, E&E News, Aug. 29. 2013 (Ex. BB),
[37] *Id*.
[38] Papoulias, D.M. and A.L. Velasco. Histopathological analysis of fish from Acorn Fork Creek, Kentucky, exposed to hydraulic fracturing fluid releases, 12 Southwestern Naturalist (Special Issue 4):92 (2013), available at http://www.eaglehill.us/SENAonline/articles/SENA-sp-4/18-Papoulias.shtml (Ex. CC).
[39] *See* US Geological Survey, "Hydraulic Fracturing Fluids Likely Harmed Threatened Kentucky Fish Species, Aug. 28, 2013, available at

Wastewaters can have high levels of salinity, which aquatic organisms are sensitive to (including plants and invertebrate species that fish may depend on); thus, accidental releases of produced and flowback waters may have harmful effects on fish and their habitat.[40] Increased levels of total dissolved solids in surface waters are associated with higher rates of fish mortality.[41] Further, produced waters can contain copper, iron, lead, manganese, arsenic, cadmium, nickel, zinc, chromium, selenium, and sodium bicarbonate at levels above thresholds that are harmful to aquatic organisms, including fish.[42] The discharge of fracking wastewater into the Susquehanna River in Pennsylvania is suspected to be the cause of fish abnormalities, including high rates of spots, lesions, and intersex.[43] Fracking fluids may also contain hydrocarbons,[44] which can cause deterioration of body tissues of aquatic organisms and reduced growth.[45] Drilling fluids may also cause impaired immune function in fish.[46] Other contaminant effects may include "changes in heart and respiratory rates; gill hyperplasia; enlarged liver; reduced growth; fin erosion; impaired endocrine system; a variety of biochemical, blood, and cellular changes; and behavioral responses."[47] As Fish and Wildlife Service has previously noted, "[d]isruption of behavioral functions can result in population declines or changes in year-class strength if enough individuals are affected."[48] Thus, chronic and persistent pollution from spills and leaks could result in harm to endangered fish at the population-scale.

3. Measures to Protect the Endangered Fish Are Inadequate.

---

http://www.usgs.gov/newsroom/article.asp?ID=3677#.VTf3oCFVhBd (Ex. DD).

[40] Brittingham, p. 11039; Souther, p. 332 (noting small increases in salinity can harm or kill aquatic plants and invertebrates).

[41] Tuckwiller, Ross, Annotated Bibliography: Potential Impacts of Energy Development on Fisheries in the Rocky Mountain West Prepared for Theodore Roosevelt Conservation Partnership Fish, Wildlife, & Energy Working Group, p. 17 (Ex. EE).

[42] *Id*. pp. 21-22 (extremely elevated chromium concentrations in fish exposed to produced waters), p. 23 (fish showing lesions and kidney damage after exposure to sodium bicarbonate).

[43] Piette, Betsy, BP Oil Spill, Fracking Cause Wildlife Abnormalities, Workers World, April 27, 2012, available at http://www.workers.org/2012/us/bp_oil_spill_fracking_0503/ (Ex. FF); Pennsylvania Fish & Boat Commission, Ongoing Problems with the Susquehanna River smallmouth bass, a Case for Impairment, May 23, 2012, www.fish.state.pa.us/newsreleases/2012press/senate_susq/SMB_ConservationIssuesForum_Lycoming.pdf (Ex. GG).

[44] EPA, State-level Summaries of FracFocus 1.0 Hydraulic Fracturing Data, p. 38 (Colorado fracking chemical disclosures showing high incidence of naphthalene and "solvent naphtha, petroleum, and heavy arom.").

[45] Gasco BO, p. 27; In the Matter of Changes to the Rules and Regulations of the Oil and Gas Conservation Commission of the State of Colorado, Cause No. 1R, Dkt No. 0803-RM-02, Testimony of Colorado Division of Wildlife Staff Regarding Surface Occupancy Restrictions, p. 39 (describing effects of toluene, naphthalene, and crude oil on various fish) (Ex. HH).

[46] Tuckwiller, p. 22.

[47] Gasco BO, p. 27.

[48] *Id*.

BLM's Biological Assessment and the Service's Concurrence discuss a few measures that might avoid the impacts of potential spills and leaks on the endangered fish, but these measures are wholly inadequate.

First, the Biological Assessment misleadingly suggests that measures to protect endangered fish critical habitat are required when they are not. The BA states:

> [T]he absence of automatic shutoff valves for natural gas pipelines that cross the White River's critical habitat has been identified as a potential threat to endangered Colorado River fishes. In response to these concerns, Alternative E *has adopted the following measures* (see Attachment 1 Table 19 Record 18):
>
> • Pipelines would not be constructed in sites considered important for pikeminnow reproduction;
>
> • Pipelines crossing the river's 100-year flood plain or within the lower mile of larger perennial tributaries (e.g., Piceance Creek, Yellow Creek, and Crooked Wash) would be double-walled and equipped with automatic shut-off valves;
>
> • Project proponents would be required to prepare a spill/leak contingency plan as part of BLM's biological assessment.

RMPA Biological Assessment, PDF 69.

However, the EIS notes that only a "spill/leak contingency plan would be analyzed integral with BLM's biological assessment to the FWS," and that the above pipeline measures merely "could be considered" in granting an exception to NSO stipulations that apply to endangered fish critical habitat. *See* FEIS, Appendix A, NSO 27 ("Specific measures that could be considered for granting exceptions include, but would not be limited to the following…1) Pipelines could not be constructed in sites identified by the CPW or FWS as important for Colorado pikeminnow reproduction and recruitment of young. 2) Pipelines transporting potential contaminants would be equipped with automatic shutoff valves"; double-walled pipelines "may be required"). The NSO may also be modified "if the proposed action can be sited, conducted, or conditioned to remain compatible with habitat protection and species recovery objectives" – and without imposing any of the "requirements" as described above. The Service, however, relies on the Biological Assessment's misrepresentation of the NSO stipulation in its concurrence that the RMPA is not likely to adversely affect the endangered fish, rendering the Service's determination fatally flawed.[49]

[49] *See* FWS Concurrence, p. 4 ("A No Surface Occupancy (NSO) stipulation will be applied to designated Colorado pikeminnow critical habitat on Federal estate that addresses specific aquatic habitat issues, including the avoidance of special fishery habitats and management of potential contamination (e.g., installation of emergency shut-off valves and development of spill contingency plans) as a precursor to ESA Section 7 consultation.")

The Service's Concurrence also cites to other measures intended to protect sensitive habitat, but they contain exceptions without specifying any measures as to how leaks and spills will be avoided. These include:

- NSO-55-E, a "no surface occupancy" restriction that applies to the ACEC-designated "White River Riparian" (950 acres) planning area;

- CSU-02, which requires avoidance of surface-disturbance activities in
  1) Mapped 100-year floodplains;
  2) Areas within 500 feet from perennial waters, springs, water wells, and wetland/riparian areas; and
  3) Areas within 100 feet from the inner gorge of ephemeral or intermittent stream channels; and

- CSU-06, which requires avoidance of surface-disturbance activities in riparian and wetland habitats (and potential habitats).

FWS Concurrence, p. 4; FEIS, Appendix A (listing NSO and CSO measures). All of these restrictions are subject to exception if, essentially, the values or functions of the protected area would not be compromised. *See* NSO-55 (exception applies if "values or functions for which the ACEC was established " would not be compromised); CSU-02 (exception for activity that "would not degrade the resource identified"); CSU-06 (exception if "proper functioning condition of the riparian/wetland area" would not be degraded). But the potential for spills and leaks to compromise or degrade local values and functions, or simply harm downstream endangered fish, would exist in any case seeking an exception, and, as already noted, the local impacts of just one spill can be devastating. Rather than deferring consideration of the risks and protective measures until an exception is applied for, the Service and BLM must formally consult over those issues now.

Finally, the Biological Assessment cites to conditions of approval that would purportedly protect the endangered fish from contaminants, which the Service's Concurrence appears to rely on. *Compare* RMPA Biological Assessment, PDF 72 (specifying conditions of approval that "effectively contend with insults to aquatic systems" and "require riparian avoidance") *with* FWS Concurrence, p. 4 (referring generally to "Conditions of Approval (COAs)" that do same). These measures, however, either do not relate to the avoidance of spills or leaks, or they appear to be incorrect references. The BA cites to its own Attachment 1, Table 19, Records 17 and 22 as COAs "that effectively contend with insults to aquatic systems," but Table 19 relates to cultural resources. *See* BA, PDF 147. Table 9 was most likely the intended reference, which pertains to water resources. However, the cited COAs simply restrict development on steep slopes (Record 17) and require "[u]se of evaporation facilities for the disposal of produced water [to] be evaluated on a case-by-case basis," but without any standards for evaluation (Record 22). Neither of these specifically address mitigating the risk of spills and leaks. The BA also cites to "Attachment 1 Table 13 Record 20," which purportedly requires "riparian avoidance," but this provision relates to sage grouse forbs. Further, as already discussed above, CSO-06 which does relate to riparian avoidance, is not sufficiently protective, as it allows exceptions without any protective standards for spill avoidance or mitigation.

II. The RMPA Fails to Incorporate Adequate Regulatory Measures to Prevent the Extirpation of Greater Sage-Grouse.

In March 2010 the U.S. Fish and Wildlife Service (FWS) found that the greater sage grouse (*Centrocercus urophasianus*) is warranted but precluded for listing under the Endangered Species Act (ESA) of 1973, as amended, 16 U.S.C. § 1531–1544.[50] In July 2011, FWS signed landmark agreements settling litigation brought by the Center and WildEarth Guardians over FWS's long-standing failure to make ESA determinations in response to listing petitions for hundreds of species, including the sage grouse. Under these agreements, FWS is required to determine by September 30, 2015, whether the listing remains warranted.[51]

The science is unequivocal that loss of habitat, including from livestock grazing and energy development, and inadequacy of regulatory mechanisms, including land management of federal public lands, are primary factors contributing to the risk of extinction for greater sage grouse.[52] FWS's 2010 warranted but precluded finding identified U.S. Bureau of Land Management (BLM) resource management plans and U.S. Forest Service (USFS) land and resource management plans as the principal mechanism by which these agencies could adequately regulate land management to conserve sage grouse, but determined that current plans lacked adequate measures and/or are inconsistently applied to conserve the species. FWS found that

> the BLM has the regulatory authority to address [threats to greater sage grouse] in a manner that will provide protection for sage grouse. However, BLM's current application of those authorities in some areas falls short of meeting the

[50] 12-Month Findings for Petitions to List the Greater Sage-Grouse (*Centrocercus urophasianus*) as Threatened or Endangered, 75 Fed. Reg. 13,910 (proposed Mar. 23, 2010) ("12-Month Findings"); *see also Western Watersheds Project v. United States Forest Serv.*, 535 F. Supp. 2d 1173 (D. Id. 2007) (holding prior USFWS "not warranted" finding for greater sage-grouse arbitrary and capricious). The 2010 findings found that listing of greater sage grouse is warranted both rangewide and with respect to the bi-state distinct population segment ("DPS"), which occurs only in the Mono Basin area of Mono County, California, and Lyon County, Nevada. 12-Month Findings, 75 Fed. Reg. 13,988, 14,007. All references cited in this section (except case law) can be found in Exhibit RR.

[51] 12-Month Findings for Petitions to List the Greater Sage-Grouse (*Centrocercus urophasianus*) as Threatened or Endangered, 75 Fed. Reg. 13,910 (proposed Mar. 23, 2010) ("12-Month Findings"); *see also Western Watersheds Project v. United States Forest Serv.*, 535 F. Supp. 2d 1173 (D. Id. 2007) (holding prior USFWS "not warranted" finding for greater sage-grouse arbitrary and capricious). The 2010 findings found that listing of greater sage grouse is warranted both rangewide and with respect to the bi-state distinct population segment ("DPS"), which occurs only in the Mono Basin area of Mono County, California, and Lyon County, Nevada. 12-Month Findings, 75 Fed. Reg. 13,988, 14,007.

[52] *See* 12-Month Findings, 75 Fed. Reg. at 13,962 ("habitat conversion for agriculture, urbanization, infrastructure (e.g. roads, powerlines, fences); fire, invasive plants, pinyon-juniper woodland encroachment, grazing, energy development, and climate change are all contributing, individually and collectively, to the present and threatened destruction, modification, and curtailment of the habitat and range of the greater sage-grouse."); *id.* at 13,982 ("Based on our review of the best scientific and commercial information available, we conclude that existing regulatory mechanisms are inadequate to protect the species. The absence of adequate regulatory mechanisms is a significant threat to the species, now and in the foreseeable future.").

> conservation needs of the species. This is particularly evident in the regulation of oil, gas, and other energy development activities.[53]

Consistent with the National Greater Sage-grouse Planning Strategy[54] and associated instruction memoranda[55] to avoid risk of sage grouse extinction, the land management agencies should amend the plans with a combination of land allocations and management prescriptions, including new terms and conditions, on activities permitted in sage grouse habitat.

Although the White River RMP may ultimately be amended further by ongoing BLM range-wide sage-grouse habitat planning, FEIS at 1-8, the proposed alternative makes significant decisions regarding oil and gas development within priority and general greater sage-grouse habitat. *See* FEIS at 2-31. Unfortunately, by the BLM's own acknowledgment, none of the alternatives it considered are likely to prevent the extirpation, due to habitat loss, of the Parachute-Piceance-Roan ("PPR") population of greater sage-grouse.[56]

Strategies for avoiding such extirpation can be found in the U.S. Department of the Interior (DOI) and U.S. Department of Agriculture's (USDA) expert recommendations made in the National Technical Team (NTT) report of 2011, whose charter was "to ensure that BLM management actions are effective and based on the best available science" for conserving and restoring greater sage grouse populations and habitat. The National Technical Team was comprised of 23 federal and state agency biologists and land managers—including 16 DOI and two USDA experts—and drew from the extensive scientific literature on sage grouse to produce "A Report on National Greater Sage-grouse Conservation Measures."[57] The NTT report recommends concrete management actions based on review of published scientific literature. Specifically for oil and gas development, the NTT report and available science call on land management agencies to:

- Restrict development to one site per section in priority habitat.[58]

---

[53] 12-Month Findings, 75 Fed. Reg. at 13,979.

[54] Bureau of Land Management, National Sage-Grouse Planning Strategy (Aug. 22, 2011), *available at* http://www.blm.gov/style/medialib/blm/wo/Communications_Directorate/public_affairs/sage-grouse_planning/documents.Par.2415.File.dat/Final%20Signed%20GSG%20Planning%20Strategy%20Charter.pdf.

[55] Bureau of Land Management, Greater Sage-Grouse Interim Management Policies and Procedures, Instruction Memorandum No. 2012-043 (Dec. 22, 2011); Sage-Grouse National Technical Team, A Report on Greater Sage-Grouse Conservation Measures ("NTT report") (Dec. 21, 2011), *available at http://www.blm.gov/style/medialib/blm/wo/Information_Resources_Management/policy/im_attachments/2012.Par.52415.File.dat/IM%202012-044%20Att%201.pdf.*

[56] FEIS at 4-229 ("It appears likely that conventional development practices applied to PPR sage-grouse habitats, regardless of alternative well development intensities, would result in the extirpation of the PPR population within the life of the plan.")

[57] Sage-Grouse National Technical Team, A Report on Greater Sage-Grouse Conservation Measures ("NTT report") (Dec. 21, 2011), *available at http://www.blm.gov/style/medialib/blm/wo/Information_Resources_Management/policy/im_attachments/2012.Par.52415.File.dat/IM%202012-044%20Att%201.pdf.*

[58] *See* NTT report at 21, 24; Matthew Holloran & Stanley Anderson, *Spatial Distribution of Greater*

- Limit surface disturbance to less than 3 percent per section in priority habitat.[59]
- Allow no new mineral leasing within priority habitat.[60]
- Require conditions of approval for existing fluid minerals leases as outlined in the NTT report, including four-mile no-surface-occupancy lek buffers.[61] Larger buffers may be required to conserve the species.[62]

Participants in the planning process, including Rocky Mountain Wild (formerly Center for Native Ecosystems), brought the NTT recommendations to the attention of the White River Field Office throughout the planning process.[63] The White River Field Office, however, rejected the NTT findings and recommendations, electing instead to employ a demonstrably ineffective buffer of only 660 feet, that will cause "at least 70 to 80 percent of all available habitat (within 660 to 990 feet of infrastructure) would be heavily influenced by development activity." FEIS 4-269. Instead of employing the NTT recommendations of no new leasing and a four-mile buffer around leks for existing leases, BLM elects an admittedly "unproven," FEIS 4-270 strategy of allowing "adverse influences" on a full 10 percent of suitable sage-grouse habitat within mapped Priority Habitat, FEIS 4-270. The BLM claims that it did not consider the NTT standard because:

> The DEIS did not consider managing lands within 4 miles of a sage-grouse lek and we did not add it to the FEIS because it would have been a substantial change from the DEIS and because decisions on how to manage sage-grouse will ultimately be made in the Northwest Colorado Greater Sage-Grouse EIS (Section 1.3.3), which does consider the use of NSO stipulations within 4 miles of a lek.[64]

The fact that management of sage-grouse habitat within the WRFO may ultimately be further amended by the range-wide grouse planning decision does not provide a reasonable justification to eliminate from consideration in this plan revision measures that could prevent the species'

Sage-grouse Nests in Relatively Contiguous Sagebrush Habitats, 107 CONDOR 742–52 (2005); Kevin Doherty et al., *Greater Sage-Grouse Nesting Habitat: The Importance of Managing at Multiple Scales*, 74 J. WILDLIFE MGMT. 1544–53 (2010).

[59] *See* NTT report at 7–8; Steven T. Knick et al., *Modeling Ecological Minimum Requirements for Distribution of Greater Sage-grouse Leks: Implications for Population Connectivity Across Their Western Range*, U.S.A. Ecology & Evolution 9 (2013).

[60] *See* NTT report at 22, 24–26.

[61] *See* NTT report at 22–24.

[62] A four-mile lek buffer may include an average of 80 percent of nesting females, *see* NTT report at 21; larger buffers may be recommended to conserve the species. *See* Daniel Manier et al., Conservation Buffer Estimates for Greater Sage-Grouse—A Review, United States Geological Survey Open-File Report 2014-1239 (2014).

[63] *See* Attachment A: Wilderness Society, et al. Comments on the White River Draft Resource Management Plan Amendment and EIS for Oil and Gas Development ("DEIS Comment"), 10-11 (Jan. 28, 2013); Letter from Center for Native Ecosystems to Kent Walter, WRFO 2 (March 9, 2007) (nominating four-mile area around greater sage-grouse leks for Area of Critical Environmental Concern designation).

[64] FEIS K-25.

local extirpation that the BLM concedes as inevitable under all the alternatives it considered in detail. Even if subsequent decisions may change grouse management practices, in the interim, under the proposed White River amendment, BLM will likely continue to approve drilling locations on existing leases wholly inconsistent with the recommendations of the NTT and its obligations under FLPMA, the ESA, and its sensitive species policy to avoid actions impairing the viability of species warranted for listing under the ESA.

III. The RMPA EIS Is Deficient under NEPA.

A. The EIS's discussion of the RMPA's impacts on water depletion and indirect effects on water-dependent species is deficient.

As already alluded to above, the EIS fails to properly disclose the amount of freshwater that will be needed for new natural gas development, and as a result, fails to fully disclose the RMPA's impacts on endangered fish and other freshwater-dependent species. *See* section I.A above. The EIS does not clearly state the amount of water that will be required for new natural gas development and underestimates the amount needed, failing to take into account the higher water use required by horizontal drilling and hydraulic fracturing. These issues were previously raised in public comment. *See* FEIS, Appendix K, PDF 20, 92, 95, 232. The EIS further fails to analyze site-specific impacts in which significant water depletion will be required; misleads the public as to the significance of the RMPA's overall water use consumption; and fails to descibe adequate mitigation for these impacts.

The EIS suggests that 2.62 acre feet of water will be needed for each well (with depletions to decrease over time), but then elsewhere suggests that horizontal wells will deplete significantly greater amounts of water and that average water depletion may be higher than 2.62 acre-feet per well. *Compare* FEIS, Ch. 4, PDF 134, 160 (citing 2.62 figure with expectation of declining use due to recycling) with *id*. PDF 134 (suggesting horizontal drilling may cause excess depletions), PDF 318 ("surface water depletions of approximately 2.62 acre-feet per well *or greater* would be expected" [emphasis added]). The EIS must provide a clear estimate of how much water will be required for each well and the total water use expected under the RMPA. To the extent that 2.62 acre feet of water per well represents the RMPA's water use, this figure is a severe underestimate. As already discussed in section I.A it fails to account for the full scope of water use expected under the RMPA, including the water required by hydraulic fracturing, horizontal drilling, and infrastructure projects, which all require significant amounts of water.

The EIS also fails to acknowledge local, site-specific impacts that could occur near horizontal and directional drilling sites and other areas where significant drilling could occur. Such an analysis is especially important because horizontal drilling operations could be required near sensitive areas that support numerous species dependent on water resources. Because horizontal drilling may be the only way to reach NSO areas that contain riparian and wetland areas (because no surface drilling is allowed on these lands), water withdrawals close to these areas are likely to adversely affect sensitive species that rely on aquatic and riparian habitat. *See* FEIS, Ch. 4, PDF 105 (noting "concentration of development and exploration activities along the border of [NSO] areas using directional and horizontal drilling techniques"). But the EIS fails to

assess the impacts of high rates of water depletion near these sensitive areas, or even acknowledge the potentially significant impacts. *See* FEIS, Appendix K, PDF 20 ("Indirect impacts to other resources such as wildlife from this water use may be speculative and difficult to predict.")

In addition, the EIS's attempt to minimize the RMPA's overall water consumption by comparing it to total water use, including irrigation withdrawals, in the Yampa and White River Basins is a red herring. *See* FEIS Ch. 4, PDF 134; *id.*, Appendix K, PDF 20. This reasoning ignores significant localized impacts of water depletion in sensitive areas and sub-watersheds within these Basins. It further ignores the plain fact that water depletion by oil and gas development results in a permanent loss of the Colorado River Basin's water; freshwater used for fracking will be irreversibly contaminated and permanently disposed of underground.[65] In contrast, "[r]oughly 90–95% of water used indoors returns to a wastewater treatment plant and is ultimately released to streams."[66] The USGS estimates that 45% of irrigation water returns to surface waters.[67] This permanent loss of water to natural systems in the Colorado River Basin is entirely ignored in the EIS.

Finally, the EIS fails to describe effective mitigation to reduce the impacts of increased water use under the RMPA. The supposed requirement for operators to develop water management plans for site-specific areas is a sham. *See* FEIS, Ch. 4. PDF 169; *id.* Appendix K PDF 107 (EPA comment). Not only does such deferred planning and analysis sweep under the rug the RMPA's cumulative impacts on water resources, such planning is unlikely to ever occur. While the EIS purports to impose water use planning for multi-well developments, the requirement is entirely illusory. A water management plan is only required when an operator submits a "development plan," *see* FEIS, Ch. 2, Table 2-2, Record Number 19, but Alternative E includes no corresponding requirement for submitting a development plan. The submission of development plans is only "encourage[d]." *See id.* Table 2-17, Record Number 12 ("Encourage industry to submit development plans that would direct time referenced, managed activities intended to concentrate development, promote effective reclamation, and to reduce the cumulative adverse resource effects attributable to oil and gas activities.") The EIS thus misleadingly represents that water management plans will effectively mitigate or avoid cumulative water depletion impacts in site-specific areas.

B. The EIS Fails to Disclose the Risk of Increased Spills and Leaks from Oil and Gas Development on Water Resources and Sensitive Species.

The EIS provides only a cursory discussion of the potential impacts of leaks and spills on soil, water resources (including surface waters and groundwater), and aquatic species. *See* FEIS, Ch. 4, PDF 131-133, 164-165, 171;*id.*, Appendix K, PDF 108, 115, 151, 232, 234 (public comments). It provides no sense of the magnitude of release that could occur and the potentially

[65] *See* Western Resources Advocates, Fracking Our Future, July 2012, pp. 14-15 available at http://www.westernresourceadvocates.org/frackwater/fracking_our_future_july_2012.pdf (Ex. II).
[66] *Id*. at 15.
[67] *See* U.S. Geological Survey, Estimated Withdrawals and Use of Water in Colorado, 2005 (2010), p. 47, available at http://pubs.usgs.gov/sir/2010/5002/pdf/SIR10-5002.pdf (Ex. JJ).

devastating harms to water quality and aquatic species that might result from a significant release. *See* pp. 13-15 above.

In response to comments, the EIS minimizes the risk of harm to water resources and aquatic species, dismissing the potential for spills and leaks to reach surface waters, based on the past history of spills in Rio Blanco County. FEIS, Appendix K, PDF 235. But, again, this reasoning fails to consider the enormous quantities of chemicals that will be transported into the region for fracking purposes; the massive amount of wastewaters produced by fracking; and the unprecedented level of oil and gas development that will occur under the RMPA. As discussed earlier, recent data show that spills reaching surface waters have occurred on a fairly regular basis in the Upper Colorado River Basin. Indeed, the EIS notes several spills of produced water, but it fails to acknowledge the potentially harmful effects of produced-water spills, suggesting that only spills of hydrocarbons are of concern. *Id*.; *cf.* pp. 14-15 above (discussing effects of produced water on fish and aquatic habitat). It further minimizes the potential harm resulting from accidental spills and leaks, claiming that "[r]apid and effective containment and cleanup are typical responses to spills in the WRFO." But again, spills and leaks may potentially go undetected for a long time until they become visible on land or surface waters, and after severe damage has already occurred.

The EIS also fails to discuss the effectiveness of mitigation measures to reduce the impacts of spills. This includes groundwater monitoring measures (especially where funding for such monitoring appears to be limited, FEIS, Appendix K, PDF 111, 115 ["Monitoring is expected to continue in the same directions as funds allow."), pipelines (instead of truck transport), clean-up measures, and spill prevention plans. *See* FEIS, Ch. 4 PDF 131-33, 164-165, 171. Further, while it suggests that pipelines are a (voluntary) mitigation measure that is a safer alternative to truck transport and that operators will increasingly use in the WRFO planning area, pipelines have been prone to massive leaks and spills that may not be detected until severe contamination and damage has already occurred. *See* footnote 26 above.

The National Park Service recommended several mitigation measures to reduce the impacts of spills and leaks from pipelines, but the EIS fails to discuss their effectiveness. These measures include a "no surface occupation of sites in critical habitat for the endangered species, including the 100-year floodplain that is part of designated critical habitat *without exceptions*," and "emergency shut-off-valves for pipelines, including temporary lines from each well, or some other suitable preventative method to prevent contamination of water bodies, *regardless of how far the site is from permanent water*." FEIS, Appendix K, PDF 232 (emphases added). The EIS includes the NSO measure in Alternative B, and one with exceptions in Alternative E. *See* Appendix A, NSO 26 & 27. However, it fails to explain whether either of these measures would be feasible or effective or provide any comparison of the two measures. Likewise, the EIS adds to Alternative E "consideration" of an emergency valve requirement for pipelines crossing critical habitat, but fails to include or discuss the Park Service's recommendation that *all* pipelines, "including temporary lines" be equipped with emergency shut-off valves "regardless of how far the site is from permanent water," or at least for sites within a certain distance of surface waters. Emergency shut-off valves are feasible and have been required in large-scale projects. For example, the Gasco Uinta Basin Natural Gas Development project adopted the following condition of approval to protect endangered fish and water resources:

> Natural gas-condensate pipelines that cross perennial, intermittent, and ephemeral stream channels or…100-year floodplain, mapped riparian or wetland areas, or perennial, intermittent, or ephemeral stream channels will be routinely pigged and will have emergency/automatic shutoff valves located directly beyond the area at risk of flooding to reduce the magnitude of contamination in the event of an accidental pipeline break.[68]

The EIS must discuss the effectiveness of these proposed mitigation measures to fulfill its "action-forcing" function under NEPA.

C. The EIS Must Analyze the RMPA's Indirect Impacts, Including the Effet of Increased Carbon Dioxide and Methane Emissions on Climate.

The EIS fails to provide any analysis of the consequences of carbon emissions that would result from the RMPA's implementation. NEPA requires agencies to analyze the effects of its actions on global climate change, *see Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin*., 538 F.3d 1172, 1217 (9th Cir. 2008), including "ecological,… economic, [and] social" impacts, "whether direct, indirect, or cumulative." 40 C.F.R. § 1508.8(b).

Public comment on the DEIS raised the EIS's failure to consider the environmental, social and economic effects carbon emissions that would result from more oil and gas development under the RMPA, while the BLM explicitly considers the economic benefits of the production and sale of oil and gas. *See* FEIS, Appendix K, PDF 459 ("Our atmosphere cannot safely absorb any more carbon dioxide, and this liability to human welfare and survival must be incorporated into BLM's assessment of the net economic value of the oil and gas to be extracted, which would likely become a number less than zero."). The FEIS's response to the comment is entirely non-responsive, simply indicating BLM's "commitment to work on curbing global warming as well as a mission for multiple use on our public lands." *Id*. This failure to respond violates 40 C.F.R. § 1502.9(b), which requires the FEIS to "discuss at appropriate points in the final statement any responsible opposing view which was not adequately discussed in the draft statement and shall indicate the agency's response to the issues raised." If comments "do not warrant further agency response," the FEIS must "explain why…, citing the sources, authorities, or reasons which support the agency's position and, if appropriate, indicate those circumstances which would trigger agency reappraisal or further response." 40 C.F.R. § 1503.4(a)(5). The FEIS fails to provide any rationale as to why it need not account for the social cost of carbon in the EIS.

Although cost-benefit analysis is not necessarily the ideal or exclusive method for assessing contributions to an adverse effect as enormous, uncertain, and potentially catastrophic as climate change, BLM does have tools available to provide one approximation of external costs, and is required to at least provide a reasonable justification should it elect to not use those

---

[68] Record of Decision for the Gasco Energy Inc. Uinta Basin Natural Gas Development Project, Attachment 2, pp. 2-13, 2-18, available at http://www.blm.gov/style/medialib/blm/ut/vernal_fo/planning/gasco_eis/gasco_rod.Par.20707.File.dat/Gasco%20ROD%20Attachment%202%20COA%202012.pdf (Ex. KK).

tools. The EIS states that "BLM does not have an established mechanism to accurately predict the effect of resource management-level decisions from the planning effort on global climate change," FEIS, Ch. 4, PDF 27, but this excuse lacks merit. Perfect accuracy is not required: "[r]easonable forecasting and speculation is implicit in NEPA." *Scientists' Inst. For Pub. Info, Inc. v. Atomic Energy Comm'n*, 481 F.2d 1079, 1092 (D.C. Cir. 1973). Further, BLM has previously perfomed such analyses in prior environmental reviews.[69] Its own internal memo identifies one available analytical tool: "For federal agencies the authoritative estimates of [social cost of carbon] are provided by the 2013 technical report of the Interagency Working Group on Social Cost of Carbon, which was convened by the Council of Economic Advisers and the Office of Management and Budget."[70] As explained in that report:

> The purpose of the "social cost of carbon" (SCC) estimates presented here is to allow agencies to incorporate the social benefits of reducing carbon dioxide (CO2) emissions into cost-benefit analyses of regulatory actions that impact cumulative global emissions. The SCC is an estimate of the monetized damages associated with an incremental increase in carbon emissions in a given year. It is intended to include (but is not limited to) changes in net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services due to climate change.[71]

Thus, there is no reason that BLM cannot include an analysis of the RMPA's social costs of carbon.

Without analyzing these costs, BLM's analysis of the RMPA's economic benefits is improperly skewed. *See* FEIS, Ch. 4, PDF 604 (estimating "Energy-Associated Revenue Projections" for Alternative E, including natural gas jobs, production value, state severance tax

---

[69] *See High Country Conserv'n Advocates v. United States Forest Serv.*, 2014 U.S. Dist. Lexis 87820 (D. Colo. 2014) (invalidating environmental assessment ["EA"] for improperly omitting social cost of carbon analysis, where BLM had included it in preliminary analysis); *Greenwire*, "BLM crafting guidance on social cost of carbon -- internal memo," April 15, 2015, available at http://www.eenews.net/greenwire/stories/1060016810/ (Ex. LL); BLM Internal Memo from Assistant Director of Resources and Planning Ed Roberson (Roberson Internal Memo), April 2015, available at http://www.eenews.net/assets/2015/04/15/document_gw_01.pdf (Ex. MM) (noting "some BLM field offices have included estimates of the [social cost of carbon] in project-level NEPA documents"); *see also* Council on Environmental Quality, Revised Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts, p. 18, available at www.whitehouse.gov/administration/eop/ceq/initiatives/nepa/ghg-guidance (quantitative analysis required if GHGs > 25k tons/yr (Ex. NN).

[70] BLM, Roberson Internal Memo.

[71] *See* Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis - Under Executive Order 12866, Interagency Working Group on Social Cost of Carbon, United States Government, May 2013, available at https://www.whitehouse.gov/sites/default/files/omb/inforeg/social_cost_of_carbon_for_ria_2013_update.pdf (Ex. OO); *see also* Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866, Interagency Working Group on Social Cost of Carbon, United States Government, Feb. 2010, available at http://www.epa.gov/otaq/climate/regulations/scc-tsd.pdf (Ex. PP).

and other state revenues, and county property tax revenues); *id*., PDF 560-65 (noting metrics for RMPA's economic and social benefits, which do not include social cost of carbon); FEIS, Appendix G, PDF 57-62 (describing expected severance tax, royalty, and property tax revenues). "[B]y deciding not to quantify the costs at all, the agenc[y] effectively zeroed out the cost in its quantitative analysis" of the RMPA's economic impacts. *See High Country*, 201 U.S. Dist. LEXIS 87820, at *36 (citing *Ctr. for Biological Diversity*, 538 F.3d at 1200 [$0/ton to greenhouse emissions arbitrary and capricious, where evidence did not support such estimate], *Border Power Plant Working Grp. v. U.S. Dep't of Energy*, 260 F. Supp. 2d 997, 1028-29 (S.D. Cal. 2003) [same]).

By omitting this analysis, significant carbon emission costs are ignored. Alternaitve E will result in 4,195,058 metric tons of CO2e emissions per year. FEIS, Ch. 4, PDF 38. Applying the 2013 SCC estimates to the RMPA's CO2e emissions, by 2035, the RMPA's annual social cost of carbon would be $83.9 to $784.5 million, in 2011 dollars. The total SCC over the lifetime of the RMPA would be an order of magnitude higher. The EIS must be revised to provide a full accounting of the RMPA's climate change impacts, when analytical tools are available to assess these impacts.

D. The EIS Fails to Consider a Reasonable Range of Alternatives

The EIS fails to consider a reasonable range of alternatives. By improperly narrowing the EIS's statement of purpose and need to accommodate increased drilling within the WRFO planning area, BLM unreasonably restricted the range of alternatives for consideration. In addition, BLM improperly rejected consideration of alternatives that restricted development in certain areas, even though they would still be consistent with BLM's planning objective to "manage the projected increase in oil and gas activity."

The EIS states that: "The purpose of this Amendment to the 1997 White River RMP is to provide effective management direction for public lands administered by the WRFO based on an analysis of oil and gas exploration and development in excess of levels evaluated in the 1997 White River RMP." FEIS Ch. 1, PDF 7. This purpose arises from the following need:

> The BLM has determined that the level of oil and gas activities and the primary area of development evaluated in the 1997 White River RMP has changed considerably. The BLM has determined it needs to update the 1997 White River RMP *to reflect a greater Reasonable Foreseeable Development (RFD) Scenario developed in 2007, and changes to where the primary oil and gas development activity would occur*. This would include establishing appropriate goals, objectives, management actions, priorities, and procedures *to manage the projected increase in oil and gas activity* in relation to other resources within the WRFO Planning Area and to address the potential environmental and socioeconomic impacts of the predicted oil and gas development.

Id. The underlying assumption driving the RMP amendment, then, is that oil and gas development *will* increase in the RMP, in excess of levels projected in 1997. This sole focus on the "need" to accommodate more oil and gas development to the exclusion of observing BLM's

multiple use mandate under FLPMA is improper. BLM must develop and revise land use plans so as to "observe the principle[ ] of multiple use." 43 U.S.C. § 1712(c)(1). "Multiple use" means "a combination of balanced and diverse resource uses that takes into account the long-term needs of future generations for renewable and nonrenewable resources, including, but not limited to, recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific and historical values." *Id*. § 1702(c). "It is past doubt that the principle of multiple use does not require BLM to prioritize development over other uses." *New Mexico ex rel. Richardson v. BLM*, 565 F. 3d 683, 710 (10th Cir. 2009).

This exclusive focus on managing an expected increase in oil and gas development foreclosed consideration of any alternatives that limited development below the current management direction, although such an alternative would have fit within BLM's mandate to "take any action necessary to prevent unnecessary or undue degradation of the lands." 43 U.S.C. § 1732(b). This included an alternative that would have restricted development to 5,000 wells to match the pace of existing development rates and defer further leasing above that level, so as to limit the overall footprint of development and impact on wildlife and wilderness-quality lands.[72]

That a large portion of the planning area is already leased for oil and gas does not prevent BLM from taking reasonable measures under the Mineral Leasing Act, FLPMA, the ESA, and the terms of those leases to protect the non-mineral resources with whose management it is charged:

> The Secretary has general statutory authority to condition post-lease approvals in accordance with section 17(g) of the Mineral Leasing Act of 1920, as amended by section 5102(g) of the Federal Onshore Oil and Gas Leasing Reform Act of 1987 (FOOGLRA), 30 U.S.C. § 226(g) (2000) (determine actions required "in the interest of conservation of the surface resources"), section 302(a) of the Federal Land Policy and Management Act of 1976 (FLPMA), 43 U.S.C. § 1732(a) (2000) (manage the public lands under principles of multiple use and sustained yield, in accordance with land use plans), and section 301(b) of FLPMA, 43 U.S.C. § 1732(b) (2000) ("take any action necessary to prevent unnecessary and undue degradation of the lands").[73]

BLM regulations governing the surface use of BLM lands subject to a mineral lease provide that the lessee may use the leased lands "subject to: Stipulations attached to the lease; restrictions deriving from specific, nondiscretionary statutes; and such reasonable measures as may be required by the authorized officer to minimize adverse impacts to other resource values, land uses or users not addressed in the lease stipulations at the time operations are proposed."[74] In addition to the species-specific stipulations proposed in the plan's Appendix A for future leases, existing leases of land that may contain potentially threatened, endangered, or other special status species, leases generally provide that:

---

[72] Attachment A, Wilderness Society, et al. The Wilderness Society, et al., DEIS Comment, p. 5.
[73] *Yates Petroleum Corporation*, 176 IBLA 144, 155 (2008).
[74] 43 C.F.R. § 3101.1-2

> Surface occupancy or use is subject to the following special operating constraints: The lease area may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or other special status species. The BLM may recommend modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activity that will contribute to a need to list such a species or their habitat. The BLM may require modifications to or disapprove proposed activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species or result in the destruction or adverse modification of a designated or proposed critical habitat. The BLM will not approve any ground-disturbing activity that may affect any such species or requirements of the Endangered Species Act as amended, 16 U.S.C. § et seq., including completion of any required procedure for conference or consultation.

In addition to the explicit reservation of authority under this general special status species stipulation, 43 C.F.R. § 3101.1-2 acknowledges BLM's retained rights under the MLA, FOOGLRA, and FLPMA to impose "reasonable measures as may be required . . . to minimize adverse impacts to other resource values." In the *Yates Petroleum* case, the IBLA affirmed that these "reasonable measures" extend to species conservation measures such as establishing a three-mile buffer zone around sage-grouse leks.[75] Similarly, just to the north of the WRFO, the Colorado BLM's Little Snake Field office recently adopted a Resource Management Plan that imposes significant limitations on the density, siting, timing, and distribution of oil and gas development activities, for both new and existing mineral leases.[76] BLM thus has ample statutory and regulatory authority to impose reasonable conditions on lessee's use of existing mineral leases, and improperly narrowed its purpose and need to consider only small variations on unfettered oil and gas development within the resource area.

Even if BLM properly limited its purpose and need statement, BLM also unreasonably ruled out alternatives that limit oil and gas development in specific areas, even if they would have met the "need" for allowing and managing an overall expected increase in development. As the EIS notes:

> Consistent with the purpose of this action, issues addressed in this RMPA/EIS are those that deal specifically with *an increase in oil and gas exploration*, development and production, and the *potential effects of that increase* on other resource uses and values within the WRFO Planning Area. Resource outcomes and management actions were evaluated for all resources in the context of an increase in oil and gas development. Other topics that could be relevant to other planning issues within the WRFO Planning Area are not addressed in this RMPA/EIS.

[75] 176 IBLA at 157-58.
[76] Bureau of Land Management Colorado, Little Snake Field Office, Little Snake Record of Decision and Approved Resource Management Plan RMP-18 to RMP-21 (2011) (Ex. SS).

FEIS, Ch. 1, PDF 16 (emphasis added). For example, at the outset, in section 1.4.4 of the EIS ("Issues that were Considered but Not Further Analyzed"), BLM summarily rejected analysis of the following issues:

- Revisions to decisions on the acreage of lands available for oil and gas leasing.
- Designation of new Wilderness or Wilderness Study Area (WSA) designations.
- Designation of new Areas of Critical Environmental Concern (ACECs) or other special designations.

…

- Considering alternative energy sources (wind and solar energy) as substitutes for activities related to mineral development.

Id. at PDF 17. Ironically, however, proposals that fell within the above categories were presented to "deal specifically with an increase in oil and gas exploration, development…and the potential effects of that increase on other resource uses and values within the WRFO Planning Area." *Id*. at PDF 16. Specifically, they were presented as either mitigation to counter the effects of increased development or alternatives that might better balance competing uses in the WRFO planning area. This included proposals for a newly proposed "backcountry conservation area" designation, designation of new ACECs, and a "closed to lease" restriction on certain lands. *See, e.g.*, FEIS, Appendix K, PDF 26, 39, 258.[77]

Alternatives introducing new protections in sensitive areas are reasonable and would have been "significantly distinguishable from those [alternatives] already analyzed." *See New Mexico*, 565 F. 3d at 711 (finding closure of area from all fluid development to be reasonable option that BLM arbitrarily excluded from consideration). Moreover, none of these proposals would necessarily *reduce* overall development; increased development compared to existing levels could still be compatible with each. *See, e.g.*, Attachment A, The Wilderness Society, et al. DEIS Comment, p. 6 ("BLM needs to designate large areas for protection, using administrative tools such as areas of critical environmental concern and recreation management areas, to balance the increase in drilling.") BLM thus arbitrarily rejected alternatives that would provide special protections to certain sensitive areas on the basis that they would not fulfill BLM's purpose and need, when in fact those alternatives could fulfill that purpose.

IV. The RMPA Violates FLPMA.

A. BLM's Deferral of ACEC Designations Is Unlawful.

BLM's refusal to consider ACEC designations in the context of the RMPA planning process is contrary to FLPMA's mandate that BLM "give priority to the designation and protection of areas of critical environmental concern [ACEC]." 43 U.S.C. § 1712(c)(3). ACECs are areas where special management attention is required "to protect and prevent irreparable

[77] *See also* Attachment A, Letter from Center for Native Ecosystems to Kent Walter, WRFO 2 (March 9, 2007).

damage." 43 U.S.C. § 1702(a). Protestor Rocky Mountain Wild (formerly Center for Native Ecosystems) provided BLM with a detailed list and maps of proposed ACECs throughout the planning process, beginning as early as 2007.[78] While the EIS notes that new designations may be considered in a later RMP revision planning process, that process could be too late, as new development under the RMPA could prejudice the consideration of certain areas for this designation. BLM arbitrarily determined that ACEC designations should be considered in a separate, later process, when nothing prevents BLM from considering these issues jointly with the RMPA, and when "priority" for these designations is required.

B. BLM's Proposed Action Does Not Prevent Unncessary or Undue Degradation of Public Lands.

The RMPA is not consistent with FLPMA, which requires BLM to prevent unnecessary or undue degradation of public lands. 43 U.S.C § 1732(b). BLM has failed to show that it is necessary to allow continued and expanded oil leasing and development, including the utilization of hydraulic fracturing, or fracking, on BLM lands and mineral estate. Such activities, as presently authorized, and as proposed to be managed under the RMPA cause, or are likely to cause, unnecessary and undue degradation of the land, air, water and wildlife resources BLM is mandated to protect through measures regarding surface disturbance, habitat degradation, air pollution, methane leakage, and surface and groundwater depletion and contamination. Neither the RMPA nor the FEIS adequately explain how BLM management under the RMPA will prevent such impacts.

***

For all of the reasons stated above, as well as in the attached and cited documents incorporated by reference herein, the RMPA and accompanying FEIS, will, if adopted unchanged, result in violations of BLM's obligations under ESA, NEPA, and FLPMA. An appropriate response to this protest would be for BLM to withdraw the RMPA, prepare an SEIS, and issue a new RMPA consistent with statutory obligations as outlined above.

Please do not hesitate to contact me if you have any questions or to schedule a protest resolution meeting.

Sincerely,

Wendy Park
Staff Attorney
Center for Biological Diversity

John Weisheit
Conservation Director
Living Rivers

Megan Mueller
Senior Conservation Biologist
Rocky Mountain Wild

[78] *See id.*

Zach Frankel
Executive Director
Utah Rivers Council

Cc: Heather Sauls, Planning & Environmental Coordinator, BLM White River Field Office Meeker, CO

Acting Field Supervisor, Western Colorado Field Office, Fish and Wildlife Service, Grand Junction

Impacts of Climate Change on the Colorado River Basin

Shaye Wolf, Ph.D., Climate Science Director, Center for Biological Diversity

March 10, 2016

Anthropogenic climate change is profoundly impacting the Colorado River in ways that are altering temperature, streamflow, and the hydrologic cycle. As detailed below, changes observed to date include rising temperatures, earlier snowmelt and streamflow, decreasing snowpack, and declining runoff and streamflow. Modeling studies project that these changes will only worsen, including continued declines in streamflow and intensification of drought. Climate change is likely to have significant effects on endangered fish species in the Colorado River basin – the Colorado pikeminnow, razorback sucker, bonytail chub, and humpback chub – and the Colorado River ecosystem.

Rising temperatures

The Colorado River basin has warmed significantly during the past century, with average increases in surface temperature of 1.6°F (0.9°C) over the Southwest during 1901-2010 (Hoerling et al. 2013). The greatest warming has occurred in spring and summer, and in daytime high temperatures and nighttime low temperatures (Bonfils et al. 2008, Hoerling et al. 2013). Surface temperatures in the Southwest are projected to increase steeply in this century by an average of 4.5 to 7.9° F depending on the emissions scenario, with an average of 2.5 to 3°F of warming projected for 2021-2050 alone (Cayan et al. 2013). As explained below, warming temperatures are having significant effects on streamflow, drought severity, and the hydrologic cycle in the Southwest (Barnett et al. 2008, Woodhouse et al. 2016).

Earlier snowmelt and streamflow

In much of the Colorado River basin, snowmelt, snowmelt runoff, and streamflow timing have trended earlier since the mid-1950s, in parallel with warming temperatures (Hamlet et al. 2005, Stewart et al. 2005, Barnett et al. 2008, Hoerling et al. 2013, Garfin et al. 2014). The Colorado River basin's spring pulse from 1978-2004 shifted to two weeks earlier compared to flows before 1978 (Ray et al. 2008). Although there are both natural and human influences on these hydrologic trends, studies indicate that anthropogenic greenhouse gases began to impact snow-fed streamflow timing during 1950-1999 (Barnett et al. 2008, Hidalgo et al. 2009, Hoerling et al. 2013). Modeling studies have projected that snowmelt, spring runoff, and streamflow timing will continue to shift earlier across much of the Southwest (Stewart et al. 2004, Rauscher et al. 2008, Dettinger et al. 2015).

Decreasing snowpack

The Colorado River receives most of its water from winter snowpack from the Rocky Mountains, where 15% of the total basin areas generates 85% of the river flow (Dettinger et al. 2015). Across much of the Colorado River basin, the spring snowpack is decreasing and more winter precipitation is falling as rain instead of snow (Hamlet et al. 2005, Pierce et al. 2008, Das et al. 2009). Approximately half of the observed decline in snowpack in the western United States during 1950-1999 has been attributed to the effects of anthropogenic greenhouse gases,

ozone and aerosols (Pierce et al. 2008). Modeling studies project a continued reduction of Southwest mountain snowpack during February through May during this century, largely due to the effects of rising temperatures (Cayan et al. 2013, Dettinger et al. 2015).

Declining Runoff and Streamflow

Annual runoff in the Colorado River basin appears to be declining (USBR 2011), with significant consequences for reduced streamflow. During 2001–2010, warm temperatures and dry conditions reduced average naturalized flows in the Colorado River (measured at Lees Ferry) to the second-lowest-flow decade since 1901, to12.6 million acre-feet per year compared to the 1901–2000 average of 15.0 million acre-feet per year (Hoerling et al. 2013).

Modeling studies project that runoff and streamflow will continue to decrease substantially in the Colorado River basin during this century (Ray et al. 2008, Das et al. 2011, USBR 2011, Cayan et al. 2013, Georgakakos et al. 2014, Dettinger et al. 2015). Barnett and Pierce (2009) concluded that anthropogenic climate change is likely to reduce runoff in the Colorado River basin by 10-30% by 2050. Projected reductions in runoff range from 6-7% (Christensen and Lettenmaier 2007) to 45% (Hoerling and Eischeid 2007) depending on the models and methods used in each study (see Barnett and Pierce 2009 at Table 2). In the short term, Hoerling and Eischeid (2007) predict streamflow to decrease by 25% during 2006-2030, and by 45% during 2035-2060.

Importantly, numerous studies show that warming temperatures alone will cause runoff and streamflow declines in the Colorado River basin. For example, in a recent review, Vano et al. (2014) estimated that future streamflow in the Colorado River basin will be reduced by 5% to 35% due to rising temperature alone. When precipitation change is considered, a 5% decrease in precipitation would further reduce streamflow by 10% to 15% (Vano et al. 2014).

Moreover, warming temperatures will play an increasingly important role in causing runoff to decline in the Colorado River basin, and must be factored into streamflow forecasts (Woodhouse et al. 2016). An empirical study of the influence of precipitation, temperature, and soil moisture on upper Colorado River basin streamflow over the past century found that warmer temperatures have already resulted in flows less than expected based on precipitation levels (Woodhouse et al. 2016). Consistent with past research, the study found that cool season precipitation explains most of the variability in annual streamflow. However, temperature was highly influential in determining streamflow under certain conditions. The study concluded that "[s]ince 1988, a marked increase in the frequency of warm years with lower flows than expected, given precipitation, suggests continued warming temperatures will be an increasingly important influence in reducing future UCRB water supplies." The researchers warned that "streamflow forecasts run the risk of overprediction if warming spring and early summer temperatures are not adequately considered."

Increasing Drought Severity

Historically, droughts in the Colorado River basin were primarily driven by precipitation deficits. However, studies indicate that rising temperatures have begun to play a more important

role in driving droughts (Hoerling et al. 2013, Vano et al. 2014). Importantly, rising temperature superimposed on natural drought variability is expected to exacerbate the impacts of droughts (Seager et al. 2012, Cook et al. 2015). Modeling studies project that droughts in Southwest will intensify due to longer periods of dry weather and more extreme heat, leading to higher evapotranspiration and moisture loss (Seager et al. 2007, Cayan et al. 2010, Trenberth et al. 2013). In the Colorado River basin, future droughts are projected to be substantially hotter, and drought is projected to become more frequent, intense, and longer lasting than in the historical record (Garfin et al. 2014).

Reduced reservoir levels and unsustainable demand for water

Of the more than 90 reservoirs on the river and its tributaries, the two largest are Lake Mead and Lake Powell which together can store up to 85% of the total flow for the basin combined (Christensen et al. 2004). Reservoirs in the Colorado River basin are highly vulnerable to climate change, particularly because the amount of storage in reservoirs is sensitive to runoff changes (Barnett and Pierce 2008). Even small decreases in runoff have caused average reservoir levels to markedly decrease (Christensen et al. 2004). Christensen et al. (2004) predicted that climate change impacts on the hydrology of the Colorado River system would result in water demand (deliveries and evaporation) exceeding reservoir inflows (which would also be decreased), resulting in a degraded system. Likewise, Barnett and Pierce (2008) projected that a 10% reduction in runoff would result in requested water deliveries surpassing sustainable deliveries by 2040, while a 20% reduction in runoff would cause unsustainable water demands by 2025. A greater demand than supply makes the system more prone to long-term sustained droughts, as reservoirs will not have sufficient time to be naturally replenished and more water will be extracted from a dwindling supply than is sustainable (Christensen and Lettenmaier 2007). Reservoirs would spend additional time in a depleted state, weakening the system's buffering ability in years where there is low precipitation (Barnett and Pierce 2009).

References

Barnett, T. P., et al. 2008. Human-induced changes in the hydrology of the western United States. Science 319: 1080–1083.

Barnett, T.P. and D.W. Pierce. 2008. When will Lake Mead go dry? Water Resources Research 44: W03201.

Barnett, T.P. and D.W. Pierce. 2009. Sustainable water deliveries from the Colorado River in a changing climate. PNAS 106: 7334-7338.

Bonfils, C., et al. 2008. Detection and attribution of temperature changes in the mountainous western United States. Journal of Climate 21: 6404–6424.

Cayan, D.R., T. Das, D.W. Pierce, T.P. Barnett, M. Tyree, and A. Gershunov. 2010. Future dryness in the southwest US and the hydrology of the early 21st century drought. PNAS 107: 21227-21276.

Cayan, D. et al. 2013. Future climate: projected average. Pages 101–125 in G. Garfin, A. Jardine, R. Merideth, M. Black, and S. LeRoy, editors. Assessment of climate change in the southwest United States: a report prepared for the National Climate Assessment. A report by the Southwest Climate Alliance. Island Press, Washington, D.C., USA.

Christensen, N.S., Wood, A.W., Voisin, N., Lettenmaier, D.P., and R.N. Palmer. 2004. The effects of climate change on the hydrology and water resources of the Colorado River basin. Climatic change 62: 337-363.

Christensen, N.S. and D.P. Lettenmaier. 2007. A multimodel ensemble approach to assessment of climate change impacts on the hydrology and water resources of the Colorado River basin. Hydrology and Earth System Sciences 11: 417-1434.

Cook, B.I., T.R. Ault, and J.E. Smerdon. 2015. Unprecedented 21st century drought risk in the American Southwest and Central Plains. Sci. Adv. 1: e1400082–e1400082.

Das, T., H. G. Hidalgo, M. D. Dettinger, D. Cayan, D. W. Pierce, C. Bonfils, T. P. Barnett, G. Bala, and A. Mirin. 2009. Structure and detectability of trends in hydrological measures over the western United States. Journal of Climate 10: 871-892.

Das, T., Pierce, D.W., Cayan, D.R., Vano, J.A., and D.P. Lettenmaier. 2011. The importance of warm season warming to western US streamflow changes. Geophysical Research Letters 38(23).

Dettinger, M., B. Udall, and A. Georgakakos. 2015. Western water and climate change. Ecological Applications 25: 2069-2093.

Garfin, G., G. Franco, H. Blanco, A. Comrie, P. Gonzalez, T. Piechota, R. Smyth, and R. Waskom, 2014: Ch. 20: Southwest. Climate Change Impacts in the United States: The Third National Climate Assessment, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 462-486.

Georgakakos, A., P. Fleming, M. Dettinger, C. Peters-Lidard, T.C. Richmond, K. Reckhow, K. White, and D. Yates. 2014. Water resources. Pages 69–112 in J. M. Melillo, T. C. Richmond, and G. W. Yohe, editors. Climate change impacts in the United States: the third National Climate Assessment. U.S. Global Change Research Program, Washington, D.C., USA.

Harding, B. L., Wood, A. W. and J.R. Prairie. 2012. The implications of climate change scenario selection for future streamflow projection in the Upper Colorado River basin. Hydrology and Earth System Sciences 16: 3989-4007.

Hamlet, A., P.W. Mote, M.P. Clark, and D.P. Lettenmaier. 2005. Effects of temperature and precipitation variability on snowpack trends in the western United States. Journal of Climate 18: 4545-4561.

Hidalgo, H. G., T. Das, M. D. Dettinger, D. Cayan, D.W. Pierce, T. P. Barnett, G. Bala, A. Mirin, A.W. Wood, C. Bonfils, B.D. Santer, and T. Nozawa. 2009 Detection and attribution of streamflow timing changes to climate change in the western United States. Journal of Climate 22: 3838-3855.

Hoerling, M. and J. Eischeid. 2007. Past peak water in the Southwest. Southwest Hydrology 35: 18–19.

Hoerling, M. P., M. Dettinger, K. Wolter, J. Lukas, J. Eischeid, R. Nemani, B. Liebmann, and K. E. Kunkel. 2013. Evolving weather and climate conditions of the Southwest United States. Pages 74–100 in G. Garfin, A. Jardine, M. Black, R. Merideth, J. Overpeck, and A. Ray, editors. Assessment of climate change in the Southwest United States: a report prepared for the National Climate Assessment. Island Press, Washington, D.C., USA.

Pierce, D. W., T. P. Barnett, H. G. Hidalgo, T. Das, C. Bonfils, B. D. Santer, G. Bala, M. D. Dettinger, D. Cayan, A. Mirin, A. W. Wood, and T. Nozawa. 2008. Attribution of declining western U.S. snowpack to human effects. Journal of Climate 21: 6425-6444.

Rauscher, S. A., J. S. Pal, N. S. Diffenbaugh, and M. M. Benedetti. 2008. Future changes in snowmelt-driven runoff timing over the western US. Geophysical Research Letters 35: L16703, doi:10.1029/2008GL034424.

Ray, A.J., Barsugli, J.J., Averyt, K.B., Wolter, K., Hoerling, M., Doesken, N. Udall, B. and R.S. Webb. 2008. Climate change in Colorado: a synthesis to support water resources management and adaptation. Report for the Colorado Water Conservation Board. University of Colorado, Boulder.

Seager, R., M. Ting, I. Held, Y. Kushnir, J. Lu, G. Vecchi, H. Huang, N. Harnik, A. Leetmaa, N. Lau, C. LI, J. Velez, and N. Naik. 2007. Model projections of an imminent transition to a more arid climate in southwestern North America. Science 316: 1181-1184.

Seager, R., M. Tang, C. Li, N. Naik, J. Nakamura, and H. Lui. 2012. Projections of declining surface-water availability for the southwestern United States. Nature Climate Change doi:10.1038/NCLIMATE1787.

Stewart, I. T., D. R. Cayan, and M. D. Dettinger. 2004. Changes in snowmelt runoff timing in western North America under a 'Business as Usual' climate change scenario. Climatic Change 62: 217-232.

Trenberth, K.E., A. Dai, G. van der Schrier, P.D. Jones, J. Barichivich, K.R. Briffa, and J. Sheffield. 2013. Global warming and changes in drought. Nature Climate Change 4: 17-22.

[USBR] US Bureau of Reclamation and Colorado River Basin Water Supply and Demand Study Team. 2011. Colorado River basin Water Supply and Demand Study: Technical Report B – Water Supply Assessment. Interim Report No. 1.

[USFWS] U.S. Fish and wildlife Service. 2008. Programmatic Biological Opinion for Water Depletions Associated with Bureau of Land Management's Fluid Mineral Program within the Upper Colorado River basin in Colorado. USDC Colorado.

Vano, J. A., Udall, B., Cayan, D. R., Overpeck, J. T., Brekke, L. D., Das, T., Hartmann, H. C., Hidalgo, H. G., Hoerling, M., McCabe, G. J., Morino, K., Webb, R. S., Werner, K. & Lettenmaier, D. P. 2014. Understanding uncertainties in future Colorado River streamflow. Bulletin of the American Meteorological Society 95: 59-78.

Woodhouse, C. A., G. T. Pederson, K. Morino, S. A. McAfee, and G. J. McCabe. 2016. Increasing influence of air temperature on upper Colorado River streamflow. Geophys. Res. Lett. 43, doi:10.1002/2015GL067613.

December 12, 2016

Via Electronic Delivery to blm_co_may_2017_lease_sale@blm.gov

Bureau of Land Management
White River Field Office
220 E. Market St.
Meeker, CO 81461

Attn: May 2017 Lease Sale

To Whom It May Concern:

The Center for Biological Diversity (the "Center") hereby submits the following comments on the Environmental Assessment ("EA") for the proposed May 2017 Competitive Oil and Gas Lease Sale. These comments are supplemental to the Center's scoping comments, and attached exhibits, previously submitted September 7, 2016, which re-submitted as Attachment A and are hereby incorporated by reference.

The Center for Biological Diversity is a non-profit environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center also works to reduce greenhouse gas emissions to protect biological diversity, our environment, and public health. The Center has over 1.1 million members and on-line activists, including those living in Colorado who have visited these public lands in the Kremmling, Little Snake, and White River management areas for recreational, scientific, educational, and other pursuits and intend to continue to do so in the future, and are particularly interested in protecting the many native, imperiled, and sensitive species and their habitats that may be affected by the proposed oil and gas leasing.

In addition to the issues raised in the Center's prior scoping comment regarding consideration of greenhouse gas emissions, impacts of unconventional oil and gas drilling methods, and impacts to wildlife, the proposed EA fails to meet the requirements of the National Environmental Policy Act and its implementing regulations in three major respects: (1) improper and inaccurate disclosure of climate consequences; (2) failure to consider significant impacts to the human environment, visual quality, recreation, and the local economy from large-scale leasing in North and Middle Parks; and (3) failure to consider impacts to endangered wildlife and wildlife of concern from additional Piceance Basin mineral leasing.

I. BLM's Carbon Budget Analysis is Inaccurate, Lacks Scientific Integrity, and Fails to Comply With National Environmental Policy Act Regulations and Guidance

We commend BLM for recognizing, EA at 47-49, that "downstream" greenhouse gas emissions from combustion are a consequence of the agency's fossil fuel leasing decisions, and that meeting climate change mitigation goals requires consideration of "the total amount of CO2 emissions released over time, where the cumulative emissions (i.e. the area under the curve)," EA 47.

Development of the leases will cause, directly and indirectly, greenhouse gas emissions that could amount to millions of metric tons of carbon dioxide equivalent. NEPA requires BLM to inform the public of the "significance" of these emissions, 40 C.F.R. § 1502.16(a)-(b); for example, BLM must "evaluate the[ir] severity." *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 352 (1989). To serve NEPA's "twin aims" of informing agency decisionmakers and the public, this evaluation must be in terms that will meaningfully inform these intended audiences of the magnitude and consequences of these effects. *Natural Res. Def. Council v. Nuclear Regulatory Comm'n*, 685 F.2d 459, 487 n.149 (D.C. Cir. 1982) *rev'd on other grounds sub nom. Balt. Gas & Elec. Co. v. Natural Res. Def. Council*, 462 U.S. 87, 106-107 (1983); *Columbia Basin Land Prot. Ass'n v. Schlesinger*, 643 F.2d 585, 594 (9th Cir. 1981).

Unfortunately, however, the carbon budget analysis at EA 47-49 has reporting and math errors, and lacks transparency in failing to cite most of the sources for its numbers or provide the math behind the estimates. Council on Environmental Policy regulations, 40 C.F.R. § 1502.24, require agencies to disclose their methodology and insure the scientific accuracy of NEPA analyses:

> Agencies shall insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements. They shall identify any methodologies used and shall make explicit reference by footnote to the scientific and other sources relied upon for conclusions in the statement.

40 C.F.R. § 1502.24. As discussed below, BLM's carbon budget analysis fails to either insure scientific integrity or accurately identify its methodologies in five distinct ways.

In addition, at a fundamental level, the carbon budget analysis relies on faulty reasoning. Its main conclusion is the annual downstream greenhouse gas emissions from Colorado federal oil and gas production is a small percentage of the global total: "the BLM CO downstream oil and gas portion of the global burden would be approximately 0.0147%." EA 49.

BLM then makes the unsubstantiated statement that climate change impacts from combustion of federal oil and gas would be negligible: "Based on our understanding of current

climate change models, we expect that the residual impacts of climate change resulting from other worldwide emissions likely would be the same with or without the contribution from combustion of federal oil and gas."

In addition to failing to disclose or explain this "understanding" of climate change models, this reasoning is contrary to NEPA scientific integrity requirements and Council on Environmental Quality Guidance. It is demonstrated that emissions from federal oil and gas production contribute a substantial amount to global emissions and to direct, indirect, and cumulative climate change impacts,[1] and that unleased federal oil and gas reserves are sufficient to exhaust the remaining carbon budget.[2]

Second, the CEQ GHG NEPA guidance explicitly frowns upon this type of analysis:

> Therefore, a statement that emissions from a proposed Federal action represent only a small fraction of global emissions is essentially a statement about the nature of the climate change challenge, and is not an appropriate basis for deciding whether or to what extent to consider climate change impacts under NEPA. Moreover, these comparisons are also not an appropriate method for characterizing the potential impacts associated with a proposed action and its alternatives and mitigations because this approach does not reveal anything beyond the nature of the climate change challenge itself: the fact that diverse individual sources of emissions each make a relatively small addition to global atmospheric GHG concentrations that collectively have a large impact. When considering GHG emissions and their significance, agencies should use appropriate tools and methodologies for quantifying GHG emissions and comparing GHG quantities across alternative scenarios. Agencies should not limit themselves to calculating a proposed action's emissions as a percentage of sector, nationwide, or global emissions in deciding whether or to what extent to consider climate change impacts under NEPA.[3]

CEQ's Final Guidance also explains the application of NEPA principles and practices to the analysis of GHG emissions and climate change, including: (1) that agencies quantify a

[1] STRATUS CONSULTING, GREENHOUSE GAS EMISSIONS FROM FOSSIL ENERGY EXTRACTED FROM FEDERAL LANDS AND WATERS: AN UPDATE (2014) ("2014 Stratus Report"), *archived at* perma.cc/59G3-Z3BX.
[2] *See* Mulvaney, Dustin *et al.*, The Potential Greenhouse Gas Emissions of U.S. Federal Fossil Fuels, EcoShift Consulting (2015) ("Mulvaney *et al.* 2015*"*) at 4
[3] Council on Environmental Quality, *Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* 10-11 (Aug. 1, 2016).

proposed action's projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools; (2) that agencies use projected GHG emissions as a proxy for assessing potential climate change effects when preparing a NEPA analysis; (3) where GHG emission tools, methodologies, or data inputs are not reasonably available, that agencies include a qualitative analysis in the NEPA document and explain the basis for determining that quantification is not reasonably available; (4) that agencies analyze foreseeable direct, indirect, and cumulative GHG emissions and climate effects; (5) that agencies consider reasonable alternatives and the short- and long-term effect and benefits in the alternatives and mitigation analysis; (6) that agencies consider alternatives that would make the actions and affected communities more resilient to the effects of a changing climate; and (7) that agencies assess the broad-scale effects of GHG emissions and climate change, either to inform programmatic decisions, or at both the programmatic and project-level. *See id.* at 4-6.

According to the IPCC, as of 2011, the remaining carbon budget of cumulative CO_2 emissions from all anthropogenic sources must remain below 1,000 $GtCO_2$ to provide a 66% probability of limiting warming to 2°C above pre-industrial levels.[4] For years 2012-2014, approximately 107 $GtCO_2$ was emitted, averaging approximately 36 $GtCO_2$ per year, which left us at the start of 2016 with a carbon budget of only 850 $GtCO_2$.[5] These emissions were the highest in human history and 60% higher than in 1990 (the Kyoto Protocol reference year). Of course, the Paris Agreement aim of limiting global warming to 1.5°C requires adherence to a more stringent carbon budget of only 400 $GtCO_2$ from 2011 onward, of which about 250 $GtCO_2$ remained at the start of 2016.[6] "With global annual emissions amounting to 36 $GtCO_2$ in 2015, scientists predict that at current rates global emissions will exceed the carbon budgets necessary to stay under the 1.5°C target by 2021 and the 2°C target by 2036.[7]

The potential carbon emissions from *existing* fossil fuel reserves—the known belowground stock of extractable fossil fuels—considerably exceed both 2°C and 1.5°C of warming. "Estimated total fossil carbon reserves exceed this remaining [carbon budget] by a factor of 4 to 7."[8] "For the 2°C or 1.5°C limits, respectively 68% or 85% of reserves must remain

[4] IPCC AR5 Synthesis Report at 63-64 & Table 2.2. For an 80% probability of staying below 2°C, the budget from 2000 is 890 $GtCO_2$, with less than 430 $GtCO_2$ remaining. Malte Meinshausen *et al.*, *Greenhouse-gas emission targets for limiting global warming to 2°C*, Nature (2009) at 1159 (attached as Exhibit 15).
[5] *See* Annual Global Carbon Emissions, available at: https://www.co2.earth/global-co2-emissions; *see also* C. Le Quéré, *et al.*, *Global Carbon Budget 2015*, Earth Syst. Sci. Data (Dec. 2015).
[6] Dustin Mulvaney, *et al.*, *Over-Leased: How Production Horizons of Already Leased Federal Fossil Fuels Outlast Global Carbon Budgets*, EcoShift Consulting (July 2016) (attached as Exhibit 17) at 2 (citing Joeri Rogelj, *et al.*, *Difference between carbon budget estimates unraveled*, Nature Climate Change (2016).
[7] Mulvaney at 2 (citing Oak Ridge National Laboratories, Carbon Dioxide Information Analysis Center (2015), available at: http://cdiac.ornl.gov/GCP/).
[8] IPCC AR5 Synthesis Report at 63.

in the ground."[9] The reserves in currently operating oil and gas field alone, even with no coal, would take the world beyond 1.5°C.[10]

In order for the world to stay within a carbon budget consistent with Paris Agreement goals—"holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C"[11]—significant fossil fuel resources must remain in the ground. More specifically, to meet the target of 2°C, globally "a third of oil reserves, half of gas reserves and over 80 percent of current coal reserves should remain unused from 2010-2050."[12] Studies estimate that global coal, oil and gas resources considered currently economically recoverable contain potential greenhouse gas emissions of 4,196 $GtCO_2$,[13] with other estimates as high as 7,120 $GtCO_2$.[14]

Critically, the United States carbon quota—equivalent to 11% of the global carbon budget needed for a 50% chance of limiting warming to 2°C—allocates approximately 158 $GtCO_2$ to the United States as of 2011.[15] By way of comparison, federal and non-federal fossil fuel emissions together would produce between 697 and 1,070 $GtCO_2$.[16] Regarding just federal fossil fuel resources, the United States contains enough recoverable coal, oil and gas that, if extracted and burned, would result in as much as 492 $GtCO_2$, far surpassing the entire global carbon budget for a 1.5°C target and nearly eclipsing the 2°C target—to say nothing of the United States 'share' of global emissions.[17] Unleased federal fossil fuels comprise 91% of these potential emissions, with already leased federal fossil fuels accounting for as much as 43 $GtCO_2$.[18]

---

[9] The Sky's Limit at 6 (attached as Exhibit 9); *see also* Kevin Anderson and Alice Bows, *Reframing the climate change challenge in light of post-2000 emission trends*, Phil. Trans. R. Soc. (2008) (attached as Exhibit 19) ("to provide a 93% mid-value probability of not exceeding 2°C, the concentration (of atmospheric greenhouse gases) would need to be stabilized at or below 350 parts per million carbon dioxide equivalent (ppm CO_2e)" compared to the current level of ~485 ppm CO_2e.).
[10] The Sky's Limit at 5, 17.

[11] Paris Agreement at Art. 2.
[12] Christophe McGlade & Paul Ekins, *The geographical distribution of fossil fuels unused when limiting global warming to 2°C*, Nature (Jan 2015).
[13] Michael Raupach, *et al.*, *Sharing a quota on cumulative carbon emissions*, Nature Climate Change (Sept. 2014).
[14] IPCC AR5, Mitigation of Climate Change, Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (2014) at Table 7.2.
[15] Raupach at 875.
[16] Dustin Mulvaney, *et al.*, *The Potential Greenhouse Gas Emissions from U.S. Federal Fossil Fuels*, EcoShift Consulting (Aug. 2015) at 16.
[17] *Id.*
[18] *Id.*

In 2012, "the GHG emissions resulting from the extraction of fossil fuels from federal lands by private leaseholders totaled approximately 1,344 $MMTCO_2e$."[19] Between 2003 and 2014, approximately 25% of all United States and 3-4% of global fossil fuel greenhouse gas emissions are attributable to federal minerals leased and developed by the Department of the Interior.[20] Continued leasing and development of federal fossil fuel resources commits the world to 'extremely dangerous' warming well beyond the 2°C threshold. As one study put it, "the disparity between what resources and reserves exist and what can be emitted while avoiding a temperature rise greater than the agreed 2°C limit is therefore stark."[21] In short, *any* new leasing of federal fossil fuel resources is inconsistent with a carbon budget that would seek to avoid catastrophic climate change.

A. The EA's estimate of the global carbon budget on page 48 misrepresents and underestimates the IPCC budget

The EA at 48 states, "[t]he IPCC's AR5 recently quantified the global 'carbon budget' at 1,000 PgC, which represents the amount of carbon emissions humans can emit while still having a likely chance of limiting global temperature rise to 2 degrees Celsius above pre-industrial levels. As of 2011 the world had already emitted approximately 515 PgC or 52% of the total budget over the last 250 years (period since industrialization began)."

The EA then indicates that the remaining carbon budget for a likely chance of limiting warming below 2C is 485 PgC (i.e., 1,000 PgC minus 515 PgC), equal to 485 GtC (i.e., PgC=GtC), which equates to 1,780 GtCO2. This is a vast underestimate.

According to the IPCC AR5, total cumulative anthropogenic emissions of CO_2 must remain below about 1,000 $GtCO_2$ from 2011 onward for a 66% probability of limiting warming to 2°C above pre-industrial levels.[22] Specifically, the AR5 states that limiting the warming caused by anthropogenic CO_2 emissions alone with a probability of >66% to less than 2°C since the period 1861–1880, will require cumulative CO_2 emissions from all anthropogenic sources to stay below 1000 GtC (3670 $GtCO_2$) since that period.[23] The AR5 goes on to state that 1000 GtC

[19] Stratus Consulting, *Greenhouse Gas Emissions from Fossil Energy Extracted from Federal Lands and Waters: An Update* (Dec. 2014) at 9.
[20] *See* Energy Information Administration, *Sales of Fossil Fuels Produced from Federal and Indian Lands, FY 2003 through FY 2014* (July 2015); *see also* Stratus Consulting.
[21] McGlade at 188.
[22] IPCC, 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change; Summary for Policymakers (2013) at 27; IPCC AR5 Synthesis Report at 63-64 & Table 2.2.
[23] Intergovernmental Panel on Climate Change, Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change; Summary for Policymakers (2013) at 25-26 ("Limiting the warming caused by anthropogenic CO_2 emissions alone with a

is reduced to about 790 GtC (2900 $GtCO_2$) when accounting for non-CO_2 radiative forcings. Furthermore, an amount of 515 GtC (1890 $GtCO_2$), was already emitted by 2011. This leaves a carbon budget of only 275 GtC or 1010 $GtCO_2$ as of 2011 (i.e., 790 GtC minus 515 GtC leaves 275 GtC which equates to 1009 GtCO2).

Given that global CO_2 emissions in 2015 alone totaled 9.8 GtC (36 $GtCO_2$),[24] this carbon budget is being rapidly consumed. The 275 GtC (1010 $GtCO_2$) carbon budget from 2011 onward has been reduced to 232 GtC (850 $GtCO_2$) from 2015 onward.[25]

B. The EA's timeline for exhausting the carbon budget is incorrect

EA at p. 48: "If one assumes an emissions trajectory that tracks the RCP8.5 scenario, the world would exceed the remaining budget in approximately 30 years (2045)."

EA at p. 48: "In terms of the IPCC carbon budget, the World Resource Institute estimates that 2011 global CO2 emissions were approximately 32,274 million metric tons or 8.79 PgC of carbon. At current emissions rates the remaining budget would be exhausted in approximately 54 years."

As detailed above, the IPCC AR5 estimated that the remaining budget in 2011 for a likely chance of staying below 2C was 275 GtC. On the RCP emissions trajectory, the remaining carbon budget would be consumed in closer to 18 years after 2011, rather than 30 years. At a steady emissions rate of 8.79 GtC, the remaining global carbon budget would be exhausted in 31 years after 2011, not 54 years.

Furthermore, the EA's 2011 estimate of global CO2 emissions is low compared with other sources. The Global Carbon Budget Project, which produces annual published estimates of global ghg emissions resulting from the work of numerous institutions, observational networks and modeling groups around the world, estimated 2011 global CO2 emissions at 34.92 GtCCO2 or 9.54 GtC, excluding the added emissions from land use change.[26] At a steady emissions rate

---

probability of >33%, >50%, and >66% to less than 2°C since the period 1861–1880, will require cumulative CO_2 emissions from all anthropogenic sources to stay between 0 and about 1570 GtC (5760 $GtCO_2$), 0 and about 1210 GtC (4440 $GtCO_2$), and 0 and about 1000 GtC (3670 $GtCO_2$) since that period, respectively. These upper amounts are reduced to about 900 GtC (3300 $GtCO_2$), 820 GtC (3010 $GtCO_2$), and 790 GtC (2900 $GtCO_2$), respectively, when accounting for non-CO_2 forcings as in RCP2.6. An amount of 515 [445 to 585] GtC (1890 [1630 to 2150] $GtCO_2$), was already emitted by 2011.").

[24] *See* Global Carbon Budget 2016, www.globalcarbonproject.org/carbonbudget/16/data htm

[25] See Table 2 in Rogelj, J. et al. 2016. Differences between carbon budget estimates unraveled. Nature Climate Change 6: 245-252.

[26] *See* Global Carbon Budget 2016, www.globalcarbonproject.org/carbonbudget/16/data htm,
Le Quéré, C. et al. Global Carbon Budget 2016, Earth Syst. Sci. Data, 8, 605-649, doi:10.5194/essd-8-605-2016, 2016. http://www.earth-syst-sci-data.net/8/605/2016/

of 9.54 GtC, the remaining global carbon budget would be exhausted in 29 years after 2011, not 54 years.

C. The EA's statement of the US "obligation" for meeting a two degree temperature target is an underestimate

EA at p. 48: "To meet the two degree temperature target, the U.S. obligation is to reduce annual GHG emissions by 83% relative to 2005 levels (7,228.3 Mt CO2e, excluding land use and changes) by mid-century. Other nations would also have to follow suit, albeit at slightly different targeted rates."

The US has pledged a long-term goal of reducing annual ghg emissions by 83% below 2005 by 2050, but the US "obligation" is much greater.

Holding temperature rise well below 2°C means that global fossil fuel emissions must end almost entirely by mid-century. A reasonable likelihood of limiting warming to 1.5° or 2°C requires global CO_2 emissions to be phased out by mid-century and likely as early as 2040-2045.[27]

A 2015 analysis by international team of climate experts[28] suggests that for a likely probability of limiting warming to 2°C, the U.S. must reduce its GHG emissions in 2025 by 68% to 106% below 1990, with the range of reductions depending on the sharing principles used. U.S. emissions in 2025 would need to range between 2 $GtCO_2e$ (i.e., 68% below 1990) and -0.4 $GtCO_2e$ (i.e., 106% below 1990). Negative emissions are required by 2050.[29]

Current US climate policy is insufficient to keep temperature rise below 2°C. The US ratified the Paris Agreement on 3 September 2016 and its pledged Nationally Determined Contribution (NDC) is to reduce net GHG emissions by 26–28% below 2005 in 2025 including land use, land use change and forestry (LULUCF), which is equivalent to 19–24% below 2005 levels excluding LULUCF, and equivalent to 6–12% below 1990 levels excluding LULUCF.[30] The US also set a long-term goal of reducing emissions by 83% below 2005 levels by 2050.[31]

---

[27] See Rogelj, J. et al. 2015. Energy system transformations for limiting end-of-century warming to below 1.5°C. Nature Climate Change 5: 519-528.
[28] Climate Action Tracker is a joint project of Climate Analytics, Ecofys, Potsdam Institute for Climate Impact Research, and the NewClimate Institute.
[29] Climate Action Tracker. 2015. Are governments doing their "fair share"? New method assesses climate action. 27 March 2015. See Figures 2 and 3.
[30] US Nationally Determined Contribution submitted to the UNFCCC: http://www4.unfccc.int/Submissions/INDC/Published%20Documents/United%20States%20of%20America/1/U.S.%20Cover%20Note%20INDC%20and%20Accompanying%20Information.pdf
[31] United States Department of State. 2010, U.S. Climate Action Report 2010. Washington: Global Publishing Services, June 2010; White House, 2009, President to Attend Copenhagen Talks: *Administration Announces U.S.*

The US Nationally Determined Contribution has been ranked as insufficient to keep warming below 2°C by as international team of climate experts: the US NDC is "not yet consistent with limiting warming to below 2°C, let alone with the Paris Agreement's stronger 1.5°C limit."[32] Current US climate policy has also been evaluated as insufficient to meet the US NDC.[33]

D. The EA text and table 3-11 on federal and total oil and gas production have numerous inaccuracies

EA at p. 48: "The Office of Natural Resources Revenue, U.S. Department of the Interior data shows that in 2015 total federal (onshore) production of oil and gas in the country stood at approximately 719,083,022 bbls of oil and 4,594,061,773 thousand cf of natural gas. The country as a whole (federal and non-federal) produced approximately 3,442,208,000 bbls of oil and 27,033,686 million cf of dry natural gas (U.S. Energy Information Administration). Federal oil and gas represents 21% and 17% for each resource respectively. Similarly, federal minerals in Colorado represent 1.3% and 10% of federal oil and gas, and 0.3% and 1.7% of total U.S. production. BLM has assumed, for purpose of conservative analysis, that all of the oil and gas produced in the U.S. (including from federal oil and gas in Colorado) is combusted as described above. Table 3-11 provides a comparison of these annual 2015 downstream emissions estimates with the EPA's data for 2014."

The Office of Natural Resources Revenue, U.S. Department of the Interior data shows that in 2015, total federal onshore and offshore production was approximately 719,083,022 bbls of oil and 4,594,061,773 mcf of natural gas.[34]

It should be noted that the US Energy Information Administration estimates somewhat higher federal production in 2015 of 755,158,065 bbls of oil and 4,782,557,794 mcf of natural gas.[35] According to the US Energy Information Administration, the country as a whole (federal and non-federal) in 2015 produced approximately 3,436,515,000 bbl of oil[36] and 27,059,503,000 mcf of dry natural gas.[37]

Based n U.S. EIA information, the numbers in Table 3-11 should be as follows:

Emission Target for Copenhagen, November 25, 2009, https://www.whitehouse.gov/the-press-office/president-attend-copenhagen-climate-talks; see also Climate Action Tracker, 2016, USA analysis, updated 2 November 2016, http://climateactiontracker.org/countries/usa html

[32] Climate Action Tracker, USA analysis, updated 2 November 2016, http://climateactiontracker.org/countries/usa html

[33] Id.

[34] See https://www.onrr.gov/About/production-data htm

[35] US EIA at https://useiti.doi.gov/explore/#all-production

[36] US EIA at https://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a htm

[37] US EIA at http://www.eia.gov/dnav/ng/ng_prod_sum_a_EPG0_FPD_mmcf_a.htm

2015 production	Oil (bbl)	Gas (Mcf)
BLM CO	5,687,216	745,357,166
US federal (onshore and offshore)	719,083,022	4,594,061,775
US total (onshore and offshore)	3,436,515,000	27,059,503,000

Using the ONRR estimates for federal production and the EIA estimates for total US production, federal oil represents 21% of total US production, and federal gas represents 17% of total US production.

If the estimates of federal oil and gas production in CO in 2015 in Table 3-11 are correct (5,687,216 bbl of oil and 745,357,166 mcf of gas), then in 2015, federal minerals in CO represented 0.8% of federal oil production and 16% of federal gas production, and 0.2% of US oil production and 2.8% of US gas production.

E. The EA estimates of the CO portion of global ghg emissions lack scientific integrity

EA at p. 49: "As shown above, the BLM CO estimated downstream emissions from oil and gas are approximately 17% of the total federal oil and gas emissions, and all federal downstream oil and gas combustion emissions are approximately 8.4% of the annual U.S. total. In 2015 the U.S. total estimated combustion (oil, gas, coal, etc.) emissions represent approximately 33% of the EPA's reported 2014 GHG emissions for the entire U.S. Presently, the total 2014 U.S. emissions represent approximately 21.3% of the 2011 global emissions, and thus the BLM CO downstream oil and gas portion of the global burden would be approximately 0.0147%."

The EA does not dislcose how it calculates the downstream emissions. Using the EPA conversion factors for bbl and mcf[38] yields the following CO2 estimates in metric tonnes:

2015 production	Oil (bbl)	Gas (Mcf)
BLM CO	5,687,216	745,357,166
US federal (onshore and offshore)	719,083,022	4,594,061,775
US total (onshore and offshore)	3,436,515,000	27,059,503,000

As explained above, the EA's comparison of annual downstream ghg emissions from CO minerals to total annual ghgs is an incorrect analysis. However, if one were to do this, global CO2 emissions from fossil fuels and cement in 2015 were 9.897 GtC, equivalent to 32.66 GtCO2.[39] BLM CO downstream oil and gas emissions in 2015 (43,228,943 mtCO2) represented about 0.12% of the global total CO2 emissions in 2015, not 0.0147% as estimated in the EA.

The EA provides an estimate of 780,174,013 CO2e as the "total (upstream, midstream and downstream) future year 2021 CO2e emissions from combustion of oil and gas produced in Colorado (Federal and non-Federal) assuming continuation of current O&G rates reflected in the CARMMS Low Scenario (see Table 3-12)." The EA provides no explanation of how it arrives at this estimate, and then attempts to claim that it is not important, even though these emissions are substantial in the lens of the remaining global and US carbon budget for staying well below 2C.

II. The EA Fails to Disclose Or Analyze Significant Impacts to the Human Environment, Wildlife, Recreation, and the Local Economy from Leasing

NEPA requires agencies to undertake thorough, site-specific environmental analysis at the earliest possible time and prior to any "irretrievable commitment of resources" so that the action can be shaped to account for environmental values. *Pennaco Energy, Inc. v. United States DOI*, 377 F.3d 1147, 1160 (10th Cir. 2004). Oil and gas leasing is an irretrievable commitment of resources. *S. Utah Wilderness All. v. Norton*, 457 F. Supp. 2d 1253, 1256 (D. Utah 2006).

[38] EPA conversion factors for oil (**0.43 metric tons CO_2/barrel) and natural gas: 0.005302 metric tons CO_2/therm and** 10.32 therms/Mcf; factors taken from https://www.epa.gov/energy/ghg-equivalencies-calculator-calculations-and-references; EPA (2015). Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2013. Annex 2 (Methodology for estimating CO_2 emissions from fossil fuel combustion), Table A-40 and Table A-47. U.S. Environmental Protection Agency, Washington, DC. U.S. EPA #430-R-15-004.

[39] See Global Carbon Budget 2016 at http://www.globalcarbonproject.org/carbonbudget/16/data.htm

Thus, NEPA establishes "action-forcing" procedures that require agencies to take a "hard look," at "all foreseeable impacts of leasing" before leasing can proceed. *Center for Biological Diversity v. United States DOI*, 623 F.3d 633, 642 (9th Cir. 2010); *N.M. ex rel. Richardson v. BLM*, 565 F.3d 683, 717 (10th Cir. 2009). Chief among these procedures is the preparation of an environmental impact statement ("EIS"). *Id*.

BLM, however, did not prepare an EIS. Instead BLM's proposed decision to proceed with the May 2017 lease sale is based solely on the broad brush analysis contained in the EA regarding some general potential effects on resources throughout the planning area. The EA's analysis does not provide any sense of how specific streams and watersheds in the proposed action area would be impacted by increased oil and gas development, including already impaired streams and watersheds. Nor does it discuss how the proposed lease sale could worsen poor air quality in those areas that already have significant well development, or significantly alter and industrialize relatively pristine or rustic landscapes and degrade prime habitat for wildlife.

Instead, BLM presupposes that it can auction off the parcels and issue the leases first, and then fulfill its NEPA obligations after the leases enter into the development stage. As we have stated in previous comments, this approach to NEPA has already been rejected by the courts. See Richardson, 565 F.3d at 688 (rejecting BLM's position that it was not required to conduct any site-specific environmental reviews until the issuance of an APD and holding that "NEPA requires BLM to conduct site-specific analysis before the leasing stage").

BLM Instruction Manual 2010-117 specifically directs BLM to conduct site-specific analysis of lease parcels in NEPA documentation.[40] See, e.g., IM 2010-117 § III(E) ("The IPDR Team will complete site-specific NEPA compliance documentation for all BLM surface and split estate lease sale parcels..."); id. ("Most parcels that the field office determines should be available for lease will require site-specific NEPA analysis."). IM 2010-117 also calls upon BLM to consider a host of factors in deciding whether to propose parcels for lease, each of which calls for site-specific analysis. For example, BLM must consider whether "[c]onstruction and use of new access roads or upgrading existing access roads to an isolated parcel would have unacceptable impacts to important resource values."[41] Other considerations include whether:

- In undeveloped areas, non-mineral resource values are greater than potential mineral development values.
- Stipulation constraints in existing or proposed leases make access to and/or development of the parcel or adjacent parcels operationally infeasible, such as an NSO parcel blocking

[40] Bureau of Land Management, IM 2010-117, Oil and Gas Leasing Use Planning and Lease Parcel Reviews (2010).
[41] IM 2010-117 § III(C)(4).

access to parcels beyond it or consecutive and overlapping timing restrictions that do not allow sufficient time to drill or produce the lease without harm to affected wildlife resources.

- Parcel configurations would lead to unacceptable impacts to resources on the parcels or on surrounding lands and cannot be remedied by reconfiguring.

- The topographic, soils, and hydrologic properties of the surface will not allow successful final landform restoration and revegetation in conformance with the standards found in Chapter 6 of the Gold Book.

- Leasing would result in unacceptable impacts to specially designated areas (whether Federal or non-Federal) and would be incompatible with the purpose of the designation.

Each of these factors should be analyzed with respect to the parcels at issue, given that affected resources include, in addition to the air, water, and climate impacts of leasing:

- Approximately 27,500 acres in North and Middle Parks, a nationally-recognized destination for tourism and outdoor recreation
- Proximity to Rocky Mountain National Park, with potential impacts on scenic views, light pollution, and air quality
- Potential adverse effects on the tourism and outdoor recreation economies of Grand County communities

III. The EA Fails to Consider Current Information Regarding Mancos Shale Development Potential

The EA for the proposed leasing action fails to consider new information concerning increased Mancos shale development potential in the Piceance Basin that emerged earlier this year. In 2015, when the White River RMPA-EIS was adopted, the total number of wells projected to be developed in the White River planning area, including federal and non-federal wells, was in the neighborhood of 50,000 wells over the next 15 years. This projection, however, did not take into account Mancos shale play development, because at the time of the White River RMPA's adoption, BLM considered Mancos shale play development to be too speculative. New information, however, indicates that vast technically recoverable Mancos shale play reserves are present throughout the Piceance Basin, including within the White River Field Office, and could lead to the development of many more wells and well pads than projected in the RMPA-EIS. The White River RMPA-EIS's and EA's failure to consider this potentially huge expansion in Piceance Basin development resulting infects BLM's entire analysis of direct, indirect, and cumulative impacts of new leasing and oil and gas development on soils and surface disturbance,

water quality, air quality, land use, wildlife and habitat fragmentation, noise, and greenhouse gas emissions, among other impacts.

In June 2016, the U.S. Geological Survey published a report re-assessing the total technically recoverable reserves in the Mancos shale play in the Piceance Basin, including the Niobrara strata of the play.[42] According to the report, the Mancos shale play's total technically recoverable natural gas reserves are over 40 times greater than the USGS's 2003 estimate and is the second-largest in the U.S., behind the Marcellus shale.[43] Specifically, 66.3 trillion cubic feet of natural gas, 74 million barrels of oil and 45 million barrels of natural gas liquids are potentially recoverable.[44] While tight gas in the younger, shallower Mancos shale intervals is produced primarily from vertical and directional wells in which the reservoirs have been hydraulically fractured, the tight gas and continuous oil and gas in the older and deeper intervals of the Mancos shale are produced mostly from horizontal wells that have been hydraulically fractured.[45] These reserves underlie large areas of the Grand Junction, White River, Royal Gorge, Colorado River Valley, Uncompahgre, and Gunnison Field Offices.[46]

Increasing interest in the Mancos Shale Play should therefore be expected given its enormous production potential. Indeed, since the 2003 USGS assessment, more than 2,000 wells have already been drilled and completed in one or more intervals of the study area.[47] A review of BLM oil and gas projects in western Colorado indicates that operators are planning a number of projects involving horizontal drilling, which would most likely target the Mancos shale.[48]

Because the White River RMPA-EIS did not consider Mancos shale play development as reasonably foreseeable, BLM must prepare a new EIS that takes into account the impacts of Mancos shale play development on the various resources of the White River planning area, or at minimum, do so in a revised EA. Moreover, because the Mancos shale play underlies many of the field offices in western Colorado, it must also take into account cumulative impacts from both private and federal Mancos shale development in neighboring areas throughout the Piceance Basin.

---

[42] Assessment of Continuous (Unconventional) Oil and Gas Resources in the Late Cretaceous Mancos Shale of the Piceance Basin, Uinta-Piceance Province, Colorado and Utah (2016) ("USGS 2016"), available at http://pubs.usgs.gov/fs/2016/3030/fs20163030.pdf.
[43] *See id*.
[44] *Id.*
[45] *Id.*
[46] Center for Biological Diversity, Map of Mancos Shale relative to BLM Field Offices (2016).
[47] *Id.*
[48] *See* Center for Biological Diversity, Spreadsheet of Horizontal Well Projects in Colorado (listing horizontal well projects listed in BLM's NEPA register and projected water use) (Exhibit G).

IV. The EA Fails to Disclose or Analyze Significant Impacts to Wildlife, Including Sensitive Species and Species of Concern

A. Mule Deer

Many of the proposed lease sale parcels overlap mule deer severe winter range and/or winter concentration areas. *See* EA 141 (North Park Leases), 144 (North Park Leases), 151-154 (White River Leases. The EA acknowledges that disturbance to mule deer habitat from energy development can pose significant adverse effects on habitat use, survival, and recruitment:

> While deer are simultaneously contending with the nutritional challenges (declining quality and access to forage) and elevated energy requirements of winter (maintaining homeothermy, reducing energy expenditures to extend fat stores), human disturbance and displacement to unfamiliar grounds divert from time and energy that would otherwise be expended in more efficient procurement of forage and managing energy expenditures (e.g., reducing heat loss, reducing travel across steep slopes or heavy snowpack). Deer exist in a negative energy balance for 4 to 6 months of the year (Garrott et al. 1987) and it is important to minimize energy expenditures and use available forage efficiently to stave off excessive weight loss which ultimately reduces prospects for winter survival or successful birthing and rearing of young. It would follow that extraneous energetic demands placed on deer, particularly during late gestation, lactation, and the winter season would contribute to chronically suppressed reproductive performance, recruitment, or animal fitness that, at expansive scales, could manifest population-level effects (Sawyer 2009b).[49]

The EA, however, then goes on to dismiss these impacts by selectively citing research to argue that its "widely criticized" use of timing limitation stipulations on certain winter activity will "reduce" (to an unquantified extent) the adverse impacts of development:

> As a means of reducing big game avoidance response, RMP-authorized timing limitation stipulations would be applied to the summer ranges and important deer winter ranges (i.e., severe winter ranges) during the core periods of occupation on those leases in the KFO and LSFO. Timing limitations are applied to all big game ranges in the WRFO. Although BLM's use of traditional stipulations (e.g., timing limitations and no surface occupancy) have been widely criticized, recent research

[49] EA 157.

> (Sawyer et al. 2009a; Sawyer et al. 2009b) implies that measures that substantially reduce human activity during the period of winter occupation are capable of reducing impacts associated with avoidance, in this case, where reductions in human activity on producing pads reduced the area avoided by deer by 43-65% compared to winter drilling activity.[50]

This selective citation of Sawyer's mule deer research ignores significant new and additional research, by Sawyer and others, showing adverse effects to mule deer migrations and population from energy development, including in Colorado's Piceance Basin.

Research shows that residential and energy development has reduced all ungulates across the West. The low-elevation valleys and mountain foothills, once important habitat for ungulates, are filled with cities and towns.[51] The same is true in Colorado, according to CPW's research, particularly on winter ranges.[52] Between 1980 and 2010, western Colorado saw a 37% increase in residential land-use in mule deer habitat, primarily on their winter range.[53] The resulting lack of high-quality winter range is limiting robust mule deer population growth in Colorado.[54]

A dearth of high-quality, long-term, and controlled studies makes it difficult to evaluate with precision the role of oil and gas development in mule deer habitat and population decline.[55] Clearly, mule deer demonstrate avoidance of roads and oil and gas infrastructure, with as-yet inadequately-understood consequences for migration, energy budgets, adult and fawn survival, and population.[56]

Some of the best available long-term, controlled studies evaluate mule deer population density before and after oil and gas development in the Sublette mule deer heard near Pinedale,

---

[50] *Id.*
[51] Polfus, J. L., and P. R. Krausman. 2012. Impacts of residential development on ungulates in the Rocky Mountain West. Wildlife Society Bulletin 36:647-657.
[52] Johnson, H.E., J.R. Shushinsky, A. Holland, E.J. Bergman, T. Balzer, J. Garner, and S.E. Reed. 2016. Increases in residential and energy development are associated with reductions in recruitment for a large ungulate. Global Change Biology, doi: 10.1111/gcb.13385 ("Johnson et al. 2016").
[53] Johnson et al. 2016.
[54] Bergman, E. J., P. F. Doherty, G. C. White, and A. A. Holland. 2015. Density dependence in mule deer: a review of evidence. Wildlife Biology 21:18-29; Johnson et al. 2016.
[55] Hebblewhite, Mark. 2011. Effects of Energy Development on Ungulates. Energy Development and Wildlife Conservation in Western North America 71-94. Island Press, Washington D.C.
[56] Hebblewhite 2011; Sawyer, H., Kauffman, M.J., Middleton, A.D., Morrison, T.A., Nielson, R.M., and Wyckoff, T.B. 2013. A framework for understanding semi-permeable barrier effects on migratory ungulates. Journal of Applied Ecology 2013:50, doi:10.1111/1365-2664.12013; Lendrum, P.E., Anderson, C.R., Long, R.A., Jie, J.G., and Bowyer, R.T. 2012. Habitat selection by mule deer during migration: effects of landscape structure and natural-gas development. Ecosphere 3(9):82.

Wyoming.[57] The Sublette mule deer study compared mule deer density in control and development zones, and found mule deer densities declined 30% in the development area, as opposed to 10% in the control area.[58] Sawyer and Strickladn found that "the observed decline of mule deer in the treatment area was likely due to gas development, rather than drought or other environmental factors that have affected the entire Sublette Herd unit."[59]

The Sublette example is particularly important when considering energy development's effects on mule deer populations, their winter range, and their migration patterns in western Colorado. Even in its relatively early stages compared to Wyoming, the most recent spatial analysis of already-occuring effects on mule deer in western Colorado finds energy development has the second-largest effect on deer recruitment, exceeded only by residential development.[60]

Although the precise connections between energy development and population-level effects are still imperfectly understood, it is demonstrated that oil and gas development affects mule deer habitat use and migration patterns by causing site avoidance, particularly in daytime,[61] and creating "semi-permeable" barriers to migration routes.[62] CPW is currently engaged in multiple research efforts to evaluate energy development effects on migration, deer response to energy development, and fawn survival in developed and undeveloped areas.[63] Those studies have thus far documented how individual deer alter their migration speed and timing in response to development.[64] A 2015 Wildlife Research Report published by CPW found that, during an

[57] Sawyer, H., R. Nielson, and D. Strickland. 2009. Sublette Mule Deer Study (Phase II): Final Report 2007. Western Ecosystems Technology, Inc. Cheyenne, Wyoming, USA.
[58] *Id.*
[59] *Id.*
[60] Johnson et al. 2016.
[61] Lendrum 2012.
[62] Sawyer, H., Kauffman, M.J., Middleton, A.D., Morrison, T.A., Nielson, R.M., and Wyckoff, T.B. 2013. A framework for understanding semi-permeable barrier effects on migratory ungulates. Journal of Applied Ecology 2013:50, doi:10.1111/1365-2664.12013 ("Sawyer 2013").
[63] Anderson, C. R. 2015. Population Performance of Piceance Basin Mule Deer in Response to Natural Gas Resource Extraction and Mitigation Efforts to Address Human Activity and Habitat Degradation.in C. D. o. P. a. Wildlife, editor., Colorado ("Anderson 2015"); Anderson, C.R. 2016. Piceance Mule Deer & Energy Development: Demographic influences and mitigation. Colorado Parks and Wildlife, presentation to Garfield County, Colorado. http://www.garfield-county.com/oil-gas/documents/energy-advisory-board/2016/F-D-EAB%20Chuck%20Anderson_Piceance%20deer-energy%20development_Oct%202016.pdf ("Anderson 2016"); Anderson, C.R. and Bishop, C.J. 2014. Migration Patterns of Adult Female Mule Deer in Response to Energy Development. Transactions of the 79th North American Wildlife and Natural Resources Conference 47-50; Lendrum, P.E., Anderson, C.R., Monteith, K.L., Jenks, J.A., and Bowyer, R.T. 2013. Migrating Mule Deer: Effects of Anthropogenically Altered Landscapes. PlosOne, 8:5:e64548 ("Anderson & Bishop 2014").
[64] Lendrum 2012; Lendrum, P.E., Anderson, C.R., Monteith, K.L., Jenks, J.A., and Bowyer, R.T. 2013. Migrating Mule Deer: Effects of Anthropogenically Altered Landscapes. PlosOne, 8:5:e64548.

active drilling phase in the Piceance Basin, deer behavior was compromised by 25% (at nighttime) and by 50% (during day time) in critical mule deer winter range.[65]

CPW has also collected data, from 2012 through 2014, in order to evaluate mule deer fawn survival in developed and undeveloped landscapes.[66] This data has not yet been published, but CPW has disclosed preliminary data to Garfield County a strong increase in fawn predation and mortality associated with oil and gas development.[67] The preliminary data disclosed to Garfield County shows 39% predation mortality and 53% total mortality in the undeveloped study area, versus 49% predation mortality and 63% total mortality in the developed study area.

In addition, it is well-documented that human development causes direct habitat loss and fragmentation through the construction of infrastructure, and indirect habitat loss through deer avoidance of infrastructure and related activities; these consequences likely reduce the carrying capacity of the landscape.[68] A recent study shows that oil and gas development causes significant habitat loss in the Piceance Basin of Colorado:

> Energy development drove considerable alterations to deer habitat selection patterns, with the most substantial impacts manifested as avoidance of well pads with active drilling to a distance of at least 800 m. Deer displayed more nuanced responses to other infrastructure, avoiding pads with active production and roads to a greater degree during the day than night. In aggregate, these responses equate to alteration of behavior by human development in over 50% of the critical winter range in our study area during the day and over 25% at night.[69]

Additionally, mule deer may suffer higher mortality rates in developed landscapes because of increased vehicle collisions and accidents (i.e., entrapment in fences); moreover, increased road densities expose mule deer to more hunters, poachers and predatory domestic pets.[70]

Mule deer also need migration corridors that are protected from human development. An ongoing mule deer study by members of the Wyoming Migration Initiative has found that mule deer migration patterns are altered by human development – herds will move faster, stop less to

---

[65] Anderson 2015.
[66] Anderson 2015.
[67] Anderson 2016.
[68] Johnson et al. 2016.
[69] Northrup, J. M. et al. Quantifying spatial habitat loss from hydrocarbon development through assessing habitat selection patterns of mule deer, Global Change Biology (Aug. 2015), available at http://onlinelibrary.wiley.com/doi/10.1111/gcb.13037/epdf.
[70] Johnson et al. 2016.

feed, and detour around developed portions of their route.[71] Moreover, herds that can't migrate in search of the most nutritious grasses just end up smaller in number, plain and simple.[72] As a result, Wyoming Game and Fish Department is working to further protect migration routes in the state, for instance, no more than four oil and gas well pads allowed in a migration corridor and no development allowed in corridors narrower than a quarter mile. Although initial CPW research suggests that existing Piceance development levels are largely influencing the timing (not the fact) of deer migration,[73] CPW acknowledges that a "threshold in development intensity" may have greater effects on migration behavior.[74]

Despite the substantial evidence and concern regarding development effects on mule deer migration and behavior, the EA fails to provide any disclosure or analysis whatsoever of migration routes that may be affected by development on the proposed leases.

None of the proposed White River lease parcel stipulations for protecting big game habitat, however, limit the density of development, but only limit timing. *See* EA, Attachment D at Exhibit WR-TL-14, Exhibit WR-TL-12. The Tres Rios RMP-EIS, in contrast, provides for controlled surface use stipulations that allow BLM to control development density. Stipulation Exhibit 3.10.2 of the most recent Tres Rios Lease Sale Notice provides:

> In order to provide for healthy ungulate populations capable of meeting state population objectives, anthropomorphic activity and improvements should be designed to maintain and continue to provide effective habitat components that support critical life functions. This includes components of size and quality on the landscape providing connectivity to seasonal habitats (wildlife travel corridors), production areas, severe winter range, and winter concentration areas, along with other habitat components necessary to support herd viability.
>
> …
>
> Justification: *There is a growing body of evidence that TL stipulations on oil and gas development activities are not adequate to protect critical winter habitat and migratory corridors for big game.Managing the concentration and development such as drilling, construction, and the density of surface facilities may be necessary to maintain big game populations in developing areas.* Examples may include surface disturbance caps, collocation of facilities, and central gathering

[71] Sawyer 2013.
[72] Edwards, M., Mule Deer Struggling To "Surf The Green Wave" Of Migration (Nov. 20, 2015) available at http://wyomingpublicmedia.org/post/mule-deer-struggling-surf-green-wave-migration.
[73] Anderson & Bishop 2014.
[74] Anderson 2016; Sawyer 2013.

> facilities, noise reduction, and efforts to minimize traffic and road densities. Routine production activities would be allowed, however workover activities should be handled on a case by case basis.[75]

Similarly, the Little Snake Field Office imposes a controlled surface use stipulation on parcels overlying medium priority sagebrush habitats, which requires "a 5 percent disturbance limitation and a POD illustrating a strategy to leave large blocks of undisturbed habitat."[76]

While the Kremmling Field Office also provides a lease sale notice alerting lessees that "[s]pecial design and construction measures" may be imposed via conditions of approval on an APD, including "relocation of roads, well pads, pipelines, and other facilities," *see* Exhibit KFO-LN-8, such conditions may still be insufficient, given the large distances at which mule deer can avoid development within suitable habitat. *See* 43 C.F.R. § 3101.1-2 (providing "measures shall be deemed consistent with lease rights granted provided that they do not: require relocation of proposed operations by more than 200 meters").

Finally, the BLM should take into account new information indicating that sagebrush—which wintering mule deer are highly dependent on—is nearly impossible to restore, such that fragmentation of sagebrush communities from oil and gas development is likely to be permanent and reclamation ineffective. Recent studies show that sagebrush communities, such as those found within the areas to be leased, are nearly impossible to restore. Drilling sites have not been restored to pre-drilling conditions even after having 20 or 50 years to recover.[77] A recent study postdating the RMP-EIS found that 50 years or more would be required to recover sagebrush on disturbed sites, and that restoring heterogeneous soil conditions with patchy nutrient conditions, was necessary for recovery of large sagebrush and ecosystem resiliency.[78] There is no evidence, however, that any measures required by the RMP-EISs here ensure attainment of these conditions. Thus, oil and gas development could have more significant effects on mule deer and other big game than previously anticipated in the RMP-EISs, but those impacts have not been analyzed in the EA. *See* IM 2010-117 (directing site-specific analysis of whether "[t]he topographic, soils, and hydrologic properties of the surface will not allow successful final landform restoration and revegetation in conformance with the standards found in Chapter 6 of the Gold Book, as revised").

---

[75] February 2017 Tres Rios Field Office Sale Notice at 65, available at __ (emphasis added).
[76] EA, Attachment D, Exhibit LS-107.
[77] Lester, Liza, Sagebrush Ecosystem Recovery Hobbled By Loss Of Soil Complexity At Development Sites, Ecological Society of America (Jan. 26, 2015), available at http://www.esa.org/esa/sagebrush-ecosystem-recovery-hobbled-by-loss-of-soil-complexity-at-development-sites/.
[78] *Id.*; Minnick, Tamara J., Plant–soil feedbacks and the partial recovery of soil spatial patterns on abandoned well pads in a sagebrush shrubland. Ecological Applications, 25(1), 2015, pp. 3–10, available at http://onlinelibrary.wiley.com/doi/10.1890/13-1698.1/full.

B. Greater Sage-Grouse

The EA acknowledges that twenty-two parcels intersect designated Greater Sage-Grouse Priority and/or General Habitat Management Areas, EA at 11 & Table B, yet declines to even consider an alternative that would defer those parcels from leasing. This refusal to even consider prioritizing leases outside greater sage-grouse habitat fails to conform to either BLM's Northwest Colorado Greater Sage-Grouse Resource Management Plan Amendments, or to recent BLM guidance on implementation of those Amendments.

On September 1, 2016, BLM's Washington, D.C. office issued Instruction Memorandum 2016-143, *Implementation of Greater Sage-Grouse Resource Management Plan Revisions or Amendments -Oil & Gas Leasing and Development Sequential Prioritization* (September 1, 2016) ("IM 2016-143"), to the BLM's State Directors, providing "guidance on prioritizing implementation decisions for . . . BLM oil and gas leasing and development" to be consistent with the Greater Sage-Grouse plan amendments. The IM, which does not amend the plans but provides implementation guidance, is "effective immediately," IM 2016-143 at 11, and therefore applies to the Wyoming High Desert District's proposed November 2016 sale. Protestors, in our September 1, 2016 protest, incorporated by reference herein, previously raised the issue of the proposed sale's inconsistency with the RMP's direction to prioritize leasing outside of sage-grouse Priority and General Habitat Management Areas, but we now submit this supplemental protest to address the proposed sale's inconsistency with the BLM's own new prioritization guidance. [79]

BLM's proposed decision to lease the parcels listed above does not conform to the agency's IM 2016-143 because the leasing EA does not consider site-specific impacts to Greater Sage-Grouse and does not prioritizing leasing outside of Priority and General Habitat Management Areas (PHMAs and GHMAs). IM 2016-143's purpose is to provide consistency across the agency when leasing decisions impact Greater Sage-Grouse habitat. It provides a "prioritization sequence" for BLM state offices to follow when choosing to lease areas near or in Greater Sage-Grouse habitats. The IM prioritization sequence is as follows:

1. Lands outside of GHMAs and PHMAs: BLM State Offices will first consider leasing EOIs for lands outside of PHMAs and GHMAs. These lands should be the first priority for leasing in any given lease sale.

2. Lands within GHMAs: BLM State Offices will consider EOIs for lands within the GHMAs, after considering lands outside of both GHMAs and PHMAs. When considering the

[79] The Center for Biological Diversity et al., Protest on High Desert District Lease Auction: November 2016 Lease Parcels (submitted Sept 2, 2016).

GHMA lands for leasing, the BLM State Office will ensure that a decision to lease those lands would conform to the conservation objectives and provisions in the GRSG Plans (e.g., Stipulations).

3. Lands within PHMAs: BLM state offices will consider EOIs for lands within PHMAs after lands outside of GHMAs and PHMAs have been considered, and EOIs for lands within GHMA have been considered. When considering the PHMA lands for leasing, the BLM State Offices will ensure that a decision to lease those lands would conform to the conservation objectives and provisions in the GRSG Plans (e.g., Stipulations) including special consideration of any identified SFAs.

IM 2016-143 at 4. The EA, however, dismisses consideration of deferring Greater Sage-Grouse habitat from leasing with the conclusion that "the remaining sage-grouse habitat within the lease parcels are represented, particularly in KFO and LSFO, by diminutive slivers of habitat that lie on the extreme periphery of mapped range."). The EA contains, however, no required site-specific consideration or analysis of the proximity of the proposed leases to "important life-history habitat features (for example, distance from any active sage-grouse leks)." IM 2016-143 at 4.

IM 2016-143 further instructs BLM that "[a]t the time the leasing priority is determined, when leasing within GHMA or PHMA is considered, BLM should consider, first, areas determined to be non-sage-grouse habitat and then consider areas of lower value habitat." *Id*. The EA does not provide either the BLM or the public with sufficient information to permit a reasonable determination of whether the proposed leasing action could be limited to areas of either non-sage-grouse habitat or areas of lower value habitat.

V. The EA Fails to Consider the Direct, Indirect and Cumulative Impacts from Colorado River Withdrawals for Fracking and Other Unconventional Drilling Methods on Endangered Fish Populations, Water Supply, and Water Quality

As stated in our previous comments, BLM must perform an adequate environmental review of the significant impacts that oil and gas development is likely to have on the Colorado pikeminnow, razorback sucker, bonytail, and humpback chub ("endangered fish") and the Colorado River ecosystem. Significant new information has arisen since the adoption of the White River and Little Snake RMP-EISs and the 2008 Programmatic Biological Opinion for Water Depletions Associated with Bureau of Land Management's Fluid Mineral Program within

the Upper Colorado River Basin in Colorado ("PBO"),[80] which is designed to address any depletions resulting from oil and gas development within the White River, Little Snake, and other western Colorado field offices (excluding areas within the San Juan River Basin). BLM's approval of the RMP-EISs relied on the PBO. However, as discussed further in Section __ below, the PBO and the RMP-EISs did not consider several important factors that may affect the endangered fish in a manner or to an extent not previously considered, including new water-intensive techniques such as horizontal drilling which will enable increased drilling of the Mancos shale play; climate change effects on stream flows; a prolonged drought since 2000 and increasing water scarcity in the Colorado River Basin; declining Colorado pikeminnow and humpback chub populations; increasing mercury and selenium contamination within the Upper Coloardo River Basin and their effects on the endangered fish; and the failure of the Endangered Fish Recovery Program to meet recommended stream flows within critical habitat in the Colorado River sub-basin.

Cumulative impacts are those impacts on the environment resulting from "the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency . . . or person undertakes such other actions." 40 C.F.R. § 1508.7. By all accounts, the impacts stemming from future oil and gas leasing and development of the parcels at issue are cumulative with the impacts from development of neighboring planning areas. *Thomas v. Peterson*, 753 F.2d 754, 759 (9th Cir. 1985) (reasoning that effects of proposed road and of timber sales that road was designed to facilitate were cumulative actions for which comprehensive analysis was required). Indeed, under NEPA, BLM has an obligation to consider the effects of neighboring lease sales and oil and gas development projects as cumulative impacts of any future development stemming from leasing in the neighboring vicinity of these parcels. 40 C.F.R. §§ 1508.7, 1508.8.

A foreseeable cumulative impact from oil and gas development occurring throughout the Colorado River Basin is water withdrawals from the Colorado River necessary for fracking and horizontal drilling techniques. Indeed, millions of gallons of water are withdrawn from the Colorado River for oil and gas extraction, potentially impacting endangered fish in the Colorado River. The loss of adequate flows in the endangered fishes' habitat within the Upper Colorado River Basin is so serious that the Fish and Wildlife Service has determined that any depletion of Upper Basin stream flows adversely affects and jeopardizes the endangered fish.[81] Any depletion should therefore also be deemed significant under NEPA.

[80] USFWS, Programmatic Biological Opinion for Water Depletions Associated with Bureau of Land Management's Fluid Mineral Program within the Upper Colorado River Basin in Colorado (2008).
[81] U.S. Bureau of Land Management, Ch. 3: Affected Environment, White River FEIS at 3-71 (2015) ("The FWS has determined that any federally authorized depletion from the Upper Colorado River Basin has an adverse effect

BLM must analyze under NEPA the effects of the massive water demand resulting from relatively new horizontal drilling techniques in the Upper Colorado River Basin (the "Upper Basin") which would impact watersheds affected by future development of the parcels at issue here. Specifically, this analysis should address the water depletion effects of new leasing on specific water supplies and watersheds. In addition, it must address significant cumulative impacts from drilling throughout the Upper Basin on local water supplies and on the Colorado River endangered fish. Section __ below discusses significant water depletion effects that have not been addressed in the PBO or RMP-EIS.

In addition, BLM must analyze in the EA the increased risk of spills from new leasing, including cumulative effects, and the adequacy of mitigation measures, which were not properly analyzed in the White River RMPA-EIS. As noted in the attached comment on the White River RMPA-EIS, incorporated here by reference and attached as Exhibit B, BLM has not properly acknowledged the increased spill effects of oil and gas development from new development throughout the entire White River planning and from increased transport and storage of fracking chemicals and wastewaters, which will vastly increase with increased fracking activities. Exhibit __ at 10-15, 22-24. Moreover, as further explained in that comment, stipulations, setbacks, and other measures to reduce the risk of contamination from pipelines and other facilities are not adequate. Exhibit __ at 16-18, 23-24. The EA has also failed to analyze site-specific spills risks, including the risk of contamination and degradation of endangered fish critical habitat underlying several lease parcels on the Colorado River, and of numerous parcels upstream from tributaries of critical habitat. According to the Grand Junction RMP EIS, COGCC studies indicate that "surface and groundwater contamination, due to oil and gas development…occurred between 1,000 to 1,800 feet from the drilling."[82] NSO setbacks provided in the White River RMPA and Little Snake RMPM are in some cases significantly less than these distances and thus inadequate to protect streams and other water bodies.

---

on listed Colorado River fishes.") (Chapter 3); Biological Opinion for BLM Resource Management Plan (RMP), Price Field Office (PFO), 138 (Oct. 27, 2008), available at: http://www.blm.gov/style/medialib/blm/ut/price_fo/Planning/rod_approved_rmp.Par.2742.File.dat/Price%20Biological%20Opinion.pdf. ("The USFWS determined that any depletion will jeopardize their continued existence and will likely contribute to the destruction or adverse modification of their critical habitat") (citing USDI, Fish and Wildlife Service, Region 6 Memorandum, dated July 8, 1997); Biological Opinion for BLM Resource Management Plan (RMP), Vernal Field Office (VFO), 113 (Oct. 23, 2008), available at: http://www.blm.gov/style/medialib/blm/ut/vernal_fo/planning/rod_approved_rmp.Par.4719.File.dat/VernalBiologicalOpinion.pdf. (same).

[82] Grand Junction Field Office RMP FEIS 6-271.

A. BLM and Fish and Wildlife Service's Must Consult Over the Impacts of the Proposed Oil and Gas Leasing on Threatened and Endangered Species Pursuant to ESA Section 7

BLM cannot proceed with leasing the parcels at issue until it has consulted with Fish and Wildlife Service regarding the impacts of oil and gas leasing development on the four Colorado River endangered fish, including developing parcels that are located within endangered fish critical habitat in the Colorado River. Because all of the parcels proposed for lease are within the Upper Colorado River Basin, and many parcels are within or upstream of critical habitat, leasing is reasonably certain to result in water depletion and water contamination impacts on the endangered fish, compelling consultation under Section 7. Moreover, to the extent BLM relies on the PBO to comply with its Section 7 duties, such reliance is misplaced in light of new information revealing that water depletions from oil and gas development may affect listed species and their critical habitat in a manner or to an extent that was not considered in the PBO.

1. Background on ESA Section 7

Congress enacted the ESA to provide "a program for the conservation of . . . endangered species and threatened species." 16 U.S.C. § 1531(b). Section 2(c) of the ESA establishes that it is "the policy of Congress that all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act." 16 U.S.C. § 1531(c)(1). The ESA defines "conservation" to mean "the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this [Act] are no longer necessary." 16 U.S.C. § 1532(3). Section 7(a)(1) of the ESA explicitly directs that all federal agencies "utilize their authorities in furtherance of the [aforesaid] purposes" of the ESA. 16 U.S.C. § 1536(a)(1).

Section 7 of the ESA requires BLM, in consultation with the Fish and Wildlife Service ("FWS"), to insure that any action authorized, funded, or carried out by the agency is not likely to (1) jeopardize the continued existence of any threatened or endangered species, or (2) result in the destruction or adverse modification of the critical habitat of such species. 16 U.S.C. § 1536(a)(2). For each proposed federal action, BLM must request from FWS whether any listed or proposed species may be present in the area of the agency action. 16 U.S.C. § 1536(c)(1); 50 C.F.R. § 402.12. If listed or proposed species may be present in such area, BLM must prepare a "biological assessment" to determine whether the listed species may be affected by the proposed action. Id.

If BLM determines that its proposed action may affect any listed species or critical habitat, the agency must engage in formal consultation with FWS. 50 C.F.R. § 402.14. To complete formal consultation, FWS must provide BLM with a "biological opinion" explaining how the proposed action will affect the listed species or habitat. 16 U.S.C. § 1536(b); 50 C.F.R. § 402.14. If FWS concludes that the proposed action will jeopardize the continued existence of a listed species, or result in the destruction or adverse modification of critical habitat, the biological opinion must outline "reasonable and prudent alternatives." 16 U.S.C. § 1536(b)(3)(A).

BLM's oil and gas leasing proposal is an agency action under the ESA. Action is broadly defined under the ESA to include all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies, including the granting of leases, and actions that will directly or indirectly cause modifications to the land, water, or air. 50 C.F.R. § 402.02

Agencies are required to reinitiate ESA consultation if (1) the amount or extent of taking specified in the incidental take statement is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the action is modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the identified action. 50 C.F.R. § 402.16.

2. BLM and FWS Must Reinitate Consultation over the Programmatic Biological Opinion Governing Fluid Mineral Development Water Depletions

Leasing of the parcels at issue would foreseeably entail significant water depletions within the Upper Colorado River Basin, increased surface disturbance, and toxic spills from hydraulic fracturing and horizontal drilling, all of which can adversely affect endangered fish that inhabit areas within and downstream of the lease areas. All of the White River and Little Snake Field parcels are within the Upper Basin and therefore fall under the PBO. While the PBO is designed to address any depletions resulting from oil and gas development within the White River, Little Snake, and other western Colorado field offices, BLM cannot rely on that consultation for its Section 7 compliance for the reasons discussed below. To the extent that approval of the lease sale would rely on the PBO, such reliance is arbitrary and cannot constitute BLM's Section 7 compliance. BLM must either reinitiate consultation on the PBO or initiate section 7 consultation on the lease sale.

The PBO does not take into account the enormous water depletion effects of horizontal drilling and other unconventional well development techniques. The PBO is also unreliable in numerous other respects due to significant new information revealing that the Fluid Mineral

Program may have effects on the endangered fish in a manner or to an extent not previously considered. This includes new information about (a) the potential for increased oil and gas development and horizontal drilling within emerging shale plays, including the Mancos shale play in the Piceance Basin, and the Gothic Shale Gas Play in southwest Colorado's Paradox Basin; (b) climate change effects on Upper Colorado River Basin stream flows; (c) long-term drought and increased water demand which have drastically reduced water supplies; (d) mercury and selenium pollution effects on the endangered fish; (e) declining humpback chub and Colorado pikeminnow populations and failure to meet these populations' recovery targets; (f) the Recovery Program's failure to meet recommended stream flows necessary for recovery of the endangered fish; and (f) BLM's failure to adequately monitor and track actual water use and depletions in the Upper Colorado River Basin, which could result in higher water use and greater depletions in the RMP and leasing area than anticipated in the PBO.

a. New Drilling, Fracking, and Horizontal Drilling Will Require Greater Water Depletions Than Previously Anticipated

While the 2008 PBO is designed to address any depletions resulting from oil and gas development within western Colorado field offices, it did not consider the likely increase in horizontal drilling and other unconventional drilling practices that deplete enormous amounts of water to develop resources in the Piceance Basin, including Mancos shale found throughout the Grand Junction, Little Snake, White River, Gunnison, Uncompahgre, and Colorado River Valley Field Offices.[83] Nor did it consider the use of these water-intensive practices throughout the rest of the programmatic action area, including the Gothic Shale Gas Play (GSGP) and the Paradox Basin in the Tres Rios Field Office.

b. The PBO Fails to Consider Increased Horizontal Drilling Within the Piceance Basin

Water use within the Piceance Basin has been grossly underestimated in the PBO, because it fails to take into account increased horizontal drilling that could be used to develop the Mancos/Mowry and Niobrara shale plays. These increased water depletion impacts throughout the entire Upper Basin could alter the Service's analysis of the Fluid Mineral Program's depletion effects on the endangered fish, as all BLM-authorized fluid mineral development activity within the Basin is part of a single programmatic action that impacts the endangered fish.

For example, in the White River planning area, the PBO projects that new vertical wells would consume 2.62 acre-feet per well, while in the Grand Junction planning area, vertical wells

[83] BLM Instruction Memorandum CO-2011-022 (April 11, 2011) ("All of the estimates in the PBO were based on using conventional vertical drilling technology.").

would require require 0.77 acre-feet of water per well. But BLM water depletion logs indicate that between FY2011 and FY2015, the average depletion for horizontal wells in BLM's western Colorado field offices was 26.45 acre-feet of water per well in the field offices covered by the PBO.[84] Indeed, in FY2015 horizontal drilling in the Grand Junction Field Office resulted in a violation of the PBO's Incidental Take Statement (ITS) water depletion limit in the Colorado River sub-basin—under the ITS, water depletions are a surrogate for take. In FY2015, an operator drilled eight horizontal wells in the Grand Junction Field Office, which consumed a total of 620.87 acre-feet of water.[85] The total amount of water depleted in the Colorado River sub-basin by all horizontal and vertical wells was 691.09 acre-feet of water, which exceeds the 379 acre-feet annual projection for this sub-basin by 1.8 times.[86]

This drastic increase in the use of water-intensive horizontal drilling techniques was not considered in the PBO, nor in BLM's consultations over the recent White River, Kremmling, Little Snake, and Grand Junction RMP amendments or revisions, which only relied on the PBO regarding the RMPs' water depletion effects.

Moreover, recently, on June 8, 2016, the U.S. Geological Survey published a report re-assessing the total technically recoverable reserves in the Mancos shale play in the Piceance Basin, including the Niobrara strata of the play.[87] According to the report, the Mancos shale play's total technically recoverable natural gas reserves are over 40 times greater than the USGS's 2003 estimate and is the second-largest in the U.S., behind the Marcellus shale.[88] Specifically, 66.3 trillion cubic feet of natural gas, 74 million barrels of oil and 45 million barrels of natural gas liquids are potentially recoverable.[89] While tight gas in the younger, shallower Mancos shale intervals is produced primarily from vertical and directional wells in which the reservoirs have been hydraulically fractured, the tight gas and continuous oil and gas in the older and deeper intervals of the Mancos shale are produced mostly from horizontal wells that have been hydraulically fractured.[90] These reserves underlie large areas of the Grand Junction, White River, Royal Gorge, Colorado River Valley, Uncompahgre, and Gunnison Field Offices, all of which fall under the PBO.[91]

---

[84] *See* Water Depletion Logs which are completed, pursuant to requirements within the PBO, on an annual basis by the BLM to estimate water depletion resulting from fluid minerals development on BLM lands in western Colorado.
[85] *Id.*
[86] *Id.*
[87] Assessment of Continuous (Unconventional) Oil and Gas Resources in the Late Cretaceous Mancos Shale of the Piceance Basin, Uinta-Piceance Province, Colorado and Utah (2016) ("USGS 2016"), available at http://pubs.usgs.gov/fs/2016/3030/fs20163030.pdf.
[88] *See id.*
[89] *Id.*
[90] *Id.*
[91] Center for Biological Diversity, Map of Mancos Shale relative to BLM Field Offices (2016).

Increasing interest in the Mancos Shale Play should therefore be expected given its enormous production potential. Water depletions throughout the entire Upper Colorado River Basin could therefore exceed projected water use estimates in the PBO. Indeed, since the 2003 USGS assessment, more than 2,000 wells have already been drilled and completed in one or more intervals of the study area.[92] A review of BLM oil and gas projects in western Colorado indicates that operators are planning a number of projects involving horizontal drilling, which would most likely target the Mancos shale.[93]

Accordingly, Mancos shale drilling projects could increase within the Upper Basin, but the PBO does not take into account this expansion in new development potential. Because the RMPs for the Piceance Basin field offices overlapping the Mancos shale play do not limit total new wells that may be drilled, the greater amount and availability of technically recoverable oil and gas reserves could result in the development of many more new wells in the Upper Basin than assumed in the RMPs and the PBO. For example, the RFDs for the Colorado River Valley and White River RMPs did not take into account Mancos shale drilling (other than exploratory wells) and thus such drilling is not considered in the PBO.[94] Further, a substantial portion of new wells would be horizontal wells, as the lower strata of the Mancos formation would likely be accessed via horizontal drilling, but again, the PBO does not take into account the extraordinarily higher water use of horizontal wells. Water depletions throughout the entire Upper Colorado River Basin could therefore exceed projected water use estimates in the PBO, both at the basin-wide and sub-basin levels.

In sum, BLM and FWS must reinitiate consultation over the increased water depletion effects of horizontal drilling and increased oil and gas development potential of the Gothic and Mancos shale plays.

c. Climate Change Is Reducing Stream Flows in the Upper Colorado River Basin.

---

[92] *Id.*

[93] *See* Center for Biological Diversity, Spreadsheet of Horizontal Well Projects in Colorado (listing horizontal well projects listed in BLM's NEPA register and projected water use) (Exhibit G).

[94] *See* White River RMP FEIS at K-358 ("Development of the Mancos and Niobrara outside the Rangely Field in Rio Blanco County in the WRFO are not [] currently well defined and are exploratory in nature. This development is in the initial stages of the exploration phase to determine of the maturity of the reservoir and the potential viability of the Niobrara within the WRFO."); *see also* Colorado River Valley RMP FEIS at 4-576 ("To date, use of horizontal drilling in relation to the deep marine shales [i.e., Niobrara, Mancos, and Eagle Basin formations] has been limited and is considered experimental. As a result, the development intensity, timing, and location of development of the deep marine shales was considered too speculative for quantitative impact analysis in connection with this planning process.").

The PBO does not analyze or even mention climate change and its potential to reduce stream flows in the Upper Basin, which could amplify the effects of water depletions on the endangered fish and reduce the effectiveness of the Endangered Fish Recovery Program (e.g., by reducing the availability of water to supplement natural flows in dry years). The best available scientific data indicate that climate change is resulting in higher temperatures in the Colorado River Basin, reduced snowpack, diminished runoff, and more frequent and intense droughts, which have already reduced and will continue to reduce stream flows in the Basin. As shown in the Center's attached literature review (Exhibit C), ample studies document these effects and predict continuing flow declines.[95]

In the Colorado River basin, temperatures have increased roughly by 2° F, and "additional decades of warming are 'locked in' regardless of any behavioral changes that may or may not be implemented by the world's governments"—roughly an additional 5° F of warming can be expected in the basin by 2050.[96] Recently, researchers for the first time used historical data to show temperature-driven stream flow declines in the Upper Basin. As described in the Center's attached literature review (Exhibit C):

> An empirical study of the influence of precipitation, temperature, and soil moisture on upper Colorado River basin streamflow over the past century found that warmer temperatures have already resulted in flows less than expected based on precipitation levels (Woodhouse et al. 2016). Consistent with past research, the study found that cool season precipitation explains most of the variability in annual streamflow. However, temperature was highly influential in determining streamflow under certain conditions. The study concluded that "[s]ince 1988, a marked increase in the frequency of warm years with lower flows than expected, given precipitation, suggests continued warming temperatures will be an increasingly important influence in reducing future UCRB water supplies." The researchers warned that "streamflow forecasts run the risk of overprediction if warming spring and early summer temperatures are not adequately considered."[97]

[95] Wolf, Shaye Ph.D. Impacts of Climate Change on the Colorado River Basin, Center for Biological Diversity (March 10, 2016) (Exhibit C).
[96] Colorado River Research Group, Climate Change and the Colorado River: What We Already Know (Oct. 2016), available at http://www.coloradoriverresearchgroup.org/uploads/4/2/3/6/42362959/crrg_climate_change.pdf.
[97] *Id*. at 2.

According to the study's press release it is the "first to examine the instrumental historical record to see if a temperature effect [on stream flows] could be detected."[98] The study's lead author highlighted its significance: "If we have a warmer spring, we can anticipate that the flows will be less relative to the amount of snowpack[.]….What we're seeing is not just the future – it's actually now. That's not something I say lightly."[99]

In addition to reducing the overall amount of water in the Upper Colorado River Basin, these climate change effects would worsen effects from toxic spills by increasing the concentration of pollutants and toxic contaminants. Climate change is also likely to exacerbate mercury and selenium pollution effects on the Colorado pikeminnow. Mercury deposited into soil from coal burning and selenium will increasingly run off into streams with increased heavy rainfall events.[100] More frequent and severe wildfire events will result in increased charring of soil, releasing mercury and selenium that can wash off into streams.[101] Warmer water conditions will hasten the conversion of mercury into toxic methylmercury.[102]

BLM and the Service must reinitiate consultation on the Fluid Mineral Program in light of new evidence that climate change and warming temperatures are reducing Colorado River stream flows and may affect the endangered fish and its critical habitat in a manner and to an extent not previously considered.

d. Persistent Drought Conditions and Increasing Water Demand Have Reduced Water Supply

Compounding this threat to the endangered fish are persistent drought conditions that have diminished natural flows in the Colorado River Basin and reduced water storage that is needed to supplement Upper Basin flows. The period from 2000 to 2015 was the lowest 16-year period for natural flow in the last century, and one of the lowest 16-year periods for natural flow in the past 1,200 years, according to paleorecords.[103] As a result, water storage in the Colorado River system reservoirs have declined "from nearly full to about half of capacity," and led to local shortages in the Upper Colorado's sub-basins.[104]

---

[98] American Geophysical Union, Colorado River Flows Reduced by Warmer Spring Temperatures (March 9, 2016), available at http://news.agu.org/press-release/colorado-river-flows-reduced-by-warmer-spring-temperatures/.
[99] *Id.*
[100] National Wildlife Federation, Swimming Upstream: Freshwater Fish in a Warming World, 19 (2013), available at http://www.nwf.org/~/media/PDFs/Global-Warming/Reports/NWF-Swimming%20Upstream-082813-B.ashx.
[101] *Id.*
[102] *Id.*
[103] Bureau of Reclamation, Managing Water in the West: SECURE Water Act Section 9503(c) Report to Congress, Chapter 3, Colorado River Basin at 3-64 (2016) (Chapter 3)
[104] *Id.*

Further, population growth will increase water demand for agriculture and municipal uses, making it increasingly difficult to ensure sufficient water availability for the endangered fish, which rely on the release of stored water, especially in dry years.[105] An ever widening gap between water supply and water demand is weakening the Colorado River water supply system's reliability and ability to buffer the system in dry years.[106] According to the U.S. Geological Survey, "increased water demand and declining water availability make the restoration of endangered fish habitat extremely challenging."[107] This growing gap between supply and demand in the Upper Colorado River Basin must be taken into account in a reinitiated consultation.

e. Mercury and Selenium Are Adversely Impacting the Endangered Fish

New scientific information regarding (a) mercury and selenium effects on fish reproduction and population viability, (b) mercury and selenium concentrations in Upper Colorado and White River fish, (c) the potential role of oil and gas development in mercury contamination levels in the White River, (d) the potential for development of the Mancos shale play to increase selenium pollution, and (e) the relationship between climate change and mercury and selenium toxicity constitutes new information revealing that the Fluid Mineral Program may have effects on the endangered fish to an extent that was not considered in the PBO, and requires reinitiation of consultation over the Fluid Mineral Program.[108]

Mercury contamination is harming Colorado pikeminnow populations

The PBO's discussion of the environmental baseline for, and threats to, the Colorado pikeminnow and razorback sucker contains no discussion whatsoever of environmental and tissue mercury contamination or the resulting toxicity and reproductive impairment to the endangered fish. Significant new research since the 2008 PBO has demonstrated that elevated levels of mercury in Colorado pikeminnow muscle tissue, including within the Upper Colorado River Basin, are at concentrations likely to cause reproductive and behavioral impairment to the fish.[109]

---

[105] *See id*. at 3-7, 3-8.
[106] *Id*. at 3-10, 3-12.
[107] USGS, Effects of Climate Change and Land Use on Water Resources in the Upper Colorado River Basin, 5 (2010), available at https://pubs.usgs.gov/fs/2010/3123/pdf/FS10-3123.pdf.
[108] 50 C.F.R. § 402.16(b).
[109] USFWS, Upper Colorado River Endangered Fish Recovery Program, Colorado pikeminnow (*Ptychocheilus lucius*), 5-Year Review: Summary and Evaluation 21 (2011) ("[T]he recovery goal revision needs to consider the

Mercury is a potent neurotoxin shown to cause numerous reproductive and endocrine impairments in fish in laboratory experiments, including effects on production of sex hormones, gonadal development, egg production, spawning behavior, and spawning success.[110] Concentrations of mercury in Colorado pikeminnow in the Upper Basin are documented to be well in excess of the thresholds for reproductive impairment and population-level impacts.[111] 2008-2009 muscle tissue averages were 0.60 mg/Kg Hg for Colorado pikeminnow in the Upper Colorado basin and 0.95 mg/Kg Hg for Colorado pikeminnow in the White River – well above the 0.2 mg/kg threshold of concern.[112]

Mercury deposition and accumulation in critical habitat is attributable to a number of local and global factors, including air emissions from coal-fired power plants both in the immediate region and around the world.[113] In addition, because of discrepancies in mercury concentrations between pikeminnow in the Yampa and White Rivers, research suggests that "[i]t is possible that there is some localized sources of mercury contamination into the White River drainage connected with oil and gas exploration and development."[114]

Once mercury is deposited on land or water, it is converted into a biologically available form, methylmercury (MeHg) by bacteria. Methylmercury "bioaccumulates in food chains, and particularly in aquatic food chains, meaning that organisms exposed to MeHg in their food can build up concentrations that are many times higher than ambient concentrations in the environment."[115] Once it accumulates, mercury is a potent neurotoxin, affecting fish in many ways, including brain lesions, reduced gonadal secretions, reproductive timing failures, reduced ability to feed, suppressed reproductive hormones, reduced egg production, reduced reproductive

---

impacts of mercury. . . the majority (64 %) of Colorado pikeminnow may be experiencing some reproductive impairment through mercury exposure.") ("Colorado Pikeminnow 5-year Review"); USFWS, Biological Opinion for the Four Corners Power Plant and Navajo Mine Energy Project at 76 & Table 3 (April 8, 2015) ("Four Corners Biological Opinion")

[110] USFWS, Draft 2014-2015 Assessment of Sufficient Progress Under the Upper Colorado River Endangered Fish Recovery Program in the Upper Colorado River Basin, and of Implementation of Action Items in the December 20, 1999, 15-Mile Reach Programmatic Biological Opinion and December 4, 2009, Gunnison River Basin Programmatic Biological Opinion, 10 (Oct. 7, 2015) ("Sufficient Progress Assessment")
[111] *See* Barb Osmundson and Joel Lusk, Field assessment of mercury exposure to Colorado pikeminnow within designated critical habitat (May 5, 2011) ("Osmundson & Lusk 2011")
[112] *See* Four Corners Biological Opinion at 76 & Table 3; *see generally* Beckvar, N., T.M. Dillon, and L.B. Reads, Approaches for linking whole-body fish tissue residues of mercury or DDT to biological effects threshold, Environmental Toxicology and Chemistry 24:2094-2105 (2005)
[113] *See* Four Corners Biological Opinion at 73-74; Osmundson & Lusk 2011 at 9-10.
[114] *Id*. at 29.
[115] Four Corners Biological Opinion at 73.

success, and transfer of mercury into developing eggs.[116] Although the precise effects vary with relative concentrations, mercury and selenium may have synergistic toxic effects at certain ratios.[117]

The Service has acknowledged that its recovery planning for the Colorado pikeminnow needs updating to reflect this new information regarding mercury:

> In addition, the recovery goal revision needs to consider the impacts of mercury. Beckvar et al. (2005) associated studies involving survival, growth, reproduction, and behavior and recommended that 0.2 mg/kg in whole fish be viewed as protective, while adverse biological effects are more likely at higher concentrations. Based on this threshold, the majority (64 %) of Colorado pikeminnow may be experiencing some reproductive impairment through mercury exposure. Management strategies for controlling anthropogenic mercury emissions are necessary as atmospheric pollution can indirectly affect this endangered species, its critical habitat, and its recovery by ambient air exposure, deposition into aquatic habitat and bioaccumulation in diet and in fish tissues.[118]

Moreover, the Service's 2015 Sufficient Progress Assessment for the Recovery Program acknowledges that population viability studies show that mercury- and selenium-related reproductive impairment is likely to influence population levels in the San Juan Basin,[119] but no comparable analysis has yet been done for the higher levels of contamination present in Upper Colorado River Basin fish.

The significant difference in mercury concentrations in fish found in the neighboring Yampa and White Rivers also offers significant new information potentially relevant to the effect of BLM-authorized oil and gas development. Osmundson and Lusk found very high (average 0.95 mg/Kg WW) mercury concentrations in Colorado pikeminnow and in the White River, and lower (0.49 mg/Kg) concentrations in the neighboring Yampa.[120] Based on this discrepancy, they noted:

The Yampa and White rivers are relatively close geographically in northwestern Colorado. Because of this proximity, it is interesting that the Yampa River had the lowest

---

[116] *See* Lusk, Joel D., USFWS, Mercury (Hg) and Selenium (Se) in Colorado Pikeminnow and in Razorback Sucker from the San Juan River, 17 (2010), available at https://www.fws.gov/southwest/sjrip/pdf/DOC_Evaluation_Hg_Se_SJR_pikeminnow%20or_razorback_SJRIP_BC_2010.pdf.
[117] Four Corners Biological Opinion at 103.
[118] Colorado Pikeminnow 5-year Review at 21; *see also* Significant Progress Assessment at 10-11.
[119] Sufficient Progress Assessment at 10-11.
[120] Osmundson & Lusk 2011 at 21 & Table 2.

mercury concentrations in Colorado pikeminnow while the White River had the highest mercury concentrations. If most of the mercury was from aerial wet and dry deposition, the two drainages should be similar. This difference may indicate a localized source/s of mercury contamination into the White River drainage. There are currently >2,600 gas and oil wells in Rio Blanco county. It is possible that there is some localized sources of mercury contamination into the White River drainage connected with oil and gas exploration and development.[121]

Although site-specific information for the Upper Basin planning areas appears scarce, there is scientific as well as circumstantial evidence that oil and gas operations can contribute to mercury contamination.[122] The PBO does not consider the effect of oil and gas development within the White River watershed on the threat to Colorado pikeminnow and razorback sucker from mercury toxicity.

Nor does the PBO give any consideration to the multiple ways in which climate change will exacerbate mercury and selenium contamination and toxicity. Climate change can foreseeably be predicted to increase heavy rainfall events and ensuing runoff, increase pollutant concentrations due to reduced flows during low-flow periods, and contribute to increased methylmercury conversion due to higher temperatures.

Selenium pollution is harming the endangered fish

Selenium harms the endangered fish and other aquatic species through bioaccumulation in the food chain. Concentrations of 3µg/g in the food chain have been found to cause gill and organ damage in certain fish and may lead to death.[123] These bioaccumulative effects resulting in direct toxicity to juvenile and adults are known as "Type 1" effects. Moreover, selenium bioaccumulation can result in maternal transfer of selenium to fish egg yolks and lead to developmental abnormalities, known as "Type 2 effects."[124] Waterborne concentrations of selenium in the 1-5 µg/L range can bioaccumulate and lead to Type 1 and/or Type 2 effects.[125]

---

[121] *Id.* at 29 (citations omitted).

[122] *See* U.S. EPA, National Risk Management Research Laboratory, Mercury in Petroleum and Natural Gas: Estimation of Emissions from Production, Processing, and Combustion, EPA/600/SR-01/066 (Oct. 2001); Visvanathan, C., Treatment and Disposal of Mercury Contaminated Waste from Oil and Gas Exploration Facilities (1993) available at http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.549.9515&rep=rep1&type=pdf

[123] Lemly, A.D., Appalachian Center for the Economy & the Environment and Sierra Club, Aquatic hazard of selenium pollution from mountaintop removal coal mining, 3 (2009) ("Lemly 2009").

[124] Lemly 2009 at 3 ; Hamilton, S.J., Review of residue-based selenium toxicity thresholds for freshwater fish, Ecotox. Environ. Saf. 56: 201-210 (2003).

[125] *See id.*

Recent studies reveal significant exposures of the endangered fish to selenium. In one study analyzing selenium concentrations of 26 fish specimens collected from designated critical habitat in the Gunnison River, one Colorado pikeminnow specimen exhibited concentrations in muscle plugs that exceeded the 8 micrograms per gram dry weight toxicity guideline for selenium in fish muscle tissue.[126] Several species, including the razorback sucker and Colorado pikeminnow, exhibited selenium exposures in excess of the critical concentration at which Type 1 health effects begin to occur.[127]

In the Lower Gunnison River Basin, 2014 data indicated a range of dissolved selenium (chronic values) from 0.97 µg/L to 16.7 µg/L along the Uncompahgre River. Out of 18 sites in the lower Gunnison that were considered, the Colorado water-quality standard for chronic dissolved selenium of 4.6 µg/L was exceeded at two sites.[128] In regards to acute values, the range measured was from 1.1 µg/L for a portion of the Uncompahgre River to 125 µg/L along a portion of Loutzenhizer Arroyo, with 125 µg/L being well in excess of any criteria for instantaneous selenium measurements.[129] In another 2015 study, mean concentrations of selenium in various fish species in the lower Colorado River Basin exceeded the risk for maternal transfer to eggs, while selenium concentrations in various species of macroinvertebrate prey exceeded the risk value for larval fishes.[130] Average selenium concentrations in the studied fish species were found to be 2- to 4-fold higher than the risk threshold for piscivorous (fish-eating) wildlife, with samples exceeding this threshold in 81-100% of cases depending on the species. The risk value for larval fishes, who either absorb selenium via maternal transfer to eggs or through invertebrate diet, was exceeded in 56-100% of cases depending on the adult species (with risk posed to larvae due to maternal transfer), and 86-100% of cases among invertebrates (with risk posed to larval fishes through diet). Thus, the transfer of selenium toxicity from invertebrates to fish to piscivores is readily observable.[131]

Natural erosion and runoff, as well as selenium leaching into irrigation runoff, are the primary sources of this toxic pollutant. The weathering of Cretaceous marine shales can produce

[126] May, Thomas W. and Michael J. Walther, USGS, Determination of selenium in fish from designated critical habitat in the Gunnison River, Colorado, March through October, 2012, Open-File Report 2013-1104, 2 (2013)
[127] *Id*.
[128] Henneberg, M.F., 2014 annual summary of the lower Gunnison River Basin Selenium Management Program water-quality monitoring, Colorado: U.S. Geological Survey Open-File Report 2016–1129, 25 p. (2016), http://dx.doi.org/10.3133/ofr20161129.

[129] *Id*.
[130] Walters, David M., et al. Mercury and selenium accumulation in the Colorado River food web, Grand Canyon, USA. Environmental Toxicology and Chemistry, 34(10):2385-2394, 2390 (2015).
[131] *Id*.

high selenium soils, which are present in many areas of the western U.S.[132] Most notable of these Cretaceous shales is the Mancos Shale, which is found in Colorado, Utah, Wyoming, New Mexico, and Arizona. Irrigation of selenium-rich soils for crop production in arid and semi-arid regions can mobilize selenium and move it off-site in surface water runoff or via leaching into groundwater.

f. Population Numbers of the Endangered Fish Are Declining

Colorado pikeminnow populations are in decline throughout the Green River and Colorado River Basin, indicating that the Recovery Plan for the endangered fish has not been effective and that the impacts of water depletions could be more severe than previously anticipated.

According to Fish and Wildlife Service, the latest 2014 Colorado River sub-basin population number of 501 is "cause for great concern," and catch of sub-adults and adults in 2013 and 2014 "were near lowest observed in the history of the project."[133] 2015 catch numbers are within the same range, which suggests that the population estimate for 2015 will be similar to the 2014 estimate.[134] Preliminary data show that the Green River sub-population is "in decline throughout the entire Green River Subbasin" and has fallen under 2,000, below the minimum viable population of 2,600 adults.[135] The Yampa River portion of the sub-basin population also "remains low and may be in further decline."[136] Recent studies show that Colorado pikeminnow declines in the Yampa River are linked to "persistent high densities of nonnative predators (e.g., smallmouth bass and northern pike)," and that northern pike are outnumbering Colorado pikeminnow by three to one.[137]

Humpback chub numbers are also low. Fish and Wildlife Service is "concerned that wild populations of humpback chub in Black Rocks and Westwater Canyon of the Colorado River (near the Colorado-Utah state line) have not recovered from declines detected in the late 1990's. The reason for those population declines is uncertain."[138] After this steep reduction, the Black

---

[132] Lemly, A.D., Guidelines for evaluating selenium data from aquatic monitoring and assessment studies. Environ. Monitor. Assess. 28(1):83-100 (1993)

[133] Sufficient Progress Assessment at 23, 36.
[134] *See* USFWS, Monitoring the Colorado Pikeminnow Population in the Mainstem Colorado River via Periodic Population Estimates, 3 (Nov. 2015), available at http://www.coloradoriverrecovery.org/documents-publications/work-plan-documents/arpts/2015/rsch/127.pdf (showing similar capture rates of pikeminnow in 2014 and 2015).
[135] Sufficient Progress Assessment at 7.
[136] *Id*.
[137] *Id*. at 8.
[138] *Id*. at 36.

Rocks/Westwater population continued to decline.[139] In 2008, the population "dropped below the population size downlist criterion (MVP = 2,100 adults) for the first time."[140] In 2011 and 2012, the core population estimates were 1,846 and 1,718, respectively.[141]

The Desolation/Gray Canyons population in the Green River has also not met the population-size downlist criterion, and was observed to be "trending downward" based on 2006-2007 population estimates.[142] This trend has been attributed to "increased nonnative fish abundance and habitat changes associated with dry weather and low river flows."[143] The 2014 estimate is 1,863 adults, substantially below the 2,100-adults recovery criterion.[144] Further, the proportion of captured individuals in 2015 that were first-year adults was 7.9%, continuing "a significantly declining trend in this metric since the 2001–2003 sampling period."[145] This "significant decline" in the percentage of captured individuals that were first-year adults "may be an indication that the future stability of the population is uncertain."[146]

Finally, the two smaller Yampa Canyon and Cataract Canyon populations do not indicate "self-sustaining" populations. "[I]t is not known if pure humpback chubs occur in Yampa Canyon."[147] The Cataract Canyon population is "small," decreasing by over half, from 150 wild adults in 2003 to 66 in 2005 such that population estimates are no longer possible.[148]

These declining population numbers are new baseline conditions, such that the endangered fish could be more vulnerable to water depletion and other oil and gas development effects than previously assumed. These downward trends also strongly suggest that the Endangered Fish Recovery Program is not achieving recovery targets nor adequately offsetting water depletion effects as intended.

g. The Recovery Program Is Failing to Meet Recommended Flows

[139] *Id*. at 13.
[140] *Id*.
[141] *Id*. at 13-14.
[142] *Id*. at 12.
[143] *Id*. at 23.
[144] *Id*. at 12.
[145] USFWS, Colorado River Recovery Program, FY 2015 Annual Project Report, Project No. 129, Humpback chub population estimates for Desolation/Gray Canyons, Green River Utah, p. 4 (Nov. 13, 2015), available at http://www.coloradoriverrecovery.org/documents-publications/work-plan-documents/arpts/2015/rsch/129.pdf.
[146] *Id*.
[147] Sufficient Progress Assessment at 11.

[148] *Id*. at 14.

A consistent pattern of failing to meet recommended flows in the Colorado River's 15-Mile Reach requires BLM and the Service to reinitiate consultation over the Fluid Mineral Program.

The Recovery Program establishes minimum recommended flows within various segments of the Upper Colorado River Basin that should be maintained to ensure recovery of the endangered fish.[149] The PBO's effects analysis assumes that, at the very least, the minimum recommended flow of 810 cubic feet per second (cfs) for dry years will be maintained within the 15-Mile Reach of the Colorado River within Colorado's Grand Valley in the Grand Junction Field Office.[150] The 15-Mile Reach extends from the confluence of the Gunnison River in Grand Junction to Palisade, Colorado, fifteen miles upstream.[151] According to the Service, when flows drop below 810 cfs, "habitat becomes compromised to the point that adult pikeminnow likely vacate the 15-Mile Reach to points downstream where flows increase either due to tributary input from the Gunnison River or irrigation return flow."[152] The 15-Mile Reach is one of the most important habitats to the Colorado pikeminnow and razorback sucker,[153] providing important spawning grounds for both species and year-round habitat for the Colorado pikeminnow.[154]

In its discussion of the environmental baseline, the PBO notes various recommended flows for the Colorado River sub-basins, including minimum flows for wet years, wet-average years, dry-average years, and dry years.[155] The PBO notes that in some recent years, recommended flows have not been met in the 15-Mile Reach.[156] However, the PBO's effects analysis assumes that the lowest recommended flow for dry years (810 cfs) will be maintained;

---

[149] *See id*. at 41; USFWS, Final Programmatic Biological Opinion for Bureau of Reclamation's Operations and Depletions, Other Depletions, and Funding and Implementation of Recovery Program Actions in the Upper Colorado River above the Confluence with the Gunnison River, 54 (Dec. 1999) ("Colorado River PBO"), available at http://www.coloradoriverrecovery.org/documents-publications/section-7-consultation/15mile/FinalPBO.pdf .
[150] PBO at 42, 48.
[151] PBO at 4.
[152] *See* Sufficient Progress Assessment at 34-35; Osmundson, Douglas B. & Patrick Nelson, USFWS, Relationships Between Flow and Rare Fish Habitat in the '15 Mile Reach' of the Upper Colorado River Final Report, 6 (1995), available at http://www.coloradoriverrecovery.org/documents-publications/technical-reports/isf/OsmundsonNelson1995.pdf ("Osmundson 1995").
[153] PBO at 36, 42; Colorado River PBO at 25, 32, 45; Osmundson 1995 at 6.
[154] PBO at 36; Colorado River PBO at 31-32.
[155] PBO at 41-44.
[156] *See id*. at 42-44 (e.g., "Since the publication of the spring flow recommendations in 1991, peak 1-day average flows through the 15-mile reach have been below 12,900 cfs approximately one-third of the years through 2006 and these targets have not been met."); *id*. at 42 ("Mean monthly flows have…dropped below 810 cfs [the minimum flow for drought years] for at least one of the summer-time months during 7 of the last 17 years (1991-2007).").

this minimum flow is the baseline by which the PBO determined the Fluid Mineral Program's depletion effects on the Colorado pikeminnow.[157]

The Endangered Fish Recovery Program's latest Sufficient Progress Assessment indicates that recommended flows for dry years in the 15-Mile Reach of the Colorado River were not met in 2012 and 2013.[158] Flows also fell short of recommended levels in 2015, despite it being a dry-average precipitation year. In April, May, August and October 2015, the 15-Mile Reach missed the recommended minimum average flows for those months for dry-average precipitation years.[159] This average year shortfall (following a "wet-average" year) strongly suggests that minimum recommended flows for later dry years will almost certainly not be met when water will be scarcer, and as declining stream flows overall due to climate change weaken the Recovery Program's ability to supplement natural flows in dry years.[160] Indeed, in the period since the PBO was adopted, between 2009 and 2015, the Recovery Program has failed to meet mean monthly recommended flows in the 15-Mile Reach in over half of all months.[161] This new information strongly suggests that critical habitat within the 15-Mile Reach is likely to be unsuitable for the Colorado pikeminnow and razorback sucker in dry years, and that flow depletions from oil and gas development will only exacerbate these unsuitable conditions and reduce these species' chances of recovery.

The Recovery Program's continuing pattern of failing to meet recommended flows is new information revealing that the Fluid Mineral Program may have effects on the endangered fish to an extent that was not considered in the PBO or any of the RMPs that rely on the PBO in this leasing decision.

3. Allowing New Leasing While BLM Evaluates New Information Concerning the Endangered Fish Violates BLM's Section 7 Consultation Duties

Recently, in BLM's response to the Center and Sierra Club's protest of the Colorado State Office's Grand Junction Field Office December 8, 2016 lease sale, BLM stated its intent to

---

[157] *Id*. at 48.
[158] *See* Sufficient Progress Assessment at 34 (noting average monthly flows significantly below 810 cfs in 15-mile reach in 2012 and 2013); *id*. at 31 (recognizing need to reduce the amount of time flows drop below 810 cfs in the 15-Mile Reach).
[159] *Compare* Colorado River PBO at 40-41 (recommended mean monthly stream flows for 15-Mile Reach) *with* U.S. Geological Survey, Surface Water Monthly Statistics (1991 - 2016) & Email from Tom Chart, FWS, Director, Upper Colorado River Endangered Fish Recovery Program to Wendy Park (July 15, 2016) (chart indicating dry, average, and wet precipitation years).
[160] *See* n. 415 above & accompanying text (noting ability to buffer Colorado River system will become more difficult as streamflows decrease).
[161] *See* Center for Biological Diversity's comparison of USGS monthly mean flow data to recommended flow (spreadsheet showing 15-Mile Reach flows and months with shortfall) (Exhibit G).

prepare a new programmatic biological assessment on the Fluid Mineral Program, while at the same time allowing the December lease sale to go forward. BLM, however, cannot have it both ways—relying on the PBO to support new leasing, while also revising its analysis. Under these circumstances, proceeding with new leasing violates BLM's obligations to consult before its proposed action and insure against jeopardy.

As an initial matter, BLM's protest response asserts that the "2008 PBO is still suitable to support the decision to lease parcels in the Upper Colorado River Basin area," on the flawed basis that the PBO's overall basin-wide depletion threshold had not been exceeded.[162] This ignores the fact that the PBO's Colorado River sub-basin depletion threshold was exceeded in FY2015, in violation of the PBO. BLM's implicit position that the PBO does not establish sub-basin depletion limits (in contrast to its prior suggestion)[163] is contrary to common sense and the PBO. Depletions in a particular sub-basin may significantly affect local endangered fish populations; otherwise, there would be no reason for the PBO to analyze the effects of depletions at the sub-basin level, or to require BLM to track and report depletions to FWS by sub-basin, as it does.

More troublingly, BLM's assertion that the 2008 PBO still validly supports its leasing decision does not square with BLM's recognition, in the same decision, of "the need to consider new information and re-evaluate changing conditions on the Upper Colorado River" and to "prepar[e] an updated Programmatic Biological Assessment (PBA)."[164] The PBA, BLM notes, "may consider information about new drilling techniques and re-examine the extent and location of fluid mineral reserves by river basin. The PBA will also evaluate how climate change and contaminants (specifically selenium and mercury) are affected by water depletions associated with BLM's fluid mineral program."[165] As the foregoing section shows, all of these factors are important considerations on the long-term viability of the endangered fish, which must be considered *before* any new depletions are allowed. And given FWS's finding that any water depletion is likely to jeopardize the endangered fish, BLM cannot dismiss the effects of any depletions resulting from its leasing decision. New depletions could result in significant adverse effects on the fish before BLM and FWS have had a chance to evaluate their potential effects in light of these significant new circumstances. In addition, BLM has never consulted over the

[162] BLM, Protest Decision on December 2016 Oil and Gas Competitive Lease Sale, 13 (Dec. 7, 2016) ("December Protest Decision").
[163] *See* BLM, Protest Decision on Center for Biological Diversity's Protest of May 12, 2016 Competitive Oil & Gas Lease Sale (May 12, 2016) ("Moreover, consistent with the 2008 PBO, average annual depletions, regardless of the drilling technology employed, would not be allowed to exceed 369 acre-feet [i.e., Little Snake Field Office's projected water depletion] without further BLM and Fish and Wildlife Service analysis and reinitiated Section 7 consultation.").
[164] December Protest Decision at 13.
[165] *Id*.

depletion and spill effects of new leasing in the particular areas at issue (not to mention BLM's and FWS's consultation over the White River RMPA's spill effects is inadequate). Leasing of the parcels here could have localized effects on endangered fish downstream which have not been considered in any prior consultation, given the much higher water depletion effects, and increased surface water contamination risks, that could result from increased fracking and horizontal drilling in the leasing areas.

In the absence of a valid Section 7 consultation covering the Fluid Mineral Program and BLM's leasing decision, BLM is in violation of its Section 7 duties to both consult over the lease sale's depletion effects on the endangered fish and to insure against jeopardy to the species, before auctioning new leases. 16 U.S.C. § 1536(b). Waiting until the APD stage to consult violates BLM's duty to initiate consultation "at the earliest possible time," when meaningful consultation is possible now. *See* 50 C.F.R. § 402.14(a) ("Each Federal agency shall review its actions at the earliest possible time to determine whether any action may affect listed species or critical habitat."); *The Wilderness Society v. Wisely*, 524 F. Supp. 2d 1285, 1302 (D. Colo. 2007) (requiring Section 7 consultation before BLM's decision to resume oil and gas leasing where it was "possible… to engage in meaningful conference"); *Colorado Envtl. Coal. v. Office of Legacy Mgmt.*, 819 F. Supp. 2d 1193, 1223 (D. Colo. 2011) (requiring same for uranium leasing decision).

Indeed, the law is clear that, in the context of oil and gas leasing, "agency action" under the ESA includes not just the legal transaction of lease issuance, but also all resulting post-leasing activities from exploration, through production, to abandonment:

> we hold that agency action in this case entails not only leasing but leasing and all post-leasing activities through production and abandonment. Thus, section 7 of the ESA on its face requires the FWS in this case to consider all phases of the agency action, which includes postleasing activities, in its biological opinion. Therefore the FWS was required to prepare, at the leasing stage, a comprehensive biological opinion assessing whether or not the agency action was likely to jeopardize the continued existence of protected species, based on "the best scientific and commercial data available." 16 U.S.C. § 1536(a)(2).

Conner v. Burford, 848 F.2d 1441, 1453 (9th Cir. 1988). The Ninth Circuit's decision in *Conner* is similarly clear that the consultation requirement is not obviated by uncertainty about the precise location and extent of future drilling: "Although we recognize that the precise location and extent of future oil and gas activities were unknown at the time, extensive information about the behavior and habitat of the species in the areas covered by the leases was available." *Id.* at 1453. Similarly, the inclusion of a general Threatened and Endangered Species stipulation in the

standard lease terms cannot substitute for the ESA Section 7 obligation to prepare a comprehensive biological opinion at the initial leasing stage:

> Appellants ask us, in essence, to carve out a judicial exception to ESA's clear mandate that a comprehensive biological opinion -- in this case one addressing the effects of leasing and all post-leasing activities -- be completed before initiation of the agency action. They would have us read into the ESA language to the effect that a federal agency may be excused from this requirement if, in its judgment, there is insufficient information available to complete a comprehensive opinion and it take upon itself incremental step consultation such as that embodied in the T & E stipulations. We reject this invitation to amend the ESA. That it is the role of Congress, not the courts.

Id. at 1455. The BLM's refusal to consult at the lease stage, and proposal to defer consultation to the APD stage, is precisely the sort of incremental step consultation decisively rejected as inconsistent with the ESA in *Conner v. Burford*.[166] As a result, BLM should cancel the lease sale and halt all new leasing until an adequate consultation on the Fluid Mineral Program and proposed lease sale has been completed. Prior to any lease sale, BLM must both consult under ESA Section 7 and analyze under NEPA the effects of the massive water demand resulting from relatively new horizontal drilling techniques in the Upper Colorado River Basin (the "Upper Basin") which would impact watersheds affected by future development of the parcels at issue here. Specifically, this analysis should address the water depletion and spill potential effects of new leasing on specific water supplies and watersheds including, "[f]our lease parcels being offered in the WRFO physically encompass designated critical habitat on the White River and collectively coincide with about 1 mile of river occupied by Colorado pikeminnow below Taylor Draw dam near Rangely." EA 103.

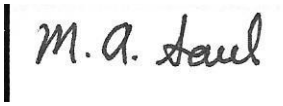
[166] Further, there is no assurance that BLM would even consult under Section 7 at the APD or site-specific stage. Instruction Memorandum 2010-023 allows projects to go forward without Section 7 consultation if (1) the project or well operator has signed a Recovery Agreement under terms set forth by the PBO, if the project or APD is located in the Yampa or Colorado river sub-basins; or (2) if the project is located in the White, Dolores, or Gunnison river sub-basins. Accordingly, BLM typically does not perform Section 7 consultation for water depletions at the APD stage.

VI. Conclusion

Oil and gas leasing is an irrevocable commitment to convey rights to use of federal land – a commitment with readily predictable environmental consequences that BLM is required to address. These include the specific geological formations, surface and ground water resources, seismic potential, or human, animal, and plant health and safety concerns present in the area to be leased. Unconventional oil and gas development not only fuel the climate crisis but entail significant public health risks and harms to the environment. Accordingly, BLM should end all new leasing on BLM lands. Should BLM proceed with the lease sale it must thoroughly analyze the alternatives of no new leasing (or no action), and no fracking or other unconventional well stimulation methods in an EIS.

Thank you for your consideration of these comments. The Center looks forward to reviewing a legally adequate EIS for this proposed oil and gas leasing action.

Sincerely,



Michael Saul
Senior Attorney
Center for Biological Diversity
1536 Wynkoop Street, Suite 421
Denver, CO 80202
msaul@biologicaldiversity.org

From: Porter, Michael
To: Michael
Subject: Decision Documents for DOI-BLM-NM-F010-2016-0252 W Lybrook UT 720 et al.
Date: Tuesday, December 13, 2016 11:04:44 AM
Attachments: 2016.12.13_WPX_W_Lybrook_720_Documents.zip

Dear Interested Parties,

Please find attached the Decision Record, Finding of No Significant Impact, and Environmental Assessment for DOI-BLM-NM-F010-2016-0252 W Lybrook UT 720 et al..

Under BLM regulations, this Decision Record (DR) is subject to administrative review in accordance with 43 CFR 3165. Any request for administrative review of this DR, with or without oral presentation, must include information required under 43 CFR 3165.3(b) (State Director Review), including all supporting documentation. Such a request must be filed in writing with the State Director, Bureau of Land Management, 301 Dinosaur Trail, Santa Fe, NM 87508, no later than 20 business days after this Decision Record is received or considered to have been received.

Any party who is adversely affected by the State Director's decision may appeal that decision to the Interior Board of Land Appeals, as provided in 43 CFR 3165.4.

Thank you for your interest in oil and gas development in the Farmington Field Office.

--

Michael Porter
Natural Resource Specialist
Bureau of Land Management
Farmington Field Office
Office: (505)564-7705

`UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Farmington District
Farmington Field Office
6251 N College Blvd., Ste. A
Farmington, NM 87402

Finding of No Significant Impact

WPX Energy Production, LLC's W Lybrook Unit 720H, 722H, 724H, 726H, 728H, 729H, 756H, 757H, 758H, 759H, 760H, & 761H Oil and Natural Gas Wells Project

NEPA No. DOI-BLM-NM-F010-2016-0252-EA

FINDING OF NO SIGNIFICANT IMPACT

I have determined that the proposed action, as described in Environmental Assessment (EA) DOI-BLM-NM-F010-2015-0252 will not have any significant impact, individually or cumulatively, on the quality of the human environment. Because there would not be any significant impact, an Environmental Impact Statement is not required.

In making this determination, I considered the following factors:

Context

The Farmington Field Office (FFO) is located in northwestern New Mexico. The field office boundaries include approximately 7,800,000 acres; 1.4 million surface acres and an additional 1 million acres of mineral estate are managed by the BLM. The distribution of BLM-managed lands is fairly well consolidated in the north and becomes increasingly mingled with Tribal lands to the south. BLM-managed lands abut the Navajo Reservation to the west and south, Jicarilla Apache Nation Reservation to the east, and the Ute Mountain Reservation and Southern Ute Indian Reservation to the north. Aztec Ruins National Monument and Chaco Culture National Historical Park, managed by the National Park Service, lie within the field office boundaries. The BLM manages approximately 18% of lands within a 10 mile radius of Chaco Culture National Historical Park.

The FFO encompasses the New Mexico portion of the San Juan Basin. The San Juan Basin and surrounding areas have been occupied by varied cultures since the Paleo Indian period (circa 10,000 BC). The San Juan Basin and Four Comers area have one of the most extensive prehistoric and protohistoric occupations in the United States. The most commonly known archaeological resources are the Anasazi structures at Chaco Culture National Historical Park, Mesa Verde National Park, and other National Park Service sites. Scattered across BLM-managed lands are similar, but smaller structures, which were probably related to these larger sites. Twenty-three Chacoan outliers are known to exist within the FFO. Each contains at least one Chacoan structure and most have associated communities, prehistoric roads, and great kivas along with features such as herraduras and special use areas. The FFO contains an extensive system of finely engineered roads radiating out form Chaco Canyon and extending a considerable distance to outlying sites through the San Juan Basin and beyond. These roads are remarkably straight and carefully constructed. The most notable is the Great North Road, which starts at Chaco Canyon and runs north to the Aztec Ruins.

Located within the boundary of the FFO is much of Dinétah, the ancestral homeland to the Navajo. Here the Navajo constructed forked-stick hogans, shades, sweat lodges, and other structures over a several hundred year span. During a short period between 1680 and the mid-1700s, pueblitos were constructed, often associated with other structures. Although not firmly dated, extensive Navajo pictograph and petroglyph sites were painted, etched, pecked, or ground onto the sandstone cliffs of the canyons of Dinétah. Most are believed to be ceremonial art which is no longer traditionally executed in a permanent form.

Native American Traditional and Sacred Areas are known to exist across the FFO. Many are associated with narrative accounts of origin or other traditional stories. Most of the identified sacred areas are associated with the Navajo culture. These places are still important in Navajo ceremonies and daily activities.

Historic Hispanic or Spanish and Anglo sites within the San Juan Basin primarily date from the late 1800s to the present. Although there are some early Spanish land grants in the southern portion of the FFO, most historic sites located on public lands are either Hispanic or Anglo homesteads with associated structures from the late 1800s and early 1900s. Associated with many clusters of homesteads were a school house and often a church which was visited every few months by a priest.

Cultural resource inventories have been conducted throughout the FFO for project undertakings, management studies, and scientific inquiries. As of April 2014, approximately 760,000 acres of the 7,800,000 acres in the FFO boundaries have been inventoried. Over 46,000 sites have been identified ranging from small artifacts to the 800-room structures in Chaco Canyon. Many of these sites are listed on the National Register of Historic Places and Chaco Culture National Historical Park along with several of the Chacoan sites which have been placed on the World Heritage List. The FFO manages 79 Areas of Critical Environmental Concern (ACECs) for relevant and important cultural values, including five World Heritage Sites.

The San Juan Basin is an important area for mammalian and reptilian fossils. A variety of paleontological resources exist in the FFO including animal fossils, fossil leaves, palynomorphs, petrified wood, and trace fossils occurring in the Triassic, Jurassic, Cretaceous, and Tertiary rocks. Dinosaur and other fossils that have made significant contribution to the scientific record have been found and excavated in the FFO. Paleontolgical resources are present in the Bisti De-Na-Zin Wilderness Area, Ah-Shi-Sle-Pa Wilderness Study Area, Fossil Forrest Research Natural Area, and seven fossil areas identified in the 2003 Farmington Resource Management Plan.

The San Juan Basin is one of the largest natural gas fields in the nation and has been under development for more than 60 years. Oil was discovered by accident in the Seven Lakes area of McKinley County in 1911. Natural gas was discovered near Aztec, New Mexico, in 1920-1921 with oil of commercial quantity discovered near the Hogback in 1922 (Barnes 1951). Several small pipelines were built to carry the oil and gas from these discoveries to Aztec and Farmington, respectively. Development began in earnest in the late 1940s and early 1950s as the demand for natural gas increased. The FFO manages 2,765 active oil and gas leases in the San Juan Basin consisting of 2.1 million acres. Leasing began in the mid-1930s and accelerated in the late 1940s. By 1950, over 1 million acres were under lease.

In 1951, El Paso Natural Gas completed the first interstate pipeline out of the San Juan Basin to California. That same year, oil was discovered in the Mancos Shale in Dogie Canyon (Barnes 1951). Since that time, over 30,000 oil and gas wells have been drilled in the San Juan Basin with approximately 16,000 associated rights-of-way. Approximately 23,000 wells are currently producing. Since Stanolind Oil introduced hydraulic fracturing in 1949, nearly every well in the San Juan Basin has been fracture stimulated.

Intensity

1. The activities described in the proposed action do not include any significant beneficial or adverse impacts (40 CFR 1508.27(b)(1)). Per 40 CFR 1500.1(b), the EA concentrated on issues that are truly significant to the action in question, rather than amassing needless detail. Issues have a cause and effect relationship with the proposed action or alternatives; are within the scope of the analysis; have not been decided by law, regulation, or previous decision; and are amendable to scientific analysis rather than conjecture (BLM 2008, page 40). The following issues were identified related to the proposed:

- How would surface disturbance associated with proposed action impact the establishment and distribution of noxious weeds and invasive species?
- How would vegetation-clearing from surface disturbance and increased human activity associated with the proposed action impact nesting habitat for migratory bird species?
- How would surface disturbance associated with the proposed action impact the following BLM Special Status Species (SSS) and their habitat: Bendire's thrasher (*Toxostoma bendirei),* golden eagle (*Aquila chrysaetos), prairie* falcon (*Falco mexicanus),* Aztec gilia *(Aliciella Formosa),* and Brack's hardwall cactus (*Sclerocactus cloveriae ssp. Brackii)*?

- How would the Proposed Action impact cultural resources, including historic properties, properties listed on the National Register of Historic Places or New Mexico State register of Cultural Properties, Chaco Protection Sites, World Heritage Sites, National Historic Trails, or other places of traditional religious and cultural importance in the impact analysis area?
- How would the proposed action impact forage availability and livestock grazing operations?
- What are the impacts of the proposed action on environmental justice?
- How would traffic related to the proposed action impact public health and safety?

The EA includes a description of the expected environmental consequences of the proposed activities for those issues in Chapter 3.

2. The activities included in the proposed action and alternatives would not significantly affect public health or safety (40 CFR 1508.27(b)(2)). The following design features have been included in the proposed action to address any impacts to public health and safety:

- The hauling of equipment and materials for the proposed project on public roads would comply with Department of Transportation regulations. No toxic substances would be stored or used within the proposed project area. WPX would have inspectors present during construction. Any accidents involving persons or property would immediately be reported to the BLM-FFO. WPX would notify the public of potential hazards by posting signage, as necessary.
- There are not designated recreation or commercial areas within 1 mile of the project area. The closest populated area is approximately 2 miles to the southwest. The proposed project area is accessible to the public by dirt roads.
- Vehicles would be restricted to proposed disturbance areas and existing areas of surface disturbance, such as existing roads and well pads.
- Worker safety incidents would be reported to the BLM-FFO as required under Notice to Lessees (NTL) - 3A (USGS 1979). WPX would adhere to company safety policies, Occupational Safety and Health Administration regulations, and Department of Transportation regulations.
- Construction and maintenance activities would cease when soil or road surfaces become saturated to the extent that construction equipment is unable to stay within the proposed project area and/or when activities would cause irreparable harm to roads, soils, or watercourses.
- The nearest hospital is in Farmington, New Mexico. This hospital is approximately 47 air miles or approximately 55 road miles from the proposed project area.

3. The proposed activities would not significantly affect any unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas (40 CFR 1508.27(b)(3)). Unique characteristics are generally limited to those that have been identified through the land use planning process or other legislative, regulatory or planning processes (BLM 2008, page 71). The FFO does not contain any prime and unique farmlands, suitable or designated wild and scenic rivers, or designated caves. Table 1 discloses the distance of the proposed activities to identified wetlands. Table 2 discloses the distance of the proposed activities to National Park Service units and Congressionally designated areas. The proposed action and alternatives are not located within an Area of Critical Environmental Concern. Impacts to historic or cultural resources are described in the Cultural Resources section of the EA and discussed further under item 8.

Table 1. Distance of the Proposed Activities from Identified Wetlands

Identified Wetlands	Distance from Proposed Activities
Bancos	54 miles
Blanco	35 miles
Bloomfield	37 miles
Cutter Canyon	34 miles
Carrizo Oxbow	32 miles
Desert Hills	39 miles
Valdez	37 miles

Table 2. Distance of the Proposed Activities from Park Lands and Ecologically Critical Areas

Park Land or Ecologically Critical Area	Distance from Proposed Activities
Ah-Shi-Sle-Pah Wilderness Study Area	7 miles
Aztec Ruins National Monument	46 miles
Bisti De-Na-Zin Wilderness Area	16 miles
Chaco Culture National Historical Park	25 miles
Fossil Forest Research Natural Area	18 miles

4. The activities described in the proposed action involve effects on the human environment that have the potential to be highly controversial, yet it is unlikely these effects will occur (40 CFR 1508.27(b)(4)). Controversy in this context means disagreement about the nature of the effects, not expressions of opposition to the proposed action or preference among the alternatives (BLM 2008, page 71). While there may be controversy over the appropriateness of oil and gas development and scientific dispute over the impacts of that activity, it is unlikely that highly controversial impacts will take place. The impacts of the proposed activities are described in Chapter 3 of the EA.

5. The activities described in the proposed action do not involve effects that are highly uncertain or involve unique or unknown risks (40 CFR 1508.27(b)(5)). As described under Context, oil and gas development has occurred in the San Juan Basin since the late 1940s and early 1950s. The field office has permitted over 30,000 wells and 16,000 rights-of-way. Hydraulic fracturing has occurred on nearly every well in the San Juan Basin since the 1950s. As such, the FFO has decades of experience and is knowledgeable about the impacts and risks associated with the proposed activities.

6. My decision to implement these activities does not establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration (40 CFR 1508.27(b)(6)). Approval of these activities in no way assures approval of any future activities.

7. The effects of the proposed activities would not be significant, individually or cumulatively, when considered with the effects of other actions (40 CFR 1508.27(b)(7)). Direct, indirect, and cumulative impacts are described in Chapter 3 of the EA.

8. I have determined that the activities described in the proposed action will not adversely affect or cause loss or destruction of scientific, cultural, or historical resources, including those listed in or eligible for listing in the National Register of Historic Places (40 CFR 1508.27(b)(8)). The proposed activities are not located in an ACEC containing relevant and important cultural values. Cultural resource surveys were completed. Known cultural resources will be avoided with the implementation of design features such as but not limited to reduction of construction areas, temporary barriers, and site monitoring. (DOI-BLM-NM-F010-2016-0252-EA, p. 55-58).

9. The proposed activities are not likely to adversely affect any endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act (40 CFR 1508.27(b)(9)). The project area does not contain any known populations of threatened or endangered species. (DOI-BLM-NM-F010-2016-0252-EA, p. 51-55).

10. The BLM FFO recognized eight (8) Paleontological Special Designated Areas (SDA) in the current Resource Management Plan (more than 135,000 acres) in order to preserve important paleontological resources for scientific study, protection, and other public benefits (BLM 2003b, 4-117). The BLM has determined that these areas require special management attention in order to protect, and prevent irreparable damage to important paleontological resources. The proposed W Lybrook UT 720H/726H Project would be located within the Betonnie Tsosie fossil Paleontological SDA.

Fossils found on BLM-managed lands are considered part of our national heritage and afforded protection. The BLM manages fossil resources for their scientific, educational, and recreational values. On public lands paleontological resources are managed under authorities and policy's that govern the management and preservation of the resource. Paleontological resources are managed under numerous authorities including the BLM Field Office 2003 Resource Management Plan (BLM 2003b, 4-117), Paleontological Resources Preservation Act of 2009 (Sections 6301-6312 of the Omnibus Public Lands Act of 2009, 16 USC 470aaa), Federal Land Policy and Management Act of 1976 (P.L. 94-579), National Environmental Policy Act of 1969 (P.O. 91-190), Potential Fossil Yield Classification System for Paleontological Resources on Public Lands (IM 2008-009), and the Assessment and Mitigation of Potential Impacts to

Paleontological Resources (IM 2009-011). The authorities provide for civil and criminal penalties and also require that public lands be managed to preserve and protect the quality of scientific values of paleontological resources DOI-BLM-NM-F010-2016-0252-EA, p. 11,14).

11. The proposed activities will not threaten any violation of Federal, State, or local law or requirements imposed for the protection of the environment (40 CFR 1508.27(b)(10)). Sections 1.4 and 1.5 of the EA describe the relationship of the proposed activities to relevant laws, policies, regulations, and plans.

REFERENCES

Barnes, Frank C., 1951. History of development and production of oil and gas in the San Juan Basin. In *The south and west sides of the San Juan Basin, New Mexico and Arizona*, Smith, C.T.; Silver, C. ed(s), New Mexico Geological Society, Guidebook, 2nd Field Conference, pp. 155-160.

BLM. 2008. *National Environmental Policy Handbook. H-1790-1*. Bureau of Land Management. National Environmental Policy Act Program.

APPROVED:

(s)David Mankiewicz — 11/21/16

Richard A. Fields
Field Manager
Farmington Field Office

Date

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Farmington District
Farmington Field Office
6251 N College Blvd., Ste. A
Farmington, NM 87402

Decision Record
for the

WPX Energy Production, LLC's W Lybrook Unit
720H, 722H, 724H, 726H, 728H, 729H, 756H, 757H, 758H, 759H, 760H, & 761H Oil and Natural Gas Wells Project

NEPA No. DOI-BLM-NM-F010-2016-0252-EA

I. Decision

I have decided to select Alternative B (Proposed Action) for implementation as described in the WPX Energy Production, LLC's (WPX) Proposed W Lybrook Unit 720H, 722H, 724H, 726H, 728H, 729H, 756H, 757H, 758H, 759H, 760H, & 761H Oil and Natural Gas Wells Project Environmental Assessment (EA). Based on my review of the Environmental Assessment (EA) and project record, I have concluded that Alternative B was analyzed in sufficient detail to allow me to make an informed decision. I have selected this alternative because the proposed projects would allow WPX access to BLM managed lands to develop their proposed drilling site to horizontally drill for natural gas within their valid and existing leases.

II. Conformance and Compliance

The proposed action is in conformance with the 2003 BLM-FFO Resource Management Plan (RMP). Pursuant to 40 CFR 1508.28 and 1502.21, this site-specific Environmental Assessment (EA) tiers into and incorporates by reference the information and analysis contained in the BLM-FFO Proposed Resource Management Plan/Final Environmental Impact Statement (PRMP/FEIS) (BLM 2003a). The RMP was approved by the September 29, 2003 Record of Decision (ROD) (BLM 2003b), and updated in December 2003.

It is the policy of the BLM to make mineral resources available for disposal and to encourage development of mineral resources to meet national, regional, and local needs, consistent with national objectives of an adequate supply of minerals at reasonable market prices. At the same time, the BLM strives to ensure that mineral development is carried out in a manner that minimizes environmental damage and provides for the rehabilitation of affected lands. (BLM 2003b, 2-2 – 2-3)

III. Finding of No Significant Impact

I have reviewed the direct, indirect and cumulative effects of the proposed activities documented in the EA for WPX's Proposed W Lybrook Unit 720H, 722H, 724H, 726H, 728H, 729H, 756H, 757H, 758H, 759H, 760H, & 761H Oil and Natural Gas Wells Project. I have also reviewed the project record for this analysis. The effects of the proposed action and alternatives are disclosed in the Alternatives and Environmental Consequences sections of the EA. I have determined that the construction of a well pad, pipeline tie and access road to allow WPX reasonable access to the mineral lease in order to develop the existing lease as described in the EA will not significantly affect the quality of the human environment. Accordingly, I have determined that the preparation of an Environmental Impact Statement is not necessary.

IV. Other Alternatives Considered

No reasonable alternatives to the proposed action have been developed that would result in significantly fewer impacts or any clear advantages over the proposed action. The proposed access road and proposed pipeline corridor follows the most economic and direct route based on the location of existing WPX's infrastructure, existing disturbance, surface resources, and terrain.

V. Rationale for the Decision

Pursuant to 40 Code of Federal Regulations (CFR) 1508.28 and 1502.21, this site-specific environmental assessment (EA) tiers to and incorporates by reference the information and analysis contained in the Farmington Proposed Resource Management Plan/Final Environmental Impact Statement [(PRMP/FEIS) BLM 2003a]. This EA is in conformance with the management goals set forth in the Resource Management Plan (RMP) for the Farmington Field Office (FFO) of the BLM, which was approved by the Record of Decision (ROD) signed September 29, 2003 (BLM 2003b). Specifically, this action is in conformance with the following: It is the policy of the BLM to make mineral resources available for disposal and to encourage development of mineral resources to meet national, regional, and local needs, consistent with national objectives of an adequate supply of minerals at reasonable market prices. At the same time, the BLM strives to ensure that mineral development is carried out in a manner that minimizes environmental damage and provides for the rehabilitation of affected lands (2003b, 2-2). The PRMP/FEIS, RMP, and ROD are available for review at the BLM Farmington Field Office, 6251 College Blvd., Farmington, NM, or electronically at: http://www.nm.blm.gov/ffo/ffo_home.html

I have determined that the activities described in the proposed action will not adversely affect or cause loss or destruction of scientific, cultural, or historical resources, including those listed in or eligible for listing in the National Register of Historic Places (40 CFR 1508.27(b)(8)). The proposed activities are not located in an ACEC containing relevant and important cultural values. BLM Cultural Resource Record of Reviews # 2016(II)012F and 2016(II)014F were completed, and determined there would be no effect to historic properties.

The proposed activities are not likely to adversely affect any endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act (40 CFR 1508.27(b)(9)). The project area does not contain any known populations of threatened or endangered species.

VI. Public Involvement

The Notice of Staking was made available for the public to review at the Farmington Field Office. No comments were received.

The project EA, unsigned FONSI, and Dear Reader Letter were posted in the Farmington Field Office public room, as well as on the National NEPA Register at https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=renderDefaultPlanOrProjectSite&projectId=67228&dctmId=0b0003e880bfd15e. The project was made available for public commenting from September 26, 2016 - October 26, 2016. No public comments were received.

VII. Administrative Review and Appeal

Under BLM regulations, this Decision Record (DR) is subject to administrative review in accordance with 43 CFR 3165. Any request for administrative review of this DR, with or without oral presentation, must include information required under 43 CFR 3165.3(b) (State Director Review), including all supporting documentation. Such a request must be filed in writing with the State Director, Bureau of Land Management, 301 Dinosaur Trail, Santa Fe, NM 87508, no later than 20 business days after this DR is received or considered to have been received.

Any party who is adversely affected by the State Director's decision may appeal that decision to the Interior Board of Land Appeals, as provided in 43 CFR 3165.4.

This decision to authorize a right-of-way may be appealed to the Interior Board of Land Appeals (IBLA), Office of the Secretary, in accordance with the regulations contained in 43 CFR Part 4. Any appeal must be filed within 30 days of this decision. Any notice of appeal must be filed with the Acting Field Manager, Bureau of Land Management, Farmington Field Office, 6251 College Boulevard, Suite A, Farmington, NM 87402. The appellant shall serve a copy of the notice of appeal and any statement of reasons, written arguments, or briefs on each adverse party named in the decision, not later than 15 days after filing such document (see 43 CFR 4.413(a)). Failure to serve within the time required will subject the appeal to summary dismissal (see 43 CFR 4.413(b)). If a statement of reasons for the appeal is not included with the notice, it must be filed with the IBLA, Office of Hearings and Appeals, U. S. Department of the Interior, 801 North Quincy St., Suite 300, Arlington, VA 22203 within 30 days after the notice of appeal is filed with the Farmington Field Office Manager.

Notwithstanding the provisions of 43 CFR 4.21(a)(1), filing a notice of appeal under 43 CFR Part 4 does not automatically suspend the effect of the decision. If you wish to file a petition for a stay of the effectiveness of this decision during the time that your appeal is

being reviewed by the Board, the petition for a stay must accompany your notice of appeal.

A petition for a stay is required to show sufficient justification based on the following standards:

(1) The relative harm to the parties if the stay is granted or denied;

(2) The likelihood of the appellant's success on the merits;

(3) The likelihood of immediate and irreparable harm if the stay is not granted; and

(4) Whether the public interest favors granting the stay.

In the event a request for stay or an appeal is filed, the person/party requesting the stay or filing the appeal must serve a copy of the appeal on the Office of the Field Solicitor: United States Dept. of the Interior, Office of the Solicitor, Southwest Regional Office, 505 Marquette Avenue NW, Suite 1800, Albuquerque, NM 87102

(s)David Mackiewicz (for) 11/21/16
Richard A. Fields Date
Field Manager
Farmington Field Office

United States Department of the Interior
Bureau of Land Management

Environmental Assessment DOI-BLM-NM-F010-2016-0252-EA

WPX Energy Production, LLC's W Lybrook Unit 720H, 722H, 724H, 726H, 728H, 729H, 756H, 757H, 758H, 759H, 760H, & 761H Oil and Natural Gas Wells Project

August 2016

Prepared for:

Bureau of Land Management—Farmington Field Office

Bureau of Indian Affairs – Navajo Region

U. S. Department of Interior – Federal Indian Minerals Office

U.S. Department of the Interior
Bureau of Land Management
Farmington District
Farmington Field Office
6251 N. College Blvd., Ste. A
Farmington, NM 87402
Phone: (505) 564-7600
FAX: (505) 564-7608

New Mexico • Farmington Field Office

It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

TABLE OF CONTENTS

1. Purpose and Need for Action 5
1.1. Background 5
6
1.3. Decision to be Made 7
1.4. Conformance with Applicable Land Use Plan(s) 7
1.5. Relationship to Statutes, Regulations or Other Plans 7
1.6. Scoping, Public Involvement, and Issues 12
2. Proposed Action and Alternatives 14
2.1. Alternative A: No Action 14
2.2. Alternative B: Proposed Action 14
2.3. Alternatives Considered but Eliminated from Detailed Study 30
3. Affected Environment and Environmental Consequences 31
3.1. Methodology 31
3.2. Air Resources 32
3.3. Upland Vegetation 38
3.4. Noxious Weeds and Invasive Species 44
3.5. Migratory Birds 46
3.6. Special Status Species 51
3.7. Cultural Resources 55
3.8. Livestock Grazing 58
3.9. Environmental Justice 62
3.10. Public Health and Safety 66
4. Supporting Information 68
4.1. Tribes, Individuals, Organizations, or Agencies Consulted 68
4.2. List of Preparers 69
4.3. Glossary 69
4.4. References 70
Appendix A. Maps 75
Appendix B. Plats 78
Appendix C. Photographs 79
Appendix D. Surface Reclamation Plan 98
Appendix E. Biological Survey Report 99

This page intentionally left blank.

1. PURPOSE AND NEED FOR ACTION

1.1. Background

Access to oil and gas reserves in a particular formation is regulated by spacing rules established by the New Mexico Energy, Minerals and Natural Resources Department Oil Conservation Division (NMOCD). On Federal lands, the U. S. Bureau of Land Management (BLM) generally abides by NMOCD rules but has the authority to establish its own spacing and well density rules.

On August 6, 2015, WPX Energy went to hearing before the NMOCD in its application for approval of the West Lybrook Unit (UT): creating a new pool for horizontal development within the unit area, and for allowance of 330 foot setbacks from the exterior of the unit, San Juan County, New Mexico. The NMOCD subsequently issued its order approving the West Lybrook Unit as a project area and establishing setback requirements of 330 feet from the outer boundary (Order R-14051). The BLM's approval came out in its decision letter dated December 1, 2015. The agreement has been assigned to case recordation number NMNM135216X.

The proposed Project would be within the BLM's Farmington Field Office (FFO) management area of San Juan County, New Mexico and WPX's West Lybrook Unit. Specifically, it would be located on Navajo Indian Allotted lands administered by the Bureau of Indian Affairs (BIA), Navajo Regional Office Eastern Agency, and the Federal Indian Minerals Office (FIMO), as well as, public lands managed by the BLM-FFO within Sections 23, 24, 25, and 26 of Township 23 North, Range 09 West New Mexico Principal Meridian (N.M.P.M). The project would be approximately 37 miles south-southeast of the town of Bloomfield, New Mexico; 4.3 miles south-southwest of Nageezi, New Mexico, and 3.5 miles southwest of the intersect at County Road #7890 and U.S. Highway 550 (See Appendix A).

WPX is proposing to construct the W Lybrook UT 720H, 722H, 724H, 756H, 757H, and 758H oil and natural gas wells project and the W Lybrook UT 726H, 728H, 729H, 759H, 760H, and 761H oil and natural gas wells project (W Lybrook UT 720H/726H Project). Twelve oil and natural gas wells are proposed to be horizontally drilled, possibly produced and eventually plugged and abandoned. To accommodate this action, the project would include the construction, use, and subsequent reclamation of two multi-well well pads, two access roads, and two well-connect pipelines. As part of the aforementioned project, WPX proposes to construct two range improvement ponds.

WPX would submit twelve Applications for Permit to Drill (APDs) to the BLM-FFO for the proposed W Lybrook UT 720H, 722H, 724H, 726H, 728H, 729H, 756H, 757H, 758H, 759H, 760H, and 761H oil and natural gas wells. The wells would access the Navajo Indian allotted mineral estate; as well as, Federal minerals administered by the BLM-FFO and BIA in the Lybrook Gallup pool associated with WPX's valid existing unit lease No. NMNM135216X (Refer to Table 1 below for individual lease numbers per well). The proposed action is the approval of the twelve APDs by the BLM-FFO, located in Farmington, New Mexico. The proposed 720H, 722H, 724H, 726H, 728H, 729H, 756H, 757H, 758H, 759H, 760H, and 761H wells, two well pads, two access roads, two well-connect pipeline corridors, and two range improvement ponds with temporary access would each be authorized by an approved APD.

The W Lybrook UT 720H/726H Project would result in a total of 28.62 acres of surface disturbance with 26.59 acres of new surface disturbance. The proposed access roads and well-connect pipeline corridors utilize existing two-track roads where practicable while staying in compliance with established regulations for placement of pipeline and access near existing transmission line infrastructure (where applicable). New surface disturbance would be located with respect to archeology, paleontology, geology, terrain characteristics, current/proposed WPX infrastructure, offset regulations from transmission lines, and efforts to minimize ground/vegetative disturbance. During interim reclamation, of the 28.62 acres of proposed surface disturbance, 18.53 acres would be fully reclaimed and 2.52 acres would be reseeded, but not re-contoured. For the long term, 6.53 acres would be stabilized and used as a working surface throughout the life of the W Lybrook UT 720H/726H Project. The remaining 1.04 acres would not be reclaimed as this would consist of the two 0.52-acre range improvements ponds. The working surfaces and the areas that were only reseeded would be fully reclaimed during final reclamation.

1.2. Purpose and Need for Action

The purpose of the following proposed action is to allow WPX reasonable access to BLM-managed lands to develop their Federal mineral leases (NMNM-036949, NMNM-057164, NMNM-121961), as well as Navajo Indian allotted lands to develop their Navajo Indian Allotted mineral leases administered by the BLM (NO-G-1312-1846, NO-G-1312-1857, NO-G-1312-1858, NO-G-1312-1860, NO-G-1312-1862, NO-G-1312-1863, NO-G-1401-1872, NO-G-1401-1877, NO-G-1402-1890, NO-G-1403-1945, NO-G-1403-1948, NO-G-1403-1953, NO-G-1404-1964, NO-G-1408-1974).

Table 1. Proposed action lease information including unit lease number

Well Number	Lease 1	Lease 2	Lease 3	Lease 4	Lease 5	Lease 6	Lease 7	Unit Lease
W Lybrook UT No. 720H	NO-G-1312-1858	NO-G-1312-1846	NO-G-1312-1860	NO-G-1403-1945	NO-G-1403-1948	NO-G-1312-1862	NO-G-1401-1872	NMNM135216X
W Lybrook UT No. 722H	NMNM-121961	NO-G-1312-1858	NO-G-1312-1860	NO-G-1403-1945	NO-G-1401-1872	NO-G-1312-1862	-	NMNM135216X
W Lybrook UT No. 724H	NMNM-121961	NMNM-057164	NO-G-1312-1860	NO-G-1401-1877	NO-G-1401-1872	NO-G-1312-1863	-	NMNM135216X
W Lybrook UT No. 726H	NMNM-057164	NO-G-1312-1860	NO-G-1401-1877	NO-G-1401-1872	NO-G-1312-1863	-	-	NMNM135216X
W Lybrook UT No. 728H	NMNM-057164	NO-G-1404-1964	NO-G-1401-1877	NO-G-1402-1890	NO-G-1312-1863	-	-	NMNM135216X
W Lybrook UT No. 729H	NO-G-1403-1953	NO-G-1404-1964	NO-G-1408-1974	NO-G-1402-1890	NMNM-121961	NMNM-057164	-	NMNM135216X
W Lybrook UT No. 756H	NMNM-036949	NMNM-057164	NO-G-1312-1857	NO-G-1312-1862	-	-	-	NMNM135216X
W Lybrook UT No. 757H	NMNM-036949	NO-G-1312-1857	-	-	-	-	-	NMNM135216X
W Lybrook UT No. 758H	NMNM-036949	NO-G-1312-1857	-	-	-	-	-	NMNM135216X
W Lybrook UT No. 759H	NMNM-036949	NMNM-057164	NO-G-1312-1863	-	-	-	-	NMNM135216X
W Lybrook UT No. 760H	NMNM-036949	NMNM-057164	NO-G-1312-1863	-	-	-	-	NMNM135216X
W Lybrook UT No. 761H	NMNM-036949	NMNM-057164	-	-	-	-	-	NMNM135216X

The need for the action is the BLM and BIA's responsibility to respond to the APD under the Mineral Leasing Act (MLA) of 1920, as amended (30 United States Code [USC] 181 et seq.), the Act of March 3, 1909 (1909 Act), and 25 Code of Federal Regulations (CFR) § 212 Leasing of Allotted Lands for Mineral Development. Per 43 Code of Federal Regulations (CFR) 3160 (Onshore Oil and Gas Operations), the BLM is required to respond to a request for an APD. It is the policy of the BLM, as derived from several laws, including the MLA, to make mineral resources available for disposal and to encourage development of mineral resources to meet national, regional, and local needs.

The BIA and BLM, as agents for the Secretary of the Interior, are responsible for administering the leasing and development of oil and gas resources where the mineral estate is held in trust by the federal government for the benefit of the Indian people. The BLM manages the federal mineral program and is responsible for management of oil and gas on Indian allotments (25 CFR § 212 Leasing of Allotted lands for Mineral Development). BLM regulations (43 CFR 3160) establish procedures for obtaining approval of an APD on existing onshore federal and tribal oil and gas leases. The FIMO was established by the Department of the Interior August 1991 to provide services to individual Navajo mineral owner beneficiaries regarding their mineral interests and rights. FIMO is

staffed with personnel from the BIA and the Office of Natural Resources Revenue. The staff also works in conjunction with personnel from the BLM and Office of Special Trustee for American Indians.

1.3. Decision to be Made

The BLM-FFO and BIA will decide whether or not to issue the twelve APDs, and if so, under what terms and conditions. The BLM is mandated under the National Environmental Policy Act of 1969, as amended [42 U.S.C. §4321] which requires that environmental obligations are conducted in a manner that protects the mineral resources, other natural resources, and environmental quality. The authorized officer shall prepare an environmental record of reviews (e.g. Documentation of National Environmental Policy Act (NEPA) Adequacy [DNA]) or an environmental assessment (EA) as appropriate per [42 U.S.C. §3162.5-1(a)]. The BLM-FFO authorized officer will decide one of the following:

- To approve the APDs with design features as specified in the Proposed Action submitted;
- To approve the APDs as specified in the Proposed Action with additional mitigation added;
- To approve the APDs with design features as specified in an alternative; or
- To deny the APDs.

1.4. Conformance with Applicable Land Use Plan(s)

The proposed action is the result of oil and gas leases issued by the BIA on Allotted Indian Lands and conforms with the standard lease terms and conditions for Indian oil and gas leases as outlined in form AAO-81 for lease numbers NO-G-1312-1846, NO-G-1312-1857, NO-G-1312-1858, NO-G-1312-1860, NO-G-1312-1862, NO-G-1312-1863, NO-G-1401-1872, NO-G-1401-1877, NO-G-1402-1890, NO-G-1403-1945, NO-G-1403-1948, NO-G-1403-1953, NO-G-1404-1964, and NO-G-1408-1974 and the "*General Requirements for all Federal and Indian Oil and Gas leases"* administered by the BLM-FFO.

The proposed action conforms with the September 29, 2003 BLM-FFO Record of Decision (ROD) approving the Resource Management Plan (RMP) (ROD; BLM 2003b), as updated in December 2003. Pursuant to 40 CFR 1508.28 and 1502.21, this site-specific EA tiers into and incorporates by reference the information and analysis contained in the BLM-FFO Proposed Resource Management Plan/Final Environmental Impact Statement (PRMP/FEIS; BLM 2003a).

Specifically, the proposed action is in conformance with the following objectives:

> It is the policy of the BLM to make mineral resources available for disposal and to encourage development of mineral resources to meet national, regional, and local needs, consistent with national objectives of an adequate supply of minerals at reasonable market prices. At the same time, the BLM strives to ensure that mineral development is carried out in a manner that minimizes environmental damage and provides for the rehabilitation of affected lands. (BLM 2003b, 2-2, 2-3)

This EA addresses site-specific resources and effects of the proposed action that were not specifically covered within the PRMP/FEIS as required by NEPA. The proposed project would not be in conflict with any local, county, or state plans.

1.5. Relationship to Statutes, Regulations or Other Plans

The BIA is not required to comply with BLM regulations, policies, or plans. As such, BIA-managed lands would be managed under BIA regulations, policies, and plans and BLM management would not apply.

WPX would comply with applicable federal, state, and local laws and regulations. Necessary permits and approvals for the proposed project would be obtained prior to project implementation.

Many requirements regulating specific environmental elements are found in the appropriate sections of this EA (Chapter 3). Permits, licenses, consultations, or other requirements are discussed below.

1.5.1. Surface Water Resources

Clean Water Act

Activities affecting Waters of the U.S. are regulated under the Clean Water Act (CWA) ((33 USC 1251-1376; Chapter 758; PL 845; 62 Stat. 1155); reauthorized 1991). Specifically, Section 404 authorizes discharges to waters of the U.S. and Section 401 provides water quality certification for such activities. The Section 401 certification would be granted by the New Mexico Environment Department (NMED).

Under Section 402 of the Act, as amended, the U.S. Environmental Protection Agency (EPA) regulates storm water discharges from industrial and construction activities under the National Pollution Discharge Elimination System program (NPDES). Permits are required if discharge results in a reportable quantity for which notification is required (pursuant to 40 CFR 117.21, 40 CFR 302.6, or 40 CFR 110.6) or if the discharge contributes to a violation of a water quality standard. However, oil and gas activities have been exempt from NPDES permitting regulations in New Mexico.

The Nationwide Permit (NWP) program under Section 404 of the Act provides for fills to waters subject to jurisdiction under Section 404 for certain discharges. It is administered by the EPA and U.S. Army Corps of Engineers (USACE). Under the CWA, the USACE has jurisdiction over waters of the U.S. Waters of the U.S. are considered jurisdictional because they have a "significant nexus" to traditional navigable waters. The BLM-FFO and USACE - Durango Regulatory Office have determined that jurisdictional waters (i.e., waters of the U.S.) within the BLM-FFO planning area may include U.S. Geological Survey (USGS) watercourses (i.e., "blue lines" on USGS 1:24,000 topographic maps) and potential tributaries to these USGS watercourses. The proposed Project would not cross any USGS blue lines that may be subject to regulatory jurisdiction under the USACE. The proposed project would be designed to avoid discharge into other watercourses that are potentially USACE jurisdictional and would not result in the loss of greater than ½ acre of waters of the U.S.

1.5.2. Air Resources

Clean Air Act

The Clean Air Act of 1972, as amended (CAA; 42 USC 7401 et seq.), establishes national ambient air quality standards (NAAQS) to control air pollution. In New Mexico, the NMED has adopted most of the CAA into the New Mexico Administrative Code (NMAC). The NMED issues construction and operating permits for air quality and enforces air quality regulations and permit conditions. WPX would acquire all necessary air quality permits for the Proposed Action prior to production of the wells.

1.5.3. Wildlife Resources

Endangered Species Act 1973

The Endangered Species Act of 1973 (ESA) [16 USC. 1531 et. seq.] requires all federal departments and agencies to conserve species listed as threatened or endangered, and species listed as candidates for federal listing with the United States Fish and Wildlife Service (USFWS), or designated habitat. Under Section 7 of the Endangered ESA, all federal agencies are required to consult with the USFWS or National Marine Fisheries Service on all actions authorized, funded, or carried out by a federal agency that may affect listed species or designated critical habitat.

Consultation with the USFWS was conducted as part of the PRMP/FEIS to address the cumulative effects of RMP implementation (Consultation No. 2-22-01-1-389, Appendix M of the PRMP/FEIS). The proposed project would be in compliance with USFWS Threatened and Endangered Species management guidelines outlined in the September 2002 Biological Assessment (Consultation No. 2-22-01-I-389) conducted for the Farmington Resource Management Plan/Environmental Impact Statement (BLM 2003). No further consultation with the USFWS is required.

Migratory Bird Treaty Act of 1918

The Migratory Bird Treaty Act (MBTA) implements a series of international treaties that provide for migratory bird protection. The Act authorizes the Secretary of the Interior to regulate the taking of migratory birds. The act provides that it shall be unlawful, except as permitted by regulations, "to pursue, take, or kill any migratory bird, or

any part, nest or egg of any such bird" (16 USC 703) but does not regulate habitat. The list of species protected by the MBTA was revised in March 2010 and includes almost all bird species (1,007 species) that are native to the US. The Migratory Bird Treaty Act of 1918, as amended (16 USC §§ 703-712; 50 CFR Part 21) protects avian species that could potentially occur in the proposed project area and may be affected by the Proposed Action.

Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds

Signed on January 11, 2001, this Executive Order directs each federal agency taking actions that are likely to have a measureable effect on migratory bird populations to develop and implement a Memorandum of Understanding (MOU) with the USFWS that promotes the conservation of migratory bird populations.

Memorandum of Understanding to Promote the Conservation of Migratory Birds and FFO Interim Management Policy

On April 12, 2010, the USFWS and BLM signed a MOU pursuant to Executive Order 13186. The purpose of this MOU is to strengthen migratory bird conservation by identifying and implementing strategies that promote conservation and avoid or minimize adverse impacts on migratory birds through enhanced collaboration between the USFWS and BLM, in coordination with state, tribal, and local governments. This MOU identifies specific activities where cooperation between the USFWS and BLM would contribute to the conservation of migratory birds and their habitat. In 2010, the BLM FFO also developed an Interim Management Policy for migratory birds pursuant to MBTA that requires nest surveys for disturbance during the nesting season, and halts construction at nest sites until young have fledged.

Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act, as amended (PL 86-70, PL 87-884, PL 92-535, PL 95-616; USC 668-668d) prohibits the take or possession of bald and golden eagles with limited exceptions. Take, as defined in the Act, includes "to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb." Disturb means to agitate or bother a bald or golden eagle to a degree that causes or is likely to cause, based on the best scientific information available, injury to an eagle; a decrease in its productivity by substantially interfering with normal breeding, feeding, or sheltering behavior; or nest abandonment by substantially interfering with normal breeding, feeding, sheltering behavior. An important eagle-use area is defined in the Act as an eagle nest, foraging area, or communal roost site that eagles rely on for breeding, sheltering, or feeding, and the landscape features surrounding such nest, foraging area, or roost site that are essential for the continued viability of the site for breeding, feeding, or sheltering eagles. Golden eagles could potentially occur in the proposed project area and may be affected by the Proposed Action. The nearest BLM recorded golden eagle nest is located 9.7 miles west-northwest of the Proposed Action area.

BLM Manual 6840 – Special Status Species Management

BLM Manual 6840 provides management policy for federally listed species and BLM-designated sensitive species. Species classified as BLM-designated sensitive must be native species found on BLM-managed lands for which the BLM has the capability to significantly affect the conservation status of the species through management, and either:

1) There is information that a species has recently undergone, is undergoing, or is predicted to undergo a downward trend such that the viability of the species or a distinct population segment of the species is at risk across all or a significant portion of the species range; or

2) The species depends on ecological refugia or specialized or unique habitats on BLM-managed lands, and there is evidence that such areas are threatened with alteration such that the continued viability of the species in that area would be at risk. The BLM protects and manages habitat for the enhancement and protection of the species future existence.

1.5.4. Vegetative Resources

Federal Noxious Weed Act

This law provides for the control and management of nonindigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health. The Federal Noxious Weed Act prohibits importing or moving any noxious weeds identified by the regulation, and allows for inspection and quarantine to prevent the spread of noxious weeds. Ground disturbances associated with the Proposed Action may increase the potential for weed establishment in disturbance areas.

Executive Order 13112, Invasive Species

Signed in 1999, this Executive Order directs federal agencies to prevent the introduction of invasive species, to provide for their control, and to minimize the economic, ecological, and human health impacts caused by invasive species. To do this, the Executive Order established the National Invasive Species Council. Currently, there are 13 departments and agencies on the Council.

New Mexico Executive Order 00-22

Issued in 2000, this Executive Order directs agencies to participate in generating noxious weed awareness within their agency and among the public with whom the agency interacts; manage infestations of plant species designated by the New Mexico department of Agriculture as Class A noxious weed infestations on state land or rights-of-way under their jurisdiction by making use of integrated pest management techniques; and cooperate with the Department of Agriculture to increase the level of coordination on weed management efforts.

Final Vegetation Treatments Using Herbicides Programmatic Record of Decision

This BLM effort was developed on a national level to analyze the environmental effects of herbicides for treating and managing vegetation on western BLM-managed lands, including New Mexico. The 2007 decision allowed for the use of four (4) new approved herbicides for field-level planning and on-the ground projects designed to restore and sustain important riparian, range, and wildlife habitat on BLM-managed lands.

New Mexico Administrative Code 19.21.2

The New Mexico Energy, Minerals, and Natural Resources Department (EMNRD)-Forestry Division is responsible for the State Endangered Plant Species List. The Forestry Division gathers information relating to population abundance, distribution, habitat requirements, threats, limiting factors, and other biological and ecological data to determine the status of an endangered species. The statute directs the Division to establish a program necessary to promote the conservation of listed endangered plant species including research, inventory and monitoring, law enforcement, habitat maintenance, education and propagation. NMAC 19.21.2 authorizes the department to prohibit the taking of endangered species, with the exception of permitted scientific collections or propagation and transplantation activities that enhance the survival of endangered species. The forestry division (state forester) is the department secretary's designated representative for the purposes of endangered plant investigations and for issuing collection and transplantation permits. Within the surveyed area for the proposed W Lybrook UT 720H/726H Project, seventy-five Brack's hardwall cactus (*Sclerocacus cloveriae* var. *brackii*) individuals were identified; however, all individuals are located on Navajo Indian Allotted lands and do not require a transplant.

1.5.5. Cultural Resources

Federal law mandates protection of cultural surface resources that may be present in the proposed project area and potentially affected by the Proposed Action. These resources are protect by the Antiquities Act of 1906 (PL 52-209); Section 106 of the National Historic Preservation Act of 1966 (PL 89-665; 80 Stat. 915; 16 USC 470 et seq.), as amended (implemented under regulations of the Advisory Council on Historic Preservation, 36 CFR Part 800); the Archaeological and Historical Conservation Act of 1974 (PL 93-291); the Archaeological Resources Protection Act of 1979 (PL 96-95; 93 Stat. 721; 16 USC § 470aa et seq.), as amended (PL 100-555; PL 100-588) and its regulations (36 CFR 296); the American Indian Religious Freedom Act of 1978 (PL 95-431; 92 Stat. 469; 42 USC 1996); and the Native American Graves Protection and Repatriation Act of 1990 (PL 101-601; 104 Stat. 3048; 25 USC 3001; 43 CFR Part 10).

BLM compliance with Section 106 responsibilities of the National Historic Preservation Act is adhered to by following the 2014 BLM – New Mexico State Historic Preservation Officers (SHPO) protocol agreement, which is authorized by the *2012 National Programmatic Agreement between the BLM*, the *Advisory Council on Historic Preservation*, and the *National Conference of State Historic Preservation Officers*, and other applicable BLM handbooks.

BIA compliance with the National Historic Preservation Act (NHPA) on Navajo trust lands is adhered to by making the final decisions and issuing final notices to proceed with undertakings based on Navajo Nation Historic Preservation Department (NNHPD) review and recommendations to the BIA-NRO Regional Director.

1.5.6. Paleontological Resources

Fossils found on BLM-managed lands are considered part of our national heritage and afforded protection. The BLM manages fossil resources for their scientific, educational, and recreational values. On public lands paleontological resources are managed under authorities and policy's that govern the management and preservation of the resource. Paleontological resources are managed under numerous authorities including the BLM Field Office 2003 Resource Management Plan (BLM 2003b, 4-117), Paleontological Resources Preservation Act of 2009 (Sections 6301-6312 of the Omnibus Public Lands Act of 2009, 16 USC 470aaa), Federal Land Policy and Management Act of 1976 (P.L. 94-579), National Environmental Policy Act of 1969 (P.O. 91-190), Potential Fossil Yield Classification System for Paleontological Resources on Public Lands (IM 2008-009), and the Assessment and Mitigation of Potential Impacts to Paleontological Resources (IM 2009-011). The authorities provide for civil and criminal penalties and also require that public lands be managed to preserve and protect the quality of scientific values of paleontological resources.

The BLM FFO recognized eight (8) Paleontological Special Designated Areas (SDA) in the current Resource Management Plan (more than 135,000 acres) in order to preserve important paleontological resources for scientific study, protection, and other public benefits (BLM 2003b, 4-117). The BLM has determined that these areas require special management attention in order to protect, and prevent irreparable damage to important paleontological resources. The proposed W Lybrook UT 720H/726H Project would be located within the Betonnie Tsosie fossil Paleontological SDA.

1.5.7. Wastes, Hazardous or Solid

Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act [(42 U.S.C.) § 6926, et. seq.] (RCRA) provides Federal authority to control hazardous wastes, including the generation, transportation, treatment, storage, and disposal of hazardous waste. It also sets forth a framework for the management of non-hazardous wastes and control of underground storage of petroleum or other hazardous materials and provides authority for state hazardous waste programs under §3006 of the Act. A 1980, amendment to RCRA conditionally exempted from regulation as hazardous wastes, "drilling fluids, production waters, and other wastes associated with the exploration, development, or production of crude oil or natural gas. On July 6, 1988, the EPA determined that oil and gas exploration, development and production (ED&P) wastes would not be regulated as hazardous wastes under RCRA. A simple rule of thumb was developed for determining if an ED&P waste is likely to be considered exempt or non-exempt from RCRA regulations: If (1) the waste came from down-hole, or (2) the waste was generated by contact with the oil and gas production stream during removal of produced water or other contaminants, the waste is most likely to be considered exempt by EPA.

Comprehensive Environmental Response Compensation and Liability Act of 1980

The Comprehensive Environmental Response Compensation and Liability Act of 1980 [(42 U.S.C.) §9601, et seq.] (CERCLA) provides Federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment and provides for liability of persons responsible for releases of hazardous waste. Despite many oil and gas constituent wastes being exempt from hazardous waste regulations, certain RCRA exempt contaminants could be subject to regulations as hazardous substances under CERCLA. The New Mexico Oil Conservation Division (OCD) administers hazardous waste regulations for oil and gas activities in New Mexico.

All wastes associated with the proposed W Lybrook UT 720H/726H Project, would be disposed of in a proper manner as required by federal and state law, and as described in the Conditions of Approval (COAs). No hazardous or solid waste materials would be present within the analysis area. The notification of releases such as natural gas, natural gas liquids, and petroleum, outside a facility site is required under CERCLA and under BLM NTL-3A.

1.5.8. New Mexico State Regulations

The New Mexico Oil Conservation Division (NMOCD), which is in the EMNRD, regulates oil and gas operations in New Mexico. The NMOCD has the responsibility of gathering production data, permitting new wells, establishing pool rules and allowables, issuing discharge permits, enforcing rules and regulations, monitoring underground injection wells, ensuring that abandoned wells are properly plugged, and ensuring that the land is responsibly restored. Oil and gas regulations administered by the NMOCD are contained in NMAC 19.15. These regulations include the following, with which WPX would comply:

- The EMNRD requires operators to follow "pit rule" guidelines (NMAC 19.15.17) to reduce groundwater contamination from industry-related activities.
- NMAC 19.15.15 establishes requirements for well acreage spacing, obtaining approval of unorthodox well locations, and pooling or communitizing small acreage oil lots.
- NMAC 19.15.16.19 requires the disclosure of hydraulic fracture constituents.

1.6. Scoping, Public Involvement, and Issues

1.6.1. Scoping and Public Involvement

The BLM-FFO publishes a NEPA log for public inspection. This log contains a list of proposed and approved actions within the BLM-FFO. The log is located on the BLM's New Mexico website (http://www.blm.gov/nm/st/en/prog/planning/nepa_logs html); as well as the BLM's ePlanning website (https://eplanning.blm.gov/epl-front-office/eplanning/nepa/nepa_register.do).

An allottee meeting was held on July 27, 2015 at 9:30 AM at the San Juan College in Farmington, New Mexico. The meeting discussed the formation of the West Lybrook Unit, WPX's plans for development, and details about the unit hearing that would occur the following week. An initial on-site meeting was held for the proposed project on December 9, 2015. Interest party groups were notified via email concerning attendance to the onsite on November 13, 2015, and a public invitation to the on-site meeting was posted online (http://www.blm.gov/nm/st/en/fo/Farmington_Field_Office/ffo_oil_and_gas/ffo_onsites.html). Attendees included WPX representatives, BLM FFO representatives, the project surveyor (NCE Surveys Inc.), a dirt work consultant (Adobe Contractors Inc.), a regulatory specialist (EIS, LLC) and an environmental consultant (EIS, LLC.); no private citizens or groups attended. A second on-site meeting was held on April 27, 2016; attendees included a BLM FFO representative, a regulatory specialist (EIS, LLC) and an environmental consultant (EIS, LLC.). A BLM FFO Interdisciplinary Team meeting was held on January 11, 2016, to discuss the proposed action. At the aforementioned meetings, potential issues of concern were identified by the BLM-FFO.

Based on the size and scale, routine nature, and potential impacts associated with the proposed action, no additional external scoping was conducted. No public comments were received for the proposed action.

1.6.2. Issues to be Analyzed

The following issues were identified during internal scoping as potential issues of concern for the proposed action. These issues will be addressed in this EA.

- How would the construction (including drilling and well completion), use (including production operations) and abandonment of the W Lybrook UT 720H/726H Project impact air quality and climate?
- How would surface disturbance associated with proposed action impact upland vegetation?

- How would surface disturbance associated with proposed action impact the establishment and distribution of noxious weeds and invasive species?
- How would vegetation-clearing from surface disturbance and increased human activity associated with the proposed action impact nesting habitat for migratory bird species?
- How would surface disturbance associated with the proposed action impact the following BLM Special Status Species (SSS) and their habitat: Bendire's thrasher (*Toxostoma bendirei),* golden eagle (*Aquila chrysaetos),* prairie falcon (*Falco mexicanus),* Aztec gilia *(Aliciella Formosa),* and Brack's hardwall cactus (*Sclerocactus cloveriae ssp. Brackii)*?
- How would the Proposed Action impact cultural resources, including historic properties, properties listed on the National Register of Historic Places or New Mexico State register of Cultural Properties, Chaco Protection Sites, World Heritage Sites, National Historic Trails, or other places of traditional religious and cultural importance in the impact analysis area?
- How would the proposed action impact forage availability and livestock grazing operations?
- What are the impacts of the proposed action on environmental justice?
- How would traffic related to the proposed action impact public health and safety?

1.6.3. Issues Considered but Not Analyzed

The following issues were identified during scoping as issues of concern that would not be impacted by the proposed action or that have been covered by prior environmental review. These issues will not be analyzed in this EA.

Areas of Critical Environmental Concern (ACECs)

The nearest Area of Critical Environmental Concern (ACEC) to the proposed action is the North Road ACEC/Chacoan Roads located 9 miles west.

Groundwater

Stimulation (i.e., hydraulic fracturing or "fracking") is a process used to maximize the extraction of underground resources by allowing oil or natural gas to move more freely from the rock pores to production wells that bring the oil or gas to the surface. Fluids, commonly made up of water (99 percent) and chemical additives (1 percent), are pumped into a geologic formation at high pressure during hydraulic fracturing (USEPA 2004). Chemicals added to stimulation fluids may include friction reducers, surfactants, gelling agents, scale inhibitors, acids, corrosion inhibitors, antibacterial agents, and clay stabilizers. When the fracking pressure exceeds the rock strength, the fluids open or enlarge fractures that typically extend several hundred feet away from the well bore, and may occasionally extend up to 1,000 feet from the well bore. After the fractures are created, a propping agent (usually sand) is pumped into the fractures to keep them from closing when the pumping pressure is released. After fracturing is completed, a portion of the injected fracturing fluids returns to the wellbore and is recovered for future fracturing operations (USEPA 2004) or disposal. Stimulation techniques have been used in the United States since 1949 and in the San Juan Basin since the 1950s. Over the last 10 years, advances in multi-stage and multi-zone hydraulic fracturing have allowed development of gas fields that previously were uneconomic, including the San Juan Basin.

Hydraulic fracturing is a common process in the San Juan Basin and applied to nearly all wells drilled. The producing zone targeted by the proposed action is well below any underground sources of drinking water. The Mancos Shale formation is also overlain by a continuous confining layer. The geological confining layer is the Lewis Shale formation that is located above both the Mancos Shale and Mesaverde formations and provides an impermeable layer that isolates the Mancos Shale and Mesaverde formations from both identified sources of drinking water and surface water. On average, total depth of the proposed well bore would be about 5,000 feet below the ground surface. Fracturing in the Basin Mancos formation is not expected to occur above depths of 4,000 feet below the ground surface. Fracturing could possibly extend into the Mesaverde formation overlying the Basin Mancos; however, the formation has not been identified as an underground source of drinking water based on its depth and relative high levels of total dissolved solids (TDS). No impacts to surface water or freshwater-bearing groundwater aquifers are expected to occur from hydraulic fracturing of this proposed well.

U.S. Fish and Wildlife Service (USFWS)-Listed Species

As noted previously, cumulative effects of the RMP to federally listed species and their associated habitats were addressed in the PRMP/FEIS. A review of species currently listed by the USFWS as occurring in Sandoval County (USFWS 2015), as well as the location of the proposed project area indicates a potential for nine (9) threatened, endangered, or candidate species to occur as of March 30, 2016. All nine (9) of the listed species have been eliminated from detailed evaluation as the project area either does not provide habitat for these species, it is outside of their known range, or no individuals of the species are known to occur, or have been identified within the region. These species are Southwestern willow flycatcher (*Empidonax traillii extimus*), yellow-billed cuckoo (*Coccyzus americanus*), Colorado pikeminnow (*Ptychocheilus lucius*), razorback sucker (*Xyrauchen texanus*), Zuni bluehead sucker (*Catostomus discobolus yarrowi*), Knowlton's cactus (*Pediocactus knowltonii*), Mancos milk-vetch (*Astragalus humillimus*), Mesa Verde cactus (*Astragalus humillimus*), and Canada Lynx (*Lynx canadensis*). These species would not be affected by the project.

Water for drilling would be obtained from the permitted Blanco Trading Post (POD No. SJ 2105) water well, and no unaccounted-for water depletions within USFWS-listed fish habitat would occur. Therefore, there is no need for additional Section 7 consultation.

Paleontological Resources

The San Juan Basin in northwestern New Mexico is rich in paleontological resources. The BLM used the Potential Fossil Yield Classification (PFYC) System for Paleontological Resources on Public Lands (Instruction Manual 2008-009) to identify areas with a high potential to produce significant fossil resources (BLM 2008d). Under this system, all lands within the BLM-FFO management area were designated as Class 5 (Very High Potential) for paleontological resources. The proposed W Lybrook UT 720H/726H Project would be located within the Betonnie Tsosie fossil area Paleontological SDA.

Class 5 areas require an assessment of paleontological resources at the project level (BLM 2009). If a paleontological site is discovered during the construction phase of the proposed project, the site would be avoided by personnel, personal vehicles, and company equipment. No sites were identified along the proposed Project. Therefore, no impacts to paleontological resources are anticipated as a result of the proposed project.

2. PROPOSED ACTION AND ALTERNATIVES

2.1. Alternative A: No Action

The "No-Action" alternative would deny the approval of the APDs, causing the project not to take place. Aside from the "No-Action" alternative no other feasible alternatives were identified for the Project.

2.2. Alternative B: Proposed Action

The proposed action is the approval of WPX's twelve APDs by the BLM-FFO. The BLM-FFO would decide whether or not to issue the twelve APDs to WPX to drill the 720H, 722H, 724H, 726H, 728H, 729H, 756H, 757H, 758H, 759H, 760H, and 761H wells. The project includes the horizontal drilling, production and final abandonment of the West Lybrook UT 720H, 722H, 724H, 726H, 728H, 729H, 756H, 757H, 758H, 759H, 760H, and 761H oil and natural gas wells. To accommodate this action, the project would include the construction, use, and eventual reclamation of two multi-well well pads, two access roads, and two well-connect pipelines. As part of the proposed action, WPX proposes to construct two range improvement ponds. All construction with exception to 3,217.8 feet of well-connect pipeline, 3,152.6 feet of access road, and five pullouts, would occur on Navajo Indian allotted land. As such, construction across BLM surface would be short term in relation to the full extent of the proposed project. The proposed wells would develop Navajo Indian allotted minerals as well as federal minerals administered by the BLM-FFO in the Lybrook Gallup pool associated with WPX's valid existing unit lease No. NMNM135216X. Construction plats associated with the Project can be found in Appendix B.

2.2.1. Location of Proposed Project Area

Maps of the proposed project area are provided in Appendix A. The proposed Project area is plotted on the Lybrook NW and Kimbeto, New Mexico, 7.5-minute USGS quadrangle and the 2011 New Mexico Resource Geographic Information System Program aerial photograph.

The Project would be located on Navajo Indian Allotted lands administered by the BIA, Navajo Regional Office Eastern Agency, and FIMO; and public lands managed by the U. S. BLM-FFO in San Juan County, New Mexico. The proposed project would be located approximately 37 miles south-southeast of the town of Bloomfield, New Mexico; 4.3 miles south-southwest of Nageezi, New Mexico; and 3.5 miles southwest of the intersect at County Road #7890 and U.S. Highway 550. The Project would be located within the Escavada Wash watershed.

The proposed Project sits on the northern edge of a spur off a large mesa top. The Kimbeto Wash to the north and the Betonnie Tsosie Wash to the south contribute to the shape and formation of the mesas in this area. The general region surrounding the project is characterized by rolling sagebrush flats atop the mesa, scattered piñon and juniper trees along the eroded slope of the mesa, and badlands and clay hills along the base of the mesa that fade into sagebrush flats with a network of ephemeral dendritic drainages.

The W Lybrook UT 720H, 722H, 724H, 756H, 757H, and 758H access road would ascend/descend the mesa to the proposed well pad which sits in a rolling sagebrush basin with a few scattered piñon juniper trees. The area has an overall northern aspect. Slopes across the project area average two percent; however, along the mesa ascent/descent slopes are elevated. There are no USGS jurisdictional waters/blue line drainages; however, there are two large ephemeral tributary drainages to a USGS blue line to the north of the project. These drainages are located on the east side of the well pad (within construction buffer zone and crossed by the access road and well-connect pipeline) and west side of the well pad (runs across well pad and construction buffer zone). The proposed project sits at an elevation of approximately 6,719 feet above mean sea level (AMSL) at the W Lybrook UT No. 720H well flag.

The W Lybrook UT 726H, 728H, 729H, 759H, 760H, & 761H project area sits entirely atop the mesa. The area has an overall gentle western aspect. Slopes are nearly flat or slightly elevate across the entire project area. There are no USGS jurisdictional waters/blue line drainages and few ephemeral drainages within the project. Water courses observed followed two track disturbances. The proposed project sits at an elevation of approximately 6,748 feet AMSL at the W Lybrook UT No. 726H well flag.

Legal land descriptions of the proposed project and locations of the proposed bottom holes and surface holes (wellheads) are provided in Table 2 and Table 3, below.

Table 2. Legal Land Description for the Proposed Project

Township, Range	Section	Quarter-Quarter	Project Feature
Township 23 North, Range 9 West	24	Southwest ¼ of the Southeast ¼	Access Road and Well-Connect Pipeline
Township 23 North, Range 9 West	24	Southeast ¼ of the Southwest ¼	Access Road and Well-Connect Pipeline
Township 23 North, Range 9 West	25	North ½ of the Northwest ¼	Access Road and Well-Connect Pipeline
Township 23 North, Range 9 West	26	Northeast ¼ of the Northeast ¼	Access Road and Well-Connect Pipeline

Township 23 North, Range 9 West	23	Southeast ¼	Access Road, Well-Connect Pipeline, Well pad, and Range Pond
Township 23 North, Range 9 West	23	Southwest ¼ of the Northeast ¼	Well pad and Range Pond
Township 23 North, Range 9 West	23	South ½ of the Southwest ¼	Access Road, Well-Connect Pipeline, Well pad, and Construction Buffer Zone
Township 23 North, Range 9 West	26	Northwest ¼ of the Northwest ¼	Range Pond

Table 3. Bottom Hole and Surface Hole Location

Project Feature	North American Datum 1983		Footages (NMPM)
	Latitude	Longitude	
720H			
Surface Hole (Wellhead)	36.212443 ° North	107.756372 ° West	2626 feet from the north line, 2113 feet from the east line
Bottom Hole	36.233057 ° North	107.774934 ° West	330 feet from the north line, 2300 feet from the east line
722H			
Surface Hole (Wellhead)	36.212229 ° North	107.756158 ° West	2571 feet from the south line, 2049 feet from the east line
Bottom Hole	36.233197 ° North	107.781003 ° West	330 feet from the north line, 1250 feet from the west line
724H			
Surface Hole (Wellhead)	36.212187 ° North	107.756116 ° West	2556 feet from the south line, 2037 feet from the east line
Bottom Hole	36.231468 ° North	107.784093 ° West	1000 feet from the north line, 330 feet from the west line
726H			
Surface Hole (Wellhead)	36.206767 ° North	107.765027 ° West	588 feet from the south line, 613 feet from the west line
Bottom Hole	36.226620 ° North	107.784013 ° West	2502 feet from the south line, 330 feet from the west line
728H			
Surface Hole (Wellhead)	36.206686 ° North	107.765139 ° West	574 feet from the south line, 598 feet from the west line
Bottom Hole	36.221857 ° North	107.783950 ° West	768 feet from the south line, 330 feet from the west line
729H			
Surface Hole (Wellhead)	36.206621 ° North	107.765229 ° West	534 feet from the south line, 553 feet from the west line
Bottom Hole	36.218837 ° North	107.785983 ° West	330 feet from the north line, 278 feet from the east line
756H			

Project Feature	North American Datum 1983		Footages (NMPM)
	Latitude	Longitude	
Surface Hole (Wellhead)	36.212400 ° North	107.756329 ° West	2633 feet from the south line, 2101 feet from the east line
Bottom Hole	36.198606 ° North	107.732640 ° West	2350 feet from the north line, 330 feet from the east line
757H			
Surface Hole (Wellhead)	36.212357 ° North	107.756286 ° West	2618 feet from the south line, 2088 feet from the east line
Bottom Hole	36.194003 ° North	107.732635 ° West	1225 feet from the south line, 330 feet from the east line
758H			
Surface Hole (Wellhead)	36.212272 ° North	107.756201 ° West	2587 feet from the south line, 2062 feet from the east line
Bottom Hole	36.191548 ° North	107.735326 ° West	330 feet from the south line, 1125 feet from the east line
759H			
Surface Hole (Wellhead)	36.206804 ° North	107.764976° West	601 feet from the south line, 628 feet from the west line
Bottom Hole	36.191556 ° North	107.741378° West	330 feet from the south line, 2374 feet from the west line
760H			
Surface Hole (Wellhead)	36.206658 ° North	107.765179 ° West	548 feet from the south line, 568 feet from the west line
Bottom Hole	36.191564 ° North	107.746875 ° West	330 feet from the south line, 752 feet from the west line
761H			
Surface Hole (Wellhead)	36.206584 ° North	107.765280 ° West	521 feet from the south line, 538 feet from the west line
Bottom Hole	36.189886 ° North	107.750550 ° West	283 feet from the north line, 330 feet from the east line

2.2.2. Description of Proposed Project

For a detailed description of design features and construction practices associated with the proposed action, refer to the APDs on file at the BLM-FFO. Construction plats associated with the proposed project provide additional details (Appendix B).

Design Features and Best Management Practices

WPX would adhere to the Conditions of Approval (COAs) attached to the approved APDs. The following general design features and best management practices (BMPs) would occur.

Control of Waste

- Drilling of the horizontal laterals would be accomplished with water-based mud. All cuttings would be placed in roll-off bins and hauled to a commercial disposal facility or land farm. No blow pit would be used.
- The closed-loop system storage tanks would be sized to ensure confinement of all fluids and would provide sufficient freeboard to prevent uncontrolled releases.
- Drilling fluids would be stored on-site in aboveground storage tanks. Upon termination of drilling operations, the drilling fluids would be recycled and transferred to other permitted closed-loop systems or returned to the vendor for reuse, as practical. All residual fluids would be hauled to a commercial disposal facility.

- Any spills of non-freshwater fluids would be immediately cleaned up and removed to an approved disposal site.
- Portable toilets would be provided and maintained as needed during construction.
- Garbage, trash, and other waste materials would be collected in a portable, self-contained, and fully enclosed trash container during drilling and completion operations. The accumulated trash would be removed, as needed, and would be disposed of at an authorized sanitary landfill. No trash would be buried or burned on location.
- Immediately after removal of the drilling rig, all debris and other waste materials not contained in the trash container would be cleaned up and removed from the well location.
- No chemicals subject to reporting under the Superfund Amendments and Reauthorization Act Title III in an amount equal to or greater than 10,000 pounds would be used, produced, stored, transported, or disposed annually in association with the drilling, testing, or completing of these wells.
- No extremely hazardous substances (as defined in 40 CFR 355) in threshold planning quantities would be used, produced, stored, transported, or disposed in association with the drilling, testing, or completing of these wells.
- Berms would be constructed around all storage facilities sufficient in size to contain the storage capacity of tanks. Berm walls would be compacted with appropriate equipment to assure containment.

Protection of Paleontological Resources

- If a paleontological site is discovered, the BLM would be notified and the site would be avoided by personnel, personal vehicles, and company equipment. Workers would be informed that it is illegal to collect, damage, or disturb some such resources, and that such activities are punishable by criminal and/or administrative penalties.

- Any paleontological resource discovery by the Holder, or any person working on behalf of the Holder on public or Federal land, would be immediately reported to the Authorized Officer. The Holder would suspend all operations in the immediate area of such discovery until given written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery would be made by the Authorized Officer to determine appropriate actions to prevent the loss of significant scientific values. The Holder would be responsible for the cost of the evaluation. The results of further investigation would dictate site specific stipulations for avoidance or salvage of any potentially significant paleontological resources. Any decision as to proper mitigation measures would be made by the Authorized Officer, after consultation with the Holder.

Protection of Cultural Resources

- All cultural resources stipulations would be followed as indicated in the BLM Cultural Resource Records of Review and the BIA-NNHPD Cultural Resources Compliance Form, attached to the COA in the APD/ROW as the case may be. These stipulations may include, but are not limited to temporary or permanent fencing or other physical barriers, monitoring of earth disturbing construction, project area reduction and/or specific construction avoidance zones, and employee education. All employees, contractors, and sub-contractors of the project would be informed by the project proponent that cultural sites are to be avoided by all personnel, personal vehicles, and company equipment, and that it is illegal to collect, damage, or disturb cultural resources, and that such activities on Federal and Tribal lands are punishable by criminal and or administrative penalties under the provisions of the Archaeological Resources Protection Act (16 U.S.C. 470aa-mm). In the event of a cultural resources discovery during construction, the project proponent would immediately stop all construction activities in the immediate vicinity of the discovery and immediately notify the archaeological monitor, if present, or the BLM and/or the BIA-NNHPD. The BLM and/or the BIA-NNHPD would then evaluate or cause the site to be evaluated. Should a discovery be evaluated as significant (e.g., National Register, NAGPRA, ARPA), it would be protected in place until mitigating measures can be developed and implemented according to guidelines set by the BLM and/or the BIA-NNHPD.

Protection of Flora and Fauna, including SSS and Livestock

- Vegetation removed during construction, including trees that measure less than 3 inches in diameter (at ground level) and slash/brush, would be chipped or mulched and incorporated into the topsoil as additional organic matter. If trees are present, all trees 3 inches in diameter or greater (at ground level) would be cut to ground level and de-limbed. Tree trunks (left whole) and cut limbs would be stacked. The subsurface portion of trees (tree stumps) would be hauled to an approved disposal facility.
- A migratory bird nest survey would be conducted if any vegetation-disturbing activities greater than 4 acres in size occur between May 15 and July 31. The survey must be conducted by a BLM-approved biologist using a

survey protocol developed and provided by the BLM/FFO. If active nests are located within the proposed permitted area, project activities would not be permitted without written approval by a BLM/FFO biologist.

- During the biological field survey of the action areas, approximately seventy-five (75) Brack's hardwall cactus (a BLM SSS) were recorded within the proposed project area. All cacti identified are located on Navajo Indian allotted lands. No Brack's hardwall cactus were identified on BLM lands and as such no transplant would be required.
- Scraping, proper storing and re-spreading of the top 6 inches of top soil (if available) within Brack's Cactus habitat would take place to preserve the seed bank.
- Should any active raptor nests be observed within one-third mile of the proposed project area or should any SSS (listed by the USFWS or BLM) be observed within the proposed project area prior to or during project implementation, construction would cease and the BLM-FFO would be immediately contacted. The BLM-FFO would then ensure evaluation of the resource. Should a discovery be evaluated as significant (protected under the ESA, etc.), it would be protected in place until mitigation could be developed and implemented according to guidelines set by the BLM.
- Wildlife hazards associated with the proposed project would be fenced, covered, and/or contained in storage tanks, as necessary.
- Grazing permittees would be notified when construction is scheduled to begin. All hazards to livestock would be fenced or contained.
- All existing improvements (such as fences, gates, and bar ditches) would be repaired to previous or better than pre-construction conditions.
- Backfilling operations would be performed within a reasonable amount of time to ensure that the trenches are not left open for more than 24 hours. If a trench is left open overnight, it would be temporarily fenced or a night watchman would be utilized. The excavated soils would be returned to the trenches, atop the pipe, and compacted to prevent subsidence. The trenches would be compacted after approximately 2 feet of fill is placed over the pipe and after the ground surface has been leveled.
- Escape ramps/crossovers would be constructed every 1,320 feet. The ends of the open trench would be sloped each night with a 4:1 slope.
- Established livestock and wildlife trails would be left in place as crossovers. In areas where active grazing is taking place, escape ramps/crossovers would be placed every 500 feet. Crossovers would be a minimum of 10 feet wide and not fenced.
- The end of the pipe would be plugged to prevent animals from crawling in.
- Before the trench is closed, it would be inspected for animals. Any trapped wildlife or livestock would be promptly removed and released at least 150 yards from the trench.
- Production equipment would be placed on location in such a manner to minimize long-term disturbance and maximize interim reclamation. As practical, access would be provided by a teardrop-shaped road through the production area so that the center may be revegetated.

Protection of Topsoil

- The upper 6 inches of topsoil (if available) would be stripped following vegetation and site clearing. Topsoil would not be mixed with the underlying subsoil horizons and would be stockpiled as a berm along the perimeter of the well pad within the construction zone, separate from subsoil or other excavated material.
- Topsoil and sub-surface soils would be replaced in the proper order, prior to final seedbed preparation. Spreading shall not be done when the ground or topsoil is wet. Vehicle/equipment traffic would not be allowed to cross topsoil stockpiles. If topsoil is stored for a length of time such that nutrients are depleted from the topsoil, amendments would be added to the topsoil as advised by the WPX environmental scientist or appropriate agent/contractor.

Protection of the Public

- The hauling of equipment and materials on public roads would comply with Department of Transportation regulations. No toxic substances would be stored or used within the proposed project area. WPX would have inspectors present during construction. Any accidents involving persons or property would immediately be reported to the BLM-FFO. WPX would notify the public of potential hazards by posting signage, as necessary.

Prevention and Control of Weeds

- A pre disturbance noxious weed inventory would be conducted on all surface disturbing projects to determine the presence of noxious weeds prior to beginning the project, and to determine whether treatment would be needed prior to disturbance. If noxious weeds are found a report would be provided to the BLM Weed Coordinator including:
    - A GPS location recorded in North American Datum 1983
    - Species
    - Size of infestation (estimate of square feet or acres)
- Prior to construction equipment entering the proposed project area, construction equipment would be inspected for noxious weeds and cleaned.
- It would be WPX's responsibility to monitor, control, and eradicate all invasive, non-native plant species within the proposed project area throughout the life of the project. WPX would provide a Weed Management Plan as part of their Surface Use Plan of Operation and may utilize appropriate integrated pest management practices. WPX would be required to submit a current Pesticide Use Proposal for the location prior to any pesticide application. WPX's weed-control contractor must carry a current pesticide applicator' license and only use pesticides authorized for use on BLM lands. The use of pesticides would comply with federal and state laws, and used in accordance with their registered use and limitations. WPX's weed-control contractor would contact the BLM-FFO prior to using these chemicals.

Protection of Air Resources

- The BLM's regulatory jurisdiction over field production operations has resulted in the development of BMPs designed to reduce impacts to air quality by reducing all emissions from field production and operations. Typical measures could include flaring hydrocarbons and gases at high temperatures in order to reduce emissions of incomplete combustion, requiring that vapor recovery systems be maintained and functional in areas where petroleum liquids are stored, ensuring that compressor engines 300 horsepower or less have nitrogen oxide (NO_x) emissions limited to 2 grams per horsepower hour, revegetating areas not required for production facilities to reduce the amount of dust, and watering dirt roads during periods of high use in order to reduce fugitive dust emissions. Magnesium chloride, organic-based compounds, or polymer compounds could also be applied to roads or other surfaces to reduce fugitive dust. Neither petroleum-based products nor produced water would be used.
- BMPs for dust abatement and erosion control would be utilized to reduce fugitive dust for the life of the project, as necessary. Water application, using a rear-spraying truck or other suitable means, would be the primary method of dust suppression along the road.

Additional Design Features and BMPs

- The access road would be designed and constructed as a Resource Road in accordance with the BLM Gold Book Standards (BLM and USFS 2007) and BLM 9113-1 (Roads Design Handbook) and BLM 9113-2 (Roads National Inventory and Condition Assessment Guidance and Instructions Handbook). Construction would include ditching, draining, installing culverts, crowning and capping or sloping and dipping the roadbed, as necessary, to provide a well-constructed and safe road.
- Production facilities would be painted Juniper Green to blend with the natural color of the landscape and would be located to reasonably minimize visual impact, to the extent practical. Equipment subject to safety considerations would either not be painted, or painted in a contrasting color to highlight potential hazards.
- Vehicles would be restricted to proposed disturbance areas and existing areas of surface disturbance, such as existing roads and well pads.
- No construction or routine maintenance activities would be performed during periods when the soil is too wet to adequately support construction equipment. If equipment would create ruts deeper than six inches, the soil would be deemed too wet for construction or maintenance.
- Worker safety incidents would be reported to the BLM-FFO as required under Notice to Lessees (NTL) -3A (USGS 1979). WPX would adhere to company safety policies, Occupational Safety and Health Administration regulations, and Department of Transportation regulations.

Proposed Project Phases

Construction

The BLM-FFO would be notified at least 48 hours prior to the start of construction. The construction phase for each proposed well pad with associated infrastructure is expected to be three to four weeks. Construction of the W Lybrook UT 720H, 722H, 724H, 756H, 757H, and 758H project across BLM lands would be completed within two weeks (3,131.5 feet of access road and 3,149.5 feet of well-connect pipeline). Construction of the W Lybrook UT 726H, 728H, 729H, 759H, 760H, and 761H project across BLM lands would be completed within one week (21.1 feet of access road and 68.3 feet of well-connect pipeline). As such, construction across BLM surface would be short term in relation to the full extent of the proposed project.

The proposed well pads, access roads, and well-connect pipeline corridors would be cleared of vegetation, topsoil stripped, stockpiled, and stored as discussed in "Design Features and Best Management Practices – Protection of Topsoil," above.

The proposed access roads and well pads would be leveled with a D-8 bulldozer to provide space and a level working surface for vehicles and equipment. Excavated materials from cuts would be used as fill in order to establish a balanced surface area that utilizes native soil and materials available onsite. If sandstone is needed for surfacing, the sandstone would be retrieved from a permitted location.

The proposed access roads would be designed, constructed, and maintained in accordance with The Gold Book (BLM and USFS 2007) standards and BLM Manual 9113, Sections 1 and 2 (BLM 2011d and BLM 2011e). All construction activities and road features including clearing, cut-and-fill slopes, and drainage ditches would all take place within the 30-foot-wide corridors. Sandstone would be used as surfacing material along the roads if natural occurring binding material is not present in sufficient amounts within the existing soil and subsoil. If sandstone is needed for surfacing, the sandstone would be retrieved from a permitted location. For the long term, each access road would consist of a 14-foot-wide running surface with adequate crowning and drainage on both sides. As determined during the project onsite, excavated material from the proposed range improvement ponds would be used to build up the proposed access roads to meet the standards established in the Gold Book (BLM and USFS 2007) and BLM Manual 9113, Sections 1 and 2 (BLM 2011d and BLM 2011e). The W Lybrook UT 720H, 722H, 724H, 756H, 757H, and 758H access road would require one 24-inch culvert at engineering station 29+86.6 and a second 48-inch culvert at engineering station 63+23 as seen on the project plats in Appendix B.

The proposed well-connect pipelines would be constructed simultaneously within the pipeline corridor parallel and adjacent to the 30-foot access road corridors. Each well-connect pipeline corridor would result in an additional 20 feet of disturbance beyond the access road corridor; as opposed to, a standard 40-foot ROW generally needed when the pipeline does not parallel the access road. The corridors would be cleared of vegetation and the topsoil would be stored as a windrow along the pipeline trench within the permitted area, in the same manner as described for the proposed well pad.

Trenching activities would be conducted using a trencher, excavator, or backhoe within the 50-foot-wide pipeline/access road corridor. The proposed project would require excavating three trenches offset from one another by five feet per project corridor. Each trench would contain a 10-inch steel natural gas/liquids line, an 8-inch steel gas/liquids line, and a 6-inch gas/liquids line. In addition, a 6-inch poly water pipeline would be placed in one of the three trenches. Where required, the pipeline trench would be 4 to 5 feet in depth. The trench would be 16 inches in width if a trencher is used, 30 inches in width if an excavator is used, or 24 inches in width if a backhoe is used.

Following trenching operations, pipe installation would include stringing, bending for horizontal or vertical angles in the alignment, welding pipe segments together, inspection, coating of joints, and lowering-into the trench using a side-boom tractor. When stringing pipe, one joint of pipe would be set back every quarter mile. Fine soil would then be sifted from the excavated subsoil to provide rock-free pipeline padding and bedding. Backfilling of soils would begin after a section of pipe has been successfully placed in the ditch and final inspection has been completed. Once the pipelines are installed, the pipeline corridors would be reclaimed to pre-construction contours, topsoil replaced, and the area re-seeded. Prior to the pipelines being placed in service, the pipes would be pressure tested.

Within 90 days of installation, aboveground structures not subject to safety requirements would be painted Juniper Green to blend with the surrounding landscape and reduce visual resource impacts.

Pipeline markers would be installed along the pipeline corridors within the line of sight, without voiding safety measures.

Sediment and/or erosion control features would be installed as necessary. Additional resource protection design features and mitigation associated with construction are listed in "Design Features and Best Management Practices," above.

Production Facility Installation

Production facilities, including, but not limited to, tank batteries, water tanks, compressors, field gas separators, and electrical and automation equipment needed for the production of the wells would be installed on the level well pads prior to drilling activities. All activities would take place within the well pads and construction zones.

Drilling and Completion

Drilling operations would be conducted in compliance with Federal Oil and Gas Onshore Orders and all applicable NMOCD rules and regulations. A mobile drilling rig ("rig") and other equipment would be transported to the location, where components would be assembled and the rig derrick erected. Other facilities and equipment that would be on the drilling site include: pipe racks, catwalk, hopper, rig personnel camper trailers, closed loop mud system, and personnel vehicles.

Drilling would begin, continuing through any fresh water bearing formations, then halt. A "shoe" (i.e. a seal) would be landed at the bottom of the hole, a surface pipe ("surface casing") would be installed from the surface down to the shoe, and then cement would be circulated between the rough wall of the well bore and the casing pipe ("annulus"). The casing would be pressure-tested to ensure that a seal has been created. Drilling would resume through several zones before reaching the target formation, or production zone. An intermediate casing would be installed and cemented in place through these zones in order to seal off any troublesome zones that may present problems in drilling deeper portions of the well. Drilling would resume, entering and continuing horizontally through the target formation to the bottom hole location. A production casing or "production liner" (shortened string of casing that suspends from the intermediate casing) would then be landed and cemented in place. Casings prevent interzonal interaction between oil and gas bearing zones and usable water zones and maintain the integrity of the bore. Drilling operations would continue 24-hours a day until complete. Drill cuttings would be hauled from the location and disposed of at an approved facility.

Following drilling, the drilling rig is typically moved off the location and a completion rig would take its place. Perforations would be shot through the production string across the zone of the target formation, to prepare for hydraulic fracturing. Fracturing materials, tanks, and pumps would also be moved to the location. The completion rig would connect to the perforated casing and begin fracturing the target formations through the perforations using pressurized water, fracturing fluids, and sand (to hold created subsurface fractures open).

After completion, the fluids (water and fracturing fluids) would be removed from the well bore and a well head would be installed. Completion fluids would be allowed to flow back to the on-site tanks. Water from fracturing would be confined to storage tanks and recycled and reused. Completion rigs are considered "daylight" rigs and operate during normal daylight hours only. Drilling and completion activities would take approximately 30 days per well depending on the well.

It is estimated that 23,000 barrels of useable water would be required to drill and complete each well. Of the 23,000 barrels, approximately 10,000 to 11,000 barrels would be recovered for reuse. Water for drilling and completion would be obtained from the San Juan Basin Water Haulers Association, who would retrieve and truck their water from a permitted water well (Blanco Trading Post well (POD No. SJ 2105)). WPX would ensure that water would be obtained legally and that all required permits would be obtained prior to obtaining water.

Interim Reclamation

If the proposed wells prove to be productive, some portions of the proposed project area would be fully reclaimed (re-contoured and reseeded), some portions would only be reseeded, and remaining portions ("working areas") would remain disturbed throughout the life of the proposed wells. Production facilities for the W Lybrook UT 720H, 722H, 724H, 756H, 757H, and 758H wells would be located on the southeastern end of their respective proposed well pad. Production facilities for the W Lybrook UT 726H, 728H, 729H, 759H, 760H, and 761H wells would be located on the northeastern end of their respective proposed well pad.

The W Lybrook UT 720H, 722H, 724H, 756H, 757H, and 758H well pad would have two working areas that would not be reseeded and would total 0.96 acres. One area being 260-by-100-foot (0.60-acre) facility area located on the southeastern end of the proposed well pad. The second area being a teardrop shaped access road through the location with a 16-foot-wide (0.36-acre) driving surface located within the center of the proposed well pad to access the wells and facilities. A total of 1.25 acres would be reseeded but not re-contoured during interim reclamation. These areas include the center of the teardrop excluding the overlapping working area and a 380-by-180-foot area around the proposed wellheads for potential future activities, but would not be used on a daily basis. After accounting for the portion of this polygon that overlaps the teardrop and teardrop center, this region measures 1.25 acres. The remainder of the proposed well pad and construction zone (3.94 acres) would be fully reclaimed during interim reclamation.

The W Lybrook UT 726H, 728H, 729H, 759H, 760H, and 761H well pad would include two working areas that would not be reseeded and would total 1.0 acre. One area being 260-by-100-foot (0.60 acres) facility area located on the northeastern end of the proposed well pad. The second area being a teardrop shaped access road through the location with a 16-foot-wide (0.40 acre) driving surface located within the center of the proposed well pad to access the wells and facilities. A total of 1.27 acres would be reseeded but not re-contoured during interim reclamation. These areas include the center of the teardrop excluding the overlapping working area and a 390-by-180-foot area around the proposed wellheads for potential future activities, but would not be used on a daily basis. After accounting for the portion of this polygon that overlaps the teardrop and teardrop center, this region measures 1.27 acres. The remainder of the proposed well pad and construction zone (4.11 acres) would be fully reclaimed during interim reclamation.

A 14-foot-wide running surface and the bottoms of the bar ditches along either side of the access roads (3.82 acres, total) would remain disturbed for the lifetime of the projects. The remainder of the disturbed access road corridors (3.81 acres) would be fully reclaimed and reseeded in efforts to reduce erosion.

The proposed well connect pipeline corridors would be fully reclaimed and reseeded during interim reclamation.

Interim reclamation would likely be initiated on the well pads and associated infrastructure within 120 days after the last well on the respective pad has been drilled. If drilling has not been initiated on the well pads within 120 days of the well pads being constructed, the operator would consult with the BLM to address a site-stabilization plan. The BLM-FFO would be notified at least 48 hours prior to the start of interim reclamation activities. Interim reclamation could occur simultaneously with production. Details of the interim reclamation process (including the seed mixture) are provided in the Surface Reclamation Plan (Appendix D). During this phase, a bulldozer and a tractor with seeding capabilities would be used. Approximately four personnel would be required.

In areas that would be fully reclaimed, slopes would be re-contoured to pre-construction topographical contours, if possible. WPX would diminish the evidence of cuts, fills, and flat well pad surfaces. In areas that are to be fully reclaimed or reseeded, stockpiled topsoil would be redistributed and the surface would be ripped and seeded. Sediment and erosion control features (including water diversions, silt traps, and culverts) would be installed, as necessary. The BLM-FFO Sagebrush Community Seed Mixture would be used.

If bare ground vegetation treatment (trim-out) is desired around facility structures, the operator would submit a bare ground/trim-out design included in their Surface Use Plan of Operations (SUPO). The design would address vegetation safety concerns of the operator and BLM while minimizing impacts to interim reclamation efforts. The design must include what structures to be treated and buffer distances of trim-out. Pesticide use for vegetation control around anchor structures is not approved. If pesticides are used for bare ground trim-out, the trim-out would

not exceed three feet from the edge of any eligible permanent structure (i.e. well heads, fences, tanks). Additional distance/areas may be requested and must be approved by the FFO authorized officer.

Under the BLM-FFO Bare Soil Reclamation Procedures (BLM 2013b), monitoring reclaimed surfaces would be required to document successful reclamation. Monitoring and reporting are discussed in the Surface Reclamation Plans (Appendix D).

Production and Operation

The production phase of wells varies. The lifetime of the proposed wells is anticipated to be 30 to 50 years.

Production facilities for the W Lybrook UT 720H, 722H, 724H, 756H, 757H, and 758H project would be located within a 260-by-100-foot facility area (0.6-acre) on the southeastern end of the proposed well pad. Production equipment that would remain on the proposed well pad could include, but is not limited to, the following: wellhead, production unit, meter run, compressor, flare stack, water tanks, and oil tanks. The teardrop for the proposed well pad would consist of a looped, 16-foot-wide driving surface. The tear drop would be used to access the proposed wellheads and other production facilities.

Production facilities for the W Lybrook UT 726H, 728H, 729H, 759H, 760H, and 761H project would be located within a 260-by-100-foot facility area (0.6-acre) on the northeastern end of the proposed well pad. Production equipment that would remain on the proposed well pad could include, but is not limited to, the following: wellhead, production unit, meter run, compressor, flare stack, water tanks, and oil tanks. The teardrop for the proposed well pad would consist of a looped, 16-foot-wide driving surface; the tear drop would be used to access the proposed wellheads and other production facilities.

Site security guidelines would be followed, as identified in 43 CFR 3162.7-5 and Onshore Oil and Gas Order No. 3.

During production, normal upkeep would be required to monitor production and resolve any problems. It is anticipated that two to three trucks would visit the proposed well pad daily during a normal week. Occasional, workover or recompletion of the proposed wells would be necessary to ensure that efficient production is maintained. Workovers and recompletions would be scheduled as needed to improve and maintain production of the wells. Workover activities could include repairs to the wellbore equipment (e.g., casing, tubing, rods, and pump), wellheads, or production facilities. A 380-by-180-foot workover area would surround the W Lybrook UT 720H, 722H, 724H, 756H, 757H, and 758H wellheads and A 390-by-180-foot workover area would surround the W Lybrook UT 726H, 728H, 729H, 759H, 760H, and 761H wellheads. These workover areas could be used for future activities within the proposed well pads but would not be used for daily activities.

During the operation phase of the proposed pipeline ties, WPX personnel would rarely perform routine or emergency maintenance on the proposed pipeline ties and any associated facilities.

Final Reclamation and Abandonment

If the proposed wells prove to be unproductive, or when the proposed wells are no longer commercially viable, they would be plugged and abandoned. Downhole well abandonment would be carried out under current BLM-FFO and state regulations. The bore holes would be plugged with cement and the production facilities removed. An aboveground marker would be placed over the plugged holes. The markers would each contain individual well identification information.

The final reclamation phase would be anticipated to take two to three weeks per well pad with associated infrastructure. WPX would provide the BLM-FFO with technical and environmental aspects of the final plugging, abandonment, and reclamation procedures.

Final reclamation of the proposed well pads would take place, unless the BLM-FFO considers the retention of these facilities necessary for the management of multiple uses of natural resources. Details of the final reclamation process (including species included in the seed mixtures) are provided in the Surface Reclamation Plans (Appendix D). The goal of final reclamation would be to return disturbed areas associated with the proposed project that are no longer needed, to as close to pre-construction conditions as possible, by re-contouring and re-seeding to blend with the surrounding terrain. The portions of the proposed project areas that were not fully reclaimed during interim

reclamation, would be cleared (if vegetated), re-contoured, covered with salvaged topsoil, and seeded. Sediment- and erosion-control measures would be implemented, as necessary. Water bars would be installed across the roads, and dead-end ditches and earthen barricades would be constructed at the entrance to reclaimed areas. Measures would be taken to control sedimentation and erosion, as necessary.

The proposed range improvement ponds would not be reclaimed; they would remain a permanent feature of the landscape and serve as assets to wildlife and livestock.

Final reclamation would occur within any portion of the proposed pipeline corridors (such as locations of aboveground structures) that would be disturbed to bare soil during the abandonment phase. If final abandonment activities would disturb less than or equal to 0.1 acre to bare soil, the area(s) would be expected to revegetate naturally (no reclamation or monitoring activities would be required). If final abandonment activities would disturb more than 0.1 acre to bare soil, final abandonment reclamation activities would be the same as described for interim reclamation (discussed in the Surface Reclamation Plans [Appendix D]).

Under the BLM-FFO Bare Soil Reclamation Procedures (BLM 2013b), monitoring reclaimed surfaces would be required to document successful reclamation. Monitoring and reporting are discussed in the Surface Reclamation Plans (Appendix D).

Surface Disturbance

The W Lybrook UT 720H/726H Project, would result in a total of 28.62 acres of disturbance; of that, 26.59 acres would be new surface disturbance. The proposed well-connect pipelines and access roads would be placed adjacent to existing two-track roads where existing and practicable with respect to safety near overhead transmission lines. The proposed infrastructure would absorb and utilize the existing disturbance as to minimize new surface disturbance. New surface disturbance, would be placed with respect to archeology, paleontology, geology, terrain characteristics, current/proposed WPX infrastructure, offset regulations from transmission lines, and efforts to minimize ground/vegetative disturbance. During interim reclamation, of the 28.62 acres of proposed surface disturbance, 18.53 acres would be fully reclaimed and 2.52 acres would be reseeded (but not re-contoured). For the long term, 6.53 acres would be stabilized and used as a working surface throughout the life of the W Lybrook UT 720H/726H Project. The remainder (1.04 acres), would not be reclaimed as this would consist of the two 0.52-acre range improvements ponds. The working surfaces and the areas that were reseeded only, would be fully reclaimed during final reclamation. One range improvement pond would be created on BLM land associated with the W Lybrook UT 726H, 728H, 729H, 759H, 760H, and 761H wells project. The spoil from excavation would be hauled by dump truck and used as fill material on the proposed access roads associated with the W Lybrook UT 720H/726H Project. The pond would be 150-foot by 150-foot (0.52 acre) in size south of the proposed W Lybrook UT 726H, 728H, 729H, 759H, 760H, and 761H well pad in the northwest quarter of the northwest quarter of section 26, Township 23 North, Range 09 West. To access the proposed pond location for construction, approximately 630 feet of existing two track road would be used and 315 feet by 10 feet (0.07 acre) of temporary access route would be roughed in with intent to fully reclaim during interim reclamation. This 0.07-acre temporary access would be fully re-contoured and reseeded during interim reclamation.

Table 6, and Table 7 below, show a breakdown of the surface disturbance calculations per project component in association to respective wells; as well as, reclamation calculations.

W Lybrook UT 720H, 722H, 724H, 756H, 757H, & 758H

Well pad

The proposed well pad dimensions would be 570 feet by 315 feet (4.12 acres) with an additional 50-foot construction buffer zone surrounding three sides of the well pad. The northeastern side of the well pad would have a 35-foot construction buffer zone. The construction buffer zone would result in 2.03 acres of disturbance. The resulting area of the well pad and construction buffer zone, would encompass a 6.15-acre working surface. During construction of the well pad, elevated areas within the pad area would be excavated (cut) and utilized as fill material on low areas of the pad (fill) to establish a level working surface. The well pad would require a maximum cut of 8 feet on the south corner (corner 3) and a maximum fill of approximately 8 feet on the north corner (corner 6). This entire area would be utilized during construction, setting of production equipment, drilling and completion phases. Six horizontal wells are planned to be drilled from this well pad. Constructing the well pad would result in all new

surface disturbance. Once all drilling and completions phases are complete for the wells, the well pad would be interim reclaimed.

Access Road

The proposed access road would be 6,451.2 feet long within a 30-foot wide corridor (4.45 acres) from the kick off point at the edge of County Road #7890 to the edge of the well pad. Approximately 35 feet of access road would overlap the construction buffer zone (0.02 acre). Construction of the access road would utilize 0.23 acre of existing disturbance and initiate 4.22 acres of new disturbance. During interim reclamation, 2.22 acres of the newly constructed road would be fully reclaimed. For the long term, a 14-foot-wide running surface, the bottoms of the bar ditches along either side, and ten pullouts would remain for the life of the project (2.69 acres). Pullouts would generally be placed every 500 feet along the access road or as appropriate based on terrain. Five pullouts would be positioned on the north side of the proposed access where it crosses BLM land and five pullouts would be placed on the eastern side where it crosses Navajo Indian Allotted land so as not to overlap the well-connect pipeline. The ten pullouts measure 100 feet in length and 20 feet in width (0.46 acre total). Along the access road, it may be appropriate to install relief culverts in the topographic low spots where water may converge and transverse grade encourages flow across the road. Relief culverts, would prevent the damming and obstruction of water flow from road construction. The need for culverts would be determined during construction and interim reclamation; appropriate sites would then be selected for placement.

Well-connect pipeline corridor

The proposed pipeline corridor would be 6,778.0 feet long within a 20-foot wide construction corridor parallel and adjacent to the access road corridor. A total of 357.28 feet would overlap the proposed W Lybrook UT 720H, 722H, 724H, 756H, 757H, and 758H well pad, from the edge of the well pad, to the proposed 720H well flag (length of pipeline on pad would vary based upon number of wells and facility placement). The remaining 6,420.7 feet of pipeline, extends across the construction zone (35 feet) and continues to the tie-in location for 6,385.7 feet. The well-connect pipeline would transport produced products from the proposed wells to the Chaco Trunk 2 Extension 9 pipeline. Construction of the well-connect pipeline would result in the expansion of 0.73 acre of existing disturbance; initiating, 2.24 acres of new surface disturbance. Upon interim reclamation, all surface disturbance off the pad associated with installation of the pipeline would be fully reclaimed.

Temporary Use Area (TUA)

One TUA would be utilized along the proposed W Lybrook UT 720H, 722H, 724H, 756H, 757H, and 758H access road and well-connect pipeline corridor where they ascend/descend the mesa (STA 4400.0 to STA 5060.0). This TUA would provide adequate room along the steep slope to attain appropriate grade of eight percent of less for both the road and pipeline in order to reducing erosion and meet industry standards. TUA's are areas where ground disturbance may take place because additional area outside the proposed corridor would be needed to accommodate the task. The proposed TUA would be 660 feet long and 50 feet wide each side of the 50-foot access/pipeline corridor (1.52 acres). The proposed area may be cleared and material excavated or placed in area to establish appropriate slopes needed to stabilize the surface and reduce erosion. The TUA would be reclaimed during interim reclamation. Reclamation may include recontouring and reseeding some areas and only reseeding others as to preserve safe cut slopes.

Range Improvement Pond

One range improvement pond would be created on Navajo Indian Allotted land associated with the W Lybrook UT 720H, 722H, 724H, 756H, 757H, and 758H wells project. The spoil from excavation would be hauled by dump truck and used as fill material on the proposed access roads associated with the W Lybrook UT 720H/726H Project. The pond would be 150-foot by 150-foot (0.52 acre) in size just east of the proposed W Lybrook UT 720H, 722H, 724H, 756H, 757H, and 758H well pad in the northwest quarter of the southeast quarter of Section 23, Township 23 North, Range 09 West. To access the proposed pond location for construction, a temporary access route would be roughed in with intent to fully reclaim during interim reclamation. The temporary access route for this particular pond would be approximately 200 feet long at 10 feet wide (0.05 acre). This 0.05-acre temporary access would be fully re-contoured and reseeded during interim reclamation.

Table 4. Surface Disturbance Calculations Associated with the W Lybrook UT 720H, 722H, 724H, 756H, 757H, & 758H Oil and Natural Gas Wells

Feature	Existing/Previously Permitted Surface Disturbance	New Surface Disturbance
Well pad		
Well pad & Construction Zone on Navajo Indian Allotted land	-	670' long x 400' wide (6.11 acres)[1,2]
Access Road		
Access Road on BLM land	-	3131.5' long x 30' wide ROW (2.16 acre)
Access road parallels existing two-track road on Navajo Indian Allotted land	660' long x 15' wide ROW (0.23 acre)	660' long x 15' wide ROW (0.23 acre)
Access Road on Navajo Indian Allotted land	-	2659.7' long x 30' wide ROW (1.83 acres)
Access Road Pullouts		
Five pullouts have been placed along the North side of the access road on BLM land	-	100' long x 20' wide ROW 0.046 acre 0.046 acre x 5 pullouts (0.23 acre)
Five pullouts have been placed along the East side of the access road on Navajo Indian Allotted land	-	100' long x 20' wide ROW 0.046 acre 0.046 acre x 5 pullouts (0.23 acre)
Well Connect		
Pipeline parallels existing two-track road on BLM lands	3149.5' long x 10' wide ROW (0.73 acre)	3149.5' long x 10' wide ROW (0.73 acre)
Pipeline on Navajo Indian Allotted land	-	3271.2' long x 20' wide ROW (1.51 acre)
TUA		
TUA on sloping edge of mesa on Navajo Indian Allotted land	-	660' long x 100' wide ROW (1.52 acre)
Range Improvement Pond		
Range Improvement Pond located on Navajo Indian Allotted land	-	150' long x 150' wide (0.52 acre)
Temporary access route to range improvement pond on Navajo Indian Allotted Land	-	200' long x 10' wide ROW (0.05 acre)
Total Surface Disturbance:	**0.96 acre**	**15.12 acres**

[1] 0.02 acres of disturbance overlaps and has been accounted for in the Access Road Corridor.
[2] 0.016 acres of disturbance overlaps and has been accounted for in the pipeline corridor.

Table 5. Reclamation Calculations in Acres Associated with the W Lybrook UT 720H, 722H, 724H, 756H, 757H, & 758H Oil and Natural Gas Wells

Feature	Disturbed Acreage		Description of Acreage Following Post Construction Reclamation		
	Total	New Disturbance	Fully Reclaimed	Reseed Only	Long-term Disturbance
Well pad & Construction Zone	6.11[1,2]	6.11	3.91[3,4]	1.25	0.95[5]
Access Road Corridor	4.45	4.22	2.22	-	2.23
Pullouts	0.46	0.46	-	-	0.46
Well-Connect Pipeline Corridor	2.97	2.24	2.97	-	-

Feature	Disturbed Acreage		Description of Acreage Following Post Construction Reclamation		
	Total	New Disturbance	Fully Reclaimed	Reseed Only	Long-term Disturbance
TUA	1.52	1.52	1.52	-	-
Range Improvement Pond	0.52	0.52	-	-	0.52
Range Improvement Pond Temporary Access	0.05	0.05	0.05	-	-
Total:	**16.08**	**15.12**	**10.67**	**1.25**	**4.16**

[1] 0.02 acres of disturbance overlaps and has been accounted for in the Access Road Corridor.
[2] 0.016 acres of disturbance overlaps and has been accounted for in the Well-Connect Pipeline Corridor.
[3] 0.016 acre of fully reclaim area overlaps and has been accounted for in the Well-Connect Pipeline Corridor.
[4] 0.01 acre of fully reclaim area overlaps and has been accounted for in the Access Road Corridor.
[5] 0.01 acre of long term disturbance overlaps and has been accounted for in the Access Road Corridor.

W Lybrook UT 726H, 728H, 729H, 759H, 760H, & 761H

Well pad

The proposed well pad dimensions would be 570 feet by 315 feet (4.12 acres) with an additional 50-foot construction buffer zone surrounding all four sides (2.26 acres). The resulting area would encompass a 6.38 acre working surface. The well pad would require a maximum cut of 5 feet on the east corner (corner 3) and a maximum fill of approximately 6 feet on the west corner (corner 6). This entire area would be utilized during construction, setting of production equipment, drilling and completion phases. Six horizontal wells are planned to be drilled from this well pad. A total of 0.16 acres of the proposed activity disturbance would occur on previously disturbed ground. Once all drilling and completions phases are complete for the wells, the well pad would be interim reclaimed.

Access Road

The proposed access road would be 4,605.4 feet long within a 30-foot wide corridor (3.17 acres) from the kick off point at the edge of the proposed W Lybrook UT 720H access road to the edge of the well pad. Approximately 50 feet of access road would overlap the construction buffer zone (0.03 acre). Construction of the access road would initiate all new disturbance as the well-connect pipeline corridor would utilize the existing two-track. During interim reclamation, 1.59 acres of the newly constructed road would be fully reclaimed. For the long term, a 14-foot-wide running surface, the bottoms of the bar ditches along either side, and seven pullouts would remain for the life of the project (1.91 acres). Pullouts would generally be placed every 500 feet along the access road or as appropriate based on terrain. The pullouts would be positioned on the north side of the proposed access as not to overlap the well-connect pipeline. The seven pullouts measure 100 feet in length and 20 feet in width (0.32 acre total). Along the access road, it may be appropriate to install relief culverts in the topographic low spots where water may converge and transverse grade encourages flow across the road. Relief culverts, would prevent the damming and obstruction of water flow from road construction. The need for culverts would be determined during construction and interim reclamation; appropriate sites would then be selected for placement.

Well-connect pipeline corridor

The proposed pipeline corridor would be 4,861.9 feet long within a 20-foot wide construction corridor parallel and adjacent to the access road corridor. A total of 250.9 feet would overlap the proposed W Lybrook UT 726H, 728H, 729H, 759H, 760H, and 761H well pad, from the edge of the well pad, to the proposed 726H well flag (length of pipeline on pad would vary based upon number of wells and facility placement). The remaining 4,611.1 feet of pipeline, extends across the construction zone (50 feet) to the tie-in location (4,561.1 feet). The well-connect pipeline would transport produced products from the proposed wells, to the W Lybrook UT 720H well-connect pipeline. Construction of the well-connect pipeline would result in the expansion of 0.91 acre of existing disturbance; initiating, 1.22 acres of new surface disturbance. Upon interim reclamation, all surface disturbance off the pad associated with installation of the pipeline would be fully reclaimed.

Range Improvement Pond

One range improvement pond would be created on BLM land associated with the W Lybrook UT 726H, 728H, 729H, 759H, 760H, and 761H wells project. The spoil from excavation would be hauled by dump truck and used as fill material on the proposed access roads associated with the W Lybrook UT 720H/726H Project. The pond would be 150-foot by 150-foot (0.52 acre) in size south of the proposed W Lybrook UT 726H, 728H, 729H, 759H, 760H, and 761H well pad in the northwest quarter of the northwest quarter of section 26, Township 23 North, Range 09 West. To access the proposed pond location for construction, approximately 630 feet of existing two track road would be used and 315 feet by 10 feet (0.07 acre) of temporary access route would be roughed in with intent to fully reclaim during interim reclamation. This 0.07-acre temporary access would be fully re-contoured and reseeded during interim reclamation.

Table 6. Surface Disturbance Calculations Associated with the W Lybrook UT 726H, 728H, 729H, 759H, 760H, & 761H Oil and Natural Gas Wells

Feature	Existing/Previously Permitted Surface Disturbance	New Surface Disturbance
Well pad		
Two-track road cuts east/west across the northern corner of construction buffer zone and pad on Navajo Indian Allotted land	182' long x 10' wide (0.04 acre)	-
Two-track road cuts north/south across the construction buffer zone and pad on Navajo Indian Allotted land	513' long x 10' wide (0.12 acre)	-
Well pad & Construction Zone on Navajo Indian Allotted land	-	670' long x 415' wide (6.17 acres)[1,2]
Access Road		
Access Road on BLM land	-	21.1' long x 30' wide ROW (0.01 acre)
Access Road on Navajo Indian Allotted land	-	4584.3' long x 30' wide ROW (3.16 acres)
Access Road Pullouts		
Seven pullouts have been placed along the North side of the access road all of which occur on Navajo Indian Allotted lands	-	100' long x 20' wide ROW 0.046 acre 0.05 acre x 7 pullouts (0.32 acre)
Well Connect		
Pipeline parallels existing two-track road on BLM lands	68.3' long x 10' wide ROW (0.02 acre)	68.3' long x 10' wide ROW (0.02 acre)
Pipeline parallels existing two-track road on Navajo Indian Allotted land	3862.4' long x 10' wide ROW (0.89 acre)	3862.4' long x 10' wide ROW (0.89 acre)
Pipeline on Navajo Indian Allotted Lands	-	680.4' long x 20' wide ROW (0.31 acre)
Range Improvement Pond		
Range Improvement Pond located on BLM land	-	150' long x 150' wide (0.52 acre)
Temporary access route to range improvement pond on BLM Land	-	315' long x 10' wide ROW (0.07 acre)
Total Surface Disturbance:	**1.07 acres**	**11.47 acres**

Feature	Existing/Previously Permitted Surface Disturbance	New Surface Disturbance
[1] 0.03 acres of disturbance overlaps and has been accounted for in the Access Road Corridor. [2] 0.02 acres of disturbance overlaps and has been accounted for in the pipeline corridor.		

Table 7. Reclamation Calculations in Acres Associated with the W Lybrook UT 726H, 728H, 729H, 759H, 760H, & 761H Oil and Natural Gas Wells

Feature	Disturbed Acreage		Description of Acreage Following Post Construction Reclamation		
	Total	New Disturbance	Fully Reclaimed	Reseed Only	Long-term Disturbance
Well pad & Construction Zone	6.33[1,2]	6.17	4.075[3,4]	1.27	0.985[5]
Access Road Corridor	3.17	3.17	1.585	-	1.585
Pullouts	0.32	0.32	-	-	0.32
Well-Connect Pipeline Corridor	2.13	1.22	2.13	-	-
Range Improvement Pond	0.52	0.52	-	-	0.52
Range Improvement Pond Temporary Access	0.07	0.07	0.07	-	-
Total:	**12.54**	**11.47**	**7.86**	**1.27**	**3.41**

[1] 0.03 acres of disturbance overlaps and has been accounted for in the Access Road Corridor.
[2] 0.02 acres of disturbance overlaps and has been accounted for in the Well-Connect Pipeline Corridor.
[3] 0.02 acre of fully reclaim area overlaps and has been accounted for in the Well-Connect Pipeline Corridor.
[4] 0.015 acre of fully reclaim area overlaps and has been accounted for in the Access Road Corridor.
[5] 0.015 acre of long term disturbance overlaps and has been accounted for in the Access Road Corridor.

2.2.3. Related Actions

The W Lybrook UT 720H, 722H, 724H, 756H, 757H, and 758H oil and natural gas wells project and the W Lybrook UT 726H, 728H, 729H, 759H, 760H, and 761H oil and natural gas wells project would be part of and within the West Lybrook Federal Unit. This Unit encompasses a 12,807-acre area containing WPX leases. WPX has planned 54 horizontal laterals to develop their leases within this unit. These laterals are currently planned to be accessed from a total of 13 well pads. Of these 13 well pads, 9 pads would be within the West Lybrook Unit (on lease), 1 pad would be outside the West Lybrook Unit boundary (off lease), and 3 pads would be within WPX's neighboring Kimbeto Wash Federal Unit (collocated).

Three projects within the West Lybrook Unit have been submitted and approved by the BLM-FFO which analyzed 5 of the 13 well pads hosting 20 of the 54 laterals (DOI-BLM-NM-FO10-2016-0028, DOI-BLM-NM-FO10-2016-0036, and DOI-BLM-NM-FO10-2016-0016). In addition to the proposed project at hand, two additional projects would likely be submitted to the BLM-FFO to fully develop the West Lybrook Unit. One project would analyze 2 on lease well pads hosting 12 of the 54 laterals (W Lybrook UT 710H/716H Project). The second project would analyze 1 on lease well pad hosting 4 laterals and 3 collocated well pads hosting 6 West Lybrook Unit lateral and 6 Kimbeto Wash Unit laterals.

2.3. Alternatives Considered but Eliminated from Detailed Study

The following parameters are considered when analyzing horizontal drilling. In some cases, horizontal drilling is not always a practicable and alternative drilling methods, such as vertical or directional may be considered. Natural gas and oil wells can be drilled vertically, directionally, or horizontally. Vertical drilling places a well pad directly above the bottom hole, while directional and horizontal drilling allows for flexibility in the placement of the well pad and associated surface facilities. Directional or horizontal drilling often allows for "twinning," or drilling two or more wells from one shared well pad. Directional and horizontal drilling applications throughout the San Juan Basin have

become relatively common. Generally, the use of this technology is applied when it is necessary to avoid or minimize impacts to surface resources.

Factors such as reservoir depth, angle of deviation, lateral displacement, completion technique, and risk are considered before deciding on the use of directional drilling applications. In addition, operating factors such as production efficiency; rod, pump, and tubing wear; and workover frequency is also a consideration. Generally, directional well completion and operating costs are 20 to 25 percent higher than vertical well drilling costs. The primary economic factors that determine the feasibility of directional applications include, but are not limited to, incremental drilling, completion, and operating costs; oil and gas reserves; rates of production; oil and gas prices; royalties and taxes; and return on investment.

The original plan of development for the West Lybrook Unit was to place well pads in two rows paralleling each other. The top row of wells would run along the northwest border of the unit and the second row would run northeast to southwest through the middle of the unit, parallel to the first. Two (2) to three (3) horizontal wells would be drilled in a northwest to southeast direction from each well pad. Upon detailed analysis, WPX decided the geologic formation in West Lybrook Unit would allow them to drill wells in a northwest to southeast direction, as well as a southeast to northwest direction and thus wells could essentially be drilled "backwards"; enabling, four (4) to six (6) wells to be drilled from one well pad. In doing so, WPX was able to reduce the number of well pads by approximately half of what was originally planned by positioning one row of well pads northeast to southwest through the middle of the unit. In turn, reducing environmental impact by way of vegetation loss, habitat loss, and habitat fragmentation.

No reasonable alternatives to the proposed action have been developed that would result in significantly fewer impacts or any clear advantages over the proposed action. The proposed access road and proposed pipeline corridors follow the most economic and direct route with respect to existing WPX infrastructure, proposed WPX infrastructure, existing disturbance, surface resources, and terrain.

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1. Methodology

3.1.1. Direct and Indirect Impacts

This section describes the environment that would be affected by implementation of the alternatives described in Chapter 2. Aspects of the affected environment described in this chapter focus on the relevant major resources or issues. Certain critical environmental components require analysis under BLM policy. These items are included above in Section 1.6.2 (Issues to be Analyzed).

Under the No Action alternative, current land and resource issues within the proposed project area would continue; there would be no new impacts from oil and gas development. The No Action alternative will serve as the baseline for comparing the environmental impacts of the analyzed alternatives, and will not be further evaluated in this EA (BLM 2008b).

For the purposes of this analysis, the proposed project area is considered the area where surface disturbance would occur, that is, the proposed well pads, well pad construction buffer zones, temporary use area, access roads and pullouts, well-connect pipeline corridors, and range improvement ponds. The existing environments at these locations are described in detail for each resource in the following sections. Impacts are identified as direct, indirect, and cumulative. They are further categorizes as adverse or beneficial and described in terms of their intensity (minor, moderate, major), scope (spatial extent: localized, extensive, area-wide), and duration (short-term, long-term). These impact terms are further defined in 4.3 Glossary. Effects were analyzed assuming Design Features and Best Management Practices listed in Section 2.2.2 are implemented to mitigate impacts.

3.1.2. Cumulative Impacts

A Reasonably Foreseeable Development scenario (RFD) was prepared for the FFO in October 2014 (Engler, et al., 2014). The RFD identified high, moderate, and low potential regions for oil development of the Mancos-Gallup Formation. Within the high potential region, full development would include 5 wells per section, resulting in 1,600 completions. Within the moderate potential region, full development would include one well per section, resulting in 330 completions. Within the low potential region, full development would include one well per township, resulting in 30 well completions. Additionally, the RFD predicted 2,000 gas wells could be development in the northeastern corner of the FFO.

The following methods and assumptions were used to predict the potential impact of the development predicted in the RFD.

Past Oil and Gas Development

Past oil and gas wells were identified using Ongard. Following interim reclamation, the average well pad size for past development is 0.75 acre per well pad within the Mancos-Gallup Formation.

Present and Future Oil Development

Based on previous development, it was assumed that development of the high potential region would involve the twinning of well pads. This is the placement of two or more wells on one well pad. The assumption for the analysis is that the development of a section would include two twinned well pads and one single well pad, resulting in three well pads for five wells. In the moderate and low potential regions, it was assumed that development would involve single well pads. The proposed action would be located in the high potential region.

The average well pad size for a twinned well pad was assumed to be 500 feet by 530 feet, or 6.08 acres. An additional 0.6 acres was added to account for any associated road or pipeline development, resulting in 6.68 acres of short-term disturbance. Following completion of the well, interim reclamation of the well pad and reclamation of any pipelines would occur, resulting in 1.5 acres of long-term disturbance.

The average well pad size for a single well pad was assumed to be 500 feet by 500 feet, or 5.74 acres. An additional 0.6 acres was added to account for associated road or pipeline development, resulting in 6.34 acres of short-term disturbance. Following completion of the well, interim reclamation of the well pad and reclamation of any pipelines would occur, resulting in 1.5 acres of long-term disturbance.

The Random Point Tool in ArcMap was used to randomly assign points representing well pads and associated disturbance based on the RFD assumptions: five wells per section in the high potential region, one well per section in the moderate potential region, and one well per township in the low potential region. This allowed both long-term and short-term disturbance from oil development of the Mancos-Gallup Formation to be calculated for the analysis areas used in this EA.

Present and Future Gas Development

The RFD predicted 2,000 wells could be developed in the gas prone area. The average well pad size was assumed to be 555 feet by 410 feet, or 5.22 acres. An additional 0.6 acres of disturbance was added to account for associated roads and pipelines, resulting in a total disturbance of 5.82 acres. Following completion of the well, interim reclamation of the well pad and reclamation of any pipelines would occur, resulting in 1.5 acres of long-term disturbance.

The Random Point Tool in ArcMap was used to randomly assign points representing one well pad and associated disturbance. This allowed both long-term and short-term disturbance from gas development in the northeastern corner of the FFO to be calculated for the analysis areas used in this EA.

3.2. Air Resources

3.2.1. *Affected Environment*

The proposed wells would be located in San Juan County, New Mexico. Additional general information on air quality in the area is contained in Chapter 3 of the Farmington PRMP/FEIS. In addition, new information about greenhouse gases (GHGs) and their effects on national and global climate conditions has emerged since this document was prepared. On-going scientific research has identified the potential impacts of GHG emissions such as carbon dioxide (CO_2) methane (CH_4); nitrous oxide (N_2O); water vapor; and several trace gases on global climate. Through complex interactions on a global scale, GHG emissions may cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth back into space. Although GHG levels have varied for millennia (along with corresponding variations in climatic conditions), industrialization and burning of fossil carbon sources have caused GHG concentrations to increase measurably, and may contribute to overall climatic changes, typically referred to as global warming.

Much of the information referenced in this section is incorporated from the Air Resources Technical Report for BLM Oil and Gas Development in New Mexico, Kansas, Oklahoma, and Texas (herein referred to as Air Resources Technical Report; (BLM, 2014a)). This document summarizes the technical information related to air resources and climate change associated with oil and gas development and the methodology and assumptions used for analysis.

The Environmental Protection Agency (EPA) has the primary responsibility for regulating air quality, including six nationally regulated ambient air pollutants (criteria pollutants). These criteria pollutants include carbon monoxide (CO), nitrogen dioxide (NO2), ozone (O3), particulate matter (PM10 and PM2.5), sulfur dioxide (SO2) and lead (Pb). EPA has established National Ambient Air Quality Standards (NAAQS) for criteria air pollutants. The NAAQS are protective of human health and the environment. The EPA has approved New Mexico's State Implementation Plan and the state enforces state and federal air quality regulations on all public and private lands within the state, except for tribal lands and within Bernalillo County. Air quality is determined by atmospheric pollutants and chemistry, dispersion meteorology and terrain, and also includes applications of noise, smoke management, and visibility. Climate is the composite of generally prevailing weather conditions of a particular region throughout the year, averaged over a series of years. The EPA has proposed or completed actions recently to implement Clean Air Act requirements for greenhouse gas emissions. Climate has the potential to influence renewable and non-renewable resource management.

Air Quality

Criteria Air Pollutants

The Air Resources Technical Report describes the types of data used for description of the existing conditions of criteria pollutants, how the criteria pollutants are related to the activities involved in oil and gas development, and provides a table of current National and state standards. The EPA's Green Book web page (U.S. Environmental Protection Agency, 2013) reports that all counties in the Farmington Field Office area are in attainment of all National Ambient Air Quality Standards (NAAQS) as defined by the Clean Air Act. The area is also in attainment of all state air quality standards (NMAAQS). The current status of criteria pollutant levels in the Farmington Field Office are described below.

"Design Values" are the concentrations of air pollution at a specific monitoring site that can be compared to the NAAQS. The 2012 design values for criteria pollutants are listed below in Table 8. There is no monitoring for CO and lead in San Juan County, but because the county is relatively rural, it is likely that these pollutants are not elevated. PM10 design concentrations are not available for San Juan County.

Table 8. 2012 Criteria Pollutant Monitored Values in San Juan County (U.S. Environmental Protection Agency, 2014)

Pollutant	2012 Design Concentration	Averaging Time	NAAQS	NMAAQS
O_3	0.071 ppm	8-hour	0.075 ppm[1]	
NO_2	13 ppb	Annual	53 ppb[2]	50 ppb
NO_2	38 ppb	1-hour	100 ppb[3]	
$PM_{2.5}$	4.7 µg/m^3	Annual	12 µg/m^3[3,4]	60 µg/m^3[3,6]
$PM_{2.5}$	14 µg/m^3	24 hour	35 µg/m^3[3,5]	150 µg/m^3[3,6]
SO_2	19 ppb	1-hour	75ppb[5]	

Source: U.S. Environmental Protection Agency, 2014
[1] Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
[2] Not to be exceeded during the year
[3] 98th percentile, averaged over 3 years
[4] Annual mean, averaged over 3 years
[5] 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
[6] The NMAAQS is for Total Suspended Particulate (TSP)

In 2005, the EPA estimates that there was less than 0.01 ton per square mile of lead emitted in FFO counties, which is less than 2 tons total (U.S. Environmental Protection Agency, 2012). Lead emissions are not an issue in this area, and will not be discussed further.

Air quality in a given region can be measured by its Air Quality Index value. The air quality index (AQI) is reported according to a 500-point scale for each of the major criteria air pollutants, with the worst denominator determining the ranking. For example, if an area has a CO value of 132 on a given day and all other pollutants are below 50, the AQI for that day would be 132. The AQI scale breaks down into six categories: good (AQI<50), moderate (50-100), unhealthy for sensitive groups (100-150), unhealthy (>150), very unhealthy and hazardous. The AQI is a national index, the air quality rating and the associated level of health concern is the same everywhere in the country. The AQI is an important indicator for populations sensitive to air quality changes.

Mean AQI values for San Juan County were generally in the good range (AQI<50) in 2013 with 80% of the days in that range. The median AQI in 2013 was 42, which indicates "good" air quality. The maximum AQI in 2013 was 156, which is "unhealthy".

Although the AQI in the region has reached the level considered unhealthy for sensitive groups on several days almost every year in the last decade, there are no patterns or trends to the occurrences (Table 9). On 8 days in the past decade, air quality has reached the level of "unhealthy" and on two days, air quality reached the level of "very unhealthy". In 2009 and 2012, there were no days that were "unhealthy for sensitive groups" or worse in air quality. In 2005 and 2013, there was one day that was "unhealthy" during each year. In 2010, there were five "unhealthy" days and two "very unhealthy days."

Table 9. Number of Days classified as "unhealthy for sensitive groups" (AQI 101-150) or worse (U.S. Environmental Protection Agency, 2013a)

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Days	3	6	9	18	1	0	12	9	0	1

Hazardous Air Pollutants

The Air Resources Technical Report discusses the relevance of hazardous air pollutants (HAPs) to oil and gas development and the particular HAPs that are regulated in relation to these activities (BLM, 2014a). The EPA conducts a periodic National Air Toxics Assessment (NATA) that quantifies HAP emissions by county in the U.S. The purpose of the NATA is to identify areas where HAP emissions result in high health risks and further emissions reduction strategies are necessary. A review of the results of the 2005 NATA shows that cancer, neurological and respiratory risks in San Juan County are generally lower than statewide and national levels as well as those for Bernalillo County where urban sources are concentrated in the Albuquerque area (USEPA, 2012).

Climate

The analysis area would be located in a semiarid climate regime typified by dry windy conditions and limited rainfall. Summer maximum temperatures are generally in the range of 80 or 90 degrees Fahrenheit (°F), and winter minimum temperatures are generally in the teens to 20s. Temperatures occasionally reach above 100°F in June and July and have dipped below zero in December and January. Precipitation is divided between summer thunderstorms associated with the southwest monsoon and winter snowfall as Pacific weather systems drop south into New Mexico. Table 10 shows climate normals for the 30-year period from 1981 to 2010 for the Farmington, New Mexico, area.

Table 10. Climate Normals for the Farmington Area, 1981-2010

Month	Average Temperature (^{O}F [1])	Average Maximum Temperature (^{O}F)	Average Minimum Temperature (^{O}F)	Average Precipitation (inches)
January	30.5	40.8	20.3	0.53
February	35.8	46.8	24.8	0.59
March	43.2	56.1	30.3	0.78
April	50.4	64.7	36.2	0.65
May	60.4	74.8	46.1	0.54
June	69.8	85.1	54.5	0.21
July	75.4	89.6	61.2	0.90
August	73.2	86.5	59.8	1.26
September	65.4	79.1	51.7	1.04
October	53.3	66.4	40.1	0.91
November	40.5	52.2	28.8	0.68
December	31.0	41.2	20.7	0.50
Source: data collected at New Mexico State Agricultural Science Center - Farmington (1) degrees Fahrenheit				

Very recently, pioneering research using space-borne (satellite and aircraft) determination of methane concentrations have indicated anomalously large methane concentrations may occur in the Four Corners region (Kort, Frankenberg, Costigan, Lindenmaier, Dubey, & Wunch, 2014). A subsequent study (Schneising, Burrows, Dickerson, Buchwitz, Reuter, & Bovensmann, 2014) indicated larger anomalies over other oil and gas basins in the U.S. Methane is 34 times more potent at trapping greenhouse gas emissions than CO_2 when considering a time horizon of 100 years (Intergovernmental Panel on Climate Change, 2013). While space-borne studies can determine the pollutant concentration in a column of air, these studies cannot pinpoint the specific sources of air pollution. Further study is required to determine the sources responsible for methane concentrations in the Four Corners region; however, it is known that a significant amount of methane is emitted during oil and gas well completion (Howarth, Santoro, & A.Ingraffea, 2011). Methane is also emitted from process equipment, such as pneumatic controllers and liquids unloading, at oil and gas production sites. Ground-based, direct source monitoring of pneumatic controllers conducted by the Center for Energy and Environmental Resources (Allen, et al., 2014) show that methane emissions from controllers exhibit a wide range of emissions and a small subset of pneumatic controllers emitted more methane than most. Emissions measured in the study varied significantly by region of the U.S., the application of the controller and whether the controller was continuous or intermittently venting. The Center for Energy and Environmental Resources had similar findings of variability of methane emissions from liquid unloading (Allen, et al., 2014a). In October 2012, USEPA promulgated air quality regulations controlling volatile organic compounds (VOC) emissions at gas wells. These rules require air pollution mitigation measures that reduce the emissions of VOCs. These same mitigation measures have a co-benefit of reducing methane emissions. Future ground-based and space-borne studies planned in the Four Corners region with emerging pollutant measurement technology may help to pinpoint significant, specific sources of methane emissions in the region.

The Air Resources Technical Report summarizes information about greenhouse gas emissions from oil and gas development and their effects on national and global climate conditions. While it is difficult to determine the spatial and temporal variability and change of climatic conditions; what is known is that increasing concentrations of GHGs are likely to accelerate the rate of climate change.

3.2.2. Impacts from Alternative B (the Proposed Action)

Methodology and assumptions for calculating air pollutant and greenhouse gas emissions are described in the Air Resources Technical Report. This document incorporates the sections discussing the modification of calculators developed by the BLM to address emissions for one horizontal oil well. The calculators give an approximation of criteria pollutant, HAP, and greenhouse gas (GHG) emissions to be compared to regional and national emissions levels. Also incorporated into this document are the sections describing the assumptions used in developing the inputs for the calculator (BLM, 2014a).

Direct and Indirect Impacts

Criteria Pollutants

Table 11 shows estimated emissions from one proposed horizontal oil well for criteria pollutants, volatile organic compounds (VOC) and greenhouse gas (GHG). For comparison, Table 12 shows total human-caused emissions for each of the counties in the FFO and La Plata County, Colorado, based on USEPA's 2011 emissions inventory (U.S. Environmental Protection Agency, 2014).

Table 11. Criteria Pollutant and VOC Emissions Estimated for Construction of One Horizontal Oil Well; Average 25 Days to Drill and Complete

Activity	NOx	CO	VOC	PM_{10}	$PM_{2.5}$	SO_2	CH4	CO2
One time operations (tons)*								
Construction	5.5	1.5	0.5	2.5	0.25	0.1	0.007	598.85
Completion	0.5	0.1	0.03	0.025	0.025	-	-	55.00
Interim Reclamation	0.006	0.006	0.006	0.001	-	0.003	-	1.24
Final Reclamation	0.006	0.006	0.006	0.001	-	0.004	-	1.66
Ancillary Operations (tons)								
Workover	0.129	0.04	0.01	0.01	0.01	-	-	10.59
Road Maintenance	-	-	-	-	-	-	-	0.26
Road Traffic	-	-	-	-	-	-	-	0.06
Annual operations (tons/yr)								
Oil Haul Truck and Small Truck (100 bbl/day)	0.009	0.006	0.0012	0.0009	0.0008	-	0.0001	3.88
Total	6.13	1.64	0.55	2.54	0.29	0.11	0.01	671.54

Oil storage tanks on the well location may result in venting of VOC. Oil well production is generally presented as barrels per day produced. The emissions calculator estimated that for every barrel per day produced there may be 0.12 tons of VOC vented per year.

The average horizontal oil well in the planning area produces approximately 100 barrels per day. One hundred barrels per day is estimated to result in 12 tons of VOC emissions per year. Oil storage tanks would be subject to current EPA regulations regarding the capture or flaring of VOC emissions.

Table 12. Analysis Area Emissions in Tons/Year, 2011

County	NO_X [1]	CO [2]	VOC [3]	PM_{10} [4]	$PM_{2.5}$ [5]	SO_2 [6]
McKinley	11,952.9	17,007.8	3,891.2	70,096.4	7,645.2	1,381.1
Rio Arriba	12,012.3	27,344.6	19,149.8	33,761.2	4,130.6	60.4
San Juan	42,231.5	63,568.9	26,110.8	76,638.3	9,201.0	5,559.3
Sandoval	4,143.8	19,513.9	4,373.1	39,343.0	4,510.8	109.3
La Plata	4,838.2	17,116.3	3,740.1	2,330.0	919.6	127.9
Total	**75,187.7**	**144,551.5**	**57,265.1**	**222,168.9**	**26,407.2**	**7,237.9**

[1] NO_X – nitrogen oxides
[2] CO – carbon monoxide
[3] VOC – volatile organic compounds
[4] PM_{10} – particulate matter with an aerodynamic diameter equal to or less than 10 microns
[5] $PM_{2.5}$ – particulate matter with an aerodynamic diameter equal to or less than 2.5 microns
[6] SO_2 – sulfur dioxide

Table 13 displays the percent increase in total emissions in the analysis area from the proposed action to construct and operate one horizontal oil well.

Table 13. Percent Increase in Analysis Area Emissions from the Proposed Action

	NO_X[1]	CO[2]	VOC[3]	PM_{10}[4,5]	$PM_{2.5}$[5,6]	SO_2[5,7]
Total Emissions	75,187.7	144,551.5	57,265.1	222,168.9	26,407.2	7,237.9
Conventional Gas Well Emissions	6.13	1.64	12.55[8]	2.54	0.29	0.11
Percent Increase	**0.008**	**0.001**	**0.02**	**0.001**	**0.001**	**0.002**

[1] NO_X – nitrogen oxides
[2] CO – carbon monoxide
[3] VOC – volatile organic compounds
[4] PM_{10} – particulate matter with an aerodynamic diameter equal to or less than 10 microns
[5] Values derived from average emissions for any well drilling in the analysis area. Calculated results available upon request.
[6] $PM_{2.5}$ – particulate matter with an aerodynamic diameter equal to or less than 2.5 microns
[7] SO_2 – sulfur dioxide
[8] Current EPA regulations require operators to reduce VOC emissions by 95% if their oil storage tanks emit over six tons of VOC emissions per year

Hazardous Air Pollutants

The formulas used for calculating HAPs in the calculators are very imprecise. For many processes it is assumed that emission of HAPs would be equivalent to 10 percent of VOC emissions. Therefore, the estimated HAP emissions of 1.25 tons/year should be considered a very gross estimate. Most of the VOC emissions estimated for one horizontal oil well result from venting from oil storage tanks. Current EPA regulations require operators to reduce VOC emissions by 95% if their oil storage tanks emit over 6 tons of VOC emissions per year. A reduction of 95% of oil storage tank VOC emissions would reduce the estimated HAP emissions to 0.12 tons/year.

Total Greenhouse Gases

The available statewide GHG summary combines GHG emissions from CO2 and CH4. To compare the GHG emissions from the Proposed Action estimated by the calculator with statewide GHG emissions, CO2e emissions for both CH4 and CO2 were summed. The total statewide GHG emission estimate for 2007 was 76,200,000 metric tons CO2e (76.2 million metric tons; (New Mexico Environment Department, 2010). The estimated CO2e metric tons emissions from one horizontal oil well (609.2 metric tons) would represent a 0.0008 percent increase in New Mexico CO2 emissions.

Cumulative Impacts

The FFO manages federal hydrocarbon resources in San Juan, Sandoval, Rio Arriba, and McKinley Counties. There are approximately 21,150 active oil and gas wells in the San Juan Basin. About 14,843 of the wells in these counties are federal wells. Analysis of cumulative impacts for reasonable development scenarios and RFDS of oil and gas wells on public lands in the FFO was presented in the 2003 RMP. This included modeling of impacts on air quality. A more detailed discussion of Cumulative Effects can be found in the Air Resources Technical Report (BLM, 2014a).

The primary activities that contribute to levels of air pollutant and GHG emissions in the Four Corners area are electricity generation stations, fossil fuel industries, and vehicle travel. The Air Quality Technical Report includes a description of the varied sources of national and regional emissions that are incorporated here to represent the past, present, and reasonably foreseeable impacts to air resources (BLM, 2014a). It includes a summary of emissions on the national and regional scale by industry source. Sources that are considered to have notable contributions to air quality impacts and GHG emissions include electrical generating units, fossil fuel production (nationally and regionally), and transportation.

The emissions calculator estimated that there could be very small direct and indirect increases in several criteria pollutants, HAPs, and GHGs as a result of implementing the proposed alternative. The very small increase in

emissions that could result would not be expected to result in exceeding the NAAQS for any criteria pollutants in the analysis area.

The very small increase in GHG emissions that could result from implementing the proposed alternative would not produce climate change impacts that differ from the No Action Alternative. This is because climate change is a global process that is impacted by the sum total of GHGs in the Earth's atmosphere. The incremental contribution to global GHGs from the action alternatives cannot be translated into effects on climate change globally or in the area of this site-specific action. It is currently not feasible to predict with certainty the net impacts from the action alternatives on global or regional climate.

The Air Resources Technical Report (BLM, 2014a) discusses the relationship of past, present, and future predicted emissions to climate change and the limitations in predicting local and regional impacts related to emissions. It is currently not feasible to know with certainty the net impacts from particular emissions associated with activities on public lands.

3.3. Upland Vegetation

3.3.1. Affected Environment

The proposed 28.62-acre W Lybrook UT 720H/726H Project would be located entirely within the Escavada Wash watershed (1408010603). The Escavada Wash watershed is the analysis area for direct, indirect, and cumulative impacts to upland vegetation and is located in the larger Arizona/New Mexico Plateau ecological region. The Escavada Wash watershed encompasses the Sagebrush grassland, Greasewood, Grassland, Riparian, Badland/Rock/Wash, Gambel Oak, Ponderosa Pine, and Pinyon/Juniper Communities. There are approximately 67,077.00 acres, 8,508.00 acres, 31,863.00 acres, 49.00 acres, 22,640.00 acres, 6.00 acres, 1.00 acres, and 17,131.00 acres mapped of each vegetation community within the BLM-FFO management area boundary respectfully. The W Lybrook UT 720H/726H Project would be located specifically within the Sagebrush Grassland (25.74 acres), Grassland (2.46 acres), Badland/Rock/Wash (0.03 acre), and Pinyon-Juniper vegetation (0.39 acres) communities.

The Sagebrush, Greasewood, Grassland, Riparian, Badland/Rock/Wash, Gambel Oak, Ponderosa Pine, and Pinyon/Juniper Communities within the Escavada Wash watershed support various plants and landscape features.

The following table summarizes the vegetation community acreage and general descriptions within each watershed.

Table 14. Estimated vegetation community acreage and descriptions within the Escavada Wash watersheds.

Vegetation Community	Acres	Description
Sagebrush Grassland	67,077.00	Community is dominant in the FFO. It occupies vast areas of relatively open rolling hills and numerous mesas and canyon bottoms. It is found on all aspects. It is most common on southerly and western aspects. Community is dominated by perennial grasses and primarily sagebrush shrubs. Common species that can be expected to occur are Wyoming big sagebrush (*Artemisia tridentata*), western wheatgrass (*Pascopyrum smithii*), galleta (*Pleuraphis jamesii*), blue grama (*Bouteloua gracilis*), Indian ricegrass (*Achnatherum hymenoides*), needleandthread (*Hesperostipa comata*), and sand dropseed (*Sporobolus cryptandrus*). Forbs are highly dependent upon precipitation, and typical species are biscuit root (*Lomatium spp.*), woolly plantain (*Plantago patagonica*), astragalus spp. (*Astragalus spp.*), and asters (*Aster spp.*). Other common shrubs include broom snakeweed (*Gutierrezia sarothrae*) and rubber rabbitbrush (*Ericameria nauseosa*).
Greasewood	8,508.00	Community is most common on broad valley bottoms. It can also be found on alluvial fans (slope less than 8 percent) above the valley floor and on plateaus and mesas. Sites can

		potentially receive additional moisture from the adjacent uplands. Soils in this vegetation type can contain inclusions that have elevated soluble salts (saline) properties. Common shrub and sub-shrub species that can be expected to occur are black greasewood (*Sarcobatus vermiculatus*), big sagebrush (*Artemisia tridentata*), fourwing saltbush (*Atriplex canescens*), and shadscale saltbush (*Atriplex confertifolia*) Common grasses are alkali sacaton (*Sporobolus airoides*), western wheatgrass (*Pascopyrum smithii*), galleta (*Pleuraphis jamesii*), Indian ricegrass (*Achnatherum hymenoides*), and sand dropseed (*Sporobolus cryptandrus*).
Grassland	31,863.00	Community is most common south of Farmington, NM. It is found on all aspects. It can be found on floodplains, high stream terraces, dunes, and fan remnants on valley floors below mesas and cuestas. Slopes are generally between 0-15%. It is dominated by perennial grasses, with a lesser shrub component primarily dominated by saltbushes. Common shrub species that can be expected to occur are fourwing saltbush (*Atriplex canescens*), mound saltbush (*Atriplex obovata*), jointfir (*Ephedra spp.*), winterfat (*Krascheninnikovia lanata*), and shadscale saltbush (*Atriplex confertifolia*). Common grass species include alkali sacaton (*Sporobolus airoides*), Indian ricegrass (*Achnatherum hymenoides*), galleta (*Pleuraphis jamesii*), blue grama (*Bouteloua gracilis*), sand dropseed (*Sporobolus cryptandrus*), bottlebrush squirreltail (*Elymus elymoides*), and Muhly spp. (*Muhlenbergia spp.).* Forb species vary and depend greatly on annual precipitation, but common species include globemallow (*Sphaeralcea spp.*) and rose heath (*Chaetopappa ericoides*).
Riparian-Wetland	49.00	Community is managed by the FFO in 85 separate reaches consisting of perennial, intermittent, and ephemeral riparian habitats. The perennial systems flow continuously, intermittent systems flow for a portion of the year, and ephemeral systems have continuous subsurface water flow and surface flow during precipitation events. Riparian vegetation occurs in the active floodplain and the one-hundred-year floodplain. Active floodplain species are variable and influenced by water seasonality, and areas are typically cottonwood-willow dominated. One-hundred-year floodplain species are more influenced by soil type, and areas are typically grass dominated with shrubs and trees. Common tree species in both areas include willows, including Coyote willow (*Salix euxina*) and Peachleaf willow (*Salix amygdaloides*); cottonwoods, including Rio Grande cottonwood (*Populus deltoids*) and Narrow Leaf cottonwood (*Populus angustifolia*); and native New Mexico olive (*Forestiera pubescens neomexicana*). The invasive and nonnative trees Russian olive (*Elaeagnus angustifolia*) and tamarisk (saltcedar) (*Tamarix ramosissima*) can also potentially be present. In the active floodplain, common understory species include horsetail/rush (*Equisetum spp.*), cattails and sedges (*Carex spp.*), spikerush (*Eleocharis spp.*), rushes (in wet soil areas) (*Juncus spp.*), sunflowers (*Helianthus spp.*), Rocky Mountain beeplant (*Cleome serrulata*), saltgrass (*Distichlis spp.*),

		scratchgrass (alkali muhly) (*Muhlenbergia asperifolia*), and reed canarygrass (*Phalaris arundinacea*). In the one hundred year floodplain, understory typically includes spikerush, sedges, rushes, scratchgrass (alkali muhly), alkali sacaton, spike dropseed (*Sporobolus contractus*), Indian ricegrass (*Achnatherum hymenoides*) , giant dropseed (*Sporobolus giganteus*), sand dropseed (*Sporobolus cryptandrus*), reed canarygrass, and additional forbs such as lupine (*Lupinus spp.*) , buckwheat (*Eriogonum spp.*), Indian paintbrush (*Castilleja spp.*), and hoary tansyaster (*Machaeranthera canescens*). In dryer areas, rubber rabbitbrush (*Ericameria nauseosa*), big sagebrush (*Artemisia tridentata*), skunkbush sumac (*Rhus trilobata*), black greasewood (*Sarcobatus vermiculatus*), and fourwing saltbush (*Atriplex canescens*) can be found.
Badland/Rock/Wash	22,640.00	Community occurs on rough and broken badlands that are sparsely vegetated, highly dissected, and eroded into a series of low badland hills and gullies interspersed by somewhat sandy alluvial deposits. It often occurs adjacent to the saltbush shadscale/winterfat community. More of the surface area is comprised of bare ground and rock than vegetated ground. Large bare areas with only biological crusts are common. Badland plant communities are typically sparsely vegetated with limited vegetative cover. Endemic species restricted to specific geological formations are supported in the community. Common species are variable but may include Utah juniper (*Juniperus osteosperma*), Colorado pinyon (*Pinus edulis*), four-wing saltbush (*Atriplex canescens*), Indian ricegrass (*Achnatherum hymenoides*), galleta (*Pleuraphis jamesii*), winterfat (*Krascheninnikovia lanata*), Mormon tea (*Ephedra viridis*), alkali sacaton (*Sporobolus airoides*), globemallow (*Sphaeralcea spp.*), and broom snakeweed (*Gutierrezia sarothrae*).
Gambel Oak	6.00	Community is minor in area within the FFO. It occurs at higher elevations, primarily along the New Mexico/Colorado state line and the northeast area of the FFO. It may be comprised of coniferous mixed woodland, open stands, or montane coniferous forest stands. Common tree species include Gambel's oak (Quercus gambelii), antelope bitterbrush (Purshia tridentata), mountain mahogany (Cercocarpus montanus), ponderosa pine (Pinus ponderosa), Colorado pinyon (Pinus edulis), and Utah juniper (Juniperus osteosperma). Montane coniferous forest may also support Rocky Mountain juniper (Juniperus scopulorum) and Douglas fir (Pseudotsuga menziesii). Common shrub, forb, and grass species also include big sagebrush (Artemisia tridentata), buckwheat (Eriogonum spp.), blue grama (Bouteloua gracilis), western wheat grass (Pascopyrum smithii), prairie Junegrass (Koeleria macrantha), muttongrass (Poa fendleriana), and galleta (Pleuraphis jamesii).
Ponderosa Pine	1.00	Community is minor in area within the FFO and occurs at higher elevations. It is dominated by ponderosa pine (*Pinus ponderosa*), typically with an understory of grasses and forbs with some shrubs. Understory typically becomes sparser with increased tree density. Common species include ponderosa pine, as well as

		Gambel's oak (*Quercus gambelii*), Utah juniper (*Juniperus osteosperma*), and Colorado pinyon (*Pinus edulis*). Understory grass species typically include bottlebrush squirreltail (*Elymus elymoides*), western wheatgrass (*Pascopyrum smithii*), prairie Junegrass (*Koeleria macrantha*), muttongrass (*Poa fendleriana*), and blue grama (*Bouteloua gracilis*). Other shrub and forb species include mountain mahogany (*Cercocarpus montanus*), antelope bitterbrush (*Cercocarpus montanus*), Utah serviceberry (*Amelanchier utahensis*), scarlet globemallow (*Sphaeralcea coccinea*), and Utah sweetvetch (*Hedysarum boreale*).
Pinyon-Juniper	17,131.00	Community is dominant within the FFO and can occur as persistent pinyon-juniper woodlands or wooded shrublands. Persistent pinyon–juniper woodlands are typically found on rugged uplands in shallow rocky soils, have dominant tree canopy covers, and sparse understories. Wooded shrublands are typically found on deeper soils, have less dominant tree cover canopies, and have higher understory canopy cover and production. Common tree and shrub species that can be expected to occur include Utah juniper (*Juniperus osteosperma*), Colorado pinyon (*Pinus edulis*), big sagebrush (*Artemisia tridentata*), and antelope bitterbrush (*Purshia tridentata*). Common grass species include Indian ricegrass (*Achnatherum hymenoides*), blue grama (*Bouteloua gracilis*), muttongrass (*Poa fendleriana*), bottlebrush squirreltail (*Elymus elymoides*), needleandthread (*Hesperostipa comata*), prairie Junegrass (*Koeleria macrantha*), and western wheatgrass (*Pascopyrum smithii*). Tree and shrub species that may occur at higher elevations include Gambel's oak (*Quercus gambelii*), Utah serviceberry (*Amelanchier utahensis*), alderleaf mountain mahogany (*Cercocarpus montanus*), skunkbush sumac (*Rhus trilobata*), and black sagebrush (*Artemisia nova*).

Within the Escavada Wash watershed there are an estimated 340.08 acres of existing total disturbance from oil and gas operations within the watershed. Disturbance calculations were estimated using the RFD and methods described in 3.1 Methodology. The total existing disturbance equates to 0.23% of the total vegetation acreage of the Escavada Wash watershed.

After successful reclamation, the estimated existing short-term disturbance to vegetation within the watershed would be 262.83 acres. This equates to 0.18% of the total vegetation acreage within the watershed.

The estimated existing long-term disturbance to vegetation would be 77.25 acres. The existing long-term disturbance equates to 0.05% of the total vegetation acreage within the watershed.

The following table summarizes the existing surface disturbance to vegetation within the watershed.

Table 15. Average estimated disturbance in the Escavada Wash Watershed.

Acreage Description	Existing Short-Term Disturbance	Existing Long-Term Disturbance	Existing Total Disturbance
Disturbance estimated acreage (ac)	262.83	77.25	340.08
Disturbance of total vegetation acreage (%)	0.18%	0.05%	0.23%

3.3.2. Impacts from Alternative B (the Proposed Action)

Direct and Indirect Impacts

The proposed Project sits on the northern edge of a spur off a large mesa top. The Kimbeto Wash to the north and the Betonnie Tsosie Wash to the south contribute to the shape and formation of the mesas in this area. The general region surrounding the project is characterized by rolling sagebrush flats atop the mesa, scattered piñon and juniper trees along the eroded slope of the mesa, and badlands and clay hills along the base of the mesa that fade into sagebrush flats with a network of ephemeral dendritic drainages.

The W Lybrook UT 720H, 722H, 724H, 756H, 757H, and 758H project area vegetation is classified as sagebrush shrubland community. There are an estimated 78 Utah Juniper (*Juniperus osteosperma*) trees and 18 piñon pine (*Pinus edulis*) trees located within the project area. The dominant species throughout the entire action area is big sagebrush (*Artemisia tridentata*). Ground cover was visually estimated to be approximately 30 percent across the entire action area. The area has an overall northern aspect. Slopes across the project area average two percent; however, along the mesa ascent/descent slopes are elevated. The proposed project sits at an elevation of approximately 6,719 feet above mean sea level (AMSL) at the W Lybrook UT No. 720H well flag.

The W Lybrook UT 726H, 728H, 729H, 759H, 760H, & 761H project area vegetation is classified as sagebrush shrubland community. There are no trees located within the project area. The dominant species throughout the entire action area is big sagebrush. Ground cover was visually estimated to be approximately 30 percent across the entire action area. The area has an overall gentle western aspect. Slopes are nearly flat or slightly elevate across the entire project area. The proposed project sits at an elevation of approximately 6,748 feet AMSL at the W Lybrook UT No. 726H well flag.

The proposed W Lybrook UT 720H/726H Project would result in 28.62 acres of surface disturbance in the Escavada Wash watershed (1408010603). This would be 0.02% of the total vegetation acreage within the Escavada Wash watershed.

After successful reclamation, the estimated proposed project short-term disturbance to vegetation within the Escavada Wash watershed (1408010603) would be 21.05 acres. This equates to 0.01% of the total vegetation acreage within the watershed.

The estimated proposed project long-term disturbance to vegetation within the Escavada Wash watershed would be 7.57 acres. Of this, 6.53 acres would be allocated to working surfaces associated with the operation of the proposed wells. The remainder (1.04 acres) would be the proposed range improvement ponds. These ponds reduce overall upland vegetation availability within the Escavada Wash watershed and would not be reclaimed. As Such, 1.04 acres of upland vegetation would be lost and/or transformed permanently within the Escavada Wash watershed as a result of the proposed project. The proposed project long-term disturbance equates to 0.005% of the total vegetation acreage within the watershed. Impacts are likely to be minor pending seed establishment, adverse, localized, and long term.

The following table summarizes the direct and indirect vegetation impacts in the watershed from the proposed project.

Table 16. Proposed project disturbance acreage to vegetation in the Escavada Wash Watershed.

Acreage Description	Proposed Project Short-Term Disturbance	Proposed Project Long-Term Disturbance	Proposed Project Total Disturbance
Disturbance estimated acreage (ac)	21.05	7.57	28.62
Disturbance of total vegetation acreage (%)	0.01%	0.005%	0.02%

Best management practices to minimize these impacts are found in 2.2.2 Design Features and Best Management Practices.

During interim reclamation, the BLM Sagebrush Community seed mixture would be utilized. The plant species listed in this mixture are listed in the Surface Reclamation Plan Appendix D. Re-established vegetation would consist of native perennial grasses, forbs, and shrubs. Plant species not included in the seed mixture may also become established.

The resulting vegetation community in reclaimed areas could potentially differ from the surrounding plant communities. Within the reclaimed area, the vegetation community may not return to native conditions within 20 years (BLM 2003a, 4-18).

Cumulative Impacts

There are past, present, and reasonably foreseeable future actions within the Escavada Wash watershed that may impact vegetation. These actions include oil and gas development, including associated roads and pipelines, community development, vegetation management, and livestock grazing.

The existing disturbance due to past and present oil and gas development is described above under Upland Vegetation Affected Environment in Table 15.

Reasonably foreseeable future oil and gas related disturbance is based on 336 potential wells assumed in the RFD (Engler et al. 2014) in the Escavada Wash watershed. Oil and gas development within the Escavada Wash watershed may result in 2,156.07 acres of total disturbance. The reasonably foreseeable total disturbance equates to 1.46% of the total vegetation acreage within the watershed.

After successful reclamation, the estimated reasonably foreseeable future short-term disturbance to vegetation within the Escavada Wash watershed would be 1,652.07 acres. This equates to 1.12% of the total vegetation acreage within the watershed.

The estimated reasonably foreseeable future long-term disturbance to vegetation would be 504.00 acres. The reasonably foreseeable future long-term disturbance equates to 0.34% of the total vegetation acreage within the watershed.

The following table summarizes the reasonably foreseeable future vegetation impacts in the watershed from the potential RFD disturbance.

Table 17. Reasonably foreseeable disturbance acreage to vegetation in the Escavada Wash Watershed.

Acreage Description	RFD Short-Term Disturbance	RFD Long-Term Disturbance	RFD Total Disturbance
Disturbance estimated acreage (ac)	1652.07	504.00	2156.07
Disturbance of total vegetation acreage (%)	1.12%	0.34%	1.46%

Cumulatively, the reasonably foreseeable, existing, and proposed project disturbance together total 2,496.15 acres of total vegetation loss within the Escavada Wash watershed. This equates to 1.69% of the total vegetation acreage within the watershed.

After successful reclamation, the estimated cumulative short-term disturbance to vegetation within the watershed would be 1,914.90 acres. This equates to 1.30% of the total vegetation acreage within the watershed.

The estimated cumulative long-term disturbance to vegetation would be 581.25 acres. The cumulative long-term disturbance equates to 0.39% of the total vegetation acreage within the watershed.

Cumulative disturbance impacts for past, present, and reasonably foreseeable future oil and gas development to vegetation within the watershed is shown in the following tables.

Table 18. Cumulative disturbance acreage to vegetation in the Escavada Wash Watershed.

Acreage Description	Cumulative Short-Term Disturbance	Cumulative Long-Term Disturbance	Cumulative Total Disturbance
Disturbance estimated acreage (ac)	1,914.90	581.25	2,496.15
Disturbance of total vegetation acreage (%)	1.30%	0.39%	1.69

Community development within the Escavada Wash watersheds is currently low. It is not expected to increase in the reasonably foreseeable future based on the area's current infrastructure and development rate. As housing and access roads are constructed and/or removed, vegetation within the watershed may be altered.

Vegetation management has been implemented for various purposes and in various forms throughout the Farmington Field Office. Past vegetation management has likely altered vegetation community acreage and condition of vegetation. Potential future vegetation management within the Escavada Wash watershed may alter vegetation.

Livestock grazing is permitted within the Escavada Wash watershed in various grazing allotments. Livestock grazing as well as grazing and browsing by wildlife and other animals can alter vegetation due to factors such as timing, intensity, and duration.

3.4. Noxious Weeds and Invasive Species

3.4.1. Affected Environment

The analysis area for impacts from noxious and invasive species is the Escavada Wash watershed. The Escavada Wash watershed lies within the larger San Juan Basin. In the San Juan Basin, noxious weeds and invasive species are frequently found in areas that have been disturbed by surface activities. The re-establishment of plant communities in arid regions occurs over a longer time period than in wetter regions, which may create an increased potential for the establishment and distribution of invasive species. Invasive plant species typically develop high population densities and tend to exclude most other plant species, thereby reducing species diversity and potentially resulting in long-term effects. Some noxious and invasive weeds have been identified to change soil chemistry and some are highly toxic to livestock. Establishment and distribution of a number of designated noxious and invasive species has continued to grow within the FFO. Management of noxious weeds and invasive plant species is mandated under several pieces of legislation; including, the Lacey Act, as amended (16 USC 3371-3378); the Federal Noxious Weed Act of 1974, as amended (7 USC 2801 et seq.); the New Mexico Noxious Weed Management Act of 1998; and Executive Order (EO) 13112 regarding Invasive Species. Under EO 13112, federal agencies are ordered not to authorize or carry out actions that would cause or promote the introduction of invasive species.

The U.S. Department of Agriculture (USDA) has designated certain plants as federally listed noxious weeds (NRCS 2010). The New Mexico Department of Agriculture (NMDA) has designated certain plants as state-listed noxious weeds (NMDA 2009). NMDA categorize the listed noxious weeds into Class A, B or C species. Class A species are currently not present in New Mexico, or have limited distribution. Preventing new infestations of these species and eradicating existing infestations is the highest priority. Class B Species are limited to portions of the state. In areas with severe infestations, management should be designed to contain the infestation and stop any further spread. Class C species are wide-spread in the state. Management decisions for these species should be determined at the local level, based on feasibility of control and level of infestation. NMDA has also identified species that fall under a "Watch List". Watch List species are species of concern in the state. These species have the potential to become problematic. The PRMP/FEIS lists the invasive, non-native plant species of concern in the BLM-FFO area (BLM 2003a).

Within the Escavada Wash watershed, approximately 26 acres have been identified containing invasive and/or noxious weed species. During the biological field surveys of the proposed W Lybrook UT 720H/726H Project, no USDA- or BLM-FFO-listed Class A or C noxious or invasive weed species were observed. However, halogeton (*Halogeton glomeratus*), a NMDA Class B listed species was identified throughout the proposed project area.

Treatment and management of noxious and invasive weeds occurs throughout the FFO. Approximately 2,000-5,000 acres are treated annually utilizing integrated pest management practices, including chemical, mechanical, and physical.

3.4.2. Impacts from Alternative B (the Proposed Action)

Direct and Indirect Impacts

The impact indicator for analysis is the acres of surface disturbance associated with the proposed action. The proposed project would result in short-term surface disturbance of 28.62 acres and 7.57 acres of long-term surface disturbance. Noxious weeds and invasive species are generally tolerant of disturbed conditions and disturbed soils. The proposed project area could provide an opportunity for the spread of existing weeds or the introduction and establishment of additional noxious weeds and invasive species.

Disturbed soils from the proposed project may provide an opportunity for the introduction and establishment of non-native invasive species. During construction and operation, noxious weed sources could be introduced to disturbed areas from vehicles, equipment, people, wind, water, or other mechanisms. WPX would be responsible for monitoring and controlling any non-native invasive weed species within the permitted area for the life of the project. The reclamation entailing re-vegetation of the disturbed area, would reduce the potential for non-native invasive weeds to establish. Impacts are likely to be minor, adverse, localized, and long term. The proposed range improvement ponds would remain permanent features of the landscape; as a result, increased usage and disturbance by livestock and wildlife may promote the spread of noxious weeds and invasive species to these areas.

Also, the establishment of invasive species, particularly annual grasses, such as cheatgrass can produce large amounts of easily ignitable fuel over large contiguous areas, and potentially alter fire regimes. This situation may result in an increase in the frequency and intensity of wildfires, and in some areas, such as in some desert-scrub communities, a fire regime may be created where none was previously present. In plant communities that are not adapted to frequent or intense fires, native species, particularly shrubs and trees, may be adversely affected, and their populations may be greatly reduced, creating opportunities for greater increases in invasive species populations (Brooks and Pyke 2001). Increases in fire frequency or severity may thus result in a reduction of biodiversity and may promote the conversion of some habitats (such as forest, shrubland, or shrub-steppe) to other types, prolonging or preventing the development of mature native habitats (BLM 2007). Seeds or other propagules of invasive species could be transported to the proposed project area from infested areas by heavy equipment or other vehicles associated with the proposed project. Noxious weeds and invasive species could also spread from established populations near the proposed project area and colonize disturbed soils within the proposed project area. The establishment of invasive species within the proposed project area could greatly reduce the success of native plant community reclamation efforts and create a source of future colonization and degradation of adjacent, undisturbed areas. However, implementation of design features (See Section 2.2.2) and a Surface Reclamation Plan (Appendix D) would reduce the likelihood of weed establishment and distribution throughout the life of the proposed action.

Cumulative Impacts

The analysis area and impact indicator for cumulative impacts is the same as for direct and indirect impacts. Past, present, and reasonably foreseeable future actions within the Escavada Wash watershed which may have influence to the development of noxious and invasive weeds mainly from surface disturbance associated with oil and gas development.

Surface disturbance activities within the Escavada Wash watershed that may contribute to the establishment and distribution of noxious and invasive weeds include:

- Livestock grazing
- Vegetation management
- Oil and gas development, including associated roads and pipelines

Livestock grazing and level of intensity may impact the establishment and spread of noxious weeds in the analysis area. Livestock grazing is closely managed by both land owners and land management agencies. Livestock grazing is expected to continue at the same rate and in the same manner as it currently occurs. As such, impacts would be similar to those currently experienced and would not likely increase beyond the current state.

Vegetation manipulation and management activities, such as sagebrush clearing and prescribed fires, impact vegetation and are often implemented by land managers. These activities are likely to occur at varying levels in the analysis area in the future, however it is not possible to predict when and to what degree with any certainty.

One hundred and three (103) oil and gas wells have been developed in the Escavada Wash watershed. These wells have resulted in a long-term surface disturbance of 77.25 acres. Based on the RFD (Engler, et al., 2014), oil and gas development in the Escavada Wash watershed may result in 2,156.07 acres of short-term disturbance from potential future development, with 1,652.07 acres of that being reclaimed. This results in 504 acres of long-term surface disturbance from potential future oil and gas development in the Escavada Wash watershed. The total long-term disturbance for existing and potential oil and gas development in the Escavada Wash watershed would be 581.25 acres. This disturbance would have the same impacts as described for direct and indirect impacts. The Proposed Action would account for 7.57 acres of that total and represents 1.3% of the cumulative impacts to ground surface that may lead to noxious weed and invasive species impacts within the Escavada Wash watershed.

3.5. Migratory Birds

3.5.1. Affected Environment

The proposed 28.62-acre W Lybrook UT 720H/726H Project would be located entirely within the Escavada Wash watershed (1408010603). The vegetation communities within the Escavada Wash watershed is the analysis area for direct and indirect impacts to migratory birds. The Escavada Wash watershed is the analysis area for cumulative impacts to migratory birds. The Escavada Wash watershed encompasses the Sagebrush grassland, Greasewood, Grassland, Riparian, Badland/Rock/Wash, Gambel Oak, Ponderosa Pine, and Pinyon/Juniper Communities. There are approximately 67,077.00 acres, 8,508.00 acres, 31,863.00 acres, 49.00 acres, 22,640.00 acres, 6.00 acres, 1.00 acres, and 17,131.00 acres mapped of each vegetation community within the watershed boundary respectfully. The W Lybrook UT 720H/726H Project would be located specifically within the Sagebrush Grassland (25.74 acres), Grassland (2.46 acres), Badland/Rock/Wash (0.03 acre), and Pinyon-Juniper vegetation (0.39 acres) communities. These vegetation communities provide foraging areas and nesting substrates for a variety of ground, shrub, and tree nesting avian species protected under the Migratory Bird Treaty Act.

Executive Order 13186 dated January 17, 2001 calls for increased efforts to more fully implement the Migratory Bird Treaty Act of 1918. In keeping with this mandate, the BLM/FFO has issued an interim policy to minimize unintentional take as defined by the EO 13186 and to better optimize migratory bird efforts related to BLM-FFO activities (BLM 2010). In keeping with this policy, a list of priority birds of conservation concern which occur in similar eco-regions as the proposed action area was compiled through a review of existing bird conservation plans including:

- Fish and Wildlife Service (USFWS) Birds of Conservation Concern (BCC)
- New Mexico Partners in Flight (NMPIF) New Mexico Bird Conservation Plan
- Comprehensive Wildlife Conservation Strategy for New Mexico (CWCS)
- Gray Vireo Recovery Plan
- The North American Waterbird Conservation Plan
- Recovery plans and conservation plans/strategies prepared for federally-listed candidate species.

The U.S. Fish and Wildlife Service's Birds of Conservation Concern (2008) report identifies species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become listed under the Endangered Species Act as amended (16 U.S.C 1531 et seq.) (USFWS 2015). There are twenty-one (21) listed migratory birds that have the potential to occur in the action area. The selected species have a known distribution in the BLM-FFO area and may be affected by various types of perturbations. These species and an evaluation of their potential to occur within the proposed project area is discussed below in Table 19. A list of

species identified within the proposed project area during the biological surveys is provided in the BSR (Appendix D).

Table 19. Migratory Birds of Conservation Concern

Species	Habitat Requirements	Potential to Occur in the Action Area
Bald Eagle *Haliaeetus leucocephalus*	Wintering areas are commonly associate with open water, though eagles may use open grasslands, shrublands and forested areas adjacent to large bodies of water for foraging.	UNLIKELY: Action area does not contain any large bodies of water or suitable habitat for foraging, nesting, or perching.
Brewer's Sparrow *Spizella breweri*	During the time period the Brewers Sparrow is present, it is primarily found in its breeding habitat. This habitat is primarily open space shrublands dominated by sagebrush. It is also possible to find them in areas of pinion and juniper woodlands and large areas of coniferous forests. The nests are typically located within sagebrush scrubs that dominate the surrounding habitat.	**POSSIBLE:** Sagebrush shrubland vegetation community within action area.
Brown-capped Rosy-Finch *Leucosticte australis*	The Brown-capped Rosy-Finch is found in remote high elevation alpine/tundra areas. They are found primarily in areas of caves, cliffs, and rockslides. These birds prefer to be above timberline overlooking snowfields that are crucial to nest site selection during the summer months. Nests are built in holes, cliff edges, or under rocks within a slide and always have overhead protection from weather and predators.	UNLIKELY: No high elevation alpine/tundra areas. No caves, cliffs, or rockslides.
Burrowing owl *Athene cunicularia*	Open, treeless grassland and other open areas. Nests in abandoned burrows and is typically associated with prairie dog colonies.	UNLIKELY: No open grasslands within action area. No prairie dog colonies observed.
Flammulated owl *Otus flammeolus*	The flammulated owl is often found in open forest stands with large trees and snags near openings for feeding. These owls are seen nesting in a variety of conifers, aspens, and some oak woodlands. This species is a cavity nester making the snags an important part of survival. They often utilize cavities that have been made by woodpeckers.	UNLIKELY: No conifer forest habitat with large trees and snags present.
Golden eagle *Aquila chrysaetos*	Mostly open habitats from mountainous areas to canyon terrain with elevated perches, including grasslands, prairies, open woodlands, shrublands, and barren areas. Nest primarily on cliffs and in large trees.	**POSSIBLE**: Primarily shrubland country within and surrounding the action area that may be used for foraging. No appropriate nesting habitat.
Grace's Warbler *Dendroica graciae*	This warbler species occupies tall mature open park like pine areas with commonly an oak brush understory. Often in New Mexico this species is found on high mesa tops or canyon bottoms where ponderosa and gambel oak is present.	UNLIKELY: No ponderosa pine nor Gambel oak habitat present.

Species	Habitat Requirements	Potential to Occur in the Action Area
Gray vireo *Vireo vicinior*	The gray vireo can be found associated with arid hot areas of pinion and juniper. It prefers areas of vegetation cover of about 35-45% with bare ground breaking it up. Often in northwest New Mexico they are found near flat or gently sloped canyons, rock outcrops, or near ridge tops. The nests are found in forks of branches typically of juniper trees.	**POSSIBLE:** Action area has few dispersed trees that is broke up by sagebrush flats.
Juniper Titmouse *Baeolophus ridgwayi*	Open juniper woodlands and other woodland areas. Relies heavily on juniper woodlands in breeding season. They enjoy roosting in dense foliage and heavily wooded areas.	UNLIKELY: Lack of dense juniper woodlands this species relies on.
Lewis's Woodpecker *Melanerpes lewis*	Stays year around in the four corners area, most of Colorado, northern New Mexico and parts of Oregon, California, and Nevada. Pine forest, cottonwoods and grasslands are preferred lands.	UNLIKELY: No dense pine forest, cottonwoods, or grasslands found within or surrounding the action area.
Loggerhead Shrike *Lanius ludovicianus*	Open country with scattered shrubs and trees. Also found in heavily wooded areas that have openings and in very short habitats with few or no trees.	**POSSIBLE:** Sagebrush shrubland in action area with few trees.
Olive-Sided flycatcher *Contopus cooperi*	Montane and northern coniferous forests, at forest edges and openings. Prefers areas with tall trees or snags.	UNLIKELY: No montane and coniferous forests present in or near action area.
American peregrine falcon *Falco peregrinus anatum*	Rugged terrain with rocky cliffs and canyons that are at least 30 feet high and often near water. Nests on cliff ledges.	UNLIKELY: No rocky cliffs, outcrops, canyons, or open water within action area.
Pinyon jay *Gymnorhinus cyanocephalus*	Piñon-juniper woodlands and less frequently pine. May occur in scrub oak and sagebrush.	UNLIKELY: Trees within action area are dispersed with no dense populations. Habitat within action area is poor for this species.
Prairie falcon *Falco mexicanus*	Arid, open regions of grassland or scrub vegetation with cliff formations that are at least 30 feet high	**POSSIBLE**: Open sagebrush flat within action area may be utilized for foraging. No appropriate nesting habitat.
Short-eared Owl *Asio flammeus*	Open country including prairie, meadows, tundra, moorlands, marshes, savannas, and open woodlands. May be found nesting on reclaimed strip-mines.	UNLIKELY: The action area does not provide suitable grassland habitat this species requires. There are no sightings near the action area.
Swainson's hawk *Buteo swainsoni*	Typically occurs in wide-open spaces of the American West and nest in grasslands. They will also use sage flats and even swaths of agriculture intermixed with native habitat.	UNLIKELY: No suitable grasslands found within or surrounding the action area. Very few sightings within the region.
Virginia's Warbler *Vermivora virginiae*	During the breeding season this species is found in oak canyons, brushy slopes, and pinyons. The project is located within the breeding range.	UNLIKELY: The action area and the surrounding region lacks suitable habitat.
Western Grebe *Aechmophorus occidentalis*	Breed on freshwater lakes and marshes with extensive open water bordered by emergent vegetation. During the winter they move to saltwater or brackish bays, estuaries, or sheltered sea coasts.	UNLIKELY: No permanent water resource in or near action area.

Species	Habitat Requirements	Potential to Occur in the Action Area
Williamson's Sapsucker *Sphyrapicus thyroideus*	Summers in the four corners area and parts of Idaho. Winters in New Mexico and Mexico. They prefer high conifer forests, and burn areas that provide areas for cavity nesting.	UNLIKELY: Action area contains no high coniferous forests or habitat for cavity nesting.
Southwestern willow flycatcher *Empidonax traillii extimus*	Breeding in s.CA, AZ, NM, extreme s. NV, UT, & extreme S.W. CO. Dense riparian & willow thickets. Breeding resident mid-May through mid-August (NatureServe 2013)	UNLIKLY: no riparian willow habitat within action area.

3.5.2. Impacts from Alternative B (the Proposed Action)

Direct and Indirect Impacts

Migratory Birds

Reasonable search for past nesting activity, in the form of year-round nest structures and/or remnant nesting material from past activity, for the aforementioned species was implemented for the action area during the biological field surveys on November 12, 2015 and November 18, 2015. These two biological field surveys were conducted outside of the migratory bird nesting season and as such conclusions could not be drawn concerning current activity. However, evidence of past nesting may suggest the potential for future nesting activity. Reasonable search for current nesting activity for the aforementioned species was implemented for the action area during the biological field surveys on May 27, 2016. No evidence of nesting activity was observed within or immediately surrounding the proposed project area. As discussed in Section 2.2.2 (Description of Proposed Project - Protection of Flora and Fauna, Including SSS and Livestock), if the vegetation-clearing phase of construction is scheduled to occur during migratory bird breeding season, a pre-construction migratory bird nest survey would be conducted within the associated proposed project area. As such, it is unlikely that nests, eggs, or young birds within the proposed project area would be directly harmed. Adult migratory birds are highly mobile; therefor, they are unlikely to be directly harmed by the proposed project. If project activities occur during migratory bird breeding season, birds nesting outside of but near the proposed project area, could abandon existing nests as a result of visual and audial disturbances. The nearest BLM recorded golden eagle nest is located 9.7 miles west-northwest of the Proposed Action area.

The proposed W Lybrook UT 720H/726H Project would result in the initial removal and modification of 28.62 acres of vegetation during construction; including, 78 Utah Juniper (*Juniperus osteosperma*) trees and 18 piñon pine (*Pinus edulis*) trees of varying ages and size. The project would disturb 25.74 acres of Sagebrush Grassland habitat, 2.46 acres of Grassland habitat, 0.03 acre of Badland/Rock/Wash habitat, and 0.39 acre of Pinyon-Juniper vegetation habitat (See Table 20). These vegetation communities provide forage and nesting substrates for a variety of ground, shrub, and tree nesting avian species protected under the Migratory Bird Treaty Act. During interim reclamation, 18.53 acres of initial disturbance would be re-contoured and/or reseeded. These areas could be used by migratory birds once the seed germinates and establishes a stand of vegetation. The lifetime operation of the wells would result in a loss of 7.57 acres of vegetation. Of this, 6.53 acres would be allocated to working surfaces associated with the operation of the proposed wells. Working surfaces would remain as barren ground for the life of the proposed wells. The remainder (1.04 acres) would be from the proposed range improvement ponds. These ponds would remove the existing natural habitat; however, a water resource in the area may promote usage of habitat around the project area that otherwise would be less appealing. The range improvement ponds would not be reclaimed; as such, they would remain as permanent beneficial assets to migratory birds.

Impacts to migratory birds from the W Lybrook UT 720H/726H Project are likely to be minor pending seed establishment, adverse, localized, and long term.

Table 20. Project Disturbance to Vegetation Communities within the Escavada Wash Watershed

Vegetation Community the	Acres of Vegetation	Acres of disturbance to	Percent Disturbance to

proposed project would disturb within the Escavada Wash Watershed	Community within the Escavada Wash Watershed	the Vegetation Community within the Escavada Wash watershed from the proposed project	the Vegetation Community from the proposed project within the Escavada Wash watershed
Sagebrush Grassland	67,077.00	25.74	0.04%
Grassland	31,863.00	2.46	0.008%
Badland/Rock/Wash	22,640.00	0.03	0.0001%
Pinyon-Juniper	17,131.00	0.39	0.002%

Surface disturbance from the proposed W Lybrook UT 720H/726H Project would result in a corridor of fragmentation of approximately 8,000 feet long east to west with an approximate 3,000-foot spur to the north. The impacts of habitat fragmentation are related to the loss of large contiguous areas of habitat and the relative increase in habitat "edge" effect. Such disturbance can cause wildlife to shift their activity or alter their behavior. The aforementioned fragmentation follows an 8-wire transmission line and/or existing two-tracks for its entirety with exception to approximately 670 feet. Disturbance from two-tracks were used where practicable and the transmission line was paralleled in efforts to utilize the existing fragmentation. Not all of the two tracks being paralleled can be absorbed and utilized in construction due to safety when constructing in proximity to a transmission line and topography.

It is difficult to predict the effects of the proposed project on migratory birds. The increased activity, noise, and disturbed vegetation associated with the proposed project could result in the increased usage of the immediate area by some migratory bird species, while decreased usage by other species. Studies have shown mixed impacts of oil and gas development on nesting migratory birds. According to a study by Ortega and Francis (2007), the presence of oil and gas compressors affected bird species differently; however, there was no difference in overall nest density on plots with and without compressors. A study by Holmes and King (2006) found that the sage sparrow had lower nest survival in an area with ongoing gas development; however, the Brewer's sparrow had higher nest survival rates in a developed gas field when compared with populations in an undeveloped control area.

Use of a closed-loop system would minimize potential impacts to migratory birds from exposure to chemicals or fluids during drilling and completion. During operation, any open pits would be netted and vent caps placed on all open pipes to prevent bird entry and nesting. Any spills would be promptly cleaned up and an emergency response plan prepared. All chemicals or fluids stored on-site would be properly contained and would have secondary containment.

Cumulative Impacts

One hundred three (103) oil and gas wells have been developed in the Escavada Wash watershed. These wells have resulted in a long-term surface disturbance of 77.25 acres. Based on the RFD (Engler, et al., 2014), oil and gas development in the Escavada Wash watershed may result in 2156.07 acres of short-term disturbance from potential future development, with 1652.07 acres of that being reclaimed. This results in 504 acres of long-term surface disturbance from potential future oil and gas development in the Escavada Wash watershed. The total long-term disturbance for existing and potential oil and gas development in the Escavada Wash watershed would be 581.25 acres. This disturbance would have the same impacts to migratory birds as described for direct and indirect impacts. The Proposed Action would account for 7.57 acres of that total and represents 1.3% of the cumulative impacts to ground surface that adversely affect migratory birds within the Escavada Wash Watershed.

3.6. Special Status Species

3.6.1. Affected Environment

The BLM manages certain species which are not federally listed as threatened or endangered in order to prevent or reduce the need to list them as threatened or endangered in the future. BLM Special Status Species (SSS) include BLM Sensitive Species and BLM-FFO Special Management Species (SMS).

New Mexico BLM State Directors have developed a list of BLM Sensitive Species for the State of New Mexico (BLM 2011a, BLM 2011b, BLM 2011c, BLM 2012a). In accordance with BLM Manual 6840, the BLM-FFO has prepared a list of BLM-FFO SMS to focus species management efforts toward maintaining habitats under a multiple-use mandate (BLM 2008a, BLM 2008c). BLM-FFO SMS include some BLM Sensitive Species and other species for which the BLM-FFO has determined special management is appropriate (BLM 2008c). The authority for this policy and guidance is established by the ESA; Title II of the Sikes Act, as amended (16 USC 670a-670o, 74 Stat. 1052); Federal Land Policy and Management Act of 1976 (FLPMA); and Department of Interior Manual 235.1.1A. In accordance to Bureau of Land Management Manual 6840 (Special Status Species Management), it is the policy to manage for the conservation of BLM Sensitive Species and their associated habitats and to ensure that actions authorized, funded, or carried out do not contribute to the need to list any sensitive species as Threatened or Endangered under the Endangered Species Act.

Aztec gilia (*Aliciella Formosa*) and Brack's cactus (*Schlerocactus cloveriae var brackii*) are on the BLM Sensitive Species list approved by the State Director in 2011. In 2012, the BLM/FFO first became aware that new habitat areas for these two species may exist in the southern region of their management area. Subsequent biological surveys have located several large populations of Brack's cactus, confirming previous reports. Aztec gilia has yet to be located. However, potential habitat does exist within the same area. Given this new information, interim guidance for this new habitat area has been developed until the BLM-FFO can collect new information while recognizing valid existing lease rights. New management would be developed as the appropriate habitat information is collected and a more refined habitat map is developed. Potential habitat in this EA is defined as this new habitat area discovered in 2011 and mapped in the interim guidance, referred to "New Suitable Habitat Area" (2014c. BLM/FFO IM No. NMF000-2014-010).

Based on known range and habitat, five (5) BLM SSS have the potential to occur within the proposed project area. The SSS with the potential to occur within the proposed project area are as follows:

- Bendire's Thrasher *(Toxostoma bendirei):* potential foraging and nesting habitat available
- Golden eagle *(Aquila chrysaetos):* potential foraging habitat available
- Prairie falcon *(Falco mexicanus):* potential foraging habitat available
- Aztec gilia *(Aliciella Formosa):* Within mapped potential habitat
- Brack's hardwall cactus *(Sclerocactus cloveriae ssp. Brackii):* Present in Project area

3.6.2. Impacts from Alternative B (the Proposed Action)

Direct and Indirect Impacts

Bendire's Thrasher

The Bendire's thrasher is found in southwest US and northwest Mexico. Its breeding range extends from southeastern California and southern Nevada to the eastern third of New Mexico, and from southern Utah and Colorado south into Sonora and Chihuahua, and along the Pacific slope of Mexico to Sinaloa. Distribution appears to be patchy within the breeding range, with details still being poorly understood. The thrasher breeds in scattered locations in central and western portions of New Mexico, most commonly in the southwest part of the state. In winter, the species withdraws from the northern portion of its summer range, including breeding areas in the Mojave and Great Basin deserts and the Colorado Plateau (NMPIF 2007). New Mexico holds approximately 41% of the species population (BLM 2011). Typically inhabiting sparse desert shrubland and open woodland with scattered shrubs.

No sign of Bendire's thrashers was observed during the biological field surveys. The action area being a sagebrush shrubland community with few trees could provide nesting and foraging habitat. The proposed project would result in the disturbance and modification of up to 28.62 acres of foraging and nesting habitat; 6.53 acres of this disturbance would be for the life of the wells. An additional 1.04 acres of habitat would be transformed from shrubland habitat to ponds; these may be beneficial to Bendire's thrashers. The remaining 21.05 acres of disturbance would be reclaimed (reseeded only or re-contoured and reseeded) during interim reclamation; these reclaimed areas could be used by individuals for foraging and nesting. If interim and final reclamation are successful, native vegetation communities would become re-established within the proposed project area.

Well equipment, and to a greater extent, drilling operations would cause increased noise levels in the vicinity of the proposed project area. Occasional human and vehicle presence within the vicinity of the proposed project area would increase above present levels. Audial and visual disturbances associated with the proposed project could cause indirect habitat loss by deterring individuals from using available habitat adjacent to the proposed project area. If vegetation-clearing activities are to occur during migratory bird breeding season (May 15 through July 31), the BLM-FFO would require a migratory bird nest survey to take place one to two days prior to construction. As such, no active nests surrounding the action area are expected to be directly impacted. Due to the mobility of adult birds, it would be unlikely that adult birds would be directly impacted by the proposed project.

Impacts to Bendire's thrasher from the W Lybrook UT 720H/726H Project are likely to be minor, adverse, localized, and long term.

Prairie falcon

The prairie falcon breeds from southern Canada south to central Mexico and from interior portions of the Pacific states east to the Dakotas, eastern Colorado and New Mexico, and west Texas. In winter its range extends further east, and west to the Pacific coast. They are sparsely distributed across New Mexico and can be found in appropriate habitat including arid plains and steppes at all elevations, wherever cliffs and bluffs present cliff ledges or crevices for nesting. They will occasionally nest in trees, power poles, buildings and steep sides of arroyos (NMPIF 2007).

The action area includes potential foraging habitat and perching areas on transmission poles. However, no suitable nesting habitat exist near the action area for the prairie falcon. There is similar habitat available in the surrounding area that falcons could utilize, as well as more suitable cliff faces to the north for nesting. Impacts would include the disturbance and modification of up to 28.62 acres of foraging habitat and 6.53 acres of this disturbance would be for the life of the wells. An additional 1.04 acres of habitat would be transformed from shrubland habitat to ponds; these may be beneficial to prairie falcons. The remaining 21.05 acres of disturbance would be reclaimed (reseeded only or re-contoured and reseeded) during interim reclamation. These reclaimed areas could be used by individuals for foraging and nesting. If interim and final reclamation are successful, native vegetation communities would become re-established within the proposed project area.

Well equipment, and to a greater extent, drilling operations would cause increased noise levels in the vicinity of the proposed project area. Occasional human and vehicle presence within the vicinity of the proposed project area would increase above present levels. Audial and visual disturbances associated with the proposed project could cause indirect habitat loss by deterring these falcons from using available habitat adjacent to the proposed project area. If vegetation-clearing activities are to occur during migratory bird breeding season (May 15 through July 31), the BLM-FFO would require a migratory bird nest survey to take place one to two days prior to construction.

Due to the mobility of adult raptors and the lack of appropriate nesting sites for prairie falcons in the vicinity of the proposed project area, it would be unlikely that the proposed project would result in 1) injury to a raptor, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.

Impacts to prairie falcons from the W Lybrook UT 720H/726H Project are likely to be minor, adverse, localized, and long term.

Golden eagle

Golden eagles are year-round residents of New Mexico and breed in suitable habitat throughout the state. Suitable nesting sites may occur within a variety of habitats, from desert to mountain areas. Typically, dense forests tend to be avoided and the most common areas in New Mexico include steep-walled mountain canyons. Cliffs are the most common nesting substrate; however, trees or man-made structures are sometimes used. Nests usually located in an area having a wide view of the surrounding area and are on prominent escarpments, with proximity to hunting grounds playing an important role in nest-site selection (NMPIF 2007).

The action area includes potential foraging habitat and perching areas on transmission poles. However, no suitable nesting habitat exist near the action area for golden eagles. The nearest BLM recorded golden eagle nest is located 9.7 miles west-northwest of the Proposed Action area. There is similar habitat available in the surrounding area that Golden Eagles could utilize, as well as more suitable cliff faces to the north for nesting. Impacts would include the disturbance and modification of up to 28.62 acres of foraging habitat and 6.53 acres of this disturbance would be for the life of the wells. An additional 1.04 acres of habitat would be transformed from shrubland habitat to ponds; these may be beneficial to Golden Eagles. The remaining 21.05 acres of disturbance would be reclaimed (reseeded only or re-contoured and reseeded) during interim reclamation. These reclaimed areas could be used by individuals for foraging and nesting. If interim and final reclamation are successful, native vegetation communities would become re-established within the proposed project area.

Well equipment, and to a greater extent, drilling operations would cause increased noise levels in the vicinity of the proposed project area. Occasional human and vehicle presence within the vicinity of the proposed project area would increase above present levels. Audial and visual disturbances associated with the proposed project could cause indirect habitat loss by deterring eagles from using available habitat adjacent to the proposed project area. If vegetation-clearing activities are to occur during migratory bird breeding season (May 15 through July 31), the BLM-FFO would require a migratory bird nest survey to take place one to two days prior to construction.

Due to the mobility of adult eagles and the lack of appropriate nesting sites in the vicinity of the proposed project area, it would be unlikely that the proposed project would result in 1) injury to a raptor, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.

Impacts to golden eagles from the W Lybrook UT 720H/726H Project are likely to be minor, adverse, localized, and long term.

Brack's Hardwall Cactus and Aztec Gilia

Brack's hardwall cactus and Aztec gilia occur in the sandy clay strata of the Nacimiento Formation in sparse shadscale scrub from 5,000 to 6,000 feet AMSL. However, a newly designated BLM habitat "zone" for these species included elevations that are greater the 6,000 feet AMSL (BLM 2003). The proposed action area is occupied by a dense sagebrush shrubland community; however, there are a few small areas of badlands which prove to be marginal habitat for Brack's hardwall cactus.

No Aztec gilia were identified during the biological field surveys of the proposed project areas. The blooming period for this species is late April to mid-June. As such, the proposed range improvement ponds were surveyed within the blooming period. The remainder of the project was surveyed outside of the blooming period. Individuals of this species are typically very small and difficult to identify outside of the blooming period. As such, it is possible that individuals could have been overlooked during the biological field surveys outside of the blooming period.

During the biological field surveys of the proposed action areas, 75 Brack's hardwall cacti were observed. All cacti were located on Navajo Indian Allotted land within the W Lybrook UT 720H, 722H, 724H, 756H, 757H, and 758H well pad, access road, well-connect pipeline, and associated range improvement pond at the base of the mesa (See below). The surveys were completed both outside and during the blooming period (late April to mid-June) for this species. Individuals of this species are typically very small and difficult to identify outside of the blooming period. As such, it is possible that individuals could have been overlooked during the surveys outside the blooming period. No mitigation or design features are required of the operator prior to construction to preserve these individuals as they are all located on Navajo Indian Allotted land.

Table 21. Brack's Hardwall Cactus Locations

Group ID	Location (decimal degrees)	Land Ownership	Number of Individuals	
1	Within the polygon of: -107.756653, 36.211943 -107.756639, 36.212072 -107.756722, 36.212090	Navajo Allotted	37	
2	-107.755967, 36.212289	Navajo Allotted	1	
3	-107.755810, 39.212960	Navajo Allotted	8	
4	-107.756158, 36.213117	Navajo Allotted	4	
5	-107.756213, 36.213154	Navajo Allotted	2	
6	-107.756258, 36.213209	Navajo Allotted	4	
7	-107.756557, 36.213043	Navajo Allotted	2	
8	-107.756463, 36.212776	Navajo Allotted	2	
9	-107.756324, 36.212663	Navajo Allotted	6	
10	-107.754710, 36.212173	Navajo Allotted	1	
11	-107.752708, 36.210112	Navajo Allotted	1	
12	-107.7539, 36.2123	Navajo Allotted	1	
13	-107. 7541, 36.2122	Navajo Allotted	1	
14	-107.754, 36.2121	Navajo Allotted	1	
15	-107.7538, 36.2121	Navajo Allotted	1	
16	-107.754, 36.2122	Navajo Allotted	3	
		Total by Landowner:	Navajo Allotted 75	BLM 0

In accordance with the BLM Brack's Cactus Interim guidance (IM NMF000-2014-010), the proposed access roads, pipeline corridors, and well pads were placed parallel to, and overlapping existing two-track roads, pipeline corridors, and the county road for 660 feet, 7,080.2 feet, and 695 feet respectively in order to reduce the amount of disturbance and fragmentation to habitat. Additionally, six wells have been co-located on each of the two well pads. The proposed project would result in up to 28.62 acres of surface disturbance. Of this, 6.22 acres appears to be appropriate Aztec gilia/Brack's fishhook cactus habitat. Appropriate habitat was determined by field surveys of the project area and mapping measurable polygons of the appropriate habitat. Of the total 28.62 acres of potential disturbed area, 6.53 acres would remain as compacted, barren surface for the life of the proposed wells. An additional 1.04 acres of habitat would be transformed from shrubland habitat to ponds. For the long-term, these areas would not provide potential habitat for these species. The remaining acreage would be reclaimed during interim reclamation; it would be possible that Aztec gilia and Brack's hardwall cacti could become established within these reclaimed areas. During final reclamation, WPX would fully reclaim all portions of the proposed project areas that were not fully reclaimed during interim reclamation (9.05 acres) with exception to the range improvement ponds (1.04 acres). In order to fully reclaim the 2.52 acres of the proposed project areas that were only reseeded during interim reclamation, WPX would need to first clear the vegetation from within these areas in order to recontour them; during this process, it would be possible that Aztec gilia and/or Brack's fishhook cacti that become established or reestablished could be destroyed.

Impacts to Brack's hardwall cactus and Aztec gilia from the W Lybrook UT 720H/726H Project are likely to be moderate (due to removal of multiple Brack's cacti and potential habitat), adverse, localized, and long-term.

Cumulative Impacts

The analysis area and impact indicator for cumulative impacts is the same as for direct and indirect impacts. Past, present, and reasonably foreseeable future actions within the Escavada Wash watershed which may have impacts to SSS mainly from surface disturbance associated with oil and gas development.

One hundred and three (103) oil and gas wells have been developed in the Escavada Wash watershed. These wells have resulted in a long-term surface disturbance of 77.25 acres. Based on the RFD (Engler, et al., 2014), oil and gas development in the Escavada Wash watershed may result in 2156.07 acres of short-term disturbance from potential future development, with 1652.07 acres of that being reclaimed. This results in 504 acres of long-term surface

disturbance from potential future oil and gas development in the Escavada Wash watershed. The total long-term disturbance for existing and potential oil and gas development in the Escavada Wash watershed would be 581.25 acres. This disturbance would have the same impacts as described for direct and indirect impacts. The Proposed Action would account for 7.57 acres of that total and represents 1.3% of the cumulative impacts to ground surface that adversely affect BLM SSS within the Escavada Wash Watershed.

The proposed project may contribute to the reduction of potential available habitat within the spatial analysis area. The intensity of indirect effects would be dependent upon the species, its life history, time of year and/or day and the type and level of human and vehicular activity occurring. This disturbance would have the same impacts as described for direct and indirect impacts and similar to those described for Migratory Birds (Section 3.5.2 [Migratory Birds - Impacts from Alternative B (the Proposed Action)]) and Upland Vegetation (Section 3.4.2 [Upland Vegetation - Impacts from Alternative B (the Proposed Action)]).

3.7. Cultural Resources

3.7.1. Affected Environment

BLM Manual 8100, The Foundations for Managing Cultural Resources (2004) defines a cultural resource as:

> A definite location of human activity, occupation, or use identifiable through field inventory (survey), historical documentation, or oral evidence. The term includes archaeological, historic, or architectural sites, structures, or places with important public and scientific uses, and may include definite locations (sites or places) of traditional cultural or religious importance to specified social and/or cultural groups. (cf. "traditional cultural property"). Cultural resources are concrete, material places and things that are located, classified, ranked, and managed through the system of identifying, protecting, and utilizing for public benefit described in this Manual series. They may be but are not necessarily eligible for the National Register (a k.a. "historic property").

In the broadest sense cultural resources include sites, buildings, structures, objects, and districts/landscapes (NPS 1997). Cultural resources (prehistoric or historic) vary considerably, and can include but are not limited to simple artifact scatters, domiciles of various types with a myriad of associated features, rock art and inscriptions, ceremonial/religious features, and roads and trails. Traditional Cultural Properties (TCPs) are cultural resources that are eligible for the National Register of Historic Places (NRHP) and have cultural values, sometimes sacred, that transcend for instance the values of scientific importance that are normally ascribed to cultural resources such as archaeological sites and may or may not coincide with archaeological sites (Parker and King 1998). Historically Native American communities are most likely to identify TCPs, although TCPs are not restricted to those associations. Some TCPs are well known while others may only be known to a small group or otherwise only vaguely known. Native American tribal perspectives on what is considered a TCP are not necessarily limited by a places National Register eligibility or lack thereof.

The National Register of Historic Places (NRHP; 36 CFR Part 60) is the basic benchmark by which the significance of cultural resources are evaluated by a federal agency when considering what effects its actions may have on those resources. To summarize, to be considered eligible for the NRHP a cultural resource must meet one or more of the following criteria: a) are associated with events that have significantly contributed to the broad patterns of our history; or b) are associated with the lives of persons significant in our past; or c) embody distinctive characteristics of the type, period, or method of construction, or represents the work of a master, or possesses high artistic value, or represent a significant and distinguishable entity whose components may lack individual distinction; or d) have yielded, or may be likely to yield, information that is important in a pre-history or history. The resource, as applicable to its eligibility criteria, must also possess one or more of the following aspects of integrity; location, design, setting, materials, workmanship, feeling, and association. In the event a determination of eligibility cannot be made, the resource is treated as eligible (a historic property). Historically in the FFO approximately 80±% of the sites are determined eligible or treated as eligible.

Section 106 of the National Historic Preservation Act (NHPA) and its implementing regulations (36 CFR Part 800) requires federal agencies to consider what effect their licensing, permitting, funding or otherwise authorizing an undertaking, such as an APD or R-O-W, may have on properties eligible for the NRHP. Pursuant to 36 CFR 800.16 (i), "Effect means alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for

the National Register." Effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance, or be cumulative. Area of Potential Effect (APE) means the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The APE is typically defined as areas to be directly disturbed and areas in immediate close proximity. Cultural resources are identified and reported through a combination of literature review and pedestrian survey consistent with guidelines set forth in the Procedures for Performing Cultural Resources Fieldwork on Public Lands in the Area of New Mexico BLM Responsibilities (BLM 2005).

BLM Farmington Field Office compliance with Section 106 of the National Historic Preservation Act is adhered to by following the State Protocol Agreement between New Mexico BLM and New Mexico State Historic Preservation Officer (BLM-SHPO 2014), which is authorized by the National Programmatic Agreement among the BLM, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers (NPA 2012), and other applicable BLM handbooks.

On Navajo trust lands cultural resources are identified and reported through a combination of literature review and pedestrian and ethnographic survey consistent with guidelines set forth in the Navajo Nation Historic Preservation Department (NNHPD) Fieldwork and Report Standards and Guidelines (NNHPD 2010). BIA Compliance with Section 106 on Navajo trust lands is adhered to by making the final decisions and issuing final notices to proceed with undertakings based on NNHPD review and recommendations to the BIA-NRO Regional Director.

The Proposed Action would be located within the archaeologically rich San Juan Basin of northwest New Mexico. In general, the history of the San Juan Basin can be divided into five major periods: PaleoIndian (ca. 10000 B.C. to 5500 B.C.), Archaic (ca. 5500 B.C. to A.D. 400), Basketmaker II-III and Pueblo I-IV periods (aka Anasazi; A.D. 1-1540), and the historic (A.D. 1540 to present), which includes Native American as well as later Hispanic and Euro-American settlers. Detailed descriptions of these various periods are provided in the Bureau of Land Management Farmington Field Office Final Environmental Impact Statement (2003) and are incorporated by reference. Additional information can also be found in an associated documented, Cultural Resources Technical Report (SAIC 2002).

The Impact Analysis Area for cultural resources is the Proposed Action APE and the Escavada Wash watershed. Watersheds can be viewed as a naturally defined landscape and impacts to cultural resources in one part of that landscape could, theoretically, affect a broader understanding of the interrelationships between sites in the landscape as a whole. The boundaries are distinguished by hydrographic and topographic criteria that delineate an area of land upstream from a specific point on a river, stream or similar surface waters (USGS 2013, NRCS 2013). The next to smallest hydrologic unit area, typically from 40,000-250,000 acres (62- 390mi²; HUC 10) or combination thereof is used for the analysis.

The Escavada Wash watershed is 147,175 acres. Based on New Mexico Cultural Resource Information System data (NMCRIS; May 2016), there are 969 recorded sites and approximately 20% of the watershed (29,790 ac) has been inventoried for cultural resources by 460 unique investigations since 1972. This is a site density of 1:31 acres. Approximately 80% of the sites (n≈775) are historic properties (eligible for the NRHP). According to NMCRIS data approximately 10% of the sites (n≈101) have some disturbance attributed to "construction", presumably from actions conducted prior to the National Historic Preservation Act of 1966 and regular implementation in the early-mid 1970s of cultural resources studies in advance of some form of development. The current cultural inventory coverage is likely higher as not all survey and site data is digitally available (e.g., Navajo lands, surveys since May 2016).

Within the Escavada Wash watershed there are 133 places of traditional religious and cultural importance, the nearest to the Proposed Action being >.75 mile away. Current data does not provide information on condition and none have been evaluated for the NRHP. Certain examples such as historic graves are typically not considered historic properties.

Within the Escavada Wash watershed there is one property listed on the National Register of Historic Places (Chaco Culture National Historical Park; CCNHP), two properties on the New Mexico State Register of Cultural Properties (CCNHP, Bis sani), and one Chaco Protection Site (Bis sani). The extreme southwestern edge of the watershed overlaps the northern boundary of the World Heritage Site of Chaco Culture National Historical Park. There are no National Historic Trails within the analysis area.

The entire APE for the Proposed Action was archaeologically surveyed by Western Cultural Resource Management, Inc. (WCRM) at a BLM Class III level (100%) and a report was prepared and submitted to the BLM and the BIA-NNHPD.

For the Proposed Action, places of traditional religious and cultural importance (e.g., TCPs) were identified by reviewing existing published and unpublished literature (e.g. Van Valkenburgh 1941, 1974; Brugge 1993; Kelly et al. 2006), and the site-specific Class III survey report prepared for the Proposed Action. In addition, the BLM's cultural resources program was contacted for information regarding the presence of places of traditional religious and cultural importance identified through ongoing BLM tribal consultation efforts. A file search of existing information, TCPs, mission records, and other pertinent materials was also conducted at the Navajo Nation Historic Preservation Department office in Window Rock, Arizona. Ethnographic field investigations consisted of discussing the proposed project area with officials and staff at the Counselor and Nageezi Chapters, and with the allottees who live on or near the Allotments where the project is planned. Field investigations, record searches, and reporting are conducted in accordance with the Navajo Nation Historic Preservation Department Permit Package 2015 requirements.

The Class III inventory resulted in the recording of three isolated occurrences (IOs) (WRCM Report Nos. WCRM(F) 1418; BLM 2016(II)012F; Navajo HPD 16-096, and WCRM(F) 1420; BLM 2016(II)014F; Navajo HPD 16-116) within the APE. The IOs represent nonsignificant resources and no further analysis is needed. As such, no places of traditional religious and cultural importance are known to exist in the APE.

3.7.2. Impacts from Alternative B (the Proposed Action)

Direct and Indirect Impacts

The Impact Analysis Area for direct and indirect impacts is the Escavada Wash watershed and the APE. The impact indicator for analysis is the acres of surface disturbance and number of historic properties, properties listed on the National Register of Historic Places or New Mexico State Register of Cultural Properties, Chaco Protection Sites, World Heritage Sites, National Historic Trails, and other places of traditional religious and cultural importance in the analysis area.

No historic properties, properties listed on the National Register of Historic Places or New Mexico State Register of Cultural Properties, Chaco Protection Sites, World Heritage Sites, National Historic Trails, or other places of traditional religious and cultural importance were identified within the APE. The proposed action would not impact any known TCPs, prevent access to sacred sites, prevent the possession of sacred objects, or interfere with or hinder the performance of traditional ceremonies and rituals pursuant to the American Indian Religious Freedom Act of 1978 (AIRFA; 42 USC 1996) or Executive Order (EO) 13007.

The Proposed Action would have no direct or indirect impacts on historic properties or other places of traditional religious and cultural importance in the APE (no historic properties affected).

Cultural resources "discoveries" and risks of impacting unknown (i.e., buried) historic properties during surface disturbing components of a proposed action are infrequent in the FFO. Since FY2000, 28 discoveries have occurred in association with 21,290 actions (e.g. road, well, pipeline, etc.), or 1:760. During that period 153,626 ac of land were inspected for cultural resources, with an average of 7.2 ac per action and one discovery per 5,472 ac. All authorizations (e.g., APDs, R-O-Ws) have stipulations, under penalty of law, require the reporting of and avoidance of further disturbing cultural discoveries during a proposed action. Where the risk of discoveries can be reasonably expected (e.g., $\leq$ 100' of a known historic property, or in environmental settings known or suspected to be conducive to buried sites), archaeological monitoring by a qualified and permitted archaeologist during initial disturbance (e.g., blading, trenching) is normally required. If buried historic properties are discovered, collaborative steps are taken to protect them in place or recover their important information.

Cumulative Impacts

The analysis area and impact indicator for cumulative impacts is the same as for direct and indirect impacts. Past, present, and reasonably foreseeable future actions within the analysis area that may also risk impacting historic properties, properties listed on the National Register of Historic Places or New Mexico State Register of Cultural Properties, Chaco Protection Sites, World Heritage Sites, National Historic Trails, or other places of traditional religious and cultural importance from surface disturbance include the following:

- Oil and gas development, including associated roads and pipelines

One-hundred three (103) oil and gas wells have been developed in the Escavada Wash watershed. These wells have resulted in 340.08 acres of surface disturbance. Based on the RFD (Engler, et al., 2014), oil and gas development in the Escavada Wash watershed may result in 1652.07 acres of short-term disturbance and 504.00 acres of long-term disturbance. This results in a total of 2156.07 acres of additional surface disturbance from oil and gas development in the Escavada Wash watershed. The Proposed Action would contribute 21.05 acres of short-term disturbance and 7.57 acres of long-term disturbance to cumulative amount of disturbance from oil and gas development in the Escavada Wash watershed.

The Escavada Wash watershed has an average site density of 1:31 ac. This additional disturbance of 2156acres would potentially intersect an additional 70 cultural sites and approximately 80% would be historic properties, properties listed on the National Register of Historic Places or New Mexico State Register of Cultural Properties, Chaco Protection Sites, World Heritage Sites, National Historic Trails, or other places of traditional religious and cultural importance and have the same impacts as described for direct and indirect impacts.

For the Proposed Action there would be no cumulative impact on historic properties, properties listed on the National Register of Historic Places or New Mexico State Register of Cultural Properties, Chaco Protection Sites, World Heritage Sites, National Historic Trails, or other places of traditional religious and cultural importance, if present, as they are being avoided. Reasonably foreseeable future actions would also avoid historic properties.

On average, 7.2 acres have been culturally inventoried per oil and gas project component (i.e., well pad, access road, pipeline) in the FFO since 2000. One hundred and three (103) oil and gas projects have occurred in the Escavada Wash watershed for a total of 2,266 inventoried acres. In addition, 336 oil and gas projects are presently being developed or reasonably foreseeable based on the 2014 RFD. These projects could result in 7,392 acres of cultural survey. Approximately 1-2 cultural resources discoveries are anticipated to occur for all foreseeable oil and gas projects in the Escavada Wash watershed and have the same impacts as described for direct and indirect impacts.

3.8. Livestock Grazing

3.8.1. Affected Environment

The proposed W Lybrook 720H/726H Project is located within the BLM-FFO Grazing Allotment No. 6013, Kimbeto Community. The Kimbeto Community is the analysis area for direct, indirect, and cumulative impacts to livestock grazing. The Kimbeto Community permits 324 head of cattle and 1554 head of sheep March 1 thru February 28; as well as, 15 head of horses August 1 thru October 31, annually. The Kimbeto Community encompasses the Sagebrush, Greasewood, Grassland, Riparian, Badland/Rock/Wash, Gambel Oak, and Pinyon/Juniper vegetation communities. Within the allotment, there are an estimated 49,205.93 acres, 7,767.22 acres, 27,785.54 acres, 61.04 acres, 9,841.06 acres, 5.98 acres, and 8,912.81 acres of each community respectively. The W Lybrook UT 720H/726H Project would be located specifically within the Sagebrush Grassland (25.74 acres), Grassland (2.46 acres), Badland/Rock/Wash (0.03 acre), and Pinyon-Juniper vegetation (0.39 acres) communities.

The Sagebrush, Greasewood, Grassland, Riparian, Badland/Rock/Wash, Gambel Oak, and Pinyon/Juniper vegetation communities produce forage for livestock grazing. Forage available to livestock grazing within the allotment is estimated in total pounds (lbs.) of above-ground production. Subsequently, pounds per acre (lbs/ac) based on the vegetation acreage within the allotment can be estimated. Estimations of lbs/ac of forage per vegetation community are derived from a combination and average of United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRS) ecological site descriptions (ESDs).

Within the Kimbeto Community; the Sagebrush, Greasewood, Grassland, and Pinyon/Juniper vegetation communities provide approximately 300 lbs./ac, 400 lbs./ac, 300 lbs./ac, and 70 lbs./ac of forage on average respectively. Badlands/Rock/Wash, Gambel Oak, Riparian, and Ponderosa Pine area acreages are not analyzed for livestock grazing impacts as they are not key grazing communities within the FFO. Based on the vegetation acreage within the allotment, there are 26,828,225.7 lbs. of forage available for livestock grazing. Combining the vegetation community estimated production and dividing by the allotment vegetation acreage yields an average of 259.21 lbs./ac of forage across the allotment that can be utilized for livestock grazing.

The following table summarizes the vegetation community acreage and estimated forage production within the Kimbeto Community.

Table 22. Vegetation acreage and estimated forage values per vegetation community in the Kimbeto Community.

Acreage & Production Description	Sagebrush Acreage & Production Values	Greasewood Acreage & Production Values	Grassland Acreage & Production Values	Pinyon/Juniper Acreage & Production Values
Allotment vegetation acres (ac)	103,498.06	103,498.06	103,498.06	103,498.06
Estimated lbs./ac	300 lbs./ac	400 lbs./ac	300 lbs./ac	70 lbs./ac
Estimated acreage	49,205.93 acres	7,767.22 acres	27,785.54 acres	8,912.81 acres
Estimated total lbs. per vegetation community	14,761,779 lbs.	3,106,888 lbs.	8,335,662 lbs.	623,896.7 lbs.

Average estimated production values in the Kimbeto Community.Table 23 provides the average estimated lbs./ac and total production in the allotment derived from the above values in Table 22**Error! Reference source not found.**.

Table 23. Average estimated production values in the Kimbeto Community.

Allotment average estimated lbs./ac	Allotment total estimated production (lbs.)
259.21 lbs./ac	26,828,225.7 lbs.

Within the Kimbeto Community, there are 187.82 acres of total existing disturbance from oil and gas operations, which is 0.18% of the total allotment vegetation acreage. Of this, 145.07 acres are short-term disturbance and 42.75 acres are long-term disturbance. Disturbance calculations were estimated using the RFD and methods described in 3.1 Methodology. Multiplying this existing disturbance by the allotment average estimated at 259.21 lbs./ac results in the estimated 48,684.82 lbs. of forage loss for short-term and long-term disturbance within the Kimbeto Community.

After successful reclamation, the estimated short-term existing impact to forage for livestock on the allotment based on the estimated average lbs./ac would be 37,603.59 lbs. of forage. This equates to 0.14% of the total estimated pounds of forage available for livestock grazing on the allotment.

The estimated existing long-term forage loss would be 11,081.23 lbs. of forage. This existing long-term disturbance forage loss equates to 0.04% of the total estimated pounds of forage available for livestock grazing on the allotment.

Table 24 summarizes the estimated existing forage impacts on the allotment from oil and gas development surface disturbance.

Table 24. Average estimated lbs./ac, total forage production (lbs.), and existing disturbance acreage and forage loss in the Kimbeto Community.

Acreage & Forage Production Description	Existing Short-Term Disturbance	Existing Long-Term Disturbance	Existing Total Disturbance
Disturbance estimated acreage (ac)	145.07 acres	42.75 acres	187.82 acres
Disturbance estimated forage loss (lbs.)	37,603.59 lbs.	11,081.23 lbs.	48,684.82 lbs.
Disturbance forage loss of total estimated production (%)	0.14%	0.04%	0.18%

No permanent livestock water sources currently exist within the proposed project area.

3.8.2. Impacts from Alternative B (the Proposed Action)

Direct and Indirect Impacts

The proposed W Lybrook UT 720H/726H Project would result in 28.62 acres of total disturbance, which would be 0.03% of the total allotment vegetation acreage. Of this, 21.05 acres would be short-term surface disturbance and 7.57 acres would be long-term surface disturbance within the Kimbeto Community. Direct and indirect forage loss can be estimated by multiplying this proposed disturbance by the allotment average estimated 259.21 lbs./ac.

After successful reclamation, the estimated short-term impact to forage for livestock on the allotment based on the estimated average lbs./ac would be a loss of 5,456.37 lbs. of forage. This equates to 0.02% of the total estimated pounds of forage available for livestock grazing on the allotment.

The estimated long-term forage impact would be 1,962.22 lbs. of forage. This proposed disturbance forage loss equates to 0.007% of the total estimated pounds of forage available for livestock grazing on the allotment.

Table 25 summarizes the direct and indirect forage impacts on the allotment from the proposed project disturbance.

Table 25. Proposed project disturbance acreage and forage loss in the Kimbeto Community.

Acreage & Forage Production Description	Proposed Project Short-Term Disturbance	Proposed Project Long-Term Disturbance	Proposed Project Total Disturbance
Disturbance estimated acreage (ac)	21.05 acres	7.57 acres	28.62 acres
Disturbance estimated forage loss (lbs.)	5,456.37 lbs.	1,962.22 lbs.	7,418.59 lbs.
Disturbance forage loss of total estimated production (%)	0.02%	0.007%	0.03%

Additional short term impacts may include displacement of permitted livestock during construction activities or exposure of livestock to hazards. After construction, livestock should become acclimated to the well and traffic associated with its maintenance. Vehicle traffic associated with this well could pose adverse impacts to livestock considering that the area is open range and livestock may be found on roads in the area.

Direct impacts to livestock occur when holes or ditches are not excluded properly. Any type of hole or ditch would potentially be a hazard to livestock while grazing. Cow or calf injuries may occur when they fall into a ditch-type cavity or in process of trying to get out. Cow or calf leg injuries also may occur when any type of small hole is left uncovered. Livestock can step into the hole and break a leg.

Impacts to livestock may occur when containment of livestock is compromised (i.e., fencing cutting). This could result in injury to livestock or individuals in the event of a vehicular accident. Indirect impacts include extra time required by the permittee to locate livestock or potential trespass issues for the respective livestock owner if the livestock cross allotment boundaries.

Two range improvement ponds are proposed to be constructed as part of the proposed action. These ponds would provide livestock with a water resource pending collection of storm water. Impacts from these ponds would be beneficial, moderate, localized and long-term.

Best management practices to minimize these impacts are found in Section 2.2.2 (Design Features and Best Management Practices).

Fugitive dust or deposition and introduction of invasive species associated with the proposed project in the immediate area could impact the vegetation that provides forage for livestock grazing.

Cumulative Impacts

There are past, present, and reasonably foreseeable future actions within the Kimbeto Community that may impact forage available for livestock grazing. These actions include oil and gas development, including associated roads and pipelines, community development, and vegetation management.

The existing disturbance due to past and present oil and gas development is described above under Livestock Grazing Affected Environment in Table 24**Error! Reference source not found.**.

Reasonably foreseeable future oil and gas related disturbance is based on 121 potential wells assumed in the RFD (Engler et al. 2014) in the Kimbeto Community. Potential future Oil and gas development within the Kimbeto Community may result in 762.98 acres of total disturbance, which is 0.74% of the total allotment vegetation acreage. Of this, 581.48 acres would be short-term disturbance after successful reclamation and 181.50 acres would be long-term disturbance.

After successful reclamation, the estimated short term reasonably foreseeable future impact to forage for livestock on the allotment based on the estimated average lbs./ac would be a loss of 150,725.43 lbs. of forage. This equates to an 0.56% loss of the total estimated pounds of forage available for livestock grazing within the allotment.

The estimated reasonably foreseeable future long-term disturbance impact to forage would be 47,046.62 lbs. of forage. This reasonably foreseeable future long-term disturbance loss equates to 0.18% of the total estimated pounds of forage available for livestock grazing on the allotment.

Table 26 summarizes the reasonably foreseeable future forage impacts in the allotment from the RFD potential wells.

Table 26. Reasonably foreseeable disturbance acreage and forage loss in the Kimbeto Community.

Acreage & Forage Production Description	RFD Short-Term Disturbance	RFD Long-Term Disturbance	RFD Total Disturbance
Disturbance estimated acreage (ac)	581.48 acres	181.5 acres	762.98 acres
Disturbance estimated forage loss (lbs.)	150,725.43 lbs.	47,046.62 lbs.	197,772.05 lbs.
Disturbance forage loss of total estimated production	0.56%	0.18%	0.74%

(%)			

Cumulatively, the reasonably foreseeable and existing disturbance together total 950.80 acres of oil and gas development disturbance, which would be 0.92% of the total allotment vegetation acreage. Of this, 726.55 acres would be short-term disturbance after successful reclamation and 224.25 acres would be long-term disturbance.

After successful reclamation, the estimated short term cumulative impact to forage for livestock on the allotment based on the estimated average lbs./ac would be a loss of 188,329.03 lbs. of forage. This equates to 0.7% loss of the total estimated pounds of forage available for livestock grazing within the allotment.

The estimated cumulative long-term disturbance impact to forage would be 58,127.84 lbs. of forage. This cumulative future long-term disturbance loss equates to 0.22% of the total estimated pounds of forage available for livestock grazing on the allotment.

Cumulative disturbance impacts for past, present, and reasonably foreseeable future oil and gas development, including acreage and estimated forage loss for livestock grazing, is shown in Table 27.

Table 27. Cumulative disturbance acreage and forage loss in the Kimbeto Community.

Acreage & Forage Production Description	Cumulative Short-Term Disturbance	Cumulative Long-Term Disturbance	Cumulative Total Disturbance
Disturbance estimated acreage (ac)	726.55 acres	224.25 acres	950.8 acres
Disturbance estimated forage loss (lbs.)	188,329.03 lbs.	58,127.84 lbs.	246,456.87 lbs.
Disturbance forage loss of total estimated production (%)	0.7%	0.22%	0.92%

Community development within the Kimbeto Community is currently low. It is not expected to increase in the reasonably foreseeable future based on the area's current infrastructure and development rate. As housing and access roads are constructed and/or removed, vegetation available as livestock forage within the Kimbeto Community may be altered.

Vegetation management has been implemented for various purposes and in various forms throughout the Farmington Field Office. Past vegetation management has likely altered forage available for livestock grazing, and potential future vegetation management on the Kimbeto Community may alter forage available for livestock grazing.

3.9. Environmental Justice

3.9.1. Affected Environment

The analysis area for impacts to Environmental Justice is the BLM-FFO regional management area. Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations, requires that federal agencies identify and address any disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations.

Environmental justice refers to the fair treatment and meaningful involvement of people of all races, cultures, and incomes with respect to the development, implementation, and enforcement of environmental laws, regulations, programs, and policies. It focuses on environmental hazards and human health to avoid disproportionately high and adverse human health or environmental effects on minority and low-income populations.

Guidance on environmental justice terminology developed by the President's Council on Environmental Quality (CEQ 1997) is discussed below.

- Low-income population. A low-income population is determined based on annual statistical poverty thresholds developed by the US Census Bureau. In 2012, poverty level is based on total income of $11,720 for an individual and $23,283 for a family of four (US Census Bureau 2012a). A low-income community may include either a group of individuals living in geographic proximity to one another or dispersed individuals, such as migrant workers or Native Americans.
- Minority. Minorities are individuals who are members of the following population groups: American Indian, Alaskan Native, Asian, Pacific Islander, Black, or Hispanic.
- Minority population area. A minority population area is so defined if either the aggregate population of all minority groups combined exceeds 50 percent of the total population in the area or if the percentage of the population in the area comprising all minority groups is meaningfully greater than the minority population percentage in the broader region. Like a low-income population, a minority population may include either individuals living in geographic proximity to one another or dispersed individuals.
- Comparison population. For the purpose of identifying a minority population or a low-income population concentration, the comparison population used in this study is the state of New Mexico as a whole

Low-income Populations

Income and poverty data estimates for study area counties from the US Census Small Area Poverty Estimates model indicate that the percent of the population living below the poverty level in the socioeconomic study area as a whole is slightly above that of the state (21.3 percent and 20.6 percent), but it is much higher than the national average of 12.1 percent (Table 28). Poverty levels ranged from 37.7 percent in McKinley County to 13.7 percent in Sandoval County. Only that of Sandoval County was below the state average.

Table 28. Study Area County Population in Poverty (2002-2012)

	McKinley County	Rio Arriba County	Sandoval County	San Juan County	Study Area Total	New Mexico	United States
Percent of Population in Poverty 2002	21,766	7,165	19,934	22,152	71,017	421,123	34,569,951
	30.2%	17.7%	11.1%	18.2%	21.3%	20.6%	12.1%
Percent of Population in Poverty 2012	27,296	8,806	18,502	25,802	80,406	327,444	48,760,123
	37.7%	22.0%	13.7%	20.3%	21.5%	17.7%	15.9%
Median Household Income 2002	$25,197	$30,557	$45,213	$34,329	N/A	$34,827	$45,409
Median Household Income 2012	$29,821	$36,900	$57,376	$45,901	N/ A	$42,828	$51,371
Classified as Low Income Population in 2012 based on CEQ guidelines?	No	No	No	No	No	NA	NA
Source: US Census Bureau 2013							

Similarly, estimates from 2012 indicate that Sandoval and San Juan Counties had household median incomes ($57,376 and $45,901) that were above the state level of $42,828. McKinley County ($29,821) and Rio Arriba County ($36,900) were below that of the state in 2012 (Table 28). While no area communities meet the CEQ definition of a low-income population area (50 percent or higher), the highest poverty rates were seen in Bloomfield (29 percent), Espanola (26.3 percent), and Bernalillo (24.1 percent) (Table 29).

Table 29. Study Area Key Community Race/Ethnicity and Poverty Data

Community	% Population Racial or Ethnic Minority	Classified as Minority Population based on CEQ?	% of Individuals Below Poverty	Classified as Low-income Population based on CEQ?
Aztec	36.4%	No	14.4%	No
Bernalillo	78.8%	Yes	24.1%	No

Community	% Population Racial or Ethnic Minority	Classified as Minority Population based on CEQ?	% of Individuals Below Poverty	Classified as Low-income Population based on CEQ?
Bloomfield	55.8%	Yes	29.0%	No
Espanola	91.6%	Yes	26.3%	No
Farmington	48.8%	No	15.5%	No
Gallup	76.9%	Yes	20.9%	No
Rio Rancho	46.7%	No	9.8%	No

Source: US Census Bureau 2012b
Note: American Community Survey estimates are based on data collected over a 5-year time period. The estimates represent the average characteristics of populations between January 2008 and December 2012 and do not represent a single point in time.

Census Tracts are geographic regions within the United States that are defined by the US Census Bureau in order to track changes in a population over time. Census Tracts are based on population sizes and not geographic areas. The average population of a Census Tracts is about 4,000 people, so rural areas that are sparsely populated may have very large Census Tracts while densely populated urban areas may have very small Census Tracts.

When broken down by Census Tract, 3 out of 87 tracts in the socioeconomic study area have greater than 50 percent of individuals living below the poverty line: Census Track 9440 in eastern McKinley County had an individual poverty rate of 54.6 percent; Census Tract 9405 in southwestern McKinley County had an individual poverty rate of 59.4 percent; and Census Tract 9409 in northwestern Sandoval County had an individual poverty rate of 51.9 percent (US Census Bureau 2012b). These 3 Census Tracts are all relatively large, indicating a sparsely populated, rural area.

Minority Populations

Based on 2008-2012 data, minorities made up 59.5 percent of the population in New Mexico, compared to 36.3 percent in the United States as a whole (Table 30**Error! Reference source not found.**). The proportion of minorities in the socioeconomic study area (65.3 percent) substantially exceeded the United States and is slightly higher than the state average. At the county level, the population ranged from 89.7 percent minority in McKinley County to 52.8 percent in Sandoval County. Within relevant tribal nations, Native Americans represented the vast majority of the population. The largest minority groups were Hispanics/Latinos in Rio Arriba and Sandoval Counties and Native Americans in McKinley and San Juan Counties.

Table 30. Study Area County Population by Race/Ethnicity (2008-2012)

Population	McKinley County	Rio Arriba County	Sandoval	San Juan	Study Area	New Mexico	United States	Jicarilla Apache Nation	Navaho Nation	Ute Mountain Nation
Hispanic or Latino ethnicity of any race	9,744	28,714	46,334	24,496	109,288	952,569	50,545,275	382	2,958	99
	13.6%	71.4%	35.3%	19%	29%	46.3%	16.4%	11.6%	1.7%	6.0%
White alone	7,413	5,370	61,977	54,218	128,978	831,543	196,903,968	74	3,762	47
	10.3%	28.6%	47.2%	42.2%	34.67%	40.5%	63.7%	2.3%	2.2%	2.9%
Black or African American alone	353	149	2,704	794	4000	35,586	37,786,591	0	250	5
	0.5%	0.4%	2.1%	0.6%	1.08%	1.7%	12.2%	0%	0.1%	0.3%
American Indian or Alaskan Native alone	52,358	5,629	15,964	46,676	120,627	176,766	2,050,766	2,692	162,920	1,429
	72.8%	14.0%	12.2%	36.3%	32.43%	8.6%	0.7%	82.0%	94.3%	87.0%
Asian alone	506	173	1,685	464	2828	25,411	14,692,794	73	834	14
	0.7%	0.4%	1.3%	0.4%	0.76%	1.2%	4.8%	2.2%	0.5%	0.9%

Population	McKinley County	Rio Arriba County	Sandoval	San Juan	Study Area	New Mexico	United States	Jicarilla Apache Nation	Navaho Nation	Ute Mountain Nation
Native Hawaiian and Other Pacific Islander alone	38	7	100	72	217	989	480,063	0	209	0
	0.1%	0%	0.1%	0.1%	0.06%	<.01%	0.2%	0%	0.1%	0%
Some Other Race	7	22	437	84	550	3,623	616,191	0	102	0
	<.01%	0.1%	0.3%	0.1%	0.15%	0.2%	0.2%	0%	0.1%	0%
Two or more Races	1,469	137	2,101	1,796	5,503	28,800	6,063,063	62	1,660	49
	2.0%	0.3%	1.6%	1.4%	1.48%	1.4%	2.0%	1.9%	1.0%	3.0%
Classified as Minority Population based on CEQ guidelines?	Yes	Yes	Yes	Yes		Yes	NA	Yes	Yes	Yes

Source: US Census Bureau 2012b
Note: American Community Survey estimates are based on data collected over a 5-year time period. The estimates represent the average characteristics of populations between January 2008 and December 2012 and do not represent a single point in time

Based on the CEQ definition of a minority population area (minority residents exceed 50 percent of all residents), Bernalillo, Bloomfield, Espanola, and Gallup all are considered minority communities.

When examined at the Census Tract level, there are 24 out of 87 tracts that have a minority population greater than 50 percent. These range from Census Tract 6.1 located just north of the city of Aztec with a minority population of 80.5 percent to Census Tract 107.17 located north of the city of Rio Rancho with a minority population of 50.2 percent (US Census Bureau 2012b). These Census Tracts are relatively small and are based around the city of Rio Rancho and the Aztec/Farmington/Bloomfield area.

Native American Populations

Data in Table 30**Error! Reference source not found.** accounts for a substantial portion of the study area population in some areas, notably McKinley and San Juan Counties, where the population is 72.8 and 36.3 percent American Indian respectively. Three tribal governments have reservations within the planning area: the Jicarilla Apache Nation, the Navajo Nation, and the Ute Mountain Nation (Table 31**Error! Reference source not found.**). The Southern Ute Nation has lands just north of the planning area in the state of Colorado, but none within the planning area. Almost one half of the planning area is tribal lands. Each tribe maintains a general concern for protection of and access to areas of traditional and religious importance, and the welfare of plants, animals, air, landforms, and water on reservation and public lands. Policies established in 2006 by the BLM and US Forest Service, in coordination with federal tribes, ensure access by traditional native practitioners to area plants. The policy also ensures that management of these plants promotes ecosystem health for public lands. The BLM is encouraged to support and incorporate into their planning traditional native and native practitioner plant-gathering for traditional use (Boshell 2010).

Table 31. Tribal Nations in the Planning Area

Tribe	Acres in Planning Area	General Location
Jicarilla Apache Nation	739,600	The majority of the Jicarilla Apache Nation is located in western Rio Arriba County, but within the eastern portion of the planning area
Navajo Nation	860,900	A portion of the Navajo Nation extends into western San Juan County and into the western portion of the planning area

Tribe	Acres in Planning Area	General Location
Ute Mountain Nation	103,500	A portion of the Ute Mountain Nation extends into the northern portion of San Juan County, just east of the Navajo Nation, and into the northern portion of the planning area
Unknown	196,300	Lands located in the southern portion of the planning area [Note to BLM: this is due to inconsistencies between US Census Bureau tribal areas dataset and BLM land status dataset.]
Source: BLM GIS 2014, US Census Bureau 2014		

3.9.2. Impacts from Alternative B (the Proposed Action)

Direct and Indirect Impacts

As noted in the PRMP/FEIS, most activities, including oil and gas development occur without influence of demographic or income values. They are primarily the response of various resource values and are balanced for overall public benefit. San Juan County, along with the other counties that make up the larger development area, have a high proportion of minority populations compared to the state and national percentages. San Juan County has a distinctly high percentage of American Indians, while Rio Arriba has a large Hispanic population. The poverty levels for all counties, except Sandoval County were higher than the state and national level. As such, the potential exists for minority and low-income populations to be affected by the proposed action.

Specific issues of concern outlined in the PRMP/FEIS include the potential for economic impacts (such as job losses or increases), potential for land use impacts (as outlined in previous sections), and the potential for conditions that pose a public health or safety risk. The development and production of the proposed wells would allow WPX to develop their leases and provide additional natural gas and oil for the national energy market. This would generate federal and state tax revenues as well as revenue for WPX, its contractors, and additional jobs, royalties, and revenues to local economies. The additional jobs and economic activity in the region from oil and gas development have the potential to benefit local communities and residents and would be considered a positive effect. The four proposed wells would be part of an increase from the larger scale oil and gas development in the region. Potential land use impacts and public health and safety risks have been addressed in both previous sections of this document and/or the PRMP/FEIS. Project specific design features and best management practices (Section 2.2.2), as well as COAs attached to the approved APDs help to reduce adverse impacts to the surrounding communities as they relate to land use and public health and safety. See PRMP/FEIS for further discussion of Environmental Justice (BLM 2003a).

Cumulative Impacts

The analysis area for cumulative impacts is the same as for direct and indirect impacts. The proposed action would contribute to the effects of the local economy in the form of increased natural gas production, new jobs and increased revenues. Any additional well development and production in the area would result in incremental impacts to local economy. The energy industry is subject to boom and bust cycles. However, the continued development of these resources still represents a desirable economic engine. With the development of these resources being concentrated in Rio Arriba and San Juan counties that both have disproportionately minority population, benefits from growth in resource development both federal and non-federal interests would provide jobs and therefore benefit these groups (BLM 2003a, 4-129).

3.10. Public Health and Safety

3.10.1. Affected Environment

The analysis area for impacts to Public Health and Safety is San Juan County and the impact indicator for analysis is the number of truck trips. The proposed project would comply with the use and disposal of hazardous materials as regulated primarily under RCRA outlined above in Section 1.5.7. No extremely hazardous substances (40 CFR 355)

would be used during the Proposed Action. Hazardous substances that may be found at the site may include minimal quantities of materials that may be necessary for drilling, welding, or gluing. Flammable or combustible substances such as fuels and aids/gels (corrosives) associated with vehicles and the drilling and welding processes may also be found at the site. These materials may include oil, fuel, hydraulic fluid, drilling fluids, and coolants. These chemicals are subject to reporting under the Emergency Planning and Right-to-Know Act of 1968 and may be used, produced, stored, transported or disposed of in association with the proposed project. Releases of non-freshwater fluids would be promptly handled in accordance with applicable federal and state regulations. Waste disposal would be made in accordance with applicable federal and state regulations and at permitted facilities.

Non-hazardous solid waste generated at the proposed project area would be stored in appropriate containers and disposed of at an approved facility. Human solid and liquid wastes would be generated primarily during the drilling and construction phases of the project and would be contained within portable facilities at the site.

Worker safety is regulated under the Occupational Safety and Health Act of 1970, as amended (29 USC 651). Safety practices in accordance with OSHA would be followed at all times during the project. Standard safety procedures for drilling and completion of the proposed project would include pipeline markers, monitoring, and inspections that are required by federal and state regulations. The BLM-FFO reviews the operator's drilling and operation plans prior to approving the APD. The reviews consider the reservoir pressures that may be encountered, compare these pressures to the operator's proposed equipment ratings, casing design, and cement program. Wells would be drilled and completed in accordance with these plans and as directed by the BLM-FFO.

The proposed project area is fairly remote and roads in the area are generally unimproved dirt roads used to access natural gas facilities and a few remote residents in the area. These roads may become hazardous or impassable during periods of inclement weather. Exposure of the public to activities associated with the Proposed Action is limited by the remoteness of the location and proximity to areas where the general public may occur. The nearest town, Bloomfield (population 7,801 [U.S. Census Bureau 2015]), would be 41.50 road miles to the north-northwest, and U.S. Highway 550 would be located 3.24 road miles to the northeast. No BLM SMA's managed for recreation are located within the Escavada Wash watershed. The nearest resident would be 0.30 miles north northeast from place of residence to the W Lybrook UT 720H, 722H, 724H, 756H, 757H, and 758H well pad.

The nearest hospital would be in Farmington, New Mexico. This hospital is approximately 44 air miles or 55.50 road miles from the proposed project.

3.10.2. Impacts from the Proposed Action

Direct and Indirect Impacts

The proposed project would affect transportation. During construction, the proposed project would result in increased traffic on area roads; some vehicles would be hauling heavy equipment. Therefore, there would be an increased potential for traffic accidents. Dust associated with construction activities or travel on dirt access roads may result in poor visibility in the area. The increased use of dirt access roads during muddy conditions may worsen the roads' conditions. Following construction and drilling, traffic levels would be similar to current levels; long-term effects on transportation would be beneficial, moderate, extensive, and long-term due to the reduction of truck traffic from the piping of products from the location to a gathering system.

During construction, drilling, and maintenance activities, the operation of heavy equipment poses potential safety concerns. During the operation of the proposed well-connect pipelines, facility failure (such as pipeline ruptures) could represent a potential danger to the public. Impacts are likely to be adverse, moderate, localized, and short-term.

Cumulative Impacts

The analysis area and impact indicator for cumulative impacts is the same as for direct and indirect impacts. The general BLM-FFO region has been developed by the oil and gas industry for over six decades, which contributes to public health and safety concerns in the area. Transportation issues are a primary safety concern. Vehicles associated with the oil and gas industry utilize the developed highway and county road systems. In addition, the oil and gas

industry constructs and utilizes dirt access roads in the area. These roads, most of which are accessible by the public, are often hazardous, particularly during and following periods of inclement weather.

Additional safety concerns in the region include wildfire; oil and gas facility leakage or rupture; moving equipment (such as pump jacks); oil and gas explosions; and the handling, storage, and disposal of wastes, chemicals, or condensate.

28,870 oil and gas wells have been developed in the BLM-FFO region. Based on the RFD (Engler, et al., 2014), oil and gas development across the BLM-FFO region may result in a total of 3,590 oil and gas wells from potential future development. The total number of wells from past, present, and reasonably foreseeable actions in the BLM-FFO region is 32,460 wells. The proposed action would contribute twelve (12) wells to that total and represents .04% of the cumulative impacts to public health and safety from the initial development and long term operations associated with these wells. This disturbance would have the same impacts as described for direct and indirect impacts.

4. SUPPORTING INFORMATION

4.1. Tribes, Individuals, Organizations, or Agencies Consulted

Table 32 contains a list of tribes, individuals, organizations, and agencies invited to attend the on-site for the project.

Table 32. Tribes, Individuals, Organizations, and Agencies Invited to the On-Site

Name	Tribe, Organization, or Agency	Attended On-Site
Colleen Cooley	Dine Care	No
Thomas Singer	Western Environmental Law Center	No
Mike Eisenfeld	San Juan Citizens Alliance	No
Sarah White		No
Erik Schlenker-Goodrich	Western Environmental Law Center	No
Kyle Tisdale	Western Environmental Law Center	No
Samantha Ruscavage-Barz	WildEarth Guardians	No
Time Ream	WildEarth Guardians	No
Victoria Gutierrez		No
Pete Dronkers	Earthworks	No
Jeremy Nichols	WildEarth Guardians	No
Anson Wright	Chaco Alliance	No
Bruce Baizel	Earthworks	No
Tweetie Blancett		No
Lori Goodman	Dine Care	No
Penny Anderson	Western Resource Advocates	No
Samuel Sage	Counselor Chapter	No
Don Schrieber	Devil Springs Ranch	No
Miya King-Flaherty	Sierra Club	No
Johnna Oberly	FIMO	No
Annette Ahill	FIMO	No
Harrilene Yazzie	BIA	No
Bertha Spencer	BIA	No

The BLM fulfills its responsibilities under the National Historic Preservation Act (NHPA) through a number of agreements. The National Programmatic Agreement (NPA 2012) between the BLM, Advisory Council on Historic Preservation (ACHP), and the National Council of State Historic Preservation Officers (NCSHPO) allows the agency to fulfill its NHPA responsibilities according to the provisions of the NPA in lieu of 36 CFR 800.3 through 800.7 regulations. The NPA, which applies to all BLM activities below specified thresholds, provides among other things, regulatory relief in many instances from the requirement for case-by-case review by State Historic

Preservation Officers (SHPOs) and the ACHP, in exchange for managers' maintenance of appropriate staff capability and observance of internal BLM standards as set out in the 8100 Manual series.

The New Mexico BLM has a two-party protocol with the New Mexico SHPO (BLM-SHPO 2014) specifically encouraged by the NPA. This protocol details how the New Mexico BLM and SHPO would regulate their relationship and consult. Specifically, this document outlines among other things, how and when consultation would be conducted between the BLM, SHPO, Tribes, and the public. The protocol also outlines when case-by-case SHPO consultation is or is not required for specific undertakings and the procedures for evaluating the effects of common types of undertakings and resolving adverse effects to historic properties. These common types of undertakings regularly include the common actions undertaken in the BLM FFO.

BIA Compliance with the National Historic Preservation Act (NHPA) on Navajo trust lands is adhered to by making the final decisions and issuing final notices to proceed with undertakings based on Navajo Nation Historic Preservation Department (NNHPD) review and recommendations to the BIA-NRO Regional Director.

4.2. List of Preparers

This EA was prepared by EIS in conformance with the standards of and under the direction of the BLM-FFO. The following individuals assisted in the preparation of this EA:

- Casey Haga, Biologist, EIS
- Mindy Paulek, Biologist, EIS
- Mark Ames, Project Manager for NEPA review, BLM-FFO
- Neal Perry, Wildlife Biologist
- Marcus WhiteBull, Range Specialist, BLM-FFO
- John Kendall, SSS Wildlife Biologist, BLM-FFO
- Heather Perry, Noxious Weed Coordinator, BLM-FFO
- Jim Copeland, Archaeologist, BLM-FFO
- Craig Townsend, Natural Resource Specialist, BLM-FFO
- Michael Porter, Natural Resource Specialist, BLM-FFO
- Lola Henio, Tribal Program Coordinator, BLM-FDO

4.3. Glossary

Direct impacts – Direct impacts occur at the same time and location where a management action or set of management actions take place.

Indirect impacts – Indirect impacts occur later in time or in a different location as a management action or set of management actions, but are still reasonably foreseeable. Indirect effects may include effects related to changes in the pattern of land use, population density, or related effects on air and water and other natural systems, including ecosystems.

Cumulative impacts – Cumulative impacts are impacts on the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes those other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over time.

Adverse – The effect results in a decline in a resource, resource use, special designation, or social and economic feature when compared to current conditions or trends. Adverse effects to a resource are those that result in a decrease in the amount, extent, or quality of the resource. Adverse effects to a resource use are those that result in a decrease in the opportunity to engage in the use, either through a reduction in the area available for that use or an increase in the amount of restrictions on that use. Adverse effects to a special designation are those that result in a decrease in the amount, extent, or quality of the values for which the area was designated. Adverse effects to social and economic features result in a decrease in social and economic opportunities. The term "adverse" has a specific legal context with regard to ESA and the regulations for the National Historic

Preservation Act of 1966 (NHPA; 36 CFR 800) that is typically used when discussing site-specific projects. The use of the term "adverse" in the Jarbidge RMP/EIS is not synonymous with the definition for either ESA or NHPA.

Beneficial – The effect results in an increase in a resource, resource use, special designation, or social and economic feature when compared to current conditions or trends. Beneficial effects to a resource are those that result in an increase in the amount, extent, or quality of the resource. Beneficial effects to a resource use are those that result in an increase in the opportunity to engage in the use, either through an increase in the area available for that use or a decrease in the amount of restrictions on that use. Beneficial effects to a special designation are those that result in an increase in the amount, extent, or quality of the values for which the area was designated. Beneficial effects to social and economic features result in an increase in social and economic opportunities. Beneficial impacts are also qualified by how well they meet the resource goals and objectives.

Minor – The effect is slight but detectable; there would be a small change (e.g., the impact to air quality from particulate matter generated by a prescribed fire for noxious weed control).

Moderate – The effect is readily apparent; there would be noticeable change (e.g., the impacts to upland vegetation from management actions that result in the conversion of thousands of acres of annual community vegetation to native shrubland).

Major – The effect is large and highly noticeable (e.g., reducing route density throughout the majority of the planning area is expected to have a major beneficial impact to special status wildlife species).

Localized – The effect occurs at a specific site or within a relatively small area [e.g., within a specific area in a Vegetation Management Area (VMA)].

Extensive – The effect occurs within a larger area, but not throughout the entire planning area (e.g., within an entire VMA).

Area-wide – The effect occurs throughout all or most of the planning area (e.g., across multiple VMAs). This could include an effect to the majority of acres within the planning area or to a smaller number of acres scattered throughout the planning area.

Short-term – The effect occurs for a short time after implementation of a management action. The effective time period is five years or less.

Long-term – The effect occurs for an extended period after implementation of a management action. The effective time period is greater than five years.

4.4. References

Allen, D., Pacsi, A., Sullivan, D., Araiza, D. Z., Harrison, M., Keen, K., et al. (2014). Methane Emissions from Process Equipment at Natural Gas Production Sites in the United States: Pneumatic Controllers. *Environmental Science and Technology*, es5040156.

Allen, D., Sullivan, D., Araiza, D. Z., A.Pacsi, Harrison, M., Keen, K., et al. (2014a). Methane Emissions from Process Equipment at Natural Gas Production Sites in the United States: Liquid Unloadings. *Environmental Science and Technology*, es504015.

Boshell, Cynthia. 2010. Public Land Policy as a Cultural Empowerment Tool: The Federal Land Policy and Management Act of 1976 (FLPMA), with special emphasis on the California Traditional Gathering Policy. Internet Web Site: http://users.humboldt.edu/boshell/PDF/boshell_FLPMA.pdf. Accessed September 8, 2011.

Brugge, David M. 1993. An Investigation of AIRFA [American Indian Religious Freedom Act] Concerns Relating to the Fruitland Coal Gas Development Area. Albuquerque, New Mexico: Office of Contract Archaeology, University of New Mexico. Ms. on file at BLM-FFO.

Bureau of Land Management (BLM). 2003a. Farmington Proposed Resource Management Plan and Final Environmental Impact Statement (PRMP/FEIS). Farmington, New Mexico: BLM-FFO.

_____. 2003b. Farmington Resource Management Plan with Record of Decision. (RMP and ROD). Farmington, New Mexico: BLM-FFO.

_____. 2004. Notice to Lessees and Operators on Onshore Oil and Gas Leases Within the Jurisdiction of the Farmington Field Office - Management of Sound Generated by Oil and Gas Production and Transportation (NTL 04-2 FFO). Farmington, New Mexico: BLM-FFO.

_____. 2004b. The Foundations for Managing Cultural Resources. BLM Manual 8100. Washington DC. http://www.blm.gov/style/medialib/blm/wo/Information_Resources_Management/policy/blm_manual.Par.71969.File.dat/8100.pdf

_____. 2005. *Procedures for Performing Cultural Resource Fieldwork on Public Lands in the Area of New Mexico BLM Responsibilities*. http://www.blm.gov/pgdata/etc/medialib/blm/nm/programs/more/cultural_resources/cultural_docs.Par.77051.File.dat/H-8100-1_manual_final_V_8-21_.pdf

_____. 2008a. BLM Manual 6840: Special Status Species Management.

_____. 2008b. BLM National Environmental Policy Act Handbook H-1790-1. Washington, D.C.: BLM National Environment Policy Act Program Office of the Assistant Director, Renewable Resources and Planning.

_____. 2008c. Memorandum: Farmington Field Office (FFO) Special Management Species Policy 2008 Update. Farmington, New Mexico: BLM-FFO.

_____. 2010. Climate Change Supplementary Information Report for Montana, North Dakota, and South Dakota, Bureau of Land Management. Report on Greenhouse Gas Emissions and Climate Change for Montana, North Dakota, and South Dakota. Technical report prepared for the Montana/Dakotas BLM by URS Corporation. URS Project 22241790.

_____. 2011a. BLM New Mexico Sensitive Birds List. Revised August 2011.

_____. 2011b. BLM New Mexico Sensitive Mammals List. Revised July 2011.

_____. 2011c. BLM New Mexico Sensitive Molluscs, Crustaceans, and Arthropods List. Revised August 2011.

_____. 2011d. Roads Design Handbook. H-9113-1

_____. 2011e. BLM Roads National Inventory and Condition Assessment Guidance and Instructions. H-9113-2.

_____. 2012a. BLM New Mexico Sensitive Plants List. January.

_____. 2013a. aztec_gilia_habitat (Shapefile of the new Aztec gilia and Brack's fishhook cactus potential habitat "zone"). Provided by the BLM-FFO September 26, 2013.

_____. 2013b. BLM-FFO Bare Soil Reclamation Procedures. Available at: http://www.blm.gov/nm/st/en/fo/Farmington_Field_Office/ffo_planning/surface_use_plan_of.html. Accessed April 2013.

_____. 2013d. Farmington Field Office Visual Resource Management Proposed Resource Management

_____. 2015. FFO_TRANSPORT_BLM_roads_12-14-2015 (Shapefile of recorded BLM roads). Available at: http://www.blm.gov/nm/st/en/prog/more/geographic_sciences/spatial_data_metadata/farmington_spatial.html.

BLM-SHPO. 2014. State Protocol Agreement between New Mexico BLM and New Mexico State Historic Preservation Officer. http://www.blm.gov/nm/st/en/prog/more/cultural_resources/need_to_know html

CEQ (Council on Environmental Quality). 1997. Environmental Justice Guidance under the National Environmental Policy Act. December 10, 1997.

Enquist, Carolyn and Gori, Dave. 2008. Implications of Recent Climate Change on Conservation Priorities in New Mexico. April 2008.

Griffith, G.E., J.M. Omernik, M.M. McGraw, G.Z Jacobi, C.M. Canavan, T.S. Schrader, D. Mercer, R. Hill, and B.C. Moran. 2006. Ecoregions of New Mexico (color poster with map, descriptive text, summary tables, and photographs). Reston, Virginia: U.S. Geological Survey (map scale 1:1,400,000).

Hebblewhite, M. 2011. Effect of Energy Development on Ungulates in Energy Development, editor David E. Naugle. Island Press, Washington, DC, USA.

Holmes, A.L. and A.V. King. 2006. Vital Rates of Sagebrush Obligate Songbirds in Relation to Natural Gas Development and Weather. Abstract Oral Presentation to IV North American Ornithological Congress. Veracruz, Mexico.

Howarth, R., Santoro, R., & A.Ingraffea. (2011). Methane and the greenhouse-gas footprint of natural gas from shale formations. *Climate Change*, 679-690.

Independent Petroleum Association of New Mexico (IPANM). 2014. Energy New Mexico. Available at: http://www.ipanm.org/images/library/File/Energy%20New%20Mexico%202014.pdf

Intergovernmental Panel on Climate Change. (2013). *Climate Change 2013: The Physical Science Basis.* Cambridge: Cambridge University Press.

Kelly, Klara, Rena Martin, Richard Begay, Ted Neff, and Clifford Werito. 2006. *"We Will Help You With What We Know": Diné Traditional Cultural Places In Dinétah*. Flagstaff, Arizona: Museum of Northern Arizona Environmental Solutions, Inc. Ms. on file at BLM-FFO.

Kort, E., Frankenberg, C., Costigan, K., Lindenmaier, R., Dubey, M., & Wunch, D. (2014). Four corners: The largest US methane anomaly viewed from space. *Geophysical Research Letters*, 6898-6903.

Navajo Nation Historic Preservation Department (NNHPD). 2010. Fieldwork and Report Standards and Guidelines. http://www hpd.navajo-nsn.gov/index.php?option=com_content&view=article&id=79&Itemid=484.

NPA. 2012. National Programmatic Agreement among the BLM, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers. http://www.blm.gov/wo/st/en/prog/more/CRM/blm_preservation_board/prog_agreement html

NPS. 1997. How to Apply the National Register Criteria for Evaluation. National Register Bulletin 15. Washington.

NRCS. 2013. http://www nrcs.usda.gov/wps/portal/nrcs/main/national/water/watersheds/dataset/. Accessed July 30, 2013.

New Mexico Environment Department (NMED). 2010. Inventory of New Mexico Greenhouse Gas Emissions: 2000-2007. Santa Fe: New Mexico Environment Department.

New Mexico Office of the State Engineer. 2011. GIS shapefile: ose_wells_July2011. http://www.ose.state.nm.us/water_info_data html.

Ortega, C.P. and C.D. Francis. 2007. Effects of Gas Well Compressor Noise on Breeding Birds in the Rattlesnake Canyon Habitat Management Area, San Juan County, New Mexico. Report to the Bureau of Land Management, Farmington Field Office. Final Report.

Parker, Patricia L. and Thomas F. King. 1998. Guidelines for Evaluating and Documenting Traditional Cultural Properties. National Park Service, *National Register Bulletin 38.* Washington.

Schneising, O., Burrows, J. P., Dickerson, R. R., Buchwitz, M., Reuter, M., & Bovensmann, H. (2014). Remote sensing of fugitive methane emissions from oil and gas production in North American tight geologic formations. *Earth's Future*, 548-558.Science Applications International Corporation. 2002. Cultural Resources Technical Report: Background Information on Cultural Resources for the Farmington Draft RMP/EIS. Ms. on file at BLM-FFO, Farmington, New Mexico.

Science Applications International Corporation. 2002. *Cultural Resources Technical Report: Background Information on Cultural Resources for the Farmington Draft RMP/EIS*. Ms. on file, Bureau of Land Management, Farmington, New Mexico.

U.S. Census Bureau. 2012a. Poverty threshold by size of family. Internet Web site: http://www.census.gov/hhes/www/poverty/data/threshld/index html. Accessed on Accessed on February 20, 2014.

U.S. Census Bureau 2012b. American Community Survey, 2012 American Community Survey 5-Year Estimates, Tables DP-02, DP-03, DP-04, DP-05; generated by Lauren Zielinski; using American FactFinder; http://factfinder2.census.gov. Accessed February 17, 2014.

U.S. Census Bureau. 2013. Small Area Estimates Branch 2002 and 2012 Poverty and Median Income Estimates - Release date December 2013. Accessed on February 20, 2014.

U.S. Census Bureau. 201. US Census Bureau GIS data. Tiger Products. Internet Web Site: http://quickfacts.census.gov/qfd/states/35/3507880.html Accessed on July 2015.

U.S. Department of Agriculture/Natural Resources Conservation Service (USDA/NRCS). 2014. Web Soil Survey. Information for San Juan County, New Mexico, Eastern Part. Available at http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx. Accessed September 11, 2014.

U.S. Environmental Protection Agency (USEPA). 2004. Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reserves. Office of Ground Water and Drinking Water (4606M). EPA 816-R-04-003.

_____. (2012, May 21). *2005 National-Scale Air Toxics Assessment*. Retrieved February 27, 2014, from U.S. Environmental Protection Agency: http://www.epa.gov/ttn/atw/nata2005/

_____. (2013, December 5). *The Green Book Nonattainment Areas for Criteria Pollutants*. Retrieved February 25, 2014, from U.S. Environmental Protection Agency: http://www.epa.gov/airquality/greenbook/

_____. (2013a, November 15). *Air Quality Index Report*. Retrieved March 12, 2014, from U.S. Environmental Protection Agency: http://www.epa.gov/airdata/ad_rep_aqi html

_____. (2014, February 7). *Air Trends: Design Values.* Retrieved February 25, 2014, from U.S. Environmental Protection Agency: http://www.epa.gov/airtrends/values.html

_____. (2014, February 3). *The 2011 National Emissions Inventory*. Retrieved February 27, 2014, from U.S. Environmental Protection Agency: http://www.epa.gov/ttn/chief/net/2011inventory.html

U.S. Fish and Wildlife Service (USFWS). 2015. Threatened and Endangered Species. U.S. Fish and Wildlife Service Environmental Conservation Online System. Available at http://ecos.fws.gov/ecos/home.action

U.S. Geological Survey (USGS). 1979. Notice to Lessees and Operators of Onshore Federal and Indian Oil and Gas Leases (NTL-3A). Reporting of Undesirable Events.

USGS. 2013. http://water.usgs.gov/GIS/huc.html. Accessed July 30, 2013.

Van Valkenburgh, Richard F. 1941.Diné Bikeyah. Window Rock, Arizona: Department of the Interior, Office of Indian Affairs, Navajo Services. Ms. on file at BLM-FFO.

_____. 1974. Navajo Sacred Places. Edited by Clyde Kluckhohn. Garland American Indian Ethnohistory Series, Navajo Indians, 3 Vols. New York, New York: Garland Publishing.

Western Cultural Resource Management, Inc. (WCRM). 2016a. Cultural Resource Inventory of WPX Energy Production West Lybrook Unit 720H, 722H, 724H, 756H, 757H, 758H Well Pad, Access Road, and Pipeline, San Juan County, New Mexico. WCRM(F)1418.

_____. 2016a. Cultural Resource Inventory of WPX Energy Production Proposed West Lybrook Unit 726H, 728H, 729H, 759H, 760H, 761H Well Pad and Access Road and Pipeline, San Juan County, New Mexico. WCRM(F)1420.

Willeto, Harry (Counselor Chapter President, Navajo Nation Counselor Chapter House (NNCCH)). Letter to: Bureau of Land Management Farmington Field Office. 2013 April 5. 1 leaf.

APPENDIX A. MAPS

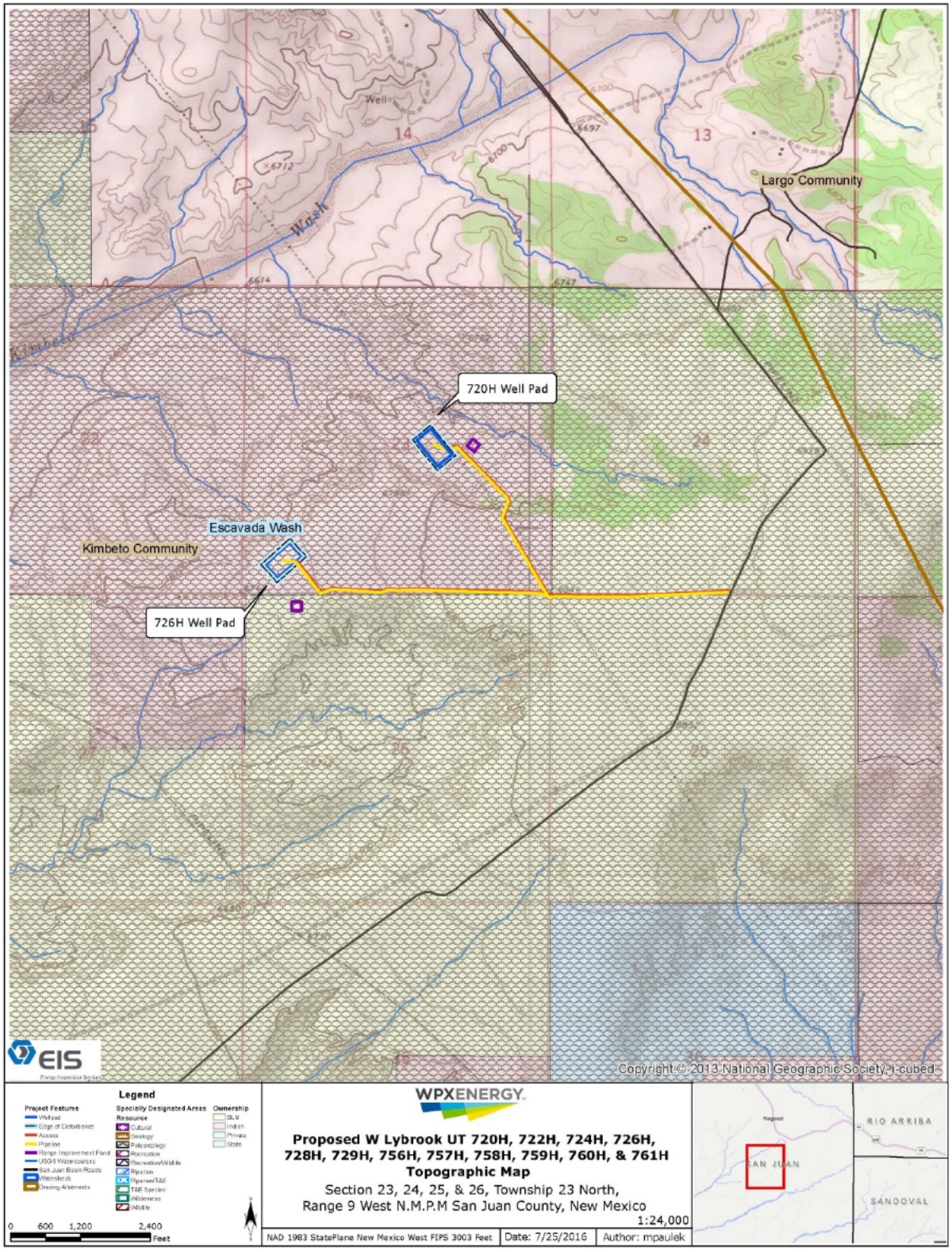


Figure 1. W Lybrook UT 720H, 722H, 724H, 726H, 728H, 729H, 756H, 757H, 758H, 759H, 760H, 761H Topographic Map

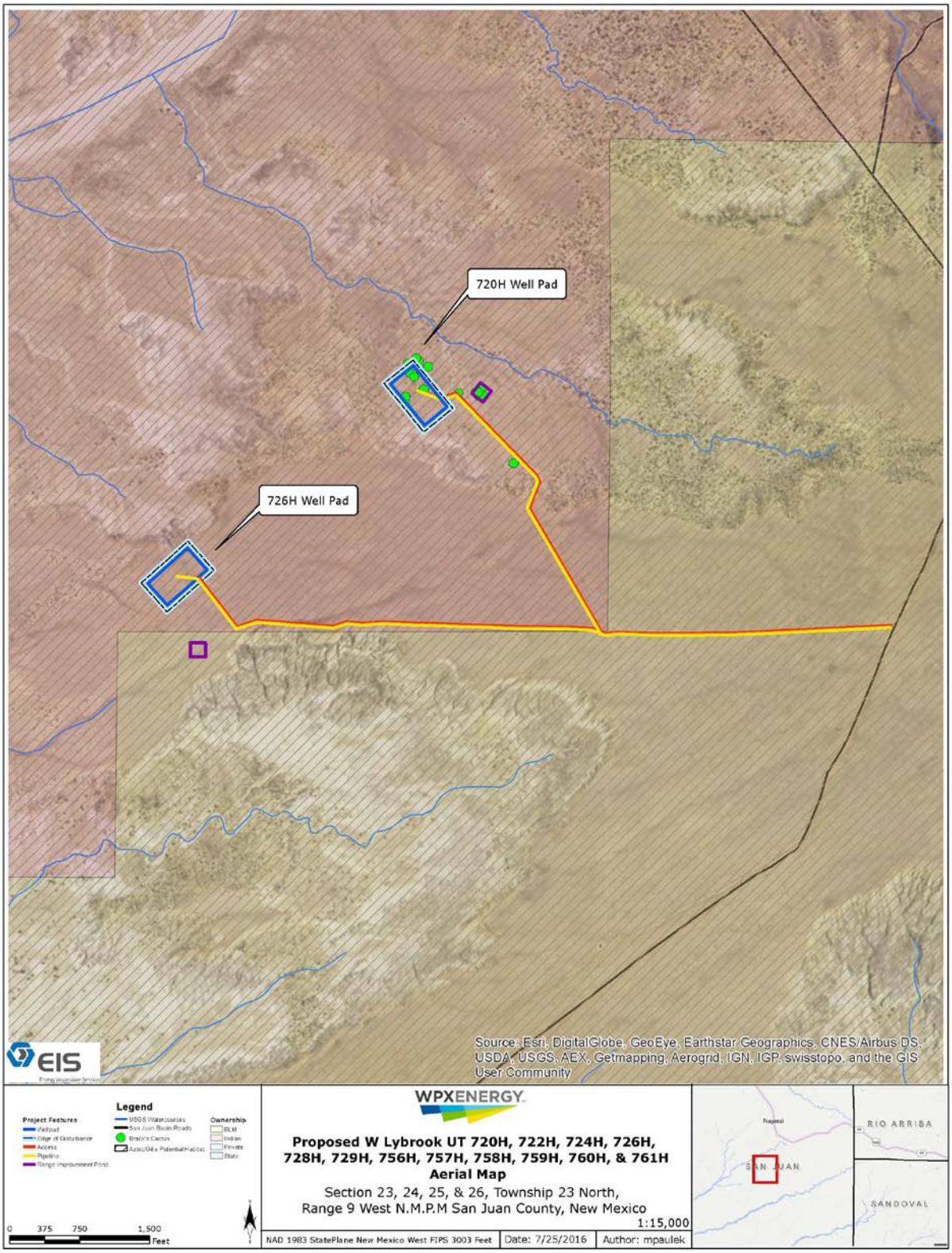


Figure 2. W Lybrook UT 720H, 722H, 724H, 726H, 728H, 729H, 756H, 757H, 758H, 759H, 760H, 761H Aerial Map

APPENDIX B. PLATS

APPENDIX C. PHOTOGRAPHS

Figure 3. 720H Well pad Pre-disturbance photograph looking North from corner 3

Figure 4. 720H Well pad Pre-disturbance photograph looking East from corner 5

Figure 5. 720H Well pad Pre-disturbance photograph looking South from corner 6

Figure 6. 720H Well pad Pre-disturbance photograph looking West from corner 2

Figure 7. 720H Well pad Pre-disturbance photograph looking North from the proposed well flags

Figure 8. 720H Well pad Pre-disturbance photograph looking East from the proposed well flags

Figure 9. 720H Well pad Pre-disturbance photograph looking South from the proposed well flags

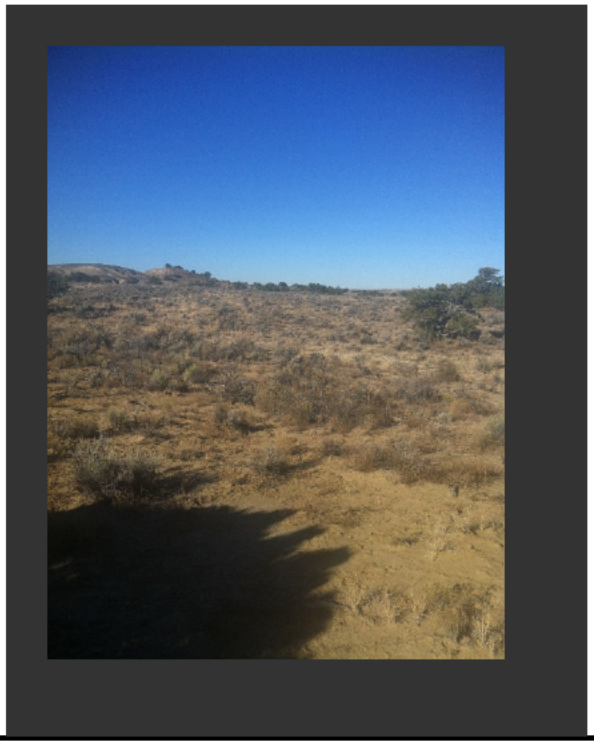


Figure 10. 720H Well pad Pre-disturbance photograph looking West from the proposed well flags

Figure 11. 720H Well pad Pre-disturbance photograph looking West at the access road and well-connect pipeline start

Figure 12. 720H Well pad Pre-disturbance photograph looking Southeast at the access road and well-connect pipeline end

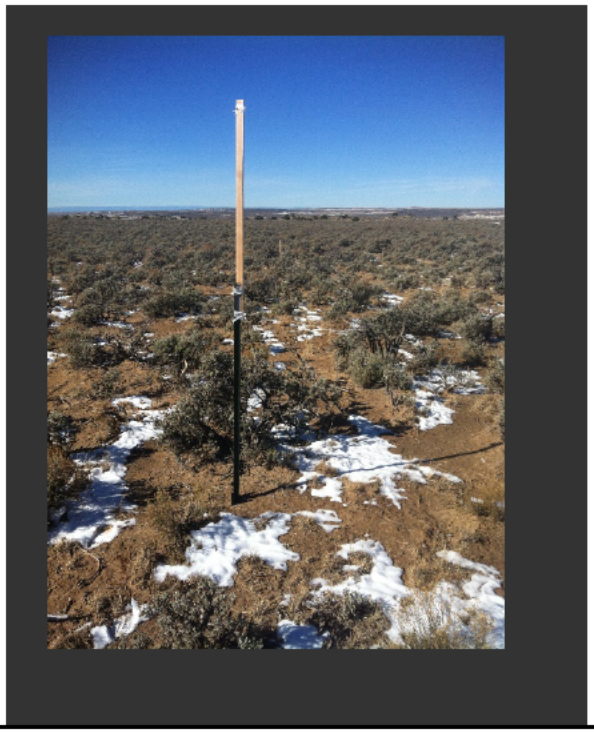


Figure 13. 726H Well pad Pre-disturbance photograph looking West from corner 3

Figure 14. 726H Well pad Pre-disturbance photograph looking North from corner 5

Figure 15. 726H Well pad Pre-disturbance photograph looking East from corner 6

Figure 16. 726H Well pad Pre-disturbance photograph looking South from corner 2

Figure 17. 726H Well pad Pre-disturbance photograph looking North from the proposed well flags

Figure 18. 726H Well pad Pre-disturbance photograph looking East from the proposed well flags

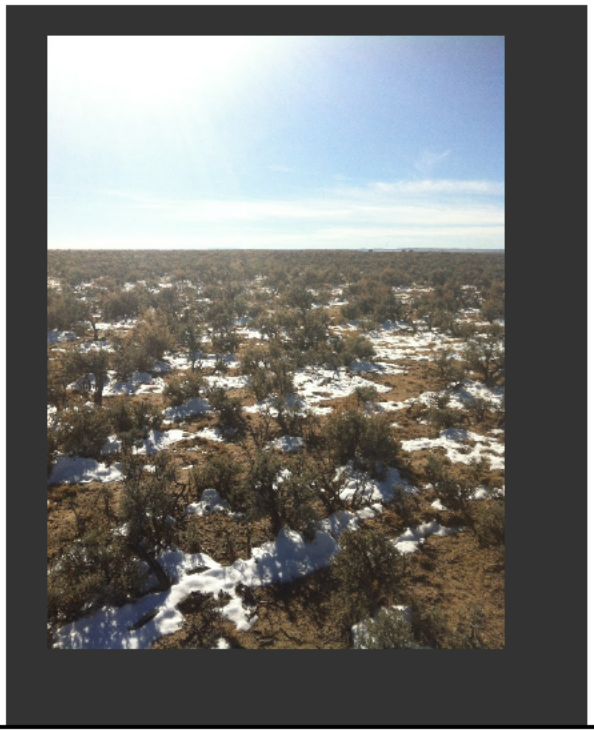


Figure 19. 726H Well pad Pre-disturbance photograph looking South from the proposed well flags

Figure 20. 726H Well pad Pre-disturbance photograph looking West from the proposed well flags

Figure 21. 726H Well pad Pre-disturbance photograph looking West at the access road and well-connect pipeline start

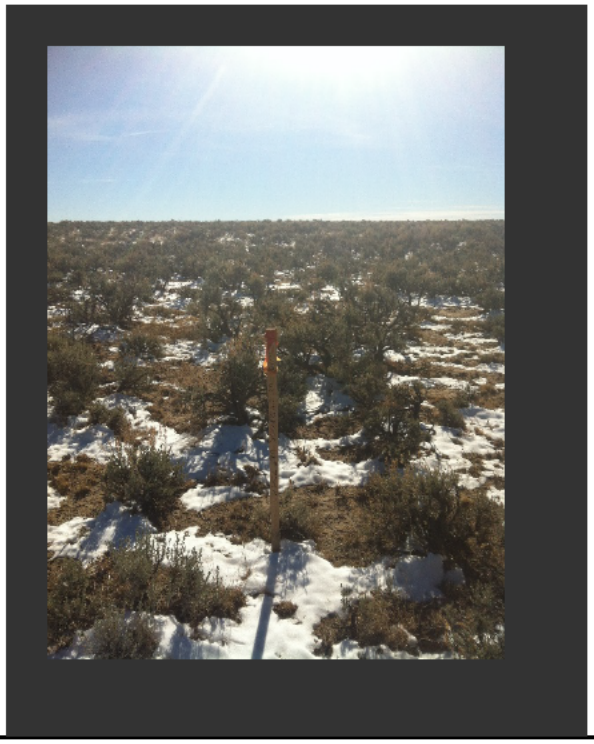


Figure 22. 726H Well pad Pre-disturbance photograph looking Southeast at the access road and well-connect pipeline end

Figure 23. 720H Pond Pre-disturbance photograph looking south from the north corner

Figure 24. 720H Pond Pre-disturbance photograph looking west from the east corner

Figure 25. 720H Pond Pre-disturbance photograph looking north from the south corner

Figure 26. 720H Pond Pre-disturbance photograph looking east from the west corner

Figure 27. 720H Pond Pre-disturbance photograph looking north from the center of the pond

Figure 28. 720H Pond Pre-disturbance photograph looking east from the center of the pond

Figure 29. 720H Pond Pre-disturbance photograph looking south from the center of the pond

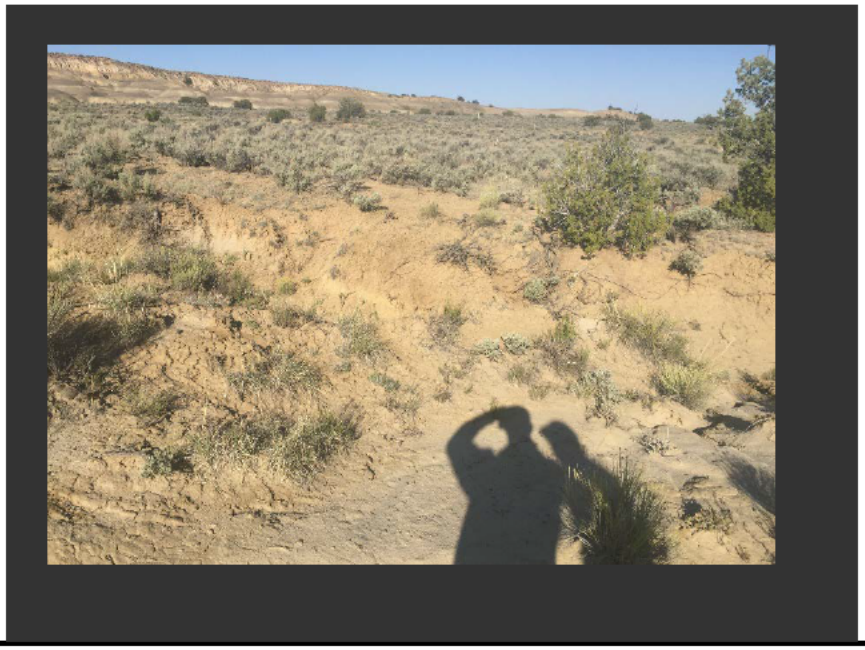


Figure 30. 720H Pond Pre-disturbance photograph looking west from the center of the pond

Figure 31. 726H Pond Pre-disturbance photograph looking southwest from the northeast corner

Figure 32. 726H Pond Pre-disturbance photograph looking northwest from the southeast corner

Figure 33. 726H Pond Pre-disturbance photograph looking northeast from the southwest corner

Figure 34. 726H Pond Pre-disturbance photograph looking southeast from the northwest corner

Figure 35. 726H Pond Pre-disturbance photograph looking north from the center of the pond

Figure 36. 726H Pond Pre-disturbance photograph looking east from the center of the pond

Figure 37. 726H Pond Pre-disturbance photograph looking south from the center of the pond

Figure 38. 726H Pond Pre-disturbance photograph looking west from the center of the pond

APPENDIX D. SURFACE RECLAMATION PLAN

APPENDIX E. BIOLOGICAL SURVEY REPORT

From:	Spotts, Richard
To:	Phil Hanceford; nada_culver@tws.org; megan_dickie@tws.org; Kieran Suckling; RRomero@biologicaldiversity.org; rspivak@biologicaldiversity.org; John Horning; Greta Anderson; Sandy Bahr; alicyn.gitlin@sierraclub.org; Roger Clark; eaumack@grandcanyontrust.org; kim@grandcanyonwildlands.org; kelly@grandcanyonwildlands.org; Katie Davis; Samantha Hammer; admin@sonorandesert.org; kim@wildlandsnetwork.org; Northern Jaguar Project
Subject:	FYI - Attached Federal Register notice relating to BLM"s Sonoran Desert National Monument
Date:	Friday, December 16, 2016 11:19:58 AM
Attachments:	SDNM FRN DRMP Recreational Target Shooting.15Dec2016.pdf

FYI - If you have not already seen it, you may find the attached Federal Register notice relating to BLM's Sonoran Desert National Monument of interest. RS

Notice of Availability of the Draft

Resource Management Plan

Amendment/Draft Environmental

Impact Statement for Recreational

Target Shooting in the Sonoran Desert

National Monument, AZ

AGENCY: Bureau of Land Management

mixed ownership pattern of lands managed by the BLM, Utah School and Institutional Trust Lands Administration (SITLA), and several private property owners. The area encompassed by the closure is primarily used by residents of Utah County and southern Salt Lake County for target shooting.

The target shooting closure is necessary to protect persons, property, and the public lands and resources in the area. An existing target shooting closure of the area will expire on December 15, 2016 (see 79 FR 74111, December 15, 2014). The Eastern Lake Mountains Target Shooting Plan Amendment (plan amendment) is currently underway and is expected to be completed by March 2017. This plan amendment process is analyzing management of target shooting in the Lake Mountains. Following the final agency decision on the plan amendment, the promulgation of supplementary rules may be necessary to implement the plan amendment.

Prior to the 2012 closure, the Lake Mountains received about 4,000 target shooters each month; on weekends, as many as 400 shooters concentrated into 5 areas, and other dispersed locations. The slopes of the Lake Mountains provide a natural backstop that is ideal for target shooting; however, some shooters chose to target practice in the relatively flat terrain on the lower slopes. Given the topography of the area and the number of people who visit it, the area subject to this Order is not conducive to safe target shooting. Target shooting in the area has resulted in nearby private residences being shot and near-misses of automobiles and people. An additional danger is the annual threat from target shooting-related wildfires adjacent to private residences, a major power line, communication towers on the ridge top, and public land resources.

The previous two-year closure proved effective in redirecting target shooting to safer locations, allowing cleanup of the area, eliminating illegal dumping and significantly reducing target shooting-related wildfires. Since the implementation of the closure in August 2012, no near-misses from errant gunfire have been reported to law enforcement.

Since the implementation of the 2012 target shooting closure, several additional actions have been taken by private landowners, other agency partners and the BLM to augment the closure. Regular patrols have been conducted by the Utah County Sheriff's Office, BLM law enforcement rangers and private property owners. Barricades have been installed to identify the closure boundary, especially along private property and in areas receiving recurring violations, such as the Little Cove area. In 2014, Utah County installed a six-mile fence along the west side of Highway 68 with gates to allow public access on a few controlled routes. Utah County also has started planning for development of a nearby managed target shooting range. In April 2014, SITLA closed approximately 1,500 acres of state lands adjacent to and near the BLM closure to recreational access. Additionally, the BLM is nearing completion of an amendment to its land use plan to develop a long-term solution for the target shooting issues in this area. With the closure and these subsequent actions, volunteers have been able to clean up the large amounts of trash and household appliances in these areas.

This closure is made under the authority of the regulations in 43 CFR 8364.1 which states: ''To protect persons, property, and public lands and resources, the authorized officer may issue an order to close or restrict use of designated public lands.'' The closure only applies to the discharge or use of firearms or dangerous weapons for the purposes of recreational target shooting and does not affect legal hunting.

Any person who violates the above restriction may be tried before a United States Magistrate and fined in accordance with 18 U.S.C. 3571, imprisoned for no more than 12 months under 43 U.S.C. 1733(a) and 43 CFR 8360.0–7, or both. Such violations also may be subject to the enhanced fines provided for in 18 U.S.C. 3571.

Authority: 43 CFR 8364.1.

Edwin Roberson,

State Director.

[FR Doc. 2016–30268 Filed 12–14–16; 8:45 am]

BILLING CODE 4310–DQ–P

DEPARTMENT OF THE INTERIOR

Bureau of Land Management

[AZ–P040–2017–1711–PH–1000–241A 17X.LLAZP04000.L1711.PH0000]

Notice of Availability of the Draft Resource Management Plan Amendment/Draft Environmental Impact Statement for Recreational Target Shooting in the Sonoran Desert National Monument, AZ

AGENCY: Bureau of Land Management, Interior.

ACTION: Notice

SUMMARY: In accordance with the National Environmental Policy Act of 1969, as amended, and the Federal Land Policy and Management Act of 1976, as amended, the Bureau of Land Management (BLM) Lower Sonoran Field Office, Phoenix, Arizona, has prepared a draft resource management plan (RMP) amendment/draft environmental impact statement (EIS) for the Sonoran Desert National Monument (SDNM). By this notice the BLM is announcing the opening of the public comment period.

DATES: To ensure that comments will be considered, the BLM must receive written comments on the draft RMP amendment/draft EIS within 90 days following the date the Environmental Protection Agency publishes its Notice of Availability in the **Federal Register**. The BLM will announce future meetings or hearings and any other public involvement activities at least 15 days in advance through public notices, media releases, and/or mailings.

ADDRESSES: You may submit comments related to the draft RMP amendment/draft EIS addressing Recreational Target Shooting in the SDNM by any of the following methods:

- *Web site: http://1.usa.gov/1ZPyFSA.*
- *Email: blm_az_sdnmtargetshooting@blm.gov.*
- *Fax:* 623–580–5580
- *Mail:* Wayne Monger, Project Manager, Lower Sonoran Field Office, 21605 North 7th Avenue, Phoenix AZ 85027

Copies of the draft RMP amendment/draft EIS addressing Recreational Target Shooting in the SDNM are available in the Lower Sonoran Field Office at the above address.

FOR FURTHER INFORMATION CONTACT: Dave Scarbrough, Monument Manager, telephone 623–580–5651 or, Wayne Monger, Project Manager, telephone 623–580–5683; address 21605 North 7th Avenue, Phoenix Arizona 85027; email *blm_az_sdnmtargetshooting@blm.gov.*

Persons who use a telecommunications device for the deaf (TDD) may call the Federal Relay Service at 1–800–877–8339 to contact the above individual during normal business hours. The Service is available 24 hours a day, 7 days a week, to leave a message or question with the above individual. You will receive a reply during normal business hours.

SUPPLEMENTARY INFORMATION: The planning area covers nearly 496,400 surface acres of south-central Arizona and lies within Maricopa and Pinal Counties. Population centers adjacent to the planning area include metropolitan Phoenix, and the communities of Ajo, Goodyear, Buckeye, Gila Bend, Mobile, and Maricopa. The planning area

encompasses Federal- and State-administered lands as well as private lands. The BLM manages 486,400 surface acres of public lands in the planning area, as well as 461,000 acres of (sub surface) mineral estate. The State of Arizona manages 3,900 surface acres in the planning area, and the remaining 6,100 surface acres are privately owned land.

The BLM has prepared the SDNM draft RMP amendment/draft EIS to address the management of recreational target shooting within the SDNM. The draft RMP amendment/draft EIS is needed to analyze recreational target shooting within the SDNM due to a ruling by the U.S. District Court-District of Arizona. The court vacated portions of the 2012 Record of Decision, approved RMP, and final EIS pertaining to the management of recreational target shooting throughout the SDNM and remanded the decision to the BLM for reconsideration. Pursuant to the court order, the BLM must complete the plan amendment by September 30, 2017. The formal public scoping process for the draft RMP amendment/draft EIS began on January 21, 2016, with the publication of a Notice of Intent in the **Federal Register** (81 FR 3463), and ended on March 21, 2016. The BLM held three public scoping meetings in February 2016. The BLM used public scoping comments to help identify planning issues that directed the formulation of alternatives and framed the scope of analysis in the draft RMP amendment/draft EIS. The BLM also used the scoping process to introduce the public to preliminary planning criteria, which set limits on the scope of the draft RMP amendment/draft EIS. Issues identified included, priority wildlife species and habitat, special status species, vegetation resources, lands with wilderness characteristics, designated wilderness, recreation, monument objects, hazardous materials, and public safety. The draft RMP amendment/draft EIS evaluates five alternatives in detail, including the No Action Alternative (Alternative A) and four action alternatives (Alternatives B, C, D and E). All alternatives provide for a hierarchy of mitigation that includes: 1) Avoiding impacts to the maximum extent compatible with the goals of the alternative; 2) Minimizing any impacts that are not avoided; and 3) Providing a range of responses commensurate to the level of unavoidable impacts. Alternative A, the No Action Alternative, provides that recreational target shooting on the SDNM will continue to be managed in accordance with the Lower Gila South RMP of 1988, which does not include management restrictions on recreational target shooting. Under Alternative B, an area temporarily restricted from recreational target shooting, by order of the U.S. District Court, District of Arizona (approximately 10,599 acres or 2.1 percent of the SDNM) would be permanently restricted from recreational target shooting. Alternative C would make recreational target shooting available in the Desert Back Country Recreational Management Zone (RMZ) only, resulting in approximately 54,817 acres, or 11 percent of the SDNM restricted from this activity. Under Alternative D, recreational target shooting would be available only outside of designated wilderness areas managed for wilderness characteristics and the Juan Bautista de Anza National Historic Trail (NHT) RMZ resulting in approximately 320,317 acres, or 66 percent of the SDNM restricted for this activity. Alternative E, would restrict recreational target shooting from occurring across the entire SDNM. Following the public comment period, comments will be used to prepare the proposed RMP amendment and final EIS. The BLM will respond to substantive comments by making appropriate revisions to the document, or by explaining why a comment did not warrant a change.

Before including your address, phone number, email address, or other personal identifying information in your comment, you should be aware that your entire comment—including your personal identifying information—may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

Authority: 40 CFR 1506.6, 40 CFR 1506.10, 43 CFR 1610.2.

Raymond Suazo,

State Director.

[FR Doc. 2016–30166 Filed 12–14–16; 8:45 am]

BILLING CODE 4310–32–P

DEPARTMENT OF THE INTERIOR

Bureau of Land Management

[LLORW00000.L16100000.DF0000. LXSS1080000.16XL1109AF. HAG17–0045]

Notice of Public Meeting for the San Juan Islands National Monument Advisory Committee

AGENCY: Bureau of Land Management, Interior

ACTION: Notice of public meeting

SUMMARY: In accordance with the Federal Land Policy and Management Act and the Federal Advisory Committee Act of 1972, and the U.S. Department of the Interior, Bureau of Land Management (BLM), the San Juan Islands National Monument Advisory Committee (MAC) will meet as indicated below:

DATES: The MAC will hold a public meeting Monday, January 30th, 2017. The meeting will run from 8:00 a.m. to 3:00 p.m. The meeting will be held at the Lopez Library at 2225 Fisherman Bay Rd, Lopez Island, WA 98261. A public comment period will be available in the afternoon from noon until 1 p.m.

FOR FURTHER INFORMATION CONTACT: Marcia deChadenèdes, San Juan Islands National Monument Manager, P.O. Box 3, 37 Washburn Ave., Suite 101, Lopez Island, Washington 98261, (360) 468–3051, or *mdechade@blm.gov.* Persons who use a telecommunications device for the deaf (TDD) may call the Federal Relay Service at 1 (800) 877–8339 to contact the above individual during normal business hours. This service is available 24 hours a day, 7 days a week, to leave a message or question with the above individual. You will receive a reply during normal business hours.

SUPPLEMENTARY INFORMATION: The twelve member San Juan Islands MAC was chartered to provide information and advice regarding the development of the San Juan Islands National Monument's RMP. Members represent an array of stakeholder interests in the land and resources from within the local area and statewide. All advisory committee meetings are open to the public. At noon members of the public will have the opportunity to make comments to the MAC during a one hour public comment period. Persons wishing to make comments during the public comment period should register in person with the BLM by 11 a.m. on the meeting day, at the meeting location. Depending on the number of persons wishing to comment, the length of comments may be limited. The public may send written comments to the MAC at San Juan Islands National Monument, Attn. MAC, P.O. Box 3, 37 Washburn Ave., Suite 101, Lopez Island, Washington 98261. The BLM appreciates all comments.

Dennis Strange,

Spokane District Manager.

[FR Doc. 2016–30111 Filed 12–14–16; 8:45 am]

BILLING CODE 4310–33–P

From: Layton, Cody
To: judy@nmwild.org; nada_culver@tws.org; joelle@nmwild.org
Cc: Benjamin Vaccaro; Williams, Michael; James Stovall
Subject: EA, COA"s, DR, FONSI, Shape file and Survey Report
Date: Friday, December 16, 2016 1:05:14 PM
Attachments: Chevron HH MDP-1.zip

Good Morning all,

I will be sending you all the information for the Chevron MDP in four separate e-mails due to the size of the files. You will have the Environmental Assessment, Twelve approved APD's, Shape file of the MDP, and a Survey Report. If anyone of you have any questions feel free to let me know. I will be sending you three additional e-mails with the associated information.

Cody R. Layton

Bureau of Land Management

Assistant Field Manager Lands and Minerals

Carlsbad Field Office

620 E. Greene St.

Carlsbad, NM 88220

Office: (575) 234-5959

Fax: (575) 234-5927

clayton@blm.gov

United States Department of the Interior
Bureau of Land Management

Environmental Assessment DOI-BLM-NM-P020-2016-1434-EA

Chevron U.S.A., Inc.
Hayhurst Master Development Plan

U.S. Department of the Interior
Bureau of Land Management
Pecos District
Carlsbad Field Office
620 East Greene Street
Carlsbad, NM 88220
Phone: (575) 234-5972
FAX: (575) 885-9264

September 2016

BLM

Carlsbad Field Office

Confidentiality Policy
Any comments, including names and street addresses of respondents, you submit may be made available for public review. Individual respondents may request confidentiality. If you wish to withhold your name or street address from public review or from disclosure under the Freedom of Information Act, you must state this prominently at the beginning of your written comment. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, will be made available for public inspection in their entirety.

TABLE OF CONTENTS

1. Purpose and Need for Action 1-1
   1.1. Background 1-1
   1.2. Purpose and Need for Action 1-5
   1.3. Decision to be Made 1-5
   1.4. Conformance with Applicable Land Use Plan(s) 1-5
   1.5. Relationship to Statutes, Regulations or Other Plans 1-6
   1.6. Scope of Analysis 1-7
   1.7. Scoping, Public Involvement, and Issues 1-8
2. Proposed Action and Alternative(s) 2-1
   2.1. Proposed Action 2-1
   2.2. No Action 2-32
   2.3. Alternatives Considered but Eliminated from Detailed Study 2-33
3. Affected Environment and Environmental Consequences 3-1
   3.1. Cumulative Impacts Assessment 3-1
   3.2. Air Resources 3-6
   3.3. Soils 3-22
   3.4. Caves and Karst 3-27
   3.5. Watershed 3-33
   3.6. Floodplains, Wetlands, and Riparian Areas 3-40
   3.7. Vegetation 3-41
   3.8. Noxious Weeds and Invasive Plants 3-43
   3.9. Wildlife 3-44
   3.10. Special Status Species, including Threatened and Endangered Species 3-51
   3.11. Range 3-59
   3.12. Cultural and Historical Resources 3-65
   3.13. Paleontology 3-67
   3.14. Visual Resource Management 3-68
   3.15. Special Land Designations 3-75
   3.16. Wastes – Hazardous and Solid 3-79
4. Supporting Information 4-1
   4.1. Consultation/Coordination 4-1
   4.2. List of Preparers and Reviewers 4-1
   4.3. References 4-2

Tables

Table 1.7-1 Biological Species Not Expected in EA Area of Analysis 1-9
Table 2.1-1 Proposed Action Estimated Surface Disturbance – MDP 2-7
Table 2.1-2 Proposed Action Surface Disturbances – APDs 2-7
Table 2.1-3 Proposed Action Estimated Surface Disturbance by Landowner 2-8
Table 2.1-4 Right-of-Way Configuration and Services in Each Trench 2-10
Table 2.1-5 Pipeline Detailed Information 2-13
Table 2.1-6 Potential Target Zones in the HDA 2-14
Table 2.1-7 Proposed Pad Size for Production-Related Surface Facilities 2-19
Table 2.1-8 Proposed Central Tank Battery Locations 2-19
Table 2.1-9 Proposed Salt Water Disposal Locations 2-20
Table 2.1-10 Proposed Permanent Containment Pond Locations 2-20
Table 2.1-11 Proposed Gas Compressor Station Locations 2-21
Table 2.1-12 Water Sources for Drilling and Completion 2-23
Table 2.1-13 Vendors Potentially Supplying Local Groundwater 2-23
Table 2.1-14 Approved Drilling Waste Disposal Sites 2-25
Table 2.1-15 Estimated Daily Peak Construction and Operations Workforces 2-25
Table 3.1-1 Estimated Cumulative Actions 3-5
Table 3.1-2 Estimated Future Oil and Gas Development 3-6
Table 3.2-1 Climate Normals for Carlsbad, 1981-2010 3-7
Table 3.2-2 Design Concentrations of Criteria Pollutants in the HDA Airshed 3-7
Table 3.2-3 National Ambient Air Quality Standards 3-11
Table 3.2-4 Class I and Sensitive Class II Areas of Concern for Air Quality Impact Analysis 3-12
Table 3.2-5 PSD Increments for Class I and Class II Areas 3-15
Table 3.2-6 Summary of Maximum Annual Emissions of Criteria and Hazardous Air Pollutants from the Proposed Action (in tons per year)[1] 3-15
Table 3.2-7 Comparison of Drilling and Completion Emissions from the Proposed Action to ARTSD 3-16
Table 3.2-8 Summary of 1-hr NO_2 Ambient Air Quality Impacts Near the Project Area[3] 3-16
Table 3.2-9 CALPUFF Modeled Results for Nitrogen Deposition in Class I Areas from the Proposed Action 3-16
Table 3.2-10 CALPUFF Modeled Results for Impacts to Visibility in Class I Areas from the Proposed Action 3-17
Table 3.2-11 Comparison of Maximum Annual Emissions of Criteria and Hazardous Air Pollutants from the Proposed Action to ARTSD (in tons per year)[1] 3-18
Table 3.2-12 CFO Oil and Gas RMP Reasonably Foreseeable Development and Proposed Action Well Counts and Emissions Comparison 3-19
Table 3.2-13 Comparison of Applicant Committed Environmental Protection Measures and New Regulations for Air Quality to “On the Books” Management Actions in the ARTSD for CFO RMP Revision 3-19
Table 3.3-1 Soil Map Units 3-25
Table 3.9-1 Wildlife Species with Potential or Known to Occur in the Analysis Area[1] 3-45
Table 3.9-2 Avian Species with Potential or Known to Occur in the Analysis Area 3-46
Table 3.10-1 USFWS T&E and BLM Sensitive Species Listed for Eddy County[1] and CFO 3-51
Table 3.10-2 State T&E Species Listed for Eddy County, New Mexico[1,2] 3-54
Table 3.11-1 Grazing Allotments, Range Improvements, and Range Study Plots within Analysis Area 3-59

Figures

Figure 1.1-1 Project Vicinity Map 1-3
Figure 2.1-1 Proposed Action Project Area and Surface Ownership 2-3
Figure 2.1-2 Proposed Action Overview 2-4
Figure 2.1-3 Proposed Action Well Pad HH SO 8 P2 Overview 2-5
Figure 2.1-4 Proposed Action Well Pad HH SO 10 P3 Overview 2-6
Figure 2.1-5 Example ROW Trench Configuration 2-11
Figure 2.1-6 Well Casing and Cement Schematic 2-17
Figure 3.1-1 Cumulative Impacts Area 3-3
Figure 3.2-1 Carlsbad, NM Windrose, 2014 3-9
Figure 3.2-2 Hobbs, NM Windrose, 2014 3-10
Figure 3.2-3 Class I and Sensitive Class II Areas of Concern Map 3-13
Figure 3.3-1 Soil Resources 3-23
Figure 3.4-1 Caves, Karst, and Subsurface Hydrology 3-29
Figure 3.4-2 Cave and Karst Features 3-30
Figure 3.5-1 Watershed, Floodplains, Wetlands, and Riparian Areas 3-35
Figure 3.11-1 Range Resources 3-61
Figure 3.14-1 Visual Resource Management Classes 3-69
Figure 3.15-1 Special Land Designations 3-77

Appendices

Appendix A Applications for Permit to Drill
Appendix B Master Development Plan (Surface Use Plan of Operation, Drilling Plan)
Appendix C Well Pad Typical (Drilling and Production)
Appendix D Hydraulic Fracturing Process
Appendix E Vascular Plant List
Appendix F Response to Comments

Acronyms and Abbreviations

°F	degrees Fahrenheit
ACEC	Area of Critical Environmental Concern
APD	Application for Permit to Drill
APLIC	Avian Power Line Interaction Committee
AQRV	air quality related value
ARTSD	Air Resources Technical Support Document
AUM	Animal Unit Month
BACT	Best Available Control Technology
bbl	barrel (unit of measurement equal to 42 gallons)
BISON-M	Biota Information System of New Mexico
BLM	Bureau of Land Management
BMP	best management practice
BOP	blowout preventer
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFO	Carlsbad Field Office
CFR	Code of Federal Regulations
Chevron	Chevron U.S.A., Inc.
CIA	Cumulative Impact Area
CO	carbon monoxide
COA	Conditions of Approval
CTB	central tank battery
DNA	Determination of NEPA Adequacy
EA	Environmental Assessment
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FLM	Federal Land Manager
FONSI	Finding of No Significant Impact
GHG	greenhouse gas
GIS	geographic information system
IM	Instruction Memorandum
HAP	hazardous air pollutant
HDA	Hayhurst Development Area
HDPE	high-density polyethylene
HP	high pressure
HUC	hydrologic unit code

kV	kilovolt
LACT	Lease Automated Custody Transfer
LDAR	leak detection and repair
LP	low pressure
MACT	Maximum Achievable Control Technology
MDP	Master Development Plan
mg/L	milligram per liter
mph	miles per hour
MSDS	Material Safety Data Sheet
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act (of 1990)
NATA	National Air Toxics Assessment
NEPA	National Environmental Policy Act of 1970
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act of 1966
NMAC	New Mexico Administrative Code
NMBGMR	New Mexico Bureau of Geology and Mineral Resources
NMDA	New Mexico Department of Agriculture
NMDGF	New Mexico Department of Game and Fish
NMED	New Mexico Environment Department
NMED/NMAQB	New Mexico Environment Department/Air Quality Bureau
NMOCD	New Mexico Oil Conservation Division
NMSO	New Mexico State Office
NMOSE	New Mexico Office of the State Engineer
NMPIF	New Mexico Partners in Flight
NMRPTC	New Mexico Rare Plant Technical Council
NMSA	New Mexico State Act
NNSR	Nonattainment New Source Review
NO_2	nitrogen dioxide
NHPA	National Historic Preservation Act
NP	National Park
NPS	National Park Service
NRHP	National Register of Historic Places
NSPS	New Source Performance Standards
NSR	New Source Review
O_3	ozone
OSHA	Occupational Safety and Health Act
PCBs	polychlorinated biphenyls
Pecos Valley WUO	Pecos Valley Water Users Organization

PFYC	Potential Fossil Yield Classification
ppb	parts per billion
ppm	parts per million
Project Area	MDP Project Area
PSD	Prevention of Significant Deterioration
psi	pounds per square inch
psig	pounds per square inch gauge
RCRA	Resource Conservation and Recovery Act of 1976
RFD	reasonable foreseeable development
RMP	Resource Management Plan
ROW	right-of-way
SAAQS	State Ambient Air Quality Standards
SCADA	supervisory control and data acquisition
SHPO	State Historic Preservation Office
SLO	State Land Office
SMA	Special Management Area
SO_2	sulfur dioxide
SPCC	Spill Prevention, Control, and Countermeasures
SUPO	Surface Use Plans of Operations
SWD	Salt Water Disposal
T&E	threatened and endangered
TCEQ	Texas Commission on Environmental Quality
TCP	traditional cultural property
TDS	total dissolved solids
TRRC	Texas Railroad Commission
USC	United States Code
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
VRM	Visual Resource Management
VRU	vapor recovery unit
WCA	Wildlife Conservation Act
WEG	wind erodibility group
$\mu g/m^3$	micrograms per cubic meter

1. PURPOSE AND NEED FOR ACTION

1.1. Background

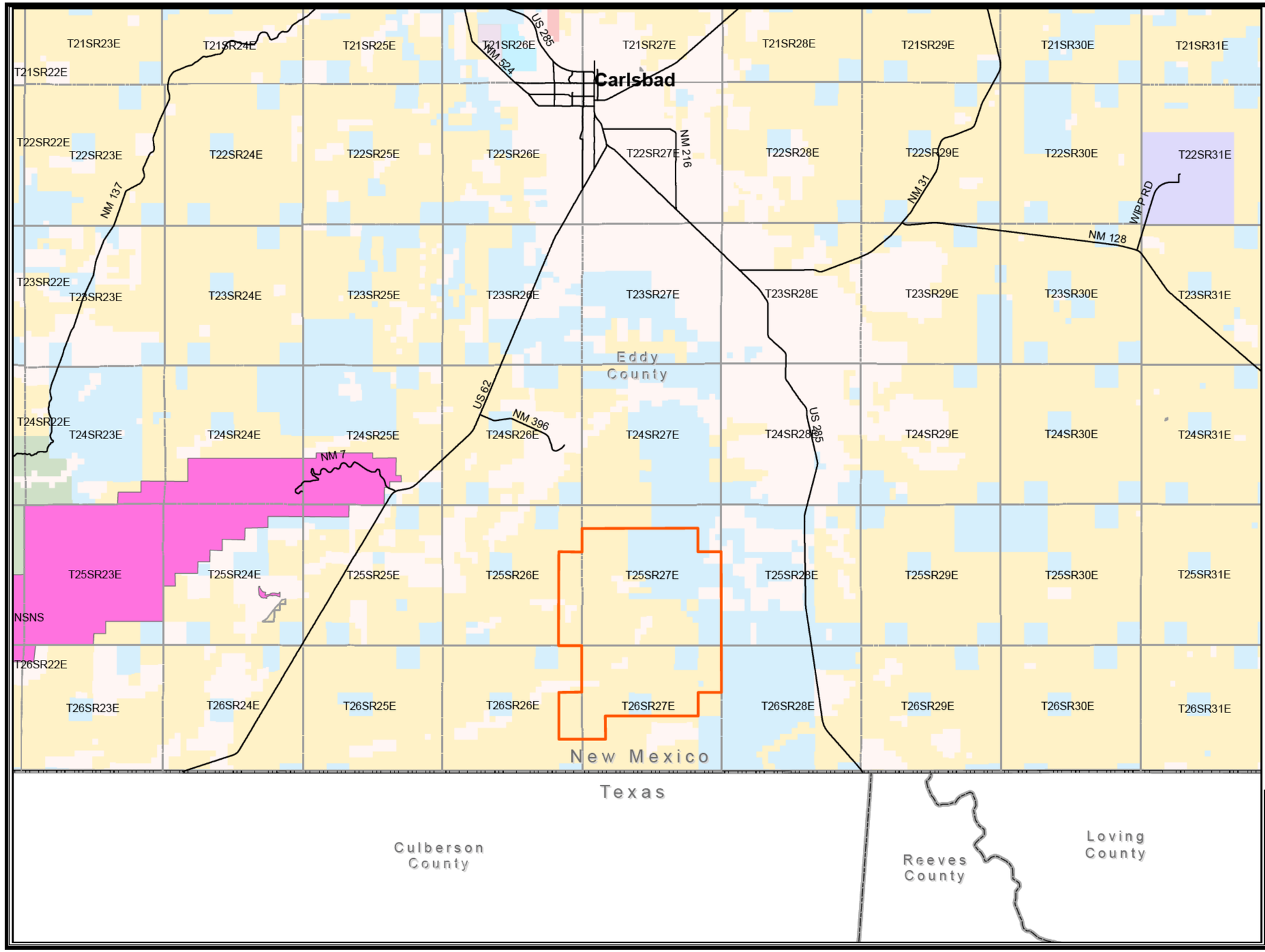
Chevron U.S.A., Inc. (Chevron) has submitted a proposed Master Development Plan (MDP) to the Bureau of Land Management (BLM) Carlsbad Field Office (CFO) for oil and natural gas exploration and development within the Hayhurst Development Area (HDA), located in Eddy County, New Mexico (**Figure** 1.1-1). An MDP provides information common to multiple planned wells, including drilling plans, Surface Use Plans of Operations (SUPOs), and plans for future production. MDPs also include information on associated facilities (e.g., roads, pipelines, utility corridors, and compressor stations). Instead of treating the development of multiple wells as a series of individual actions, the BLM encourages the use of multi-well development plans to more effectively manage federal lease development (BLM Instruction Memorandum [IM] 2005-247).

Chevron's proposed MDP includes development within an approximate 8,866-acre area on lands primarily administered by the BLM CFO, but also includes state-owned and private lands. If the proposed MDP is approved, Chevron would develop up to 436 oil and gas wells on 109 well pads. The proposed MDP also addresses all necessary infrastructure such as roads, pipelines, and facilities.

Twelve Applications for Permit to Drill (APDs) have been submitted with the proposed MDP. Information about these and other wells planned for future submission, including surface hole location, is provided in **Appendix A**.

Preparing Office:
Pecos District, Carlsbad Field Office
620 East Greene Street
Carlsbad, NM 88220

This page intentionally left blank.



LEGEND

- Hayhurst Development Area
- Major Roads

Surface Ownership

- Bureau of Land Management
- Bureau of Reclamation
- Dept. of Defense
- Dept. of Energy
- Forest Service
- Private
- State
- State Park
- Carlsbad Caverns National Park
- Township Boundary
- County Boundary
- State Boundary

Source:
BLM 2016
Analysis of the Management Situation
for the Bureau of Land Management
Carlsbad Field Office
May 2014

NORTH

5 2.5 0 5 Miles

CHEVRON HAYHURST MDP EA

FIGURE 1.1-1
Project Vicinity Map

ANALYSIS AREA: Eddy County, New Mexico

Date: 6/6/2016 | Prepared By: BW

Z:\GIS\PROJECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment Final\Figure1.1-1_ProjectVicinity.mxd

This page intentionally left blank.

1.2. Purpose and Need for Action

The BLM's purpose of this action is to consider the proponent's (Chevron's) request for an MDP to develop federal fluid minerals within the Hayhurst Development Area, while also considering the BLM's multiple-use mission.

The need for the action is established by the BLM's responsibility under the Mineral Leasing Act of 1920 as amended, the Mining and Minerals Policy Act of 1970, the Federal Land Policy and Management Act of 1976, and the Federal Onshore Oil and Gas Leasing Reform Act of 1987 to allow reasonable access to develop a federal oil and gas lease. To increase the orderly development of oil and natural gas resources consistent with the Energy Policy Acts of 2001 and 2005, which emphasize the development of domestic oil and gas reserves for supply and economic stability, and to better facilitate the planning of infrastructure, the BLM is considering the proposed MDP. The MDP takes into account field development as a whole rather than as individual actions.

The proposed action is needed to facilitate efficient and effective development of the oil and gas resources in the defined area through the use of an MDP. Accordingly, the MDP provides an effective planning process to identify infrastructure and resource needs for a larger area of development; whereas individual wells may result in more duplication of infrastructure and thus more development and related impacts.

1.3. Decision to be Made

The BLM will decide whether to approve the MDP, and if so, under what terms and conditions.

Approval of the MDP would also serve as approval of the 12 APDs submitted with the MDP. A Notice of Staking was filed for each of the 12 APDs, and the BLM conducted onsite inspections for each APD on December 8, 2015. Actions not included in the 12 APDs would require additional authorizations from the BLM (Section 1.6). Any decisions made in the Decision Record will provide a blueprint for future anticipated actions.

1.4. Conformance with Applicable Land Use Plan(s)

The 1988 Carlsbad Resource Management Plan (RMP), as amended by the 1997 Carlsbad Approved RMP Amendment, has been reviewed, and it has been determined that the proposed action conforms with the land use plan terms and conditions as required by Title 43 of the Code of Federal Regulations (CFR), Section 1610.5. The BLM is revising its RMP for the CFO. The existing RMP decisions will remain in effect during the RMP revision process until the revision is completed and approved. Any future actions associated with the MDP would need to comply with the approved RMP.

Name of Plan: 1997 Carlsbad Approved Resource Management Plan Amendment

Date Approved: October 1997

Decision: [Page 4] "Approximately 3,907,700 acres (95 percent of the oil and gas mineral estate) will be open to leasing and development under the BLM's standard terms and conditions, the Surface Use and Occupancy Requirements (Appendix 1), the Roswell District Conditions of Approval (Appendix 2), and the Practices for Oil and Gas Drilling and Operations in Cave and Karst Areas (Appendix 3)." The proposed action lies within the 95 percent of oil and gas mineral estate open to development and complies with the Surface Use and Occupancy Requirements.

Name of Plan: 2008 Special Status Species Approved Resource Management Plan Amendment

Date Approved: April 2008

Decision: [Page 7] "The BLM will continue to require oil and gas lessees to conduct operations in a manner that will minimize adverse impacts to resources, land uses, and other uses. To that end, the BLM

will continue to apply reasonable mitigation measures to all oil and gas activities." The proposed action will utilize best management practices (BMPs) when developing leases in Lesser Prairie-Chicken and Sand Dune Lizard Habitat. Special mitigation measures will be included into the Pecos District Conditions of Approval.

1.5. Relationship to Statutes, Regulations or Other Plans

This Environmental Assessment (EA) has been prepared in accordance with the National Environmental Policy Act of 1970 (NEPA) and is in compliance with all applicable subsequent regulations and laws, including the Council on Environmental Quality (CEQ) regulations (40 CFR 1500-1508) and the BLM NEPA Handbook, H-1790-1 (BLM 2008a). The proposed action would also comply with federal, state, and local laws and regulations. The following is a list of federal statutes that apply to the proposed action:

- **National Historic Preservation Act of 1966, as amended (16 United States Code [USC] 470)** - Preserves historical and archaeological sites.
- **Archaeological and Historic Preservation Act of 1974 (16 USC 469)** - Provides for the preservation of historical and archaeological data (including relics and specimens) that might otherwise be irreparably lost or destroyed as the result of (1) flooding, the building of access roads, the erection of workmen's communities, the relocation of railroads and highways, and other alterations of the terrain caused by the construction of a dam by any agency of the United States, or by any private person or corporation holding a license issued by any such agency or (2) any alteration of the terrain caused as a result of any federal construction project or federally licensed activity or program.
- **Archaeological Resources Protection Act of 1979, as amended (16 USC 470 et seq.)** - Secures, for the present and future benefit of the American people, the protection of archaeological resources and sites that are on public lands and Indian lands, and fosters increased cooperation and exchange of information among governmental authorities, the professional archaeological community, and private individuals.
- **National American Graves Protection and Repatriation Act of 1990 (25 USC 301)** - Provides a process for museums and federal agencies to return certain Native American cultural items such as human remains, funerary objects, sacred objects, or objects of cultural patrimony to lineal descendants and culturally affiliated Indian tribes and Native Hawaiian organizations, and includes provisions for unclaimed and culturally unidentifiable Native American cultural items, intentional and inadvertent discovery of Native American cultural items on federal and tribal lands, and penalties for noncompliance and illegal trafficking.
- **Clean Air Act of 1970, as amended (42 USC 7401 et seq.)** - Defines the U.S. Environmental Protection Agency's (EPA's) responsibilities for protecting and improving the nation's air quality and the stratospheric ozone layer.
- **Clean Water Act of 1977, as amended (30 USC 1251)** - Establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters.
- **Endangered Species Act of 1973 (16 USC 1531 et seq.)** - Protects critically imperiled species from extinction as a consequence of economic growth and development untempered by adequate concern and conservation.
- **Migratory Bird Treaty Act of 1918 (16 USC 703-712)** - Implements the convention for the protection of migratory birds.
- **Federal Cave Resources Protection Act of 1988 (16 USC 4301 et seq.)** - Protects significant caves on federal lands by identifying their location, regulating their use, requiring permits for removal of their resources, and prohibiting destructive acts.

The following are regulatory exemptions for petroleum industry operations that are relevant to the proposed action:

- **Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA or Superfund), Sections 101(14) and (33)**, exclude petroleum from the definitions of "hazardous substances" and "pollutant or contaminant." Petroleum derivatives to which this exclusion applies include crude oil or any fraction thereof (if the fraction is not specifically listed or designated a hazardous substance by other listed acts), natural gas, natural gas liquids, liquefied natural gas, and synthetic gas usable for fuel.
- According to the **Resource Conservation and Recovery Act of 1976 (RCRA)**, drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil, natural gas, or geothermal energy are exempt by regulatory definition. The term "other wastes associated" is specifically included to designate waste materials "intrinsically derived from primary field operations associated with the exploration, development, or production of crude oil, natural gas or geothermal energy" (Bohannon 2009). This definition includes hydrocarbon-bearing soil in and around related facilities; drill cuttings; and materials (such as hydrocarbons, water, sand, and emulsion) produced from a well in conjunction with crude oil, natural gas, or geothermal energy; and the accumulated material (such as hydrocarbons, water, sand, and emulsion) from production separators, fluid treating vessels, storage vessels, and production impoundments.
- The 2005 Energy Policy Act exempts fracturing wastes and fluids, such as flowback, from regulation under the **Safe Drinking Water Act of 1974** and the **Clean Water Act of 1972.**

State of New Mexico regulations would also apply to the Project. When handling, storing, and disposing of produced water and fracturing fluids, Chevron would comply with Title 19, Chapter 15, Part 34 of the State of New Mexico's Energy, Minerals and Natural Resources Department, Oil Conservation Commission. Releases or spills by Chevron would be handled in accordance with Title 19, Chapter 15, Part 29 of the State of New Mexico's Energy, Minerals and Natural Resources Department, Oil Conservation Commission.

Air quality standards in New Mexico (with the exception of Bernalillo County) are under the jurisdiction of the New Mexico Environment Department/Air Quality Bureau (NMED/NMAQB). The Environmental Improvement Act, New Mexico State Act (NMSA) 1978, and the Air Quality Control Act, NMSA 1978, dictate state air quality standards. Also, 40 CFR 60 "Standards of Performance for New Stationary Sources" is administered by the NMED/NMAQB. Other relevant air quality regulations include 40 CFR Subpart OOOO, Standards of Performance for Crude Oil and Natural Gas Production; Regulation #40 CFR part 52 EPA-R06-OAR-2011-0079; FRI-9932-51-Region 6, control of Volatile Organic Compound emissions from degassing of storage tanks, transport vessels and marine vessels. The BLM New Mexico State Office (NMSO) also published the following relevant document, *Air Resources Technical Report for Oil and Gas Development in New Mexico, Texas and Oklahoma* (BLM 2016a).

Additionally, Chevron would comply with all applicable federal, state, and local laws and regulations; obtain the necessary permits for drilling, construction, completion, and operation; and certify that Surface Use Agreements have been reached with the private landowners, where required.

1.6. Scope of Analysis

As stated previously, 12 APDs were submitted with the MDP. Therefore, approval of the MDP also indicates approval of the 12 APDs. Site-specific design information is known for the 12 APDs but is not known for the remainder of the MDP. Therefore, two approaches were taken for the analysis. The scope of the analysis was conducted at a site-specific level for the actions contained in the 12 APDs and at a programmatic level for all other actions in the MDP. For the programmatic analysis, this EA considers the impacts associated with potential development of all actions included in the MDP and provides an analytical framework to which subsequent analyses of site-specific decisions may be tiered. In this manner, the BLM is able to analyze future potential energy development.

All phases of oil and gas field development are included in the scope of the analysis, including siting, construction, drilling, completion, interim reclamation, production and maintenance, final wellbore

abandonment, and final reclamation. At the programmatic analysis level, the information for the well pad locations, road alignments, pipeline routes, and other facilities is approximate. The technologies described herein are representative of those most likely to be deployed over the life of the project. While actual production years may vary for individual wells, for the purpose of this analysis, it is assumed that the life of the project, through the end of production and final reclamation, is 45 years.

The environmental consequences sections provide the decision maker with the information necessary to compare and contrast the predicted effects of the proposed action and alternatives and make a reasoned and informed decision regarding which alternative or combination of actions should be selected in the Decision Record.

Requirements for Future NEPA Analysis

Components of the Hayhurst MDP EA alternatives are programmatic in nature (with the exception of the 12 APDs submitted with the MDP), meaning that the well pad and well locations, pipeline routes, and other facility placements are conceptually illustrated for the purposes of assessing impacts of proposed development within the HDA. The exact locations of wells, roads, pipelines, and other facilities would be determined when those wells and facilities are proposed for drilling or construction (e.g., when the BLM receives an APD or Right-of-Way [ROW] application for review). Siting of these locations would be subject to design features, BMPs, mitigation measures, and Conditions of Approval (COAs) adopted in the Decision Record for this EA. Implementation of the MDP would be phased over time.

Approval of the MDP would allow this EA to function as a higher level of analysis to which analysis of subsequent federal actions (e.g., approval of APDs) proposed for the HDA would be tiered. Approval of these actions would require additional NEPA analysis, such as a tiered EA, a Determination of NEPA Adequacy (DNA), or a Categorical Exclusion. Categorical Exclusions that may apply to some future development activities include those provided in Section 390 of the Energy Policy Act of 2005, 42 USC 15942(b). Phases of development would be subject to the appropriate NEPA-level and Field Office-required documentation, review, approval, and inspections. The BLM would apply appropriate mitigation measures, design features, and BMPs to all permitted actions in accordance with federal and state oil and gas regulations, the 1997 Carlsbad RMP (as amended), or the future revised Carlsbad RMP.

1.7. Scoping, Public Involvement, and Issues

The CFO publishes a NEPA log for public review. This log contains a list of proposed actions under review and actions approved by the field office. The log is located in the lobby of the CFO as well as on the BLM New Mexico website (http://www.blm.gov/nm/st/en/prog/planning/nepa_logs.html). The BLM also has an ePlanning website (https://eplanning.blm.gov/epl-front-office/eplanning/lup/lup_register.do) that allows the public to review and comment online on BLM NEPA and planning projects. Hard copies of the draft EA were also available at the BLM CFO as well as the BLM Santa Fe and Albuquerque Offices. The draft EA was made available for a 30-day public review and comment period.

The CFO uses geographic information systems (GISs) to identify resources that may be affected by the proposed action. The proposed action was reviewed by CFO resource specialists to identify any issues associated with the project. The programmatic nature of the proposed action was discussed and reviewed with resource specialists during this process. Some adjustments to the proposed action were made based on identification of issues by resource specialists and subsequent discussion with Chevron. These adjustments are reflected in this EA as revised design features or other modified components of the proposed action that differ slightly from the proposed action submitted by Chevron to the BLM. The issues that were raised include:

- How would air quality be impacted by the proposed action?
- How would climate change be impacted by the proposed action?
- How would range management be impacted by the proposed action?
- How would soils be impacted by the proposed action?

- How would vegetation be impacted by the proposed action?
- How would wildlife habitat be impacted by the proposed action?
- How would special status species be impacted by the proposed action?
- How would visual resources be impacted by the proposed action?
- Could noxious weeds be introduced to the project area as a result of the proposed action?
- How would cultural resources be impacted by the proposed action?
- How would paleontological resources be impacted by the proposed action?
- How would karst resources be impacted by the proposed action?
- How would watershed resources (including surface and groundwater) be impacted by the proposed action?

As determined by CFO resource specialists, no issues associated with the following were identified and are not evaluated further in this EA:

- Wilderness Study Areas (not present in EA area of analysis)
- Wilderness Areas (not present in EA area of analysis)
- Wild and Scenic Rivers (not present in EA area of analysis)
- Socioeconomics or environmental justice

Additionally, multiple protected biological species (e.g., threatened, endangered, BLM special status species) are listed in state and federal databases as occurring within Eddy County, New Mexico (Biota Information System of New Mexico [BISON-M] 2016; New Mexico Rare Plant Technical Council [NMRPTC] 1999a,b,c,d; U.S. Fish and Wildlife Service [USFWS] 2016b). Based on the absence of suitable habitat, the species listed in Table 1.7-1 are not expected to occur within the EA area of analysis.

Table 1.7-1 Biological Species Not Expected in EA Area of Analysis

Common Name	Scientific Name	Listing Status[1]
Arid land ribbonsnake	*Thamnophis proximus*	ST
Bald Eagle	*Haliaeetus leucocephalus*	ST
Bell's vireo	*Vireo bellii*	ST
Bigscale logperch	*Percina macrolepida*	ST
Black tern	*Chlidonias niger surinamensis*	NMSO
Blue sucker	*Cycleptus elongatus*	NMSO, SE
Broad-billed hummingbird	*Cynanthus latirostris*	ST
Brown pelican	*Pelecanus occidentalis*	SE
Common blackhawk	*Buteogallus anthracinus*	ST
Dunes sagebrush lizard	*Sceloporus arenicolus*	NMSO, SE
Gray redhorse	*Moxostoma congestum*	SE
Greenthroat darter	*Etheostoma lepidum*	ST
Gypsum wild-buckwheat	*Eriogonum gypsophilum*	FT, SE
Headwater chub	*Ictalurus lupus*	NMSO
Kuenzler's hedgehog cactus	*Echinocereus fendleri var. kuenzleri*	FE, SE
Least tern	*Sterna antillarum*	FE, SE
Lee's pincushion cactus	*Coryphantha sneedii var. leei*	FT
Lesser prairie-chicken	*Tympanuchus pallidicinctus*	FT[2], NMSO
Lucifer hummingbird	*Calothorax lucifer*	ST
Mexican spotted owl	*Strix occidentalis lucida*	FT
Mexican tetra	*Astyanax mexicanus*	ST
Neotropic cormoranat	*Phalacrocorax brasilianus*	ST

Table 1.7-1 Biological Species Not Expected in EA Area of Analysis

Common Name	Scientific Name	Listing Status[1]
New Mexico meadow jumping mouse	*Zapus hudsonius luteus*	NMSO
Northern aplomado falcon	*Falco femoralis septentrionalis*	EXPE/NE[3]
Northern beardless-tyrannulet	*Camptostoma imberbe*	ST
Northern goshawk	*Accipiter gentilis*	NMSO
Ovate vertigo snail	*Vertigo ovata*	ST
Pecos bluntnose shiner	*Notropis simus pecosensis*	FT, SE
Pecos gambusia	*Gambusia nobilis*	FE, SE
Pecos River muskrat	*Ondatra zibethicus ripensis*	NMSO
Pecos springsnail	*Pyrgulopsis pecosensis*	NMSO, ST
Peppered chub	*Macrhybopsis tetranema*	NMSO
Piping plover	*Charadrius melodus*	FT, ST
Plain-bellied water snake	*Nerodia erythrogaster*	SE
Rio Grande shiner	*Notropis jemezanus*	NMSO
Sacramento Mountain salamander	*Aneides hardii*	NMSO
Scheer's pincushion cactus	*Coryphantha scheeri var. scheeri*	SE
Shining coralroot	*Hexalectris nitida*	SE
Sneed pincushion cactus	*Coryphantha sneedii var. sneedii*	FE and SE
Southwestern willow flycatcher	*Empidonax traillii extimus*	FE, SE
Texas hornshell	*Popenaias popei*	C, SE[4]
Tharp's bluestar	*Amsonia tharpii*	SE
Thick-billed kingbird	*Tyrannus crassirostris*	SE
Western river cooter	*Pseudemys gorzugi*	ST
Wright's marsh thistle	*Cirsium wrightii*	C and SE
Yellow-billed cuckoo	*Coccyzus americanus*	FT

Notes:
Sources: BISON-M 2016; NMRPTC 1999a,b,c,d; USFWS 2016b

1 C = Candidate for Federal Listing; FE = Federally Endangered; FT = Federally Threatened; EXPE/NE = Experimental Population, Non-Essential; NMSO = BLM CFO Sensitive Species; SE = State Endangered; ST = State Threatened.

2 The USFWS listed the lesser prairie-chicken as threatened on May 12, 2014; however, on September 1, 2015, a U.S. district judge in Texas vacated the USFWS's listing decision. The listing status is still in the courts; therefore, currently (at the time of writing this EA), the lesser prairie-chicken is not protected under the Endangered Species Act.

3 Experimental populations are members of a listed species that are geographically separated from other populations of the same species. Experimental, non-essential populations are treated as threatened species on public lands under the Endangered Species Act for the purposes of Section 9 (Proh bited Acts).

4 Baseline field surveys did not identify suitable habitat for Texas hornshell (Arcadis U.S., Inc. 2016).

The EA was made available for public comment for 30 days on the BLM eplanning website, as well as via hard copies at the BLM CFO and BLM Santa Fe and Albuquerque Offices. BLM CFO received a total of nine comment letters on the EA. Comments were categorized into issue statements that primarily focused on air resources, vegetation, wildlife, karst, night skies, visual resources, Areas of Critical Environmental Concern (ACECs), Lands with Wilderness Characteristics, impacts to Carlsbad Caverns National Park, NEPA (e.g. level of documentation, alternatives), mitigation, and the RMP revision. Responses to comment issue statements is provided in **Appendix F**.

2. PROPOSED ACTION AND ALTERNATIVE(S)

2.1. Proposed Action

Under the proposed action, Chevron would construct, drill, complete, operate, plug, and abandon up to 436 horizontal oil and gas wells and five water disposal wells. Approval of the proposed action would also approve the 12 APDs submitted with the MDP (**Appendix A**). Approval of these 12 APDs would authorize the construction of two well pads and related infrastructure, including access roads, and water storage ponds. This section describes features that are common to all components of the MDP first, followed by site-specific descriptions of components included in the 12 APDs. APDs for the remaining 424 wells would be submitted at a later time.

The oil and gas wells would be drilled on a maximum of 109 new well pads (**Appendix B**). As described below, the MDP also includes the construction and operation of production, storage, and compression facilities; water disposal and recycling facilities; gathering pipelines for oil, gas, and produced water; pipelines for fresh, brackish, or recycled water to support hydraulic fracturing operations; and upgraded and new access roads.

A SUPO and Drilling Use Plan for the MDP have been submitted to the CFO as part of the proposed action (**Appendix B**). These plans contain planning elements common to all wells and facilities included in the MDP. Each APD would reference the SUPO and Drilling Use Plan to the extent practicable and would contain site-specific information as necessary in APD-specific SUPO and Drilling Plans (e.g., drilling and casing programs, reclamation seed mixes).

The proposed action would occur on a combination of BLM-administered, state-owned, and private lands (**Figure 2.1-1**). One hundred of the well pads would be located on BLM-administered surface lands, and wells drilled from these pads would produce federal minerals for which Chevron has existing leases (**Figure 2.1-2**). Nine well pads would be located on surface lands owned by the State of New Mexico (state lands) and would partially produce both federal and state leases. The numbers of well pads proposed assume development of four wells per pad. As technology improves, Chevron may increase the number of wells per pad and likewise decrease the total number of pads, while drilling the same number of wells. In the event that more wells are drilled on each pad, the configuration and size of individual pads may differ; however, surface disturbances would not increase beyond a total of 1,808 acres. This EA analyzes the predicted impacts associated with a maximum of 109 well pads and associated development.

Exact locations for the majority of proposed well pads, roads, and other facilities have not been determined through APD or ROW procurement processes. Therefore, Chevron's proposed action presents probable locations for these project components. The following description of the proposed action, descriptions of the affected environment, and analysis of environmental consequences are based on these probable locations, with more specific information for those locations specified in the 12 APDs submitted with the MDP. As stated in Section 1.6, future proposed actions that tier to the proposed MDP would require additional documentation of NEPA compliance. The "MDP Project Area (Project Area)" illustrated on **Figure 2.1-1**, **Figure 2.1-2**, and others provides the area within which Chevron would potentially shift locations of well pads, roads, and other facilities.

Chevron would obtain and comply with all appropriate federal, state, county, municipal, and local permits, including all necessary environmental clearances and permits before commencing any work.

Submitted APDs

Figure 2.1-3 and **Figure 2.1-4** illustrate the locations and layouts of facilities associated with the 12 submitted APDs. The 12 wells included in the submitted APDs would be drilled on a total of two well pads (six wells per pad). Because each of the six wells on each pad would share the same well pad, access road, and other infrastructure, discussion of the submitted APDs is combined into two groups. APD

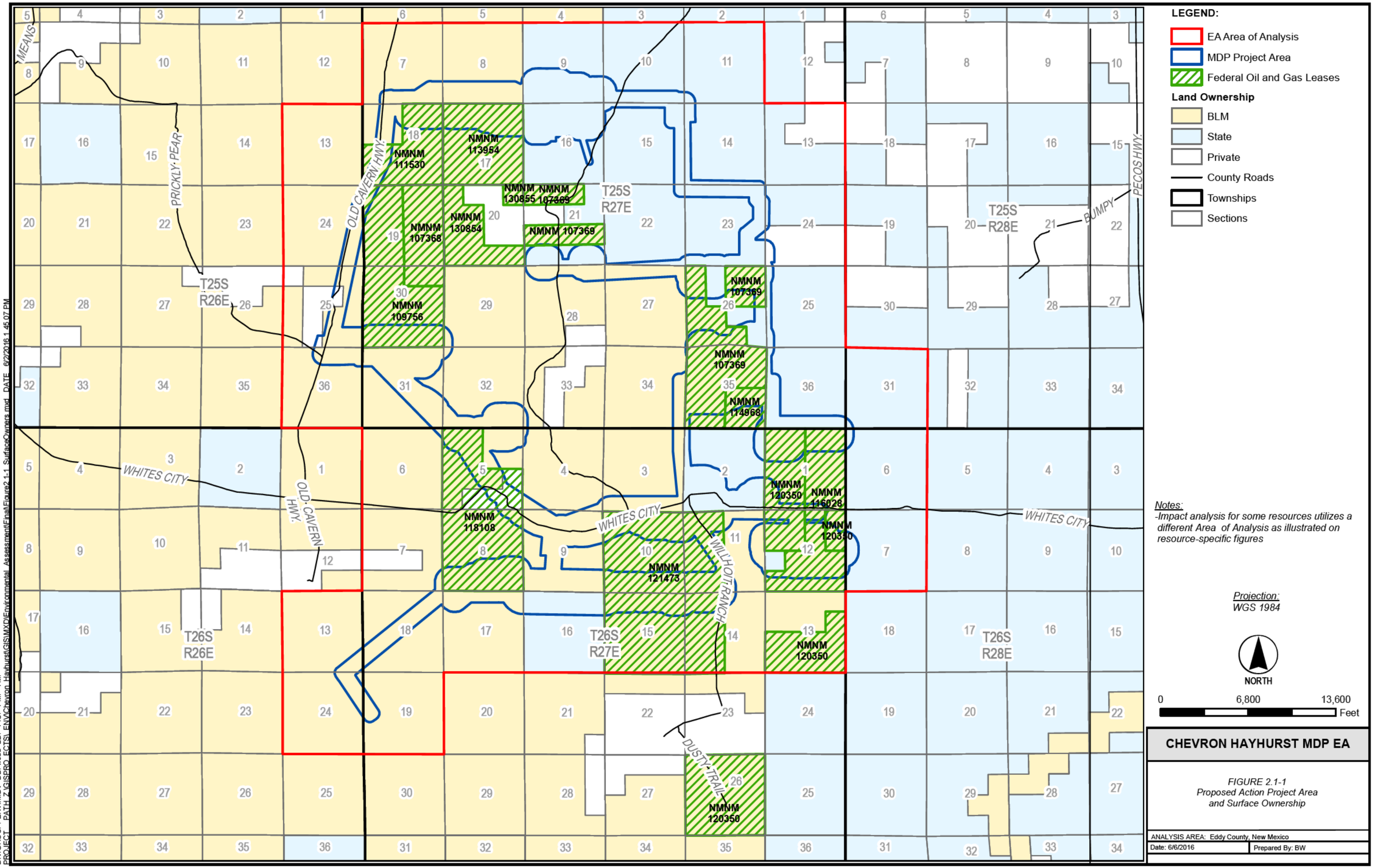
Group 1 includes all wells to be drilled on well pad HH SO 8 P2, plus associated facilities and infrastructure. APD Group 2 includes all wells to be drilled on well pad HH SO 10 P3, plus associated facilities and infrastructure. This approach is intended to simplify descriptions of the proposed APDs, as well as facilitate disclosure of potential environmental impacts. These two well pads would contain more than four wells in order to test the feasibility of increasing the numbers of wells on future pads and reducing the total number of pads.

Surface Requirements

Table 2.1-1 provides estimates of short-term (less than 18 months) and long-term (up to 45 years, assuming well production into the 2050s) disturbance for each wellfield component. **Table 2.1-2** summarizes disturbances for the 12 submitted APDs. A total of 1,808 acres of short-term surface disturbance would occur, of which approximately 1,437 acres would be on BLM-administered lands, 365 acres on state lands, and 6 acres on private lands (**Table 2.1-3**). All proposed surface disturbances on private lands would occur on a single parcel in Township 26 South (T26S), Range 27 East (R27E), Section 5. Interim reclamation would decrease project-wide long-term disturbances to an approximate total of 806 acres.

At the programmatic level of analysis for MDP features where an APD has not been submitted, estimating surface requirements for construction of project facilities requires some assumptions. The assumptions used in this analysis are conservative in order to provide a worst-case scenario for potential environmental impacts while leaving some operational flexibility. For example, the dimensions of well pads needed for operations are expected to average 475 feet by 330 feet; however, the required surface disturbance during construction may be larger to account for areas of cut or fill and storage of topsoil and spoil. To account for additional construction surface requirements for cut, fill, and topsoil or spoil storage, each non-linear feature (e.g., well pads, tank batteries, water containment ponds) was estimated to have additional surface disturbances extending 55 feet in all directions (**Table 2.1-3**). Areas where the 55-foot buffer for surface disturbances overlapped between neighboring features were double-counted to account for disturbances that could occur due to relocating the feature in the future.

Estimating surface disturbances for linear features (e.g., roads, pipelines, utility lines) also requires similar assumptions. The actual configuration of linear disturbance corridors (e.g., ROWs) would vary according to the number and types of components within the corridor. For example, the number of flowlines within a particular portion of a corridor may range from one to a few dozen. Therefore, although a typical ROW width of 106 feet is anticipated for most areas, the actual width and configuration may vary from that shown in **Table 2.1-4**. This analysis assumes that all linear disturbances would occur within a 654-acre area that encompasses all proposed roads, pipelines, flowlines, and utility lines as conceptually envisioned. This area includes approximately 0.7 miles of existing road that would be upgraded in T25S, R27E, Section 16 that was not included in the proposed MDP as submitted to the BLM. Within the 654-acre linear disturbance area, disturbances from each type of linear feature were estimated based on the total length and estimated width of disturbance for each feature type. As described above, surface requirements for each linear feature type would be larger than the trench or road width. Some areas between linear features may be disturbed multiple times (e.g., if utility construction follows pipeline reclamation) but are not double-counted.



CHEVRON HAYHURST MDP EA

FIGURE 2.1-1
Proposed Action Project Area and Surface Ownership

ANALYSIS AREA: Eddy County, New Mexico

Date: 6/6/2016 | Prepared By: BW

DIV/GROUP: ENV/MDV DB: webb LD: PIC: PM: TM:
PROJECT PATH Z:\GISPRO_ECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment\Final\Figure2.1-1_SurfaceOwners.mxd DATE 6/2/2016 1:45:07 PM

T24S R26E
T24S R27E
T24S R28E
T25S R26E
T25S R27E
T25S R28E
T26S R26E
T26S R27E
T26S R28E
MEANS
OLD CAVERN HWY.
PRICKLY PEAR
ROADRUNNER
BUMPY
PECOS HWY.
GYPSUM
WHITES CITY
OLD CAVERN HWY.
GYPSUM HILLAHUNTY
WILLIAMS RANCH
DUSTY TRAIL
APD Group 2 Area
See Figure 2.1-4
APD Group 1 Area
See Figure 2.1-3

LEGEND:

- EA Area of Analysis
- MDP Project Area

Land Ownership

- BLM
- State
- Private
- County Roads
- Major Lease Roads
- Townships
- Major Access Road and Pipeline/Flowline Corridors
- Pipeline and Maintenance Road (Two-Track) Corridor

MDP Features

- Central Tank Batteries
- Compression Station
- Frac Ponds
- Man Camp
- Salt Water Disposal Wells and Facilities
- Sub Station
- Water Tank Farm
- Well Pad

APD Features

- Well Pad
- Tank Battery
- Frac Pond
- Compression Station

Notes:
-Impact analysis for some resources utilizes a different Area of Analysis as illustrated on resource-specific figures
-ROWs included in APDs are not depicted. See Figures 2.1-3 and 2.1-4 for more details

Projection:
WGS 1984

NORTH

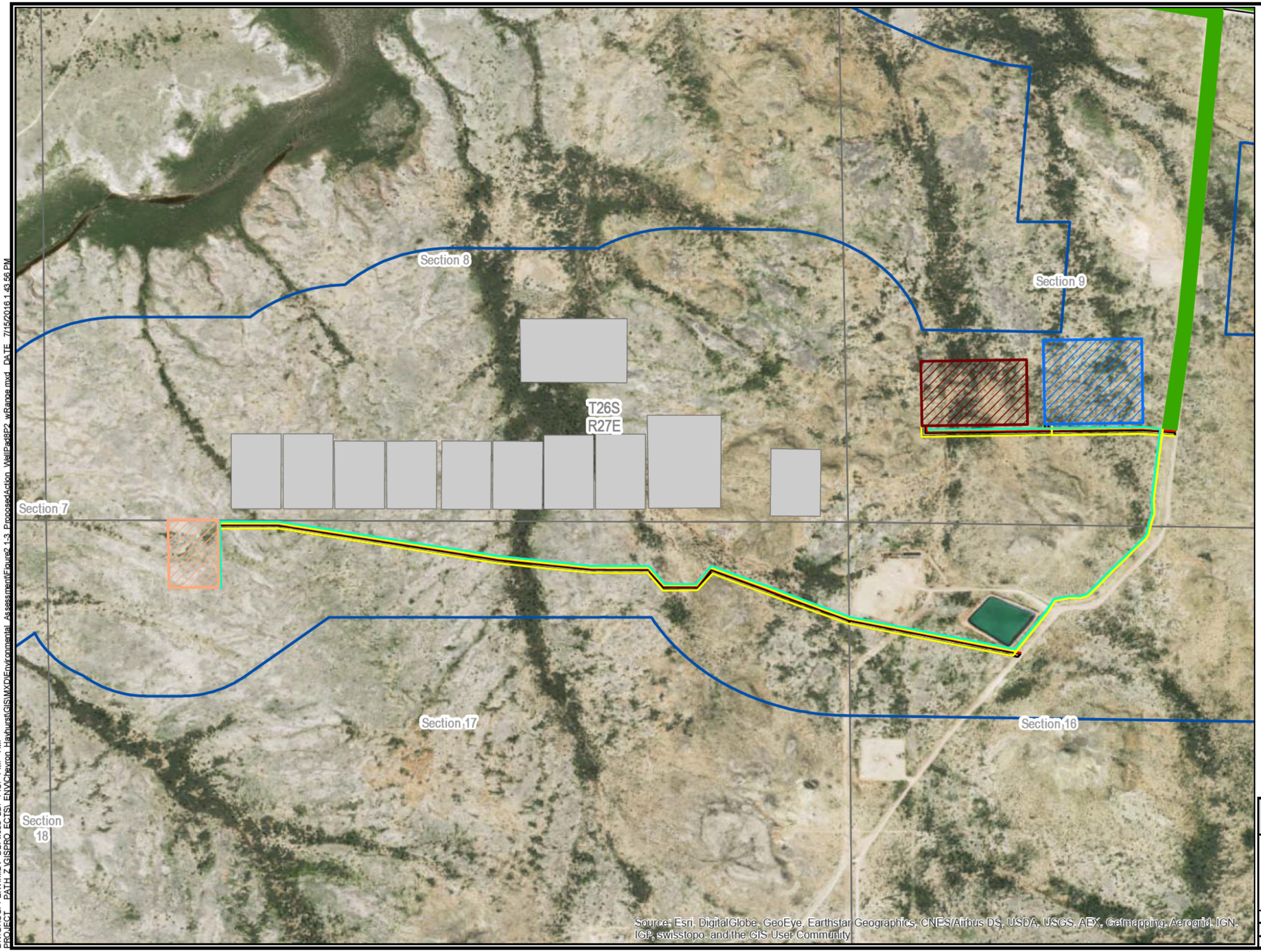
0 6,800 13,600 Feet

CHEVRON HAYHURST MDP EA

FIGURE 2.1-2
Proposed Action Overview

ANALYSIS AREA: Eddy County, New Mexico
Date: 6/6/2016 | Prepared By: BW

DIV/GROUP: ENV/MDV DB: webb LD: PIC: PM: TM:
PROJECT: PATH: Z:\GIS\PROJECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment\Final\Figure2.1-2_ProposedAction.mxd DATE: 6/6/2016 3:05:49 PM



LEGEND:

- MDP Project Area
- MDP Features - See Figure 2.1-2
- County Roads
- Sections
- Major Access Road and Pipeline/Flowline Corridors

APD Features

- Frac Pond
- Tank Battery
- Well Pad
- Flowline
- Pipeline
- Powerline
- Road

Notes:
- MDP Features final locations pending APD submittal to BLM.
- Facility sizes shown are for working area only and do not include extra space for cut and fill, or topsoil/spoil storage.

Projection:
WGS 1984

NORTH

0 750 1,500 Feet

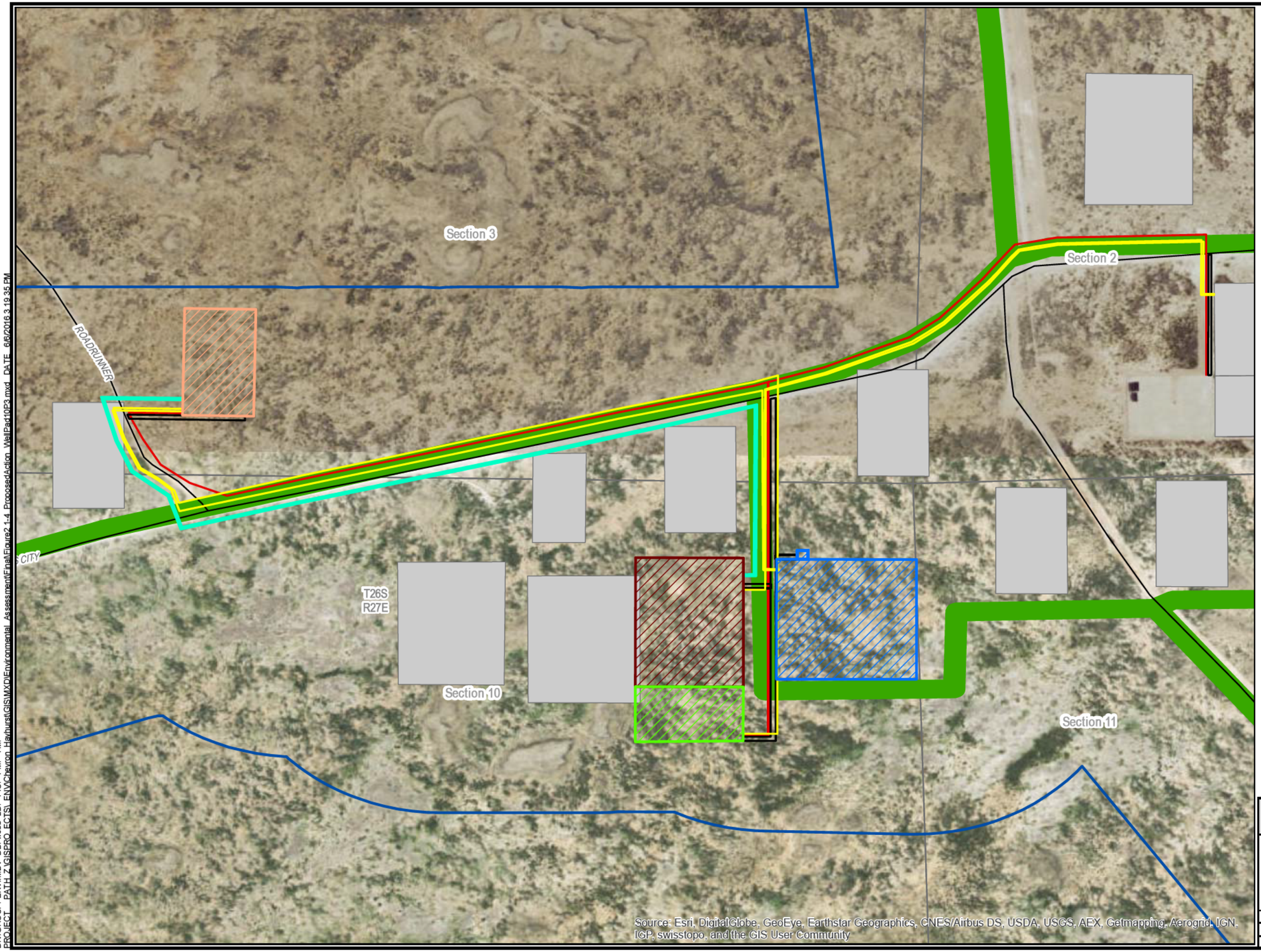
CHEVRON HAYHURST

FIGURE 2.1-3
Proposed Action
Well Pad HH SO 8 P2 Overview

ANALYSIS AREA: Eddy County, New Mexico

Date: 7/20/2016 | Prepared By: BW

DIV/GROUP: ENV/MDV DB: webb LD: PIC: PM: TM:
PROJECT PATH Z:\GIS\PRO_ECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment\Figure2.1-3_ProposedAction_WellPad8P2_wRange.mxd DATE 7/15/2016 1:43:56 PM



LEGEND:

- MDP Project Area
- MDP Features - See Figure 2.1-2
- County Roads
- Sections
- Major Access Road and Pipeline/Flowline Cooridors

APD Features

- Well Pad
- Tank Battery
- Frac Pond
- Compression Station
- Flowline
- Pipeline
- Powerline
- Road

Notes:
- MDP Features final locations pending APD submittal to BLM.
- Facility sizes shown are for working area only and do not include extra space for cut and fill, or topsoil/spoil storage.

Projection:
WGS 1984

NORTH

0 525 1,050 Feet

CHEVRON HAYHURST

FIGURE 2.1-4
Proposed Action
Well Pad HH SO 10 P3 Overview

ANALYSIS AREA: Eddy County, New Mexico

Date: 6/6/2016 | Prepared By: BW

DIV/GROUP: ENV/MDV DB: webb LD: PIC: PM: TM:
PROJECT PATH: Z:\GIS\PRO_ECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment\Final\Figure2.1-4_ProposedAction_WellPad10P3.mxd DATE: 6/6/2016 3:19:35 PM

Table 2.1-1 Proposed Action Estimated Surface Disturbance – MDP

Project Component[1,2,3]	Length (miles)	Width (feet)[4]	Quantity	Buried or Surface-Laid	Short-term Disturbance (acres)	Long-term Disturbance (acres)
Well Pads	---	--	109	---	723	163[5]
Tank Battery Pads	---	--	16	---	184	184
Compressor Station Pads	---	--	7	---	74	74
Salt Water Disposal Pads[6]	---	--	5	---	82	44
Containment Ponds	---	--	4	---	53	53
Water Storage Facilities	---	--	2	---	23	23
Electrical Substation	---	--	1	---	11	11
Central Housing Facilities	---	--	2	---	4	4
Linear Features						
Roads[7]	51	28	---	---	226	226
Roads – Maintenance and Inspection Only[8]	4	10	---	---	6	6
Flowlines[9,10]	223	4	---	Buried	140	0
Gas Pipelines[11,12]	100	6	---	Buried	94	5
Oil Gathering Pipelines	25	4	---	Buried	15	1
Water Pipelines[13]	43	8	---	Buried	54	3
Powerlines	38	20	---	Overhead	118	6
				Total	**1,808**	**806**

Notes:
1 Actual permitted disturbances for specific features will be refined during the APD or ROW review process.
2 All non-linear features assume that an additional 55 feet in all directions would be required to account for topsoil and spoil storage, cut and fill areas, and other site-specific needs.
3 All linear disturbances are anticipated to occur within an approximately 654-acre area as illustrated in **Appendix B**. Disturbances for linear feature type are estimated based on total length and average width within this 654-acre area. Actual disturbances will depend on specific ROW configuration (e.g., number of flowlines and other features).
4 Includes trench, driving surface, and roadside ditch width only. Actual width will be greater to account for topsoil and spoil stockpiles, safety offset, etc. Increased width is reflected in disturbance acreage estimates. Widths are estimated based on a weighted average of line lengths and widths presented in **Table 2.1-4**.
5 Long-term disturbance assumes all well pads reduced to 200 x 325 feet during interim reclamation.
6 Includes both salt water disposal facilities and salt water disposal well pads.
7 Roads include resource roads and well pad/surface facility access roads. Disturbances potentially required to upgrade or maintain existing roads are included.
8 Includes two-track road in northeastern corner of HDA (**Figure 2.1-2**).
9 Flowlines transport produced fluid from all target formations to the first collection point.
10 Flowline construction disturbance would be 100% reclaimed immediately following installation.
11 Gas pipelines include gas lift, high-pressure gathering, and low-pressure gathering lines. The 6-foot width is an estimated average for all gas lift (4-foot trench), high-pressure gathering (8-foot trench), and low-pressure gathering (4-foot trench) lines.
12 Pipeline and powerline disturbance would be 95% reclaimed immediately following installation. Locations of permanent risers for isolation valves and tie-ins would not be reclaimed until final reclamation
13 Water pipelines include hydraulic fracturing water and salt water disposal flowlines.

Table 2.1-2 Proposed Action Surface Disturbances – APDs

Project Component	Length (feet) or Initial Dimensions (feet)	Short-term Disturbance (acres)	Long-term Disturbance (acres)
APD Group 1			
Well Pad	600 x 400[1]	5.5	1.5
Roads	7,325	0[2]	4.7[2]
Flowlines (Temporary Surface)	8,622	0[3]	0[3]
Pipelines (Permanent Buried)	9,492[4]	22.6[5]	1.1[6]
Tank Battery Pad	550 x 750[1]	9.5	9.5
Containment Pond	760 x 760[1]	13.3	13.3
Powerlines	7,285	0[7]	0[5,6]
	Total	**50.9**	**30.1**

Table 2.1-2 Proposed Action Surface Disturbances – APDs

Project Component	Length (feet) or Initial Dimensions (feet)	Short-term Disturbance (acres)	Long-term Disturbance (acres)
APD Group 2			
Well Pad	600 x 375[1]	5.2	1.5
Roads	2,658	0[2]	1.7[2]
Flowlines (Temporary Surface)	4,823	0[3]	0[3]
Pipelines (Permanent Buried)	8,440[4]	21.3[5]	1.1[6]
Combined Tank Battery and Compressor Station Pad	1,100 x 600[1]	15.2	15.2
Containment Pond	760 x 760[1]	13.3	13.3
Powerlines	8,642	0[7]	0[5,6]
	Total	**55.0**	**32.8**
	Grand Total	**105.9**	**62.9**

Notes:
1 Includes areas for topsoil and spoil storage and areas of cut and fill.
2 Assumes 28-foot road width (including ditches) for long-term disturbance. All roads would be constructed parallel to pipelines and flowlines. Short-term road disturbances are included in calculations for Pipelines (Permanent Buried).
3 Flowline construction disturbance would be 100% reclaimed immediately following installation. In this table, short-term flowline construction disturbances are included in calculations for Pipelines (Permanent Buried).
4 Maximum length – does not equal combined length of individual flowlines. APD Group 2 includes salt water disposal flowlines to a future salt water disposal facility in T26S, R27E, Section 2 SW1/4. Surface Use Plats for salt water disposal and salt water disposal access road have not been submitted to the BLM at this time.
5 Assumes 106-foot-width, including flowlines, powerlines, and access roads.
6 Pipeline and powerline disturbance would be 95% reclaimed immediately following installation.
7 Disturbances are included in calculations for Pipelines (Permanent Buried). APD Group 2 includes salt water disposal utility lines.

Table 2.1-3 Proposed Action Estimated Surface Disturbance by Landowner

Landowner/ Management Agency	Short-term Disturbance (acres)	Long-term Disturbance (acres)
MDP		
Federal (BLM)	1,437	623
State of New Mexico	365	178
Private[1]	6	6
APD Groups 1 and 2 (combined)		
Federal (BLM)	95.3	62.4
State of New Mexico	10.6	0.5
Private	0	0
Total	**1,808[2]**	**806[2]**

Notes:
1 All disturbances on private lands would be from road or ROW construction.
2 All APD Group 1 and Group 2 disturbances are included in MDP disturbances and are not additive.

Construction

This section describes the proposed construction of well pads, access roads, gathering pipelines, and powerlines. Facilities associated with oil and gas production (e.g., tank batteries, compressor stations, salt water disposal facilities, and water storage and recycling facilities), the electrical substation, and central housing facilities are described in the "Production – Operation and Maintenance" or "Workforce" sections below. For each APD, construction, maintenance, restoration, and reclamation would be conducted in accordance with the MDP SUPO unless otherwise specified in the APD-specific SUPO, as described below.

Well Pads

Chevron is proposing to construct 109 production well pads. The well pad construction schedule has yet to be determined, but Chevron expects to construct between three and seven pads annually. The working surface (drilling and completion operations area) of the well pads would average 475 feet by 330 feet (3.6 acres) and would be surfaced with caliche. Including cut and fill slopes and topsoil storage, average surface disturbance per pad would be approximately 6.6 acres. Construction of the 109 well pads would result in an estimated 723 acres of short-term surface disturbance. Following interim reclamation (reduction of the pad size as areas unnecessary for long-term production are reshaped and revegetated), a working area of approximately 1.3 acres per well pad would remain disturbed throughout the long-term production phase of the wells. Following interim reclamation, total long-term disturbance for all well pads is estimated to be 163 acres. As stated above, Chevron may increase the number of wells per pad and likewise decrease the total number of well pads. If more than four wells are drilled on a pad, the size of the pad may need to be increased; however, the total short-term and long-term surface disturbances for well pads would not exceed 723 and 163 acres, respectively. Typical drawings of the proposed well pads during drilling and production are included in **Appendix C**.

Each proposed production well pad would accommodate approximately four wells, and would be constructed from native soil and rock materials present at the site or mined from approved caliche pits. Pads would be constructed by clearing vegetation, salvaging and storing topsoil, and leveling the drilling area using cut-and-fill techniques where appropriate. Topsoil would be placed adjacent to the pad where interim reclamation is planned to be conducted following well completion. Chevron would conduct interim reclamation within six months after well completion. If an approved APD is planned to be drilled from a location in which interim reclamation has yet to be initiated, Chevron would request an extension through Sundry Notice – Notice of Intent to delay interim reclamation until either six months following the approved APD's well completion or the APD expires, whichever occurs first.

Access Roads – Existing

Chevron proposes to use approximately 4.9 miles of existing county roads and 11.8 miles of existing lease roads for access within the HDA during construction, drilling, and completion operations. Road maintenance and upgrades on BLM-administered surface would comply with Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development (also known as the BLM Gold Book; BLM 2007). Maintenance and upgrades for existing roads are included in estimates of surface disturbances. All roads would be surfaced with caliche, crushed gravel, or river rock during construction. Chevron would restrict activities to permitted roads, facilities, and established or approved sites. Chevron would follow posted speed limits.

Chevron would improve or maintain existing roads in a condition the same as or better than before operations begin. All existing roads would be used in their present condition with the exception of minor maintenance as needed. All existing structures on the entire access route such as cattle guards, other range improvement projects, culverts, etc. would be properly repaired or replaced if they are damaged or have deteriorated beyond practical use due to Chevron's activities. Chevron would abate and, where reasonably possible, prevent fugitive dust as needed, whether created by vehicular traffic, equipment operations, or wind events. BLM written approval would be acquired before application of surfactants, binding agents, or other dust suppression chemicals on roadways.

Access Roads – New

Prior to construction, ROWs would be applied for through the BLM and all construction activity would be confined to the approved ROW. Chevron would run all ROWs parallel to existing disturbances wherever possible. Proposed ROWs would include new access roads, pipelines, and powerlines. The typical ROW configuration is provided in **Table 2.1-4** and shown on **Figure 2.1-5**. The third-party oil gathering pipeline is provided to estimate disturbances; however, Chevron would not be applying for this ROW. BLM CFO Realty would evaluate the third-party ROW application and may tier its analysis to this EA.

Table 2.1-4 Right-of-Way Configuration and Services in Each Trench

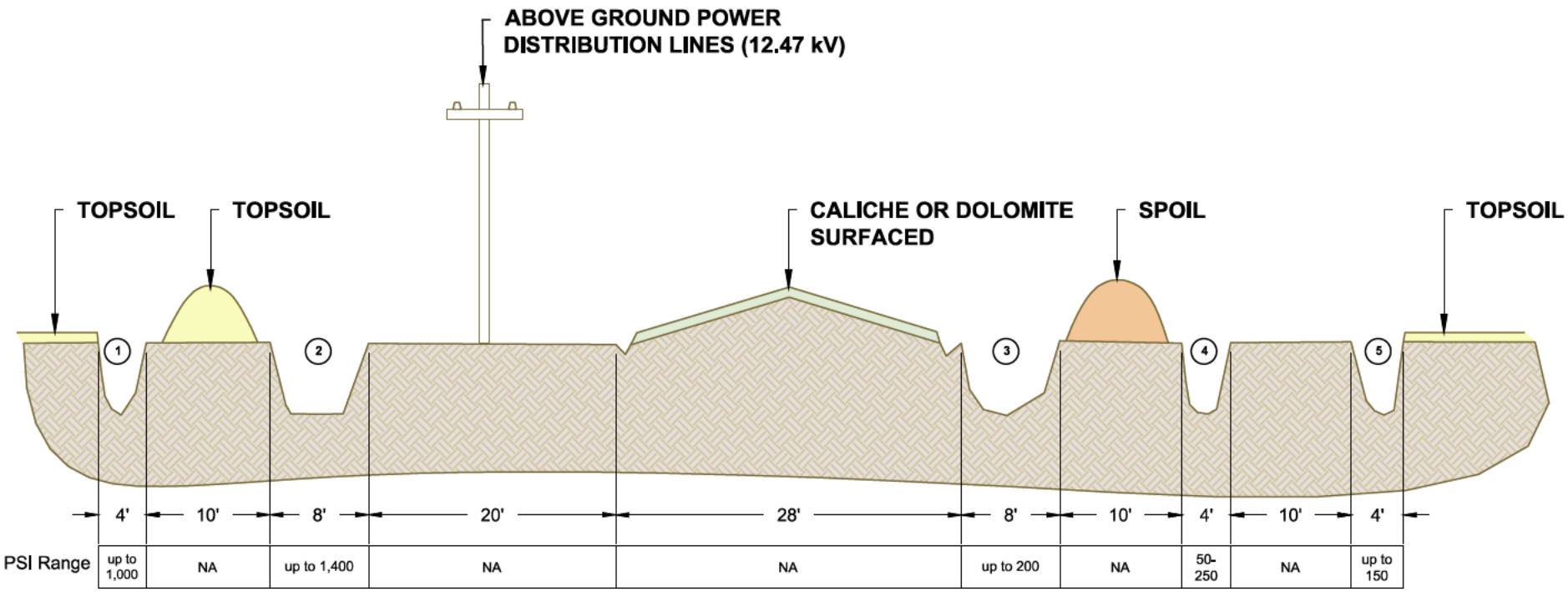
Trench ID	ROW Component	Service Description	ROW Width (feet)
1	Gas Lift Pipeline	Lift-gas distribution	4
		Safety Offset	10
2	High-Pressure Gas Pipeline	Gas gathering at up to 1,400 pounds per square inch gauge (psig), dual lines in some cases	8
		Aboveground (overhead) distribution powerlines (12.47 kilovolts)	20
		Two-lane access road with ditches	28
3	Water Pipelines	Distribution pipelines for hydraulic fracturing water and gathering pipelines for produced water	8
		Safety Offset	10
4	Low-Pressure Gas Pipeline	Gas gathering at 50 to 250 psig	4
		Safety Offset	10
5	Oil Pipeline	Third-party oil gathering pipeline	4
		Total Width	**106**

Chevron proposes approximately 16 miles of new resource roads under the proposed action. New resource roads up to 24 feet wide (28 feet including ditches) would be constructed at the same time as the well pads and facilities they are intended to serve. Road construction, maintenance, and upgrades on BLM-administered surface, state, and private surface estate would comply with the BLM Gold Book (BLM 2007). All roads would be surfaced with caliche or river rock during construction. Reclamation of new access roads is not proposed and Chevron estimates a short- and long-term disturbance of approximately 45 acres for new roads.

New access roads would be constructed as crowned and ditched roads and would be graveled as needed for drilling. If requested by the surface tenant, upgrading of this portion of the road would be kept to a minimum. In accordance with BLM standards, drainage control would be ensured over the entire road through the use of drainage dips, in-slipping and ditches, natural rolling topography, ditch turnouts, armored crossings, or culverts. Site-specific road design would consider grades, soils, and local hydrology. Culverts, low water crossings, and cattle guards would be installed as needed. Where culverts or drainage crossings are required, they would be designed for a 100-year, 24-hour storm event without development of a static head at the pipe inlet.

The following design specifications would be observed while constructing all access roads:

- No additional construction easement would be required outside the total ROW (see “Flowlines and Gathering Pipelines” subsection below).
- No turnouts are anticipated to be constructed due to the 24-foot road width; if a turnout is deemed necessary, it would be approved on a case-by-case basis.
- If the road gradient exceeds 8 percent over a 300-foot length, a site-specific engineering design would be submitted to the CFO for approval prior to construction.
- A cross slope of 2 percent would be used to allow water to drain from the crown.
- Major cuts-and-fills would use a 2:1 horizontal to vertical slope initially, and would be modified to a 3:1 slope when the road is completed.
- Six inches of base material, leadoff ditching, low water crossings, culverts, and water bars would be installed where needed to control erosion.



Notes:
1. Topsoil and Spoil pile locations would vary according to timing of component construction.
2. Working space location and width would vary according to timing and component being constructed.
3. Dolomite to be used in areas of gypsum soils.

Trench ID	ROW Component	Service Description	ROW Width (feet)
1	Gas Lift Pipeline	Lift-gas distribution	4
Safety Offset			10
2	High-Pressure Gas Pipeline	Gas gathering at up to 1,400 psig, dual lines in some cases	8
Aboveground distribution powerlines (12.47 kV			20
Two-lane access road, including drainage ditches			28
3	Water Pipelines	Distribution pipelines for hydraulic fracturing water and gathering pipelines for produced water	8
Safety Offset			10
4	Low-Pressure Gas Pipeline	Gas gathering at 50-250 psig	4
Safety Offset			10
5	Oil Pipeline	Third party oil gathering pipeline	4
		Total Width	106

CHEVRON HAYHURST MDP EA

FIGURE 2.1-5
Example ROW Trench Configuration

ANALYSIS AREA: Eddy County, New Mexico

Date: 5/18/2016 | Prepared By: BAR

CITY:ROSEVILLE DIV/GROUP:ENVCAD DB:ENVCAD PM:(Reqd)
G:\ENVCAD\Roseville-CA\ACT\B0048783\0000\0004A\B0048783,0000 ROW Trench.dwg LAYOUT: 2.1-X SAVED: 5/25/2016 10:19 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: LTR LAND PLOTSTYLETABLE: ARCADIS.CTB
PLOTTED: 6/2/2016 9:18 AM BY: ROBITAILLE, BEVERLY

This page intentionally left blank.

While not a BLM CFO requirement for resource roads, Chevron may elect to windrow, segregate, and store topsoil along the road for later spreading across the disturbed ROW corridor. If so, topsoil would be promptly seeded to control erosion, prevent weed establishment, and maintain soil microbial activity. In areas of high wind or water erosion, staked soil retention blankets would be used in combination with seeding to prevent topsoil erosion. Retention blankets would be a straw/coconut blend (or similar) and would be covered on the top and bottom with 100 percent fiber netting to reduce entanglement of small animals. Retention blanket stakes or anchors would be constructed of wood or other non-hazardous materials, not steel. All disturbed areas would be seeded by broadcast or drill-and-crimp during interim reclamation. Ground conditions would determine the seeding method used.

Flowlines and Gathering Pipelines

Proposed flowlines and gathering pipelines will be constructed immediately adjacent to roads. A flowline transports produced fluids and gases from the well head to the first collection point, and the gathering pipelines transport fluids and gases that have been separated at a collection point to another facility. Some new pipelines and flowlines would be installed adjacent to approximately 16.7 miles of existing improved roads (no upgrading needed) or adjacent to existing roads planned for upgrading. The remainder of pipelines and flowlines would be constructed adjacent to new roads or within an existing utility line corridor in the northeast portion of T25S R27E. For pipelines within the existing utility line corridor, no roads would be constructed or upgraded and the pipeline ROW would be used for inspection and maintenance access. Chevron proposes to reclaim approximately 95 percent of surface disturbances required for pipeline construction (**Table 2.1-1**). As a result, Chevron estimates a short-term disturbance of 163 acres for pipelines and a long-term disturbance of 9 acres. These estimates include pipelines for the transport of water for drilling and hydraulic fracturing operations.

All flowlines and gathering pipelines would be buried – none would be surface-laid. Flowline and pipeline trenches would be excavated mechanically; pipe segments would then be welded together and tested, lowered into the trench, and covered with excavated material. Topsoil would be salvaged and windrowed separately from the underlying subsoil and stored alongside the road until the trench is backfilled. All pipelines would be buried to a minimum depth of 36 inches from surface to top of pipe. Temporary water lines for hydraulic fracturing water would be installed on the ground surface, and located where practical within areas of previous surface disturbance.

The pipelines would be installed in separated trenches for each service (i.e., type of pipeline). **Table 2.1-4** shows the configuration of services in each trench, and **Table 2.1-5** provides detailed information about each pipeline required for drilling, completions, and production operations. Buried flowlines would also be constructed and reclaimed immediately following construction. Total short-term disturbance from flowline construction is estimated to be 140 acres.

Table 2.1-5 Pipeline Detailed Information

Pipeline Service	Nominal Size (inches)	Length (miles)	Pressure (psig)	Material of Construction	ROW Width (feet)
Gas Lift	4	26.2	1,100	Flexpipe	4
HP Gas Gathering[1]	12	14.7	1,400	Steel	8
Hydraulic Fracturing Water[2]	12	14.3	200	HDPE	8
Produced Water	12	17.8	150	HDPE	4
LP Gas Gathering	24	22.9	150	Steel	4
Oil Gathering[3]	12	22.9	150	Steel	4

Notes:
1 HP gas gathering ROW would include some third-party pipelines.
2 Hydraulic fracturing water includes all water to be used for hydraulic fracturing, which may be fresh, brackish, or recycled.
3 Oil gathering pipeline would be managed by a third-party.

Abbreviations:
psig = pounds per square inch gauge; HDPE = high-density polyethylene; HP = high pressure; LP = low pressure

Each pipeline and flowline would be pressure tested with freshwater to ensure integrity. All hydrostatic test (hydrotest) water would be purchased from local owners of water rights or sourced by Chevron and would be transported to the testing location by truck. After testing, the water would be disposed of in a produced-water injection facility where it would either be injected into a disposal well or be recycled for hydraulic fracturing operations. Cathodic protection will be used for metallic gathering pipelines. Flowlines will be made of nonmetallic material and would not require cathodic protection.

Powerlines

All powerlines would be overhead (none would be buried) and would be constructed to Avian Power Line Interaction Committee (APLIC) standards. The electrical distribution system would operate at 12.47 kilovolts (kV) with an average span of 250 feet between poles. Chevron estimates that 788 power poles would be required for a total of 37.3 miles of powerline. Chevron estimates a short-term disturbance of 118 acres for powerline construction and a long-term disturbance of 6 acres. Powerlines would be located within the same ROW as roads and pipelines as shown in **Table 2.1-4**. Chevron may post the powerline height at each road crossing.

Caliche Sources

Caliche would be required for surfacing of well pads, access roads, and some surface facilities. An existing BLM-approved caliche pit in T26S, R27E, Section 9, SWNE and SENE (Lease Number: NMNM91806) has been identified as the most likely source of caliche for the project. Disturbances associated with use of the existing caliche pit were assessed during permitting of the caliche pit and are not considered disturbances associated with the proposed action (EA-NM-067-3-1312). If additional caliche source areas are needed, Chevron would include the caliche pit in future APDs. Each APD will identify the caliche sources for that well and associated facilities. Potential future caliche pit locations have been identified in T24S R27E, Section 7 NESE (approximately 5 miles north of the HDA) and in T26S R27E, Section 17 SENE (within the HDA). Chevron will make payment to the BLM prior to removing any federal mineral materials.

Drilling and Completion

Up to 436 horizontal oil and gas wells and five vertical water disposal wells would be drilled under this proposed action. Fewer wells could be drilled than are proposed due to geologic conditions, market uncertainties, or other technological considerations. Chevron's drilling operations would be conducted in compliance with all Federal Onshore Oil and Gas Orders, as well as with all other applicable laws, rules, and regulations. As required by 43 CFR 3162.6, well signs would be installed for each well and would include the surface hole lease number, bottom hole lease number, and communitization agreement number. The seven potential target zones for the 436 total wells along with the target zone for the five water disposal wells are detailed in **Table 2.1-6**. As geology is more fully developed, Chevron may increase or decrease the number of target zones as it deems advisable.

Table 2.1-6 Potential Target Zones in the HDA

Target Zone	Approximate Depth Range[1] (feet)	Approximate Thickness Range (feet)
First Bone Spring	6,513 – 6,888	130 – 190
Second Bone Spring	7,492 – 7,621	1,080 – 1,250
Harkey Sand	7,771 – 8,123	55 – 115
Third Bone Spring Sand	8,050 – 8,617	810 – 850
Wolfcamp A	8,400 – 9,014	130 – 190
Wolfcamp C	9,459 – 9,870	130 - 145
Wolfcamp D	9,570 – 9,992	270 – 300
Disposal Zone (Devonian)	14,100 – 15,300	1,000 – 1,200

Notes:
1 Approximate depth to top of target reservoir below ground surface.

Up to four drilling rigs may be simultaneously deployed in the HDA. Drilling rigs with onsite diesel generators would maintain 4,500-foot spacing from other drilling rigs with onsite diesel generators to minimize the impact on air quality.

Drilling Plan

The Hayhurst MDP contains a 10-point drilling plan that would apply to all oil and gas wells drilled under the proposed action. Each APD would tier to this drilling plan and provide additional information specific to each well. A well is expected to require 24 to 60 days to drill and an additional 34 to 47 days to complete, depending on the targeted reservoir.

For all wells, surface casing would be run to a minimum depth of 100 feet below freshwater aquifers. The surface hole would be cased with steel casing and would be cemented in place from ground level to the depth specified in each well's approved APD. Prior to drilling below the surface casing, a Blowout Preventer (BOP) would be installed on the surface casing and both the BOP and surface casing would be tested for pressure integrity. The BOP and related equipment would meet the requirements of Federal Onshore Oil and Gas Order No. 2 and the BLM would be notified in advance of all pressure tests. Intermediate casing would also be set and cemented as specified in each well's approved APD. BOPs with a minimum system pressure rating of 10,000 pounds per square inch (psi) would be installed for the intermediate liner string for wells completed in the Wolfcamp Formation and for salt water disposal (SWD) wells.

Figure 2.1-6 provides a schematic example of the proposed casing and cementing program.[1] As stated above, the bottom of the surface casing would be placed at least 100 feet below the lowest occurrence of freshwater aquifers (e.g., Rustler Formation on diagram). Progressively smaller-diameter intermediate and production casing would be installed at greater depths. Production tubing, which transports hydrocarbons and produced water to the surface, is located in the center of the casing string. The annular space between the outside of the casing and the rock formations is filled with cement. For surface and intermediate casing, the cement extends from the bottom of the casing to the ground surface. For the production casing, cement extends from the bottom of the casing to above the base of the intermediate casing. The specific depth of each type of casing and amount of cement will vary from well to well.

Specific directional plans for each well would be included with a well's APD. Downhole operations would be completed with tools to facilitate proper direction and path of the well bore. Some wells may require a pilot hole to facilitate drilling the horizontal section of the well; these would be specified in a well's APD.

After drilling each hole section to its final depth, logging tools would be run into the well to evaluate the potential hydrocarbon resource. Once the evaluation is complete, steel production casing would be run and cemented into place in accordance with the well design as approved by the BLM. The proposed casing and cementing program would be designed to protect and isolate all usable water zones, potential productive zones, lost circulation zones, abnormally pressured zones, and any prospectively valuable deposits of minerals. BLM approval is required prior to the use of any isolating medium other than cement.

Upon cementing production casing in place, the drilling rig would be removed and replaced by a completion rig. Well completion primarily consists of hydraulic fracturing operations to stimulate a well's lateral section. Completion operations would be conducted according to "green completion" guidelines per 40 CFR 60, subpart OOOOa. A general description of the hydraulic fracturing process is included **Appendix D** (BLM 2015).

---

[1] The main purpose of cementing casing is to prevent fluid loss in production zones or aquifers and to prevent contamination of freshwater zones. The process of installing steel casing (a series of pipes that are screwed together end to end), which is then encased in cement, isolates and cushions the wel bore and casing from surrounding geologic formations and aquifers. The amount of each type of casing, depth to which they are installed, and cementing program are reviewed by the BLM prior to APD approval.

Production – Operation and Maintenance

This section describes components of the proposed action that would be required for the operation and maintenance of producing oil and gas wells. This includes facilities such as central tank batteries (CTBs), produced fluid (oil, gas, water) management, compression, work-overs, and completion. Production equipment at well pads is also described. Chevron anticipates drilling until 2033 and that production could continue until the late 2050s; however, this is dependent on funding and drill rig availability

All wells would be produced by gas lift and would not initially require a pumping unit or rotaflex. Gas lift would be accomplished by transporting produced natural gas to a centralized compressor station, where the gas would be dehydrated and compressed. The gas would then be transported via gas lift pipeline to each well pad where a valve and meter skid would control the amount of gas that is sent into the wellbore.

All permanent aboveground structures that would remain longer than six months would be painted a non-reflective BLM Standard Environmental Color, such as Shale Green. The exception would be that the Occupational Safety and Health Act (OSHA) Rules and Regulations would be complied with where special safety colors are required.

All production facilities with the potential to leak or spill oil-produced water, glycol, or other fluids that might be a hazard to public health or safety would be placed within secondary containment structures in accordance with Spill Prevention, Control, and Countermeasures (SPCC) guidelines. Secondary containment structures would consist of earthen containment berms. Secondary containment would be sized to contain a minimum of 150 percent of the storage capacity of the largest tank within the berm. All loading lines would be placed outside the containment berm with the valve protected by a drip bucket.

Well Pads

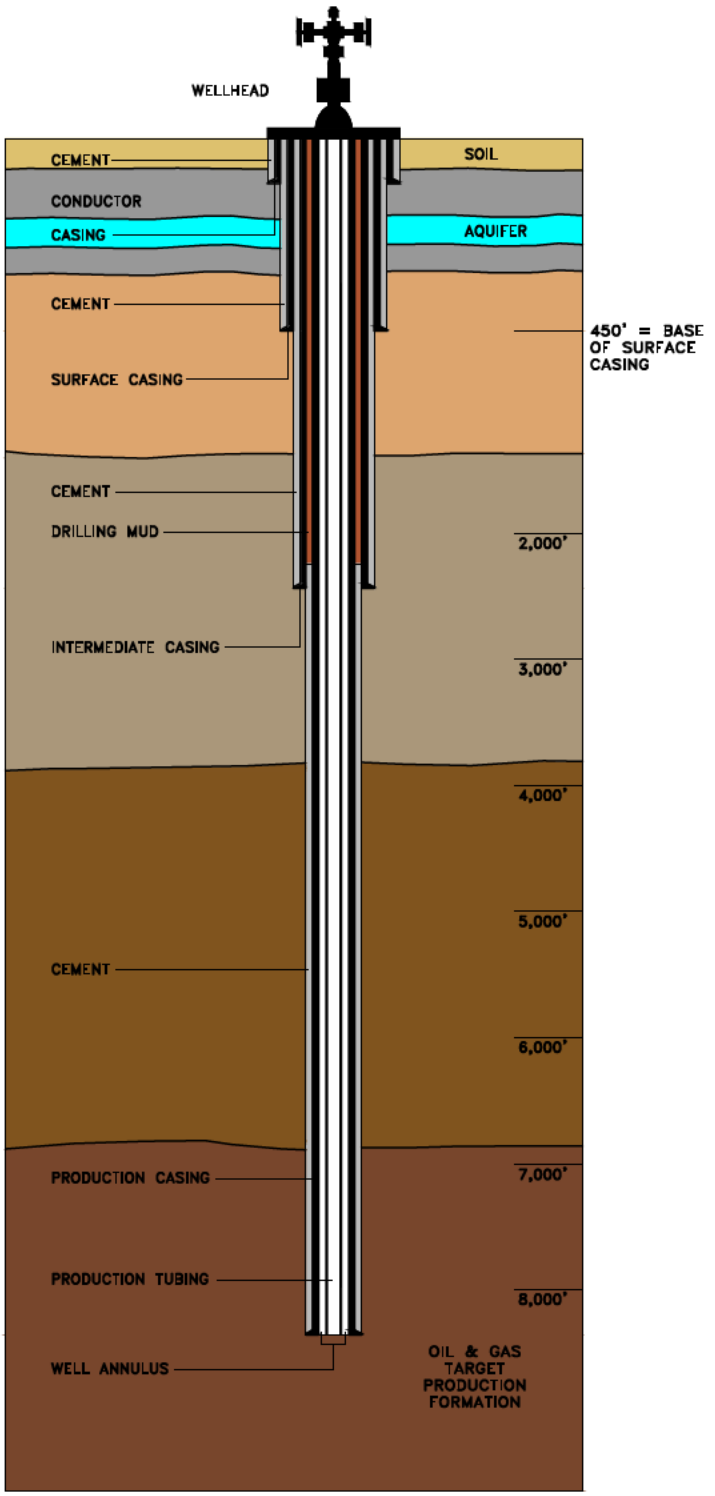
Surface facilities at each well pad location would consist of wellheads, gas lift metering units, and chemical injection equipment. Chemical injection equipment would be used to pump chemicals into flowlines to prevent freezing (e.g., methanol), or to pump chemicals into wellbores for operational purposes (e.g., scale inhibitor, paraffin inhibitor). Temporary equipment, such as sand separators and pressure let-down skids, may be installed during the first six to twelve months of production. No other equipment, including gas handling equipment, would be permanently installed on a well pad until after drilling and completion operations have finished. Telemetry and supervisory control and data acquisition (SCADA) equipment would be used to remotely monitor oil and gas wells and would reduce traffic to and from the well locations in order to minimize impacts on air quality, wildlife, and plants. A pumper truck would periodically visit the pads based upon information gathered from telemetry equipment. The approximate life of a well pad is anticipated to be 30 years.

Existing Facilities

Within the boundary of the HDA, Chevron currently operates two oil and gas facilities on BLM-administered surface lands and two facilities on state surface lands. These facilities would not be used as part of the proposed action as they are not designed for the scale of production envisioned in the MDP. Chevron would decommission these existing facilities as new facilities become operational, pending the approval of commingling agreements. The surface disturbance from the existing facilities would then be remediated or re-purposed.

Proposed Surface Facilities

Table 2.1-7 provides the expected number and pad size for each of the proposed surface facility types described below (with the exception of well pads, which are described above). Locations of these facilities, as proposed in the MDP, are shown on **Figure 2.1-2**. As for well pads, the locations of these facilities as proposed in APDs may move slightly, but would stay within the “MDP Project Area” shown on **Figure 2.1-2**.



NOT TO SCALE

NOTES:

1. Not to scale.
2. Actual depth of casing will depend on well geologic characteristics.
3. Deeper wells may have additional production casing segments of other sizes.
4. Wellhead type shown is for illistration purposes only.
5. Figure modified from ProPublica (https://www.propublica.org/artical/anatomy-of-a-gas-well-426).

CHEVRON HAYHURST

FIGURE 2.1-6
WELL CASING AND CEMENT SCHEMATIC

ANALYSIS AREA: Eddy County, New Mexico

Date: 7/8/2016 | Prepared By: RTS

G:\ENVCAD\COLUMBUS-OH\ACT\B0048783 - CHEVRON HAYHURST\0000\0004\WELLHEAD DETAIL.DWG

This page intentionally left blank.

Table 2.1-7 Proposed Pad Size for Production-Related Surface Facilities

Facility Type	Total Number	Pad Dimensions (feet x feet)[1]	Pad Size (acres)
Centralized Tank Battery	16	500 x 700	8
Compressor Station	7	500 x 700	8
Salt Water Disposal Facility	5	500 x 700	8
Containment Pond	4	710 x 710	12
Water Storage	2	500 x 700	8
Electrical Substation	1	500 x 650	7

Notes:
1 Facility dimensions are for working area only. For the purposes of estimating surface disturbances, each pad was buffered by an additional 55 feet to account for topsoil and spoil storage, cut and fill areas, and other site-specific needs.

Central Tank Batteries

Chevron expects all wells drilled in the HDA to produce oil, water, and gas. Produced oil, water, and gas would flow via buried flowlines from the wells to one of 16 proposed CTB facilities, where oil, water, and gas are separated and treated to meet sales specifications. **Table 2.1-8** and **Figure 2.1-2** detail the location of each CTB. All CTBs would have adequate oil and water tankage to minimize the risk of spills and to provide adequate time for field personnel to respond to production variations. Each CTB facility would have approximately three oil tanks and approximately six to eight water tanks. More oil and water tanks may be required based on site-specific production needs. All tanks located at a CTB would have a capacity of 750 barrels (bbl) and would be installed inside lined berms in accordance with SPCC guidelines. Secondary containment would be sized to contain a minimum of 150 percent of the storage capacity of the largest tank within each berm.

Table 2.1-8 Proposed Central Tank Battery Locations

ID	Township	Range	Section	Quarter-Quarter Section
1	26S	27E	10	NENE
2	25S	27E	9	SWSE
3	26S	27E	9	SWSW
4	25S	27E	35	NWSW
5	25S	27E	17	SENE
6	26S	27E	12	SWNW
7	25S	27E	35	NWSW
8	25S	27E	31	NWNE
9	26S	27E	12	SWNW
10	26S	27E	10	NWNE
11	26S	27E	12	SWNE
12	26S	27E	10	SESE
13	26S	27E	8	SWSE
14	25S	27E	35	NESW
15	25S	27E	16	SWNW
16	25S	27E	31	NWNE

Vapor recovery units (VRUs) would be installed to capture flash gases produced from tanks storing both oil and water. Chevron would install appropriate redundancy in VRU capacity to ensure 99 percent recovery of vapors. VRUs would typically consist of a switch that detects pressure and triggers a compressor, and a scrubber that traps and separates liquids and gas and feeds them to their respective pipelines. Leak detection and repair (LDAR) programs would be implemented at the facilities to minimize the quantity of fugitive emissions from valves and flanges. All production equipment with a chimney, vent, or stack would be fitted with a device, such as an excluder cone or equivalent, to prevent birds from

entering the chimney. Open top tanks or open containments (e.g., containment pans less than 5 bbl in capacity used at chemical tanks) will be netted.

Produced Water

Produced water would be pumped via pipeline to centralized SWD and treating facilities, where it would either be injected into a disposal well via electric pumps or be treated to remove oil, solids, and some dissolved metals for reuse in hydraulic fracturing operations. Once treated, this water would be stored in permanent containment ponds (i.e., "frac ponds"), each sized to hold approximately 770,000 bbl of water. When operational, treatment capacity of the system is anticipated to provide the required volume of water for drilling and completion activities (except freshwater for drilling in karst zones) for all proposed wells. The proposed locations of SWD and containment facilities are detailed in **Table 2.1-9** and **Table 2.1-10**, respectively, and are illustrated on **Figure 2.1-2**.

Table 2.1-9 Proposed Salt Water Disposal Locations

ID	Township	Range	Section	Quarter-Quarter Section
1	26S	27E	2	SESW
2	25S	27E	16	SENW
3	25S	27E	26	SESE
4	26S	27E	12	NWSE
5	26S	27E	2	SESE

Table 2.1-10 Proposed Permanent Containment Pond Locations

ID	Township	Range	Section	Quarter-Quarter Section
1	26S	27E	10	NENE
2	26S	27E	9	SESW
3	25S	27E	18	NENE
4	25S	27E	26	SESE

Notes:
All permanent containment facilities would have a capacity of 770,000 bbl.

Prior to completion of the permanent water recycling system, the containment ponds would be used to store water from other sources. Containment ponds would be designed as "multiwell fluid management pits" in compliance with New Mexico Administrative Code (NMAC) Section 19.15.34 and would include the following design features:

- Berms: Berms shall be sloped at 3:1 both internally and externally. Berm tops would have at least 12 feet of working area and be capable of supporting light vehicle traffic. Berm height, thickness, and depth would be determined based on site-specific information and included in each APD and ROW application (SF-299).
- Liners: Ponds shall be double-lined and have a method of leak detection, typically trenched high-density polyethylene (HDPE) pipe, between liners. An 8-ounce geotextile fabric shall be used to line the soil prior to installation of a secondary (bottom) liner. Primary liner of 60-mil smooth HDPE and secondary liner of 60-mil smooth HDPE shall be installed. Minimum 200-mil geonet shall be installed between the primary and secondary liner to maintain an interstitial space.
- Fencing: Ponds shall have 8-foot game fencing installed around the perimeter, outside of the bottom berm. The fence bottom shall be keyed-in around the perimeter of the pond site and include the use of 2-foot silt fencing to prevent access of smaller animals.
- Wildlife Protection: Typical bird deterrent options include molded decoy owls and noise-making streamers. Wildlife protection measures, including those for migratory birds, shall be monitored at least monthly to ensure deterrents are effective. Additional bird deterrent options include sound-

activated devices that mimic predatory calls. These deterrents would be monitored on a periodic basis and enhanced as necessary to ensure effectiveness.

Until the permanent HDA water disposal and recycling system is available, produced water would be hauled off location in trucks for disposal at a state-approved facility. Chevron may construct up to two water storage facilities if produced water volumes meet or exceed forecasts. Each facility would utilize site-fabricated tanks larger than 3,000 bbl and would minimize the number of 750 bbl water tanks that would need to be installed at each CTB. The water storage facilities would each be approximately 8 acres in size (16 acres total) and would be located in T26S, R27E, Section 2 NWSW and T25S, R27E, Section 17 NE1/4.

Gas and Gas Compression

Gas would be piped to one of seven compressor stations, where it would be compressed to 1,200 pounds per square inch gauge (psig), dehydrated to meet sales specifications and to reduce the risk of methane hydrate formation, and sold into a third-party gas pipeline system. The location of each compressor station is detailed in **Table 2.1-11** and illustrated on **Figure 2.1-2**. If gas-driven engines are used for compression, all engines would be designed to meet Tier 4 emissions standards. Chevron may elect to use electrically-driven compression rather than gas-driven compression. The surface disturbance for an electrical substation (which involves slightly higher surface impact) is included in the proposed action (**Table 2.1-1**). If constructed, the electrical substation would be located in T25S, R27E, Section 17 NE1/4. Prior to sales, some of the gas would be diverted for use in artificial lift operations at each wellhead. Lift gas would be metered in accordance with the Federal Onshore Oil and Gas Order No. 5 prior to injection into each well's production tubing to ensure accurate production royalty accounting.

Table 2.1-11 Proposed Gas Compressor Station Locations

ID	Township	Range	Section	Quarter-Quarter Section
1	26S	27E	10	SENE
2	25S	27E	16	SENW
3	26S	27E	8	NENE
4	25S	27E	35	NWSE
5	25S	27E	17	SWNE
6	26S	27E	12	SWNE
7	25S	27E	31	NWNE

Oil

Oil would be sold via Lease Automated Custody Transfer (LACT) to a third-party oil pipeline system, although oil may be trucked during upset conditions or periods of pipeline curtailment.

Work-overs or Recompletions

Periodically, the work-over or recompletion of wells might be required to ensure that efficient production is maintained. Work-overs can include repairs to wellbore equipment (casing, tubing, valves, rods, or pumps), a wellhead, or production facilities. Cleaning or swabbing the wellbore may also be necessary for efficient production. Repairs would usually be completed during daylight. The frequency of this work cannot be accurately predicted because the need for work-overs varies from well to well. Recompletion of horizontal hydraulically-fractured wells is not anticipated.

Plugging, Abandonment, and Reclamation

New non-producing wells would be plugged, abandoned, and reclaimed within 90 days of well completion, weather permitting. Upon abandonment, each borehole would be plugged, capped, and its related surface equipment removed. Subsurface pipelines would be purged and plugged at specific intervals. A Sundry Notice would be submitted by Chevron to the BLM proposing the engineering,

technical, and/or environmental aspects of final plugging and abandonment. This notice would include final reclamation procedures and mitigation measures, and BLM standards for plugging would be followed.

Interim Reclamation

The objectives of interim reclamation, which reestablishes vegetation, ecological function, and other natural resource values during the productive life of a well pad, are to restore vegetative cover and a portion of the landform sufficient to maintain healthy, biologically active topsoil; to control erosion and sediment transport; and to minimize loss of habitat, forage, and visual resources throughout the project life. Chevron would complete interim reclamation of a well pad within six months following the completion of the last well on the pad. Following interim reclamation, Chevron would submit the required Sundry Notice-Sundry Report (Form 3160-5) to the CFO, informing the BLM that reclamation occurred. The following best practices will be followed during interim reclamation and discussion with the BLM CFO during the APD process:

- Within six months after a well pad has been placed on production, Chevron would implement the best strategies to reduce the size of the location that were discussed with contact BLM Surface Management Specialists during the APD submittal.
- Within 30 days of completion of the last well on a pad, the well location and surrounding areas would be cleared of, and maintained free of, all materials, trash, and equipment not required for production. A plan would be submitted, with the APD, showing where interim reclamation would be completed in order to allow for safe operations and protection of the environment outside of the drilled well, and would follow BMPs found in the BLM Gold Book (BLM 2007).
- In areas planned for interim reclamation, all surfacing material (e.g., caliche) would be removed and recycled to repair or build roads and well pads.
- The areas planned for interim reclamation would then be recontoured to the original contour if feasible, or if not feasible, to an interim contour that blends with the surrounding topography as much as possible. Where applicable, the fill material of the well pad would be backfilled into the cut to bring the area back to the original contour. The interim cut and fill slopes prior to re-seeding would not be steeper than a 3:1 ratio, unless the adjacent native topography is steeper. Note: constructed slopes may be much steeper during drilling, but would be recontoured to the above ratios during interim reclamation.
- Topsoil would be evenly respread and revegetated over the entire disturbed area not needed for all-weather operations, including cuts and fills. To seed the area, a BLM-approved seed mixture, free of noxious weeds, would be used.
- Erosion controls would be used on the disturbed areas to control erosion, runoff, and siltation of the surrounding area.
- Interim reclamation would be monitored periodically to ensure that vegetation has reestablished.

Final Reclamation

The long-term objective of final reclamation is to return the land, following authorized use, to a condition approximating that which existed prior to disturbance. This includes reclaiming of the landform, natural vegetative community, hydrologic systems, visual resources, and wildlife habitats.

A well pad that no longer has a producing well would undergo final reclamation within six months following plugging and abandonment of the final well on that pad. Buried pipelines would be purged and abandoned in place and not removed, and any remaining surface disturbance associated with pipelines would be reclaimed to final reclamation standards at the time of installation. Following abandonment of the final well, all associated overhead powerlines and access roads no longer required for operations and maintenance would be removed and reclaimed as required by the BLM.

Prior to final reclamation of a well pad, Chevron would submit a Sundry Notice – Notice of Intent detailing the reclamation plan (including the appropriate seed mixture to be used) and follow any Conditions of Approval added to the plan.

Prior to re-contouring and re-seeding the well pad, Chevron would complete the following:

- All equipment, facilities, and trash would be removed from the location.
- All surfacing material would be removed and returned to the original mineral pit or recycled to repair or build roads and well pads.
- Each borehole would be plugged, capped, and its related surface equipment removed.
- Subsurface pipelines would be purged and plugged at specific intervals.
- Dry hole markers would be installed subsurface, to prevent their use as perching sites by raptors.

Re-contouring for final reclamation would consist of returning the pad, material storage piles, cut and fill slopes, and stormwater control features to natural contours that blend with adjacent undisturbed areas, as specified in the final reclamation plan or final reclamation plat approved by the BLM. Requirements for seedbed preparation, soil amendments, seed, seeding procedures, mulching, erosion control fencing, security, and monitoring would be as specified for interim reclamation.

Water Supply and Management

Chevron expects that a variety of water sources would need to be utilized over the life of the project for drilling, completion, dust control, and hydrostatic testing. A number of potential water sources are outlined in **Table 2.1-12** and **Table 2.1-13**. Chevron may include additional water sources in subsequent APDs and would be analyzed through a separate NEPA analysis. The MDP does not propose completion of any new water wells. Any such wells would be applied for and evaluated separately under NEPA. Water obtained from the sources below would be obtained from existing, permitted water wells.

Table 2.1-12 Water Sources for Drilling and Completion

Source	Location[1]	Quality (mg/L TDS)	Transport Method
Local groundwater	Within 15 miles of HDA	Zero – 5,000	Pipeline or Truck
Recycled produced water	Within HDA	150,000 – 210,000	Pipeline

Notes:
1 Locations of potential water wells to be used under the proposed action are included in MDP Appendix B.
Abbreviations: mg/L = milligrams per liter; TDS – total dissolved solids

Table 2.1-13 Vendors Potentially Supplying Local Groundwater

Vendor	Mailing Address
Gregory Rockhouse Ranch, Inc.	1108 West Pierce Street, Carlsbad, NM 88220
MMX Excavating, Inc.	2373 Pecos Highway, Carlsbad, NM 8820
Wolfcamp Water Partners	4800 Bryan Irvin Court, Fort Worth, TX 76107
XRI Blue	415 West Wall Street #130, Midland, TX 79701

Notes:
1 Actual location of water source is not reflected in mailing address; water would not be transported from Fort Worth or Midland, TX.

Drilling and completion of each well are estimated to require 90,000 to 380,000 bbl of water. Of this, up to 7,000 bbl of freshwater per well may also be needed for karst zone drilling requirements (i.e., a maximum total of approximately 3,050,000 bbl). Chevron estimates that 2,000,000 bbl of freshwater would be required to construct all pads and roads under the proposed action. An additional 1,700,000 bbl of freshwater would be required for dust control during construction and operations and 70,000 bbl of

freshwater would be required to hydrotest all pipelines and flowlines. Once all wells are in the production phase, freshwater would only be used for dust control.

The remainder of drilling and completion water would be brackish, produced, or recycled. Chevron expects that all non-fresh drilling and completion water for oil and gas wells would be supplied by the project water recycling system. Drilling and completion water for the initial SWD well would be obtained from local groundwater sources. The water recycling system would be operational prior to drilling the first oil and gas wells. Chevron expects to recycle produced water from currently producing wells within the HDA and to utilize the recycled water for drilling and completion operations for the initial wells in APD Groups 1 and 2. Recycled produced flowback water from these initial wells would then be used to drill and complete subsequent wells. As operations expand to additional well pads, additional recycling units would be constructed adjacent to proposed containment ponds locations (**Figure 2.1-2** and **Table 2.1-10**).

During the well drilling and completion process, water would be transported to each well location by temporary 10-inch-diameter, expanding surface-laid pipelines installed along the edge of the access roads or cross country. Chevron would secure all necessary ROWs prior to laying of temporary surface lines. All temporary surface lines would be removed within 30 days following last use.

Waste Management

Wastes associated with the proposed action may include produced water, garbage, sewage, drill cuttings, water recycling wastes, and other waste materials associated with drilling and completion. The following measures are proposed regarding handling waste, including those for hazardous materials management:

- Chevron would use a closed loop drilling system (constructed, maintained, and operated in accordance with rules and regulations of the New Mexico Oil Conservation Division [NMOCD] [Pit Rule 19.15.17 NMAC]) to capture drill cuttings and to recycle drilling mud. Drill cuttings, drilling fluids, and produced oil and water would be stored in steel tanks, trucked to an NMOCD-approved disposal site (**Table 2.1-14**), and disposed of properly. Additional disposal sites may be included in subsequent APDs.
- Produced water would be transported via truck outside of the HDA for disposal at a state-approved facility, or would be transported via pipeline to SWD facilities, where it would either be injected into a disposal well or be treated to remove oil, solids, and some dissolved metals for reuse in hydraulic fracturing operations.
- Garbage, trash, and other waste materials would be collected in portable, self-contained, and fully enclosed trash cages during drilling and completion. Upon completion of operations, or as needed, the accumulated trash would be disposed of at a state-approved facility. No trash would be burned or buried on location.
- Immediately after the removal of the drilling rig, all debris and other waste materials not contained in the trash cage would be cleaned up and removed from the well location.
- Self-contained chemical toilets would be provided for human waste. Upon completion of operations, or as needed, the toilet holding tanks would be pumped and the contents thereof disposed of in the nearest approved sewage disposal facility.
- Hazardous materials would be handled in the following manner:
  - Project-related activities involving hazardous materials would be conducted in a manner that minimizes environmental impacts. A file would be maintained containing current Material Safety Data Sheets (MSDSs) for all chemicals, compounds, and/or substances used in the course of construction, drilling, completion, production, and reclamation.
  - Spills of any potentially hazardous substance would be reported immediately to the BLM and other responsible parties. Spills would be mitigated immediately. Appropriate measures for

cleanup would be implemented, and spilled material removed and transported to an approved disposal site according to the SPCC plan. Any release of toxic substance (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR, Part 117 would be reported per CERCLA Section 102b. Spills or leakages of oil, gas, produced water, toxic liquids, or other materials would be reported in accordance with 43 CFR 3162.5-1(c). Copies of any report to any federal agency or state government as a result of a reportable release/spill of any toxic substances would be furnished to the BLM, concurrently with the filing of the repots to any federal agency or state government.

Table 2.1-14 Approved Drilling Waste Disposal Sites

Nearest City	Disposal Facility	Address
Carlsbad	R360 – Halfway	6601 Hobbs Highway, Carlsbad, NM
Eunice	Sundance Services	5 miles east of Eunice, NM, on Highway 18 and Wallach Lane
Seminole, TX	Permian Disposal	587 US Highway 385 South, Seminole, TX

Schedule

The schedule of construction for the proposed action has yet to be determined. However, activity is expected to begin within six months of obtaining all BLM and other federal, state, and local approvals. Chevron expects to construct between three and seven pads annually and to drill and complete between 12 and 28 wells annually, but could be more. Chevron may delay activity and control the pace of its operations according to lease obligations and market conditions.

Workforce, Access, and Traffic

Chevron estimates that 18 workers (nine per shift) would be required per drilling rig, which would drill 24 hours per day and seven days per week. Chevron also estimates that a peak of 70 workers (35 per shift) would be required per pad during completion operations, which would occur 24 hours per day and seven days per week. Additional personnel would be required for facility construction, pipeline construction, commissioning, and operations. **Table 2.1-15** provides an estimate of peak construction and operations workforces. Personnel may be housed at temporary, centralized housing facilities or at the drilling location (T26S, R27E, Section 2 SWSE). If constructed, the centralized housing facilities would be removed and reclaimed following drilling and completion of the final well, or earlier.

Table 2.1-15 Estimated Daily Peak Construction and Operations Workforces

Workforce Category	Number of Workers at Peak
Construction	
Well pad construction	4
Well drilling	72[1]
Well completion	70[2]
Interim reclamation	2
Road/pipeline/facility construction	20
Construction Total	**168**
Operations	
Commissioning	6
Production operations and maintenance	8
Compression operations and maintenance	10
Operations Total	**24**

Notes:
1 Assumes a maximum of four rigs operating at one time.
2 Assumes one completions spread – may temporarily increase to two spreads if required by logistics.

All access into the HDA would be via White City Road (CR 724). This county road can be accessed from Pecos Highway (NM 285) either from Carlsbad, New Mexico from the north or Pecos, Texas from the south.

Substantial traffic is not expected as part of the proposed action. Light vehicles for construction and operations are expected to travel to and from the HDA regularly from Carlsbad, Eunice, or Jal, New Mexico or Pecos, Texas, or other towns. Heavy vehicles (e.g., drilling rigs, hydraulic fracturing spreads, cranes, and facility equipment delivery trucks) would travel to and from the HDA sporadically during mobilization and demobilization. Heavy vehicle traffic would be routed away from the Village of Loving, New Mexico so as to avoid the school zone near the Loving Municipal Schools campus on Pecos Highway (NM 285).

Design Features

Design features are those specific means, measures, or practices that make up the proposed action. Additional design features may be added as needed, particularly after APD submittal and onsite review. Regulations, standard operating procedures, stipulations, operator-committed measures, and BMPs are usually considered design features. For example, if the proposed action sites a reserve pit for drilling fluids away from areas of shallow groundwater, this is a design feature, not mitigation. Design features are incorporated into the proposed action to reduce or avoid adverse effects.

Because the formulation of alternatives and the impact analysis is often an iterative process, additional means, measures, or practices can be identified through the impact analysis process. If any means, measures, or practices are not incorporated into the proposed action, they are considered mitigation measures. Mitigation measures, if needed, are listed at the end of each environmental consequence section in Chapter 3 of this EA. Mitigation measures are added only if the design features do not reduce or avoid adverse effects to protected resources.

Some of the more relevant design features and environmental protection measures that would reduce or eliminate adverse effects after the initial formulation of alternatives are discussed below. If deviation from these design features is necessary, Chevron would include a request for deviation as part of the APD associated with the deviation. Additional design features identified for the 12 APDs submitted with the MDP are described individually for each APD.

Archaeological, Paleontological, and Historical Sites

- In the event that prehistoric or historic archaeological material or bones are uncovered during construction or earth-disturbing activities, Chevron shall cease work immediately, protect the remains from further disturbance, and notify the appropriate land owner. On BLM land, if skeletal remains or associated funerary objects are found, Chevron shall immediately cease activities in the area of discovery, protect the remains, and notify the BLM pursuant to 43 CFR Section 10.5 (e) within 24 hours of discovery. The BLM will determine the nature and extent of the remains and determine appropriate treatment of the remains in consultation with tribes under the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA). Construction will resume only after clearance is provided by the BLM.
- If bones are found on State Trust Land, Chevron shall immediately notify local law enforcement and the Office of the Medical Investigator pursuant to 18-6-11.2C (Cultural Properties Act NMSA 1978). In accordance with 18-6-11.2C and/or 36 CFR 800 et seq. implementing Section 106 of the National Historic Preservation Act of 1966 (NHPA) as amended (54 USC 306108 et seq.), and the NAGPRA (25 USC, 3001, et seq.), Chevron shall notify the State Historic Preservation Office (SHPO) or the State Archaeologist immediately. The New Mexico State Land Office (SLO) and the SHPO will determine the necessary steps to evaluate significance and document, protect, or remove the material or remains, in compliance with the law. Construction will resume only after clearance is provided by the SLO and the SHPO.

- If the inadvertent discovery is composed of archaeological material not associated with skeletal remains, Chevron shall cease work immediately, protect the find, and notify the relevant land management agency or owner pursuant to the Antiquities Act of 1906 (34 Statute 225; 16 USC 431-433). Construction will resume only after clearance is provided by the land management agency.
- Indirect impacts will be controlled by limiting access to cultural resources, educating employees about the significance of cultural resources, and implementing a strict management policy restricting the casual collection of artifacts from the project area. All construction and monitoring personnel will be briefed on protective measures implemented for cultural resources and the importance of resource preservation.

Chemical and Fuel Secondary Containment and Exclosure Screening

- Chevron shall install and maintain an impervious secondary containment system for any tank or barrel containing hazardous, poisonous, flammable, or toxic substances sufficient to contain the contents of the tank or barrel and any drips, leaks, and anticipated precipitation.
- Chevron would dispose of fluids within the containment system in accordance with state law, and will not drain the fluids to soil or ground.
- Chevron would design, construct, and maintain all secondary containment systems to prevent wildlife and livestock exposure to harmful substances by installing effective exclosure systems such as fencing, netting, expanded metal mesh, lids, and grate covers (using a maximum netting mesh size of 1.5 inches).

Communitization Agreement

- Communitization agreements would be required for some wells. When required, Chevron shall submit the communitization agreement to the CFO when the APD is submitted.

Construction Notification

- Chevron shall notify the CFO at least three days prior to commencing construction of an access road or pad, and shall have the approved MDP, APD, and Conditions of Approval onsite and shall make them available upon request by the Authorized Officer.

Dark Skies

- Chevron would install lighting on fixed equipment and surface facilities in a way that minimizes light pollution and protects visual resources while ensuring adequate light for safe and reliable production operations.

Enclosure Fencing

- Chevron shall install and maintain enclosure fencing for all open well cellars before and after drilling operations until the pit is free of fluids and backfilling has been initiated.

Flaring

- Chevron would not flare produced or recycled gas except for instances where flaring is necessary to protect operating personnel or to ensure the safe operation of surface facilities.

Karst

- A 200-meter avoidance buffer will initially be placed around karst features. In cases where the 200-meter karst feature avoidance buffer is not reasonably achievable, karst features may be avoided by a lesser distance if deemed appropriate in consultation with BLM Karst Specialists.
- During construction, Chevron would halt all activities and immediately notify the BLM in the event that any underground voids are encountered.
- During construction, Chevron would not use blasting as a construction method.

- During construction, Chevron would berm all pads to minimize the effects of any spilled contaminant.
- While drilling, Chevron would use a closed mud system using steel tanks with all fluids and cuttings hauled off.
- While drilling, Chevron would use freshwater where cave or karst features are expected to prevent contamination of freshwater aquifers.
- While drilling, Chevron would only directional drill after at least 100 feet below the cave occurrence zone.
- While drilling, Chevron would log and report all lost circulation zones in the drilling report.
- During production operations, Chevron would install automatic shutdown systems, check valves, or similar systems on pipelines and tanks to minimize the effects of line failures.
- During production operations, Chevron would perform annual pressure monitoring on well casing and would undertake remedial action if any casing failures are identified.

Netting of Open-Topped Tanks.

- Chevron shall net, screen, or cover open-topped tanks until the tanks are removed or until the tanks no longer contain the substances that could be harmful to wildlife or livestock. If netting is used, Chevron would cover and secure the open portion of the tank to prevent wildlife entry. A maximum netting size of 1.5 inches would be used, and the netting would not be in contact with fluids and would not have holes or gaps.

Noise Control

- Chevron would install exhaust mufflers on fixed equipment so as not to exceed 75 decibels measured at 30 feet from the source of the noise.

Noxious Weeds

- Chevron would use appropriate weed control methods (per the Authorized Officer) on disturbed land where noxious weeds exist, including roads, pads, associated pipeline corridors, and adjacent lands affected by the establishment of weeds due to Chevron's action.

Open-Vent Exhaust Stack Exclosures

- Chevron would construct, modify, equip, and maintain all open-vent exhaust stacks on production equipment to prevent birds and bats from entering, and to discourage perching, roosting, and nesting. Exclosure systems would be in the shape of a cone.

Painting Requirement

- Chevron would paint all aboveground structures that are not subject to safety requirements a flat non-reflective paint color, Shale Green from the BLM Standard Environmental Color Chart (CC-001: June 2008). Exceptions would apply where special safety colors are required by OSHA.

Range Features, including Fences and Cattle Guards

- Chevron would avoid or pay to relocate structures that provide water to livestock, such as windmills, pipelines, drinking troughs, and earthen reservoirs.
- Where entry is granted across a fence line, Chevron would brace the fence and tie off on both sides of the passageway with H-braces prior to cutting. A wire gate or appropriately sized cattle guard would be installed in the fence opening during infrastructure installation to prevent livestock from crossing the fence and would remain in place during construction inactivity.

- Chevron would repair or replace new or existing cattle guards on the route if they are damaged or have deteriorated beyond practical use. Once the work is completed or the road is abandoned, Chevron would restore the fence to its prior condition, or better.
- Chevron would notify the private surface landowner or the grazing allotment holder prior to crossing any fences or livestock water pipelines.

Topsoil

- Chevron would strip the top portion of the soil (root zone – typically 6 inches in depth) from the entire ROW, road, or pad area and stockpile the topsoil, where possible, along the uphill edge of the ROW, road, or pad as depicted in the MDP SUPO. Other subsoil would be completely segregated from the topsoil stockpile. Stockpiled topsoil would be redistributed over the interim reclamation areas. Topsoil would not be used for berming the pad or facilities. For final reclamation, topsoil would be spread over the entire pad area for seeding preparation. Large rocks or subsoil clods shall be buried within the approved area for interim reclamation or scattered to match surrounding baseline surface texture.
- Blading would not be conducted in areas of gypsum soils.

Watershed

- Chevron would berm the entire well pad to prevent oil, salt, and other chemical contaminants from leaving the well pad. No water flow from the uphill side of the pad would be allowed to enter the well pad.

Well Pad Surfacing

- Chevron would surface roads and well pads with caliche, crushed gravel, or river rock which would be removed at the time of reclamation. Well pads would be constructed in a manner that creates the smallest possible surface disturbance, consistent with safety and operational needs.

Wildlife

- Chevron would protect raptor nests on special, natural habitat features – such as trees, large brush, cliff faces, and escarpments – by not allowing surface disturbance within up to 200 meters of active nests or by delaying activity for up to 90 days, or a combination of both.
- Prior to initiating construction activities, Chevron or the BLM would perform a wildlife survey to identify raptor nests in the proximity and to determine if the raptor nests are active. Chevron would contact a BLM Wildlife Biologist if any raptor nests within 200 meters of the construction site are active.
- Chevron would only consider construction within 200 meters of a raptor nest if the nest is inactive, the proposed activity is of short duration (e.g., habitat enhancement projects, fences, pipelines), and if construction would not result in continuing activity in proximity to the nest.

APD Group 1

Six APDs submitted with the MDP are for wells that would be drilled from the HH SO 8 P2 well pad. These wells and associated infrastructure would share the same well pad, access road, CTB, and containment pond (**Figure 2.1-3**). Total surface disturbances for APD Group 1 are estimated to be 50.9 acres (45.0 on BLM-administered surface; 5.9 on state surface). Following interim reclamation, long-term disturbances would be 30.1 acres (29.8 on BLM-administered surface; 0.3 on state surface). Surface disturbances for APD Group 1 are summarized in **Table 2.1-2**. These disturbances are included in the MDP estimates summarized in **Table 2.1-1** and are not additive to those totals. The well pad, tank battery, and containment pond would be located on BLM-administered surface. Access roads, pipelines, flowlines, and powerlines would be constructed on a combination of BLM and state lands. An existing well pad, containment pond, and tank battery are present in T26S, R27E, Section 16. The existing lease road for that pad would be utilized for APD Group 1.

Proposed Well Pad

To drill the proposed wells with a closed loop system, a 525-foot by 330-foot surfaced well pad would be needed, with additional surface requirements for topsoil and spoil storage and areas of cut and fill. Because six wells would be drilled from this well pad, surface dimensions are greater than for four well pads described previously in this section. Chevron would construct the well pad in accordance with the MDP SUPO. After the sixth well is drilled and completed on the well pad, the proposed well pad would be downsized to a 200-foot by 325-foot surfaced pad. All areas not needed for production would be reclaimed in accordance with the interim reclamation components of the MDP SUPO.

Proposed Access Roads

Chevron proposes to construct an access road for the well pad and separate access roads for the CTB and water containment pond. The well pad access road would connect an existing lease road with the northeast corner of the well pad. The well pad access road would be 5,538 feet long (4,384 feet on BLM surface; 1,154 feet on state surface) and would require approximately 3.6 acres of surface disturbance for construction, including roadside ditches (approximately 2.8 acres on BLM surface; 0.8 acres on state surface). Combined, the CTB and containment pond access roads would be 1,787 feet long (all BLM surface) and would require approximately 1.1 acres of surface disturbance for construction. All access roads would use waterbars, lead-off ditches, and low-water crossings for water control and would not require the installation of culverts.

Proposed Electrical Lines

Chevron proposes to construct a total of 7,285 feet of electrical utility lines parallel to the access roads. The electrical lines would connect with an existing four-wire electrical line at the existing lease road in T26S, R27E, Section 16, NWNW. The electrical lines would be constructed within the same disturbance corridor as the flowlines and pipelines. Surface disturbance calculations incorporate all components within the corridor and assume that the entire corridor would be disturbed (**Table 2.1-4**).

Proposed Flowlines and Pipelines

Chevron proposes to construct multiple flowlines and pipelines as summarized in **Table 2.1-5**. As described for the MDP, these would be constructed within a shared corridor, with safety offsets between lines. Proposed pipelines include a produced fluids flowline cluster (high-pressure gas, low-pressure gas, oil, water), gas lift flowline, SWD water flowline, and frac water flowline. The maximum combined length of buried flowlines and pipelines would be approximately 9,492 feet (6,960 feet on BLM-administered surface; 2,532 feet on state surface). Total disturbance for the pipelines would be 22.6 acres (16.7 acres on BLM-administered surface; 5.9 acres on state surface). The final permanent water recycling and disposal system described for the MDP would be determined prior to constructing water transfer pipelines. Until that determination has been made, produced water would be hauled off location in trucks. The gas purchaser pipeline is already in place at the existing tank battery.

Proposed Central Tank Battery

The CTB for APD Group 1 would be located in T26S, R27E, Section 9, SW1/4 approximately 0.9 miles east of the proposed well pad location. The CTB would be 550 feet by 750 feet (including areas for topsoil and spoil storage and areas of cut and fill) and would occupy approximately 9.5 acres of BLM-administered surface. The CTB would be designed and constructed as described for the MDP.

Proposed Water Containment Pond

One containment pond for water to be used in hydraulic fracturing operations would be located in T26S, R27E, Section 9, SW1/4 approximately 1.0 mile east of the proposed well pad location. The pond would require a construction footprint of 760 feet by 760 feet and occupy approximately 13.3 acres of BLM-administered surface. The containment pond would initially be used to hold freshwater brought to the site

by truck and would be used to store recycled water after the water recycling system has been constructed and associated water transfer pipelines (see above) have been constructed.

APD Group 2

Six APDs submitted with the MDP are for wells that would be drilled from the HH SO 10 P3 well pad. These wells and associated infrastructure would share the same well pad, access road, CTB, compressor station, and containment pond (**Figure 2.1-4**). Total surface disturbances for APD Group 2 are estimated to be 55.0 acres (50.3 acres on BLM-administered surface; 4.7 acres on state surface). Following interim reclamation, long-term disturbances would be 32.8 acres (32.6 acres on BLM-administered surface; 0.2 acres on state surface). Surface disturbances for APD Group 2 are summarized in **Table 2.1-2**. These disturbances are included in the MDP estimates summarized in **Table 2.1-1** and are not additive to those totals. The well pad, tank battery, and containment pond would be located on BLM-administered surface. Access roads, pipelines, flowlines, and powerlines would be constructed on a combination of BLM and state lands.

Proposed Well Pad

To drill the proposed wells with a closed loop system, a 580-foot by 330-foot surfaced well pad would be needed, with additional surface requirements for topsoil and spoil storage and areas of cut and fill. Because six wells would be drilled from this well pad, surface dimensions are greater than for four well pads described previously in this section. Chevron would construct the well pad in accordance with the MDP SUPO. After the sixth well is drilled and completed on the well pad, the proposed well pad would be downsized to a 200-foot by 325-foot surfaced pad. All areas not needed for production would be reclaimed in accordance with the interim reclamation components of the MDP SUPO.

Proposed Access Roads

Chevron would need to construct an access road for the well pad as well as separate access roads for the CTB, compressor station, and water containment pond. The well pad access road would connect the existing Roadrunner Road with the southern boundary of the well pad. The well pad access road would be 542 feet long (all BLM surface) and would require approximately 0.3 acres of surface disturbance for construction. The other access roads would intersect with Whites City Road. Combined, the CTB, compressor station, and containment pond access roads would be 2,116 feet long (all BLM surface) and would require approximately 1.2 acres of surface disturbance for construction. All access roads would use waterbars, lead-off ditches, and low-water crossings for water control and would not require the installation of culverts.

Proposed Electrical Lines

Chevron would need to construct a total of 8,642 feet of electrical utility lines parallel to the access roads. The electrical lines would connect with an existing four-wire electrical line at Whites City Road. The electrical lines would be constructed within the same ROW as the flowlines and pipelines and would not represent additional surface disturbance (**Table 2.1-4**).

Proposed Flowlines and Pipelines

Chevron would need to construct multiple flowlines and pipelines as summarized in **Table 2.1-5**. As described for the MDP, these would be constructed within a shared corridor, with safety offsets between lines. Proposed pipelines include a produced fluids flowline cluster (high-pressure gas, low-pressure gas, oil, water), gas lift flowline, SWD water flowline, and frac water flowline. The maximum combined length of buried flowlines and pipelines would be approximately 8,440 feet (6,504 feet on BLM-administered surface; 1,936 feet on state surface). Total disturbance for the pipelines would be 19.8 acres (15.3 acres on BLM-administered surface; 4.7 acres on state surface). The final permanent water recycling and disposal system described for the MDP (including location of SWD facilities connected to APD Group 2) would be determined prior to constructing water transfer pipelines. Until that determination has been

made, produced water would be hauled off location in trucks. The gas purchaser pipeline is already in place at the existing tank battery.

Proposed Central Tank Battery

The CTB for APD Group 2 would be located in T26S, R27E, Section 10, NW1/4, approximately 0.3 miles southeast of the proposed well pad location. Surface requirements for a combined CTB and compressor station pad would be 1,100 feet by 600 feet (including areas for topsoil and spoil storage and areas of cut and fill) and would occupy approximately 8.0 acres of BLM-administered surface. The CTB would be designed and constructed as described for the MDP.

Proposed Compressor Station

The compressor station for APD Group 2 would be located immediately south of the proposed CTB pad. The compressor station would occupy approximately 3.4 acres of the combined CTB and compressor station pad, all of which would be located on BLM-administered surface. The compressor station would be designed and constructed as described for the MDP. Once necessary pipelines are constructed, this compressor station would also serve APD Group 1.

Proposed Water Containment Pond

One containment pond for water to be used in hydraulic fracturing operations would be located in T26S, R27E, Section 10, NW1/4, approximately 0.5 miles southeast of the proposed well pad location. The pond would require a construction footprint of 760 feet by 760 feet and occupy approximately 13.3 acres of BLM-administered surface. The containment pond would initially be used to hold freshwater brought to the site by truck and would be used to store recycled water after the water recycling system has been constructed and associated water transfer pipelines (see above) have been constructed.

2.2. No Action

The BLM NEPA Handbook (H-1790-1; BLM 2008a) states that for EAs for externally initiated proposed actions, the no action alternative generally means that the proposed activity would not take place. This option is provided in 43 CFR 3162.3-1 (h) (2). This alternative would deny the approval of the proposed MDP. Under the no action alternative, the coordinated exploration of the HDA area proposed by Chevron would not be authorized by the BLM. The BLM would consider APDs and other authorizations within the HDA on a case-by-case basis outside the scope of this EA. Similar design features would likely be incorporated on a case-by-case basis and the same mitigation measures would be required. However, approval of wells on a case-by-case basis may result in separate infrastructure being constructed for individual wells, which would increase surface disturbance and lead to greater effects to the environment and resources.

Under the no action alternative, the proposed action would not be completed; no new oil and gas wells would be constructed, drilled, completed, operated, plugged, or abandoned and no access roads or other infrastructure would be constructed or upgraded. Therefore, there would be no new impacts to natural or cultural resources. The no action alternative would result in the continuation of the current land and resources uses in the project area and is used as the baseline for comparison of environmental effects of the analyzed alternatives.

2.3. Alternatives Considered but Eliminated from Detailed Study

All areas of proposed surface disturbance for the proposed action were inspected to ensure that potential impacts to natural and cultural resources would be minimized through the implementation of mitigation measures. These measures for all resources potentially impacted are described in Section 3 of this EA. Therefore, no additional alternatives other than those listed above and below have been considered for this project.

One alternative was considered, but eliminated from further consideration. This alternative would not approve road construction along 4,200 feet of existing disturbance in T25S, R27, Section 26. Chevron proposes this road to connect the northern portion of the HDA (T25S, R27E, Sections 16-20 and 30) with leases to the south. Use of the proposed road would reduce routine operational traffic passing through southern portions of the HDA, including along Whites City Road and portions of Roadrunner Road. The proposed road would be constructed in an area that is currently disturbed from an existing overhead powerline and buried water line. No significant natural or cultural resource constraints were identified in the proposed area during baseline surveys (Arcadis 2016a). Overall, the alternative is substantially similar to the proposed action and would have similar effects as the proposed action. Therefore, this alternative was not carried forward for analysis.

This page intentionally left blank.

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section describes the affected environment and the environmental consequences. The affected environment varies for each resource. Both the nature of the resource and components of the proposed action define this variation. The project area shown on **Figure 2.1-1** and many of the figures in Section 3 encompass the proposed action. The project area is larger than the proposed action. In addition, individual resource sections in this document may discuss an analysis area that is larger than the project area. The analysis area defined for a given resource consists of areas of potential direct disturbance in the project area as well as adjacent areas of indirect effects. For some resources, such as geology, soils, and vegetation, the affected area is the physical location and immediate vicinity of the areas that the proposed action would disturb. For other resources, such as air resources, the affected environment is larger (e.g., airshed).

Environmental effects are described in terms of context (site-specific, local, or regional effects), duration (short- or long-term), and intensity (negligible, minor, moderate, or major).

Duration of effects is defined as:

- Short-term - Short-term effects are defined as those effects that would not last longer than the life of the proposed action, including initial reclamation.
- Long-term - Long-term effects are effects that would remain following completion of the proposed action.

The thresholds of change for the intensity of an impact are defined as:

- Negligible - the impact is at the lowest levels of detection.
- Minor - the impact is slight, but detectable.
- Moderate - the impact is readily apparent.
- Major - the impact is a severe or adverse impact or of exceptional benefit.

With the exception of the 12 APDs filed with the MDP, due to the uncertainty of the number of wells per pad and alignments for roads and pipelines, the disturbance areas used in the environmental effects discussion are estimates only and were developed based on the assumption that the disturbance area would need to be large enough to reasonably accommodate future permitted construction or realignments. Actual and specific well pad size, pipeline width, or road width will be determined in future APDs or ROW applications and analyzed in subsequent NEPA actions, such as a DNA.

During the analysis process, the interdisciplinary team considered several resources and supplemental authorities. The interdisciplinary team determined that the resources discussed below would be affected by the proposed action. Projects requiring approval from the BLM, such as MDPs, can be denied when the BLM determines that adverse effects to resources (direct or indirect) cannot be mitigated to reach a Finding of No Significant Impact (FONSI).

3.1. Cumulative Impacts Assessment

This section describes the cumulative impacts of the proposed action described in Section 2. Cumulative impacts are the combined effect of past projects, specific planned projects, and other reasonably foreseeable future actions within the Cumulative Impact Area (CIA) to which oil and gas exploration and development may add incremental impacts. This includes all actions, not just oil and gas actions that may occur in the area, including foreseeable non-federal actions.

All resources are expected to sustain some level of cumulative impacts over time; however, these impacts fluctuate with the gradual abandonment and reclamation of wells. As new wells are being drilled, others are being abandoned and reclaimed. As the oil field plays out, the cumulative impacts will lessen as more areas are reclaimed and less are developed.

The combination of all land use practices across a landscape has the potential to change the visual character, disrupt natural water flow and infiltration, disturb cultural sites, cause minor increases in greenhouse gas emissions, fragment wildlife habitat, and contaminate groundwater. However, the likelihood of these impacts occurring is minimized through standard mitigation measures, special Conditions of Approval, and ongoing monitoring studies.

Cumulative Impacts Area

The CIA boundary is the area of analysis for cumulative impacts. The CIA is reasonably sized to prevent dilution of the cumulative impacts over large areas. Guidance from the CEQ was used to identify geographic boundaries (CEQ 1997).

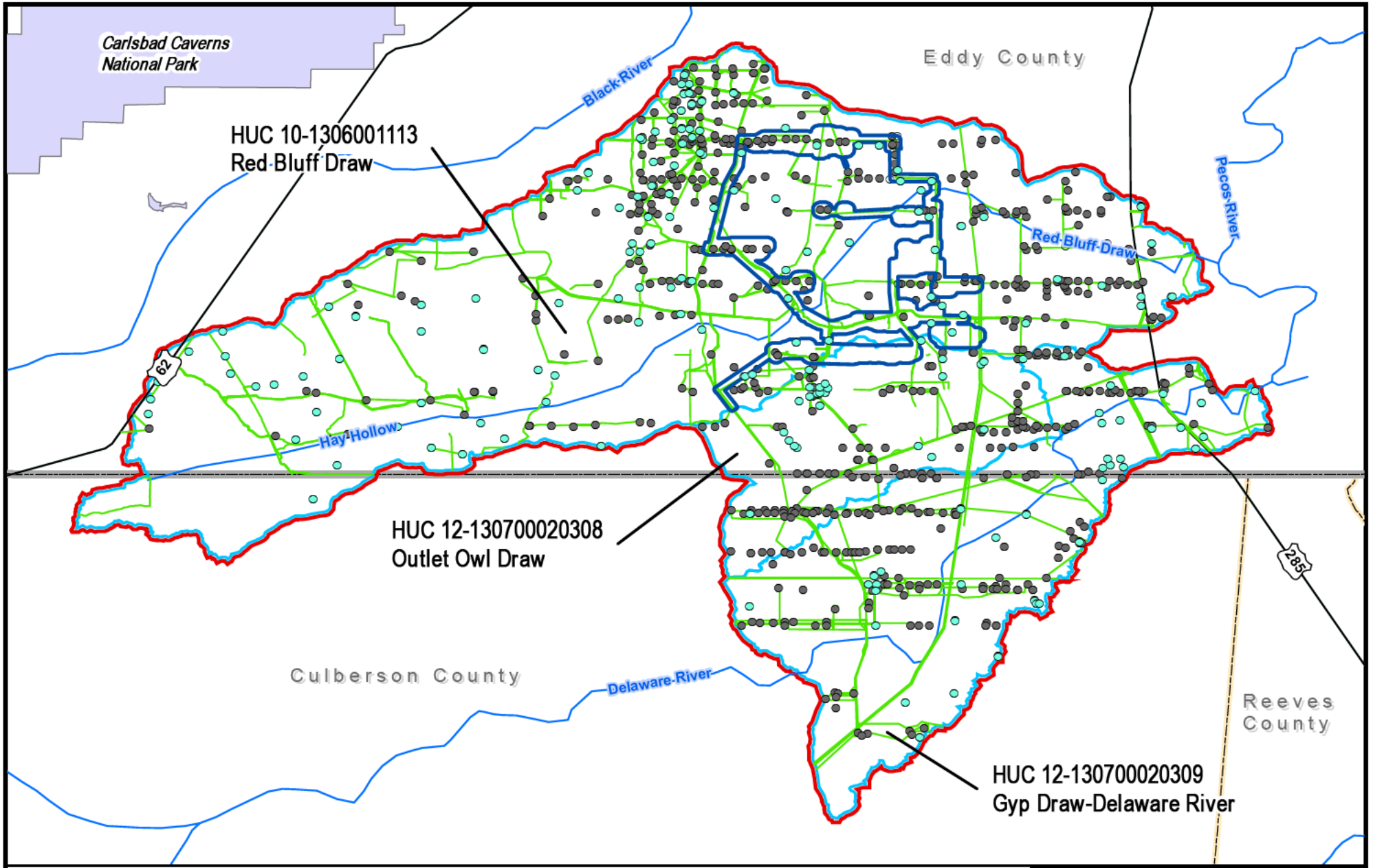
The CIA for this project has been defined as the combined Red Bluff Draw watershed (10-digit hydrologic unit code [HUC-10] 1306001113) and the 12-digit (HUC-12) Outlet Owl Draw (130700020308) and Gyp Draw-Delaware River (130700020309) sub-watersheds (**Figure 3.1-1**). Variations to this CIA for the various resources are described in the applicable individual resource sections below. This CIA was selected, and is appropriate for the assessed resources, because it would be the area potentially impacted by the proposed activities during the project and before the area would be reclaimed. This area is particularly suited for resources impacted by surface disturbances (e.g., soil, water, vegetation), because, as surface disturbances occur and water flows continue downstream, localized impacts become more and more diluted, and eventually reach a point where they become non-measurable. Watersheds provide a discrete boundary within which cumulative impacts can be quantified and analyzed. The CIA comprises approximately 259 square miles (about 165,927 acres), including 82,816 acres of BLM-administered surface.

Past, Present, and Reasonably Foreseeable Future Actions

Past, present, and reasonably foreseeable future actions in the CIA include oil and gas exploration and development, utility construction, mineral (non-hydrocarbon) exploration and extraction, livestock grazing, recreation, and off-road travel. Oil and gas exploration and development are the most prevalent activities within the CIA and are expected to continue to be over the life of the proposed action. Therefore, this analysis focuses on oil and gas industry-related actions. Quantifying cumulative impacts of livestock grazing, recreation, and off-road travel is not practicable; therefore, cumulative impacts resulting from these actions are discussed qualitatively. Estimated surface disturbances within the CIA are summarized in **Table 3.1-1**. Total surface disturbances from past, present, and reasonably foreseeable future actions are estimated to affect approximately 8,342 acres within the CIA, or approximately 5 percent of the CIA.

Within the CIA, approximately 848 oil and gas-related wells (including injection and disposal sites) have been permitted (NMOCD 2016; Texas Railroad Commission [TRRC] 2016). This evaluation assumes that all wells were drilled on single-well pads (a conservative assumption) and that 50 percent of the wells drilled in the CIA were vertical wells, and 50 percent horizontal (based on review of NMOCD data). Using per-well surface disturbance estimates presented in the reasonable foreseeable development (RFD) (1.67 acres for vertical well pads; 2.0 acres for horizontal well pads), approximately 1,919 acres are estimated to have been disturbed within the CIA.

CFO and TRRC data indicate that approximately 900 miles of ROWs, pipelines, and powerlines were previously constructed within the CIA. ROWs within the CIA typically include an access road as well as one or more pipeline/flowline and/or powerlines. Each linear component is assumed to have an average initial disturbance width of 30 feet. Total construction disturbance for existing linear features is estimated to be approximately 3,300 acres. Because the amount of access roads compared to pipelines and utility lines has not been determined, an estimate of reclaimed areas is not calculated.



DIV/GROUP: ENV/IMDV DB: webb LD: PIC: PM: TM:
PROJECT: PATH: Z:\GIS\PROJECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment\Final\Figure3.1-1_CumulativeImpacts.mxd DATE: 6/6/2016 10:30:17 PM

LEGEND:

- MDP Project Area
- National Hydrographic Dataset
- Cumulative Impacts Area
- Rivers
- Major Roads
- State Boundary
- County Boundary
- Past or Currently Permitted Oil and Gas Well Locations
- Past or Currently Permitted Well Locations (plugged/abandoned/cancelled/dry hole)
- Past or Currently Permitted Pipelines and ROWs
- Carlsbad Caverns National Park

Notes:
-The Cumulative Impact Area for some resources may differ as described in the EA text.

Projection:
WGS 1984

NORTH

0 3.75 7.5 Miles

CHEVRON HAYHURST MDP EA

FIGURE 3.1-1
Cumulative Impacts Area

ANALYSIS AREA: Eddy County, New Mexico
Date: 7/5/2016 | Prepared By: BW

This page intentionally left blank.

Table 3.1-1 Estimated Cumulative Actions

	Number or Miles	Estimated Size (acres) or Width (feet)	Estimated Disturbance (acres)
Past and Present Activities			
Oil and Gas Wells (NMOCD)	650	2 acres (horizontal); 1.67 acres (vertical)[1]	1,193
Oil and Gas Wells (TRRC)	198		363
ROWs (CFO)	702	30	2,554
Utility Lines (CFO)	100	30	364
Pipelines (TRRC)	107	30	389
Reasonably Foreseeable Future Activities (Oil and Gas)			
Oil and Gas Wells (CFO APDs)	65	NA[2]	217
Oil and Gas Wells (RFD)	573[3]	2 acres (horizontal); 1.67 acres (vertical)[4]	1,108
Oil and Gas Flowlines (CFO APDs)	20	30	71
Oil and Gas Pipelines (CFO APDs)	13	30	46
Roads (CFO APDs)	24	30	88
Utility Lines (CFO APDs)	6	30	23
ROWs (CFO Realty)	NA	NA	767
Xcel Energy Transmission Lines and Substations			74
Proposed Action			
Components except Oil and Gas Wells[5]	**Table 2.1-1**		1,085
		Total	**8,342**

Notes:
1 Assumes existing oil and gas wells are 50% vertical and 50% horizontal.
2 Disturbances for future wells within the CFO based on well pad and associated facility sizes included in APDs.
3 Through 2034 – see **Table 3.1-2**.
4 Assumes future oil and gas wells are 20% vertical and 80% horizontal.
5 Assumes proposed action wells are included in reasonably foreseeable future action totals.

In 2012 and 2014, the BLM New Mexico State Office published an RFD scenario for hydrocarbon production in southeast New Mexico for the next 20 years (i.e, through 2034) (BLM 2012 and 2014b). The RFD included a comprehensive review of existing and emerging hydrocarbon plays. The wells drilled under the proposed action would be included in the RFD. New oil and gas wells are estimated to be drilled at a rate of 800 per year within the RFD analysis area; however, the CIA encompasses only a fraction (approximately 2 percent) of the RFD analysis area. To determine the potential future oil and gas activity within the CIA, the BLM reviewed the distribution of oil and gas plays identified in the RFD. According to the RFD, the Bone Spring play within the CIA has high development potential, and portions of the Delaware Mountain Group play have high to low potential (BLM 2012 and 2014b). Other plays within the CIA (e.g., Morrow) have lower development potential and were not specifically factored into estimates of future development. The RFD only assessed lands in New Mexico; therefore, based on the presence of similar geologic conditions in Texas, the Bone Spring and Delaware Mountain Group play boundaries were extended to the south. **Table 3.1-2** summarizes the extent of these plays within the CIA and numbers of wells estimated to be drilled through 2034.

Electrical transmission infrastructure construction is considered a reasonably foreseeable future action. Xcel Energy plans to construct a 115 kV transmission line between the proposed China Draw and Yeso Hills substations. Both substations and the entire transmission line would be within the CIA. Construction of the substations is assumed to require approximately 20 acres of total surface disturbances (10 acres for each substation). Approximately 11.1 miles of this transmission line would be within the CIA. Based on a likely ROW construction width of 30 feet, approximately 40 acres of temporary surface disturbance are expected to occur. Reclamation would likely occur immediately following construction. The proposed in-service date for this transmission line is June 1, 2018 (Xcel Energy 2016a).

Table 3.1-2 Estimated Future Oil and Gas Development

Play Name and Development Potential	Extent within CIA (miles^2)	New Wells per Section	Estimated New Wells
Bone Spring (High)	65	4	260
Delaware Mountain Group (High)	12	4	48
Delaware Mountain Group (Medium)	55	2	110
Delaware Mountain Group (Low)	118	1	118
All Other Areas (Lowest)	74	0.5	37
		Total	**573**

Notes:
Bone Spring play overlaps with portions of the Delaware Mountain Group play. All areas of overlap assume both plays would be developed.
Assumption of four wells per section for high potential plays from the BLM (2014b).
One section equals one square mile.

Xcel Energy also plans to construct a 345 kV transmission line between the proposed China Draw substation and a proposed North Loving substation along US Highway 285 approximately 9 miles south of Carlsbad. Approximately 3.9 miles of this transmission line would be within the CIA. The North Loving substation would be outside the CIA. Based on a ROW width of 30 feet, approximately 14 acres of temporary surface disturbance are expected to occur. Reclamation would likely occur immediately following construction. The proposed in-service date for this transmission line is June 1, 2018 (Xcel Energy 2016b).

3.2. Air Resources

Affected Environment

The proposed action would occur within the boundaries of the BLM CFO. Air resources within the CFO are managed according to the CFO's revised RMP. As such, much of the information referenced in this section is incorporated from the Air Resources Technical Support Document (ARTSD) prepared in support of the RMP (URS Group, Inc. 2013). The ARTSD summarizes the technical information related to air resources and climate change associated with oil and gas development and the methodology and assumptions used for analysis. As described below, the two components of air resources are climate and air quality.

The area of analysis for air resources is the Permian Basin; this basin's airshed covers southeastern New Mexico and the northern panhandle of Texas. Air quality within the HDA has the potential to be affected by emissions from the construction and operation of oil and gas facilities, pipelines, and other infrastructure. Regional air quality also is affected by natural events such as windstorms and wildfires. These natural events generally are short lived, lasting from several hours to perhaps several days. The effects during these events may impact human health and the environment, and generally are considered part of the natural and physical environment. This section describes the existing air quality resources of the region and the applicable air regulations that would apply to the HDA.

Climate

The area of analysis is located in a semiarid climate regime typified by dry windy conditions, limited rainfall, hot summers, and mild winters. Summertime maximum temperatures are generally in the 90s (all temperatures are in degrees Fahrenheit [˚F]) with occasional temperatures over 110˚F. Winter minimum temperatures are generally between the 20s and 30s with extremes remaining above zero. Precipitation is mainly in the form of summer thunderstorms associated with the Southwest Monsoon, although occasional Pacific storms occur south into New Mexico during the winter. **Table 3.2-1** shows climate normals for 1981 through 2010 for the Carlsbad Monitoring Station (NOAA [National Oceanic and Atmospheric Administration 2011]).

Table 3.2-1 Climate Normals for Carlsbad, 1981-2010

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Temperature (°F)	42.6	47.2	54.0	62.4	71.5	79.3	81.2	79.9	73.2	62.9	51.5	42.8
Average Maximum Temperature (°F)	57.5	62.7	70.2	78.5	86.9	94.4	94.6	93.1	87.0	78.1	67.1	57.5
Average Minimum Temperature (°F)	27.6	31.7	37.9	46.2	56.0	64.3	67.7	66.6	59.4	47.7	35.8	28.0
Average Precipitation (inches)	0.47	0.54	0.51	0.64	1.17	1.53	2.01	1.83	2.11	1.16	0.81	0.63

Source: NOAA 2011

Prevailing winds are from the southeast with speeds varying from 0 to 20 miles per hour (mph), rarely exceeding 31 mph (Cedar Lake 2016). **Figure 3.2-1** and **Figure 3.2-2** show the distribution of magnitude and direction of local winds for 2014 from the Cavern City Airport in Carlsbad, New Mexico and the Lea County Regional Airport in Hobbs, New Mexico, respectively (NCDC [National Climatic Data Center 2014]).

Existing Air Quality

Air quality in a given location is defined by pollutant concentrations in the atmosphere and is generally expressed in units of parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$). The existing air quality in the proposed development area is considered to be acceptable for human health and the environment since it is in attainment of the National Ambient Air Quality Standards (NAAQS) and State AAQS (SAAQS) or has insufficient data to establish compliance. The EPA Green Book web page (EPA 2015) reports that the Permian Basin is in attainment for all NAAQS as defined by the Clean Air Act (CAA).

The CFO recently installed monitors in the HDA airshed, including in Carlsbad, Carlsbad Caverns National Park, and Hobbs (URS Group, Inc. 2013), to monitor ambient concentrations of criteria air pollutants. Monitored design values for ozone (O_3), nitrogen dioxide (NO_2), particulate matter with aerodynamic diameter less than 10 microns and 2.5 microns (PM_{10} and $PM_{2.5}$, respectively), carbon monoxide (CO), and sulfur dioxide (SO_2) are shown in varied units in **Table 3.2-2**. Design values are the concentrations of air pollution at a specific monitoring site represented in the averaging period that can be compared to the NAAQS. Monitoring is not conducted for lead and CO in southeastern New Mexico; however, concentrations of these pollutants are expected to be low in rural areas and are therefore not monitored. CO is monitored, however, in Texas. The New Mexico Environment Department (NMED) discontinued monitoring for SO_2 in Eddy County due to very low monitored concentrations. Design values for PM_{10} in southeastern New Mexico are not available due to incomplete data collection.

Table 3.2-2 Design Concentrations of Criteria Pollutants in the HDA Airshed

Pollutant	Averaging Period	Location	Design Value (units vary)					NAAQS
			2008	2011	2012	2013	2014	
O_3	8-hour	Hobbs	0.067 ppm[1]	0.061 ppm	--	--	0.065	0.070 ppm[4]
		Carlsbad	0.067 ppm[1]	0.069 ppm	--	--	--	
NO_2	Annual	Hobbs	--	6 ppb	--	--	--	53 ppb
		Carlsbad	--	3 ppb	--	--	2.8 ppb[2]	
	1-hour	Carlsbad	--	42 ppb	18.4 ppb[3]	18.4 ppb[3]	18.4 ppb[3]	100 ppb[5]
$PM_{2.5}$	Annual	Hobbs	--		7.8 $\mu g/m^3$[6]	7.8 $\mu g/m^3$[6]	7.8 $\mu g/m^3$[6]	12 $\mu g/m^3$
	24-hour	Hobbs	--	21.9 $\mu g/m^3$[7]	21.9 $\mu g/m^3$[7]	21.9 $\mu g/m^3$[7]	--	35 $\mu g/m^3$
PM_{10}[8]	24-hour	--	--	--	--	--	--	150 $\mu g/m^3$
CO	8-hour	El Paso, TX	--	--	1.5 ppm[9]	1.5 ppm[9]	1.5 ppm[9]	9 ppm
	1-hour	El Paso, TX	--	--	2.1 ppm[9]	2.1 ppm[9]	2.1 ppm[9]	35 ppm
SO_2	Annual	El Paso, TX	--	--	0.0006 ppm[9]	0.0006 ppm[9]	0.0006 ppm[9]	0.03 ppm
	24-hour	El Paso, TX	--	--	0.0017 ppm[10]	0.0017 ppm[10]	0.0017 ppm[10]	0.14 ppm

Table 3.2-2 Design Concentrations of Criteria Pollutants in the HDA Airshed

Pollutant	Averaging Period	Location	Design Value (units vary)					NAAQS
			2008	2011	2012	2013	2014	
	3-hour	El Paso, TX	--	--	0.0065 ppm(10)	0.0065 ppm(10)	0.0065 ppm(10)	0.5 ppm
	1-hour	El Paso, TX	--	--	4.7 ppb(11)	4.7 ppb(11)	4.7 ppb(11)	75 ppb

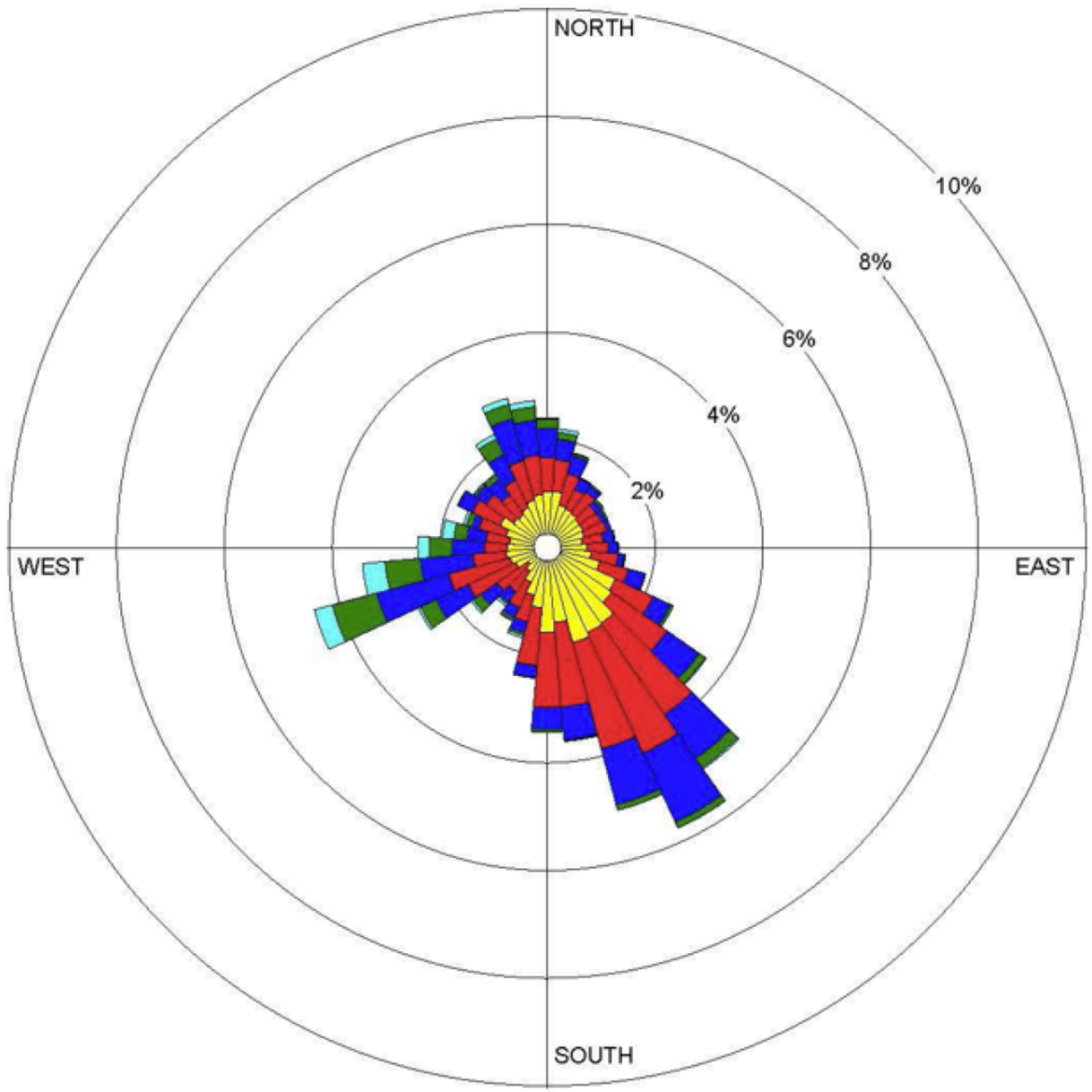
Notes:
1 Annual fourth-highest daily maximum 8-hour concentration (URS Group, Inc. 2013, Table 4-7)
2 Highest annual value from the most recent year monitored (2014) (1 part per billion [ppb] = 1.88 µg/m^3) (NMED 2014a).
3 Three-year average of 98th percentile of 1-hour maximum used (2012-2014) (1 ppb = 1.88 µg/m^3) (NMED 2014a).
4 Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years.
5 98th percentile, averaged over 3 years.
6 Average of annual values from 3 years of data set (2012-2014) (NMED 2014a).
7 Three-year average of 98th percentile of 24-hour maximum used (2011-2013) (NMED 2014a).
8 No PM_{10} data are available as there are no PM_{10} monitors within the HDA airshed.
9 Highest annual value over 3 years (2012-2014) (TCEQ 2014).
10 Highest annual value of the 3-hour maximum over three years (2012-2014) (TCEQ 2014).
11 Three-year average of 99th percentile of 1-hour maximum used (2012-2014) (TCEQ 2014).

The EPA conducts a periodic National Air Toxics Assessment (NATA) to quantify hazardous air pollutant (HAP) impacts by county and to identify areas where HAP emissions result in high health risks and therefore further emissions reduction strategies are necessary. A review of the 2011 NATA results shows that cancer, neurological, and respiratory risks in Eddy and Lea Counties are generally increasing compared to statewide and national levels (EPA 2011).

Regulatory Framework and Standards of Significance

The CAA of 1970 (42 USC 7401 et seq.) as amended in 1977 and 1990 is the basic federal statute governing air pollution. Provisions of the CAA of 1970 that potentially are relevant to the HDA are listed and discussed below:

- **NAAQS** – These standards set limits to protect public health (primary standards) and public welfare (secondary standards). Details on the NAAQS are described in the following section.
- **New Source Review (NSR)** – This program protects air quality by reviewing newly constructed or modified stationary sources to ensure that adequate controls, emission limits, and operational practices to prevent a violation of the NAAQS or other standard are in place. This program is administered by the state of New Mexico, tribal authorities, or the EPA through approved implementation plans.
- **Prevention of Significant Deterioration (PSD)** – This program serves to protect public health and welfare, and preserve, protect, and enhance air quality in areas currently compliant with the NAAQS. PSD does not prevent sources from increasing emissions, but provides a review process for large stationary sources to ensure that Best Available Control Technology (BACT) is applied and the project will not contribute to a violation of the NAAQS or degrade ambient air quality above established baselines. Special protection is given to Class I areas, which are defined as areas of special national or regional natural, scenic, recreational, or historic value. Class I areas are protected by Federal Land Managers (FLMs) by management of air quality related values (AQRVs) such as visibility and acid deposition. FLMs review the issuance of a PSD permit for any impacts that exceed guideline thresholds.
- **Nonattainment New Source Review (NNSR)** – This program ensures that new projects in areas with existing air quality that does not comply with the NAAQS are compliant. This review process requires the highest level of emission controls and must result in net emissions reductions to achieve compliance.



LEGEND

WIND SPEED
(m/s)

- >= 11.10
- 8.80 - 11.10
- 5.70 - 8.80
- 3.60 - 5.70
- 2.10 - 3.60
- 0.50 - 2.10

Calms: 13.73%

Notes:
Windrose Plot = Cavern City Air Terminal
Display = Wind speed direction (blowing from)
Start Date = 1/1/2014 - 00:00
End Date = 12/31/2014 - 23:00
Calm Winds = 13.73%
Avg. Wind Speed = 3.89 m/s
Modeler = Jalbert
Total Count = 8748 hrs.

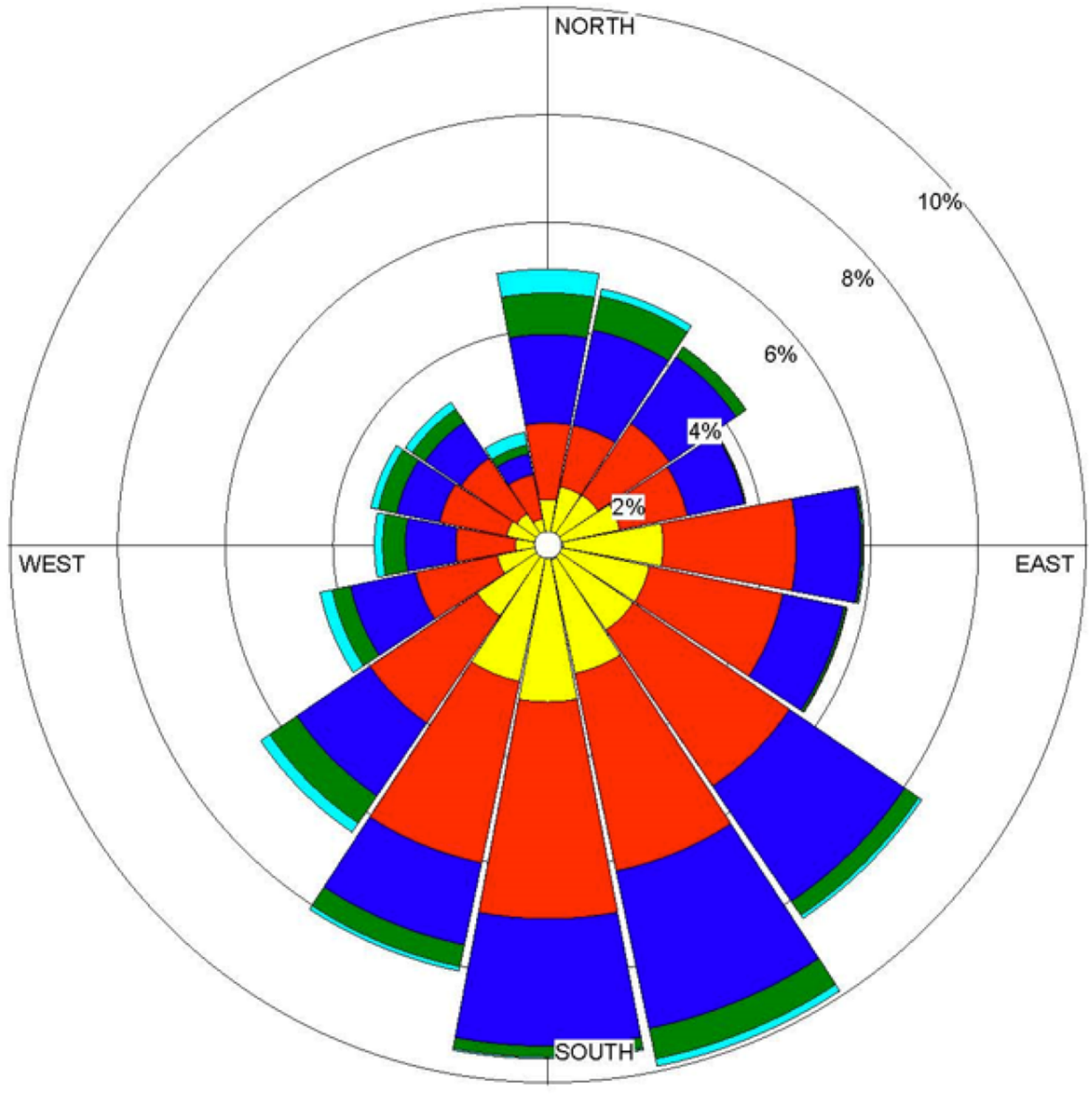
CHEVRON HAYHURST

FIGURE 3.2-1
Carlsbad, NM Windrose, 2014

ANALYSIS AREA: Eddy County, New Mexico

Date: 3/14/2016 | Prepared By: BW

Z:\G SPROJECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment Figure3.1-1_Carlsbad_Windrose.mxd



LEGEND

WIND SPEED
(m/s)

- >= 11.1
- 8.8 - 11.1
- 5.7 - 8.8
- 3.6 - 5.7
- 2.1 - 3.6
- 0.5 - 2.1

Calms: 11.66%

Notes:
Windrose Plot = Lea County Regional Airport (Hobbs, NM)
Display = Wind speed direction (blowing from)
Start Date = 1/1/2014 - 02:00
End Date = 12/31/2014 - 23:00
Calm Winds = 11.66%
Avg. Wind Speed = 4.43 m/s
Modeler = Jalbert
Total Count = 8345 hrs.

CHEVRON HAYHURST

FIGURE 3.2-2
Hobbs, NM Windrose, 2014

ANALYSIS AREA: Eddy County, New Mexico

Date: 3/14/2016 | Prepared By: BW

Z:\G SPROJECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment Figure3 3-1_Hobbs_Windrose.mxd

- **Conformity for General Federal Actions –** The purpose of these rules are to ensure that the actions taken by federal agencies in nonattainment and maintenance areas do not interfere with a state's plans to meet national standards for air quality.
- **New Source Performance Standards (NSPS) –**This program sets standards for new, modified and reconstructed stationary sources irrespective of permitting requirements. These rules establish emission limits, control requirements, and work practice standards for different source categories.
- **Maximum Achievable Control Technology (MACT) Standards** – This program promulgated under the National Emission Standards for Hazardous Air Pollutants (NESHAP) establishes technology-based standards for HAPs that require top-tier controls for affected sources.
- **Mandatory Greenhouse Gas (GHS) Reporting Rule: 40 CFR 98, Subpart W –** This rule requires data collection, monitoring, and reporting of GHG emissions to guide development of policy to reduce GHG emissions.

Details of these programs are described in the Air Quality Technical Support Document developed for the proposed action.

National Ambient Air Quality Standards

The federal CAA amendments of the 1990s require all states to control air pollution emission sources so that the NAAQS are met and maintained. In addition to these requirements, the National Park Service (NPS) Organic Act requires the NPS to protect the natural resources of the lands it manages from the adverse effects of air pollution.

The NAAQS establishes maximum acceptable concentrations for NO_2, CO, SO_2, PM_{10}, $PM_{2.5}$, ozone, and lead. Given the extremely low levels of lead emissions from project sources, the lead standards are not addressed in this analysis. These pollutants are known as criteria pollutants. The NAAQS are established by the EPA and are outlined in 40 CFR 50. These standards represent the maximum allowable atmospheric concentrations that may occur without jeopardizing public health and welfare, and include a reasonable margin of safety to protect the more sensitive individuals in the population. The NAAQS represent maximum acceptable concentrations that generally may not be exceeded more than once per year; the annual standards may never be exceeded. An area that does not meet the NAAQS is designated as a nonattainment area on a pollutant-by-pollutant basis. Applicable federal and state criteria are presented in **Table 3.2-3**.

Table 3.2-3 National Ambient Air Quality Standards

Pollutant (units)	Averaging Period	Ambient Air Quality Standards[1]	
		National	New Mexico
NO_2 (varies)	Annual[2]	100 µg/m^3	0.05 ppm
CO (varies)	1-hour[3]	40,000 µg/m^3	13.1 ppm
	8-hour[3]	10,000	8.7 ppm
SO_2 (varies)	3-hour[3]	1,300	N/A
	24-hour[3]	260 µg/m^3	0.10 ppm
	Annual[2]	60	0.02 ppm
PM_{10} (µg/m^3)	24-hour[4]	150	150
	Annual[2, 7]	50	60
$PM_{2.5}$ (µg/m^3)	24-hour[5]	35	N/A
	Annual[6]	15	N/A
Ozone (ppm)	8-hour[8]	0.070	N/A

Notes:
1 Sources: EPA 2016 and NMED 2016.
2 Never to be exceeded.
3 Not to be exceeded more than once per year.
4 Not to be exceeded more than once per year on average over 3 years.

Table 3.2-3 National Ambient Air Quality Standards

Pollutant (units)	Averaging Period	Ambient Air Quality Standards[1]	
		National	New Mexico

5 Three-year average of the 98th percentile of the 24-hour concentrations at each population-oriented monitor within an area must not exceed this standard.
6 Three-year average of the weighted annual mean concentrations from single or multiple community-oriented monitors must not exceed this standard.
7 The annual PM_{10} NAAQS of 50 µg/m^3 was revoked by EPA on September 21, 2006. See Federal Register Volume 71, Number 200, October 17, 2006.
8 Values provided reflect the new standard of 0.070 ppm. Three-year average of the fourth highest daily maximum 8-hour average measured at each monitor within an area over each year must not exceed this standard.

Prevention of Significant Deterioration and Federally Protected Areas

PSD regulations restrict the degree of ambient air quality deterioration allowed and apply to proposed new or modified major stationary sources located in an attainment area that have the potential to emit criteria pollutants in excess of predetermined threshold values (40 CFR Part 51). In New Mexico, PSD permits are required prior to construction or modification of sources subject to 20.2.74 NMAC. Increments for criteria pollutants are based on the PSD classification of the area. Class I area status is assigned to federally protected wilderness areas and allows the lowest amount of permissible deterioration. Class I areas allow the lowest amount of air quality increment consumption, while Class II designations allow higher increment consumption. There are no designated Class III or heavy industrial use areas.

In addition to more stringent PSD increments, Class I areas are protected by FLMs by management of AQRVs such as visibility and acid deposition. Though not a regulatory program under PSD, FLMs review the issuance of a PSD permit for any impacts that exceed guideline thresholds for these parameters. The air quality impacts in the area must meet the NAAQS, which apply nationwide. The locations of Class I and sensitive Class II areas within 300 kilometers of the HDA are shown on **Figure 3.2-3** and are summarized in **Table 3.2-4**. The nearest Class I area is Carlsbad Caverns National Park approximately 28 kilometers northwest of the HDA. The proximity of this Class I area provides concern that ambient air quality could experience both near-field and regional impacts.

Table 3.2-4 Class I and Sensitive Class II Areas of Concern for Air Quality Impact Analysis

Class I Areas	Sensitive Class II Areas
Carlsbad Caverns NP (NPS)	Bitter Lake National Wildlife Refuge (USFWS)
Guadalupe Mountains NP (NPS)	Grulla National Wildlife Refuge (USFWS)
White Mountain Wilderness Area (USFS)	San Andreas National Wildlife Refuge (USFWS)
Salt Creek Wilderness Area (USFWS)	White Sands National Monument (NPS)
Big Bend NP (NPS)	

Abbreviations:
NP = National Park
NPS = National Park Service
USFS = U.S. Forest Service
USFWS = U.S. Fish and Wildlife Service

Allowable deterioration to air quality can be expressed as the incremental increase to ambient concentrations of criteria pollutants, or PSD increment. Modeled air concentrations of NO_2, SO_2, and PM_{10} predicted at near-field receptors that result from emissions due to project sources are compared with the convenient threshold of allowable PSD increments. This comparison to PSD Class II increments does not represent a regulatory PSD increment consumption analysis because the focus of this study is the proposed action and alternatives under NEPA, not increment-affecting sources, which are not evaluated for regulatory purposes under NEPA. The allowable PSD increments for Class II areas are provided in **Table 3.2-5**.

Bosque del Apache (Little San Pascual U

Bosque del Apache NWR

Bosque del Apache (Chupadera Unit)

Bosque del Apache (Indian Well Unit)

Gila Wilderness

White Mountain Wilderness

Grulla National Wildlife Refuge

Salt Creek Wilderness

Bitter Lake National Wildlife Refuge

San Andreas National Wildlife Refuge

White Sands National Monument

Carlsbad Caverns NP

Carlsbad

50km radius

150km radius

300km radius

Hobbs

Study Area

Midland

Odessa

Carlsbad

El Paso

Guadalupe Mountains NP

Big Bend NP

UNITED STATES MEXICO

Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

LEGEND:

- MDP Project Area
- State Boundary
- County Boundary
- City

Clean Air Act Class I

- U.S. Fish and Wildlife Service
- U.S. National Park Service
- U.S. Forest Service

Sensitive Class II Areas

- U.S. Fish and Wildlife Service
- U.S. National Park Service

Notes:
-Impact analysis for some resources utilizes a different Area of Analysis as illustrated on resource-specific figures

Projection:
WGS 1984

NORTH

0 45 90 Miles

CHEVRON HAYHURST MDP EA

FIGURE 3.2-3
Class I and Sensitive Class II Areas of Concern Map

ANALYSIS AREA: Eddy County, New Mexico

Date: 6/2/2016 | Prepared By: BW

DIV/GROUP: ENV/MDV DB: webb LD: PIC: PM: TM:
PROJECT PATH: Z:\GIS\PRO_ECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment\Final\Figure3.2-3_SensitiveAOC.mxd DATE: 6/2/2016 3:21:57 PM

This page intentionally left blank.

Table 3.2-5 PSD Increments for Class I and Class II Areas

PSD Class	Pollutant	Allowable Increment (µg/m^3)		
		Annual Arithmetic Mean	24-hour Maximum	3-hour Maximum
Class I	NO_2	2.5	-	-
	SO_2	2	5	25
	PM_{10}	4	8	-
Class II	NO_2	25	-	-
	SO_2	20	91	512
	PM_{10}	17	30	-

Impacts from the Proposed Action

Direct and Indirect Impacts

The purpose of the air quality analysis was to assess local and regional air quality impacts from the proposed action. The approach was to develop an emissions inventory for a project base year to tabulate emissions for comparison to emissions estimates and impacts evaluated in the ARTSD prepared in support of the RMP (URS 2013). The ARTSD evaluated impacts of a 20 year projected RFD of oil and gas exploration and production within the CFO area of responsibility. This study found no significant impact from the RFD, and as such, if the proposed action's emission contributions conformed to the ARTSD analysis, then no significant impact is predicted. In cases where emissions did not conform to the ARTSD, additional modeling analysis was conducted to characterize impacts.

Emissions Data Development

Emissions data for the proposed action were developed from available emission factors, analytical methods, applicant-provided equipment specifications, and any applicant committed environmental protection measures. Further, the emissions development relied on anticipated activity levels as provided by Chevron and described in the AQTSD (Arcadis 2016b) that was developed for the proposed action. Emission rates were developed for the criteria pollutants, selected HAPs, and GHG for the maximum anticipated annual drilling, completion, and production activity. Emissions for a full list of HAPs were reviewed, but only those with greatest emissions in relation to health effects were evaluated. **Table 3.2-6** summarizes the maximum annual emissions of each pollutant by activity.

Table 3.2-6 Summary of Maximum Annual Emissions of Criteria and Hazardous Air Pollutants from the Proposed Action (in tons per year)[1]

Activity	Criteria Pollutants						Hazardous Air Pollutants			
	NO_X	CO	SO_2	PM_{10}	$PM_{2.5}$	VOC	BTEX[2]	HCHO[3]	n-Hexane	Total
Drilling and Completion	262.9	223.3	0.4	17.0	8.3	14.2	2.0	4.1	0.1	6.2
Production	102.2	85.8	0.0	6.1	6.1	193.4	1.1	0.1	5.5	6.7
Transmission	119.4	69.8	0.3	0.4	0.4	377.6	21.6	11.8	2.8	36.2
Total	484.5	378.8	0.7	23.4	14.7	585.2	24.7	16.0	8.4	49.1

Notes:
1 Arcadis 2016b
2 Total of benzene, toluene, ethy benzene, and xylene
3 Formaldehyde

Impacts on Ambient Air Quality

As shown in **Table 3.2-6**, the greatest emissions would occur during the drilling and completion of wells, particularly from diesel-fired engines powering fluid pumps during hydraulic fracturing operations. In particular, the hourly and annual emissions of NO_2 would exceed the parameters evaluated in the ARTSD (URS 2013) as shown in **Table 3.2-7**. The maximum air pollutant emissions from each well would be temporary (i.e. only occurring during well drilling and completion), would occur in unpopulated areas, and would not significantly interact with adjacent well locations. Given the temporary, transient and remote nature of these emissions, impacts to nearby receptors are not anticipated to be significant. However, due

to the proximity of Carlsbad Caverns National Park, impacts to ambient air quality, specifically the hourly NO_2 standards, were evaluated using the CALPUFF modeling system and found to not contribute to a violation of the NAAQS (Arcadis 2016b). Other Class I areas are further from the project area and presumed to have less ambient air quality impact. A summary of these impacts are provided in **Table 3.2-8**.

Table 3.2-7 Comparison of Drilling and Completion Emissions from the Proposed Action to ARTSD

Activity / Phase	Proposed Action[1]				ARTSD[2]			
	Power[3]	Maximum NO_X Emissions			Power[3]	NO_X Emissions		
	(hp)	(g/hp-hr) [4]	(lb/hr)	(ton/well)	(hp)	(g/hp-hr)[5]	(lb/hr)	(ton/well)
Drilling[6]	2,760	4.56	27.7	2.8	1,482	0.3	1.0	0.14
Fracturing and Flowback[7]	19,784	4.56	198.9	6.0	1,336	0.3	0.9	0.13
Completion	750	4.56	7.5	0.1	350	0.3	0.2	0.03
Total	23,294		198.9[8]	8.9	3,168		1.0[8]	0.30

Notes
1 Arcadis 2016b.
2 URS 2013.
3 Maximum hourly load of total engine capacity of multiple engines in simultaneous use.
4 USEPA Tier 2 emission standards for engines greater than 750 hp assuming 95% of non-methane hydrocarbon (NMHC) + NOX based on California Air Resources Board (CARB) "Emissions Factors for Compression Ignition Diesel Engines".
5 USEPA Tier 4 emissions standards for engines between 175 and 750 hp.
6 Includes primary drill rig and power generation.
7 Includes engines to power pumps to inject fluids for hydraulic fracturing, blending, and flowback. ARTSD (URS 2013) did not include hydraulic fracturing.
8 Represents maximum hourly emission rate from each phase.

Table 3.2-8 Summary of 1-hr NO_2 Ambient Air Quality Impacts Near the Project Area[3]

Criteria Pollutant	Averaging Period	Modeled Meteorological Year	Maximum Concentration ($\mu g/m^3$)			Ambient Standard ($\mu g/m^3$)[2]	Percent of Standard
			Modeled	Background[1]	Total		
NO_2	1-hr	2008	28.3	34.6	62.9	188	33.5

Notes:
1 3-year average of 98th percentile of 1-hour max used (2012-2014) (1 ppb = 1.88 $\mu g/m^3$) (NMED 2014a).
2 National Ambient Air Quality Standard of 100 ppb (1 ppb = 1.88 $\mu g/m^3$)
3 CALPUFF predicted impacts approximately 2 to 3 kilometers from the Project Area.

Acid Deposition at Class I Areas

The ARTSD (URS 2013) provided an analysis of acid deposition in nearby Class I areas. However, due the increase in NO_X emissions, CALPUFF modeling was also used to provide updated acid deposition results for nitrates in these Class I areas. **Table 3.2-9** shows the acid deposition for proposed action with the maximum added deposition from the project-related sources. The analysis predicts the incremental impacts from the project would exceed the deposition analysis threshold (DAT) of 0.005 kilogram per hectare-year (kg/ha-yr) in Carlsbad Cavern National Park during drilling operations, but would be well below the DAT once drilling has completed.

Table 3.2-9 CALPUFF Modeled Results for Nitrogen Deposition in Class I Areas from the Proposed Action

Scenario	Carlsbad Cavern National Park	Guadalupe Mountains National Park
	(kg/ha-yr)	
Scenario 1 – 2019 Drilling	0.0060	0.0008
Scenario 2 – 2025 Drilling and Production	0.0087	0.0011
Scenario 3 – 2025 Production Only	0.0036	0.0005

Notes:
1 The Deposition Analysis Threshold (DAT) is a significance threshold. If the modeled deposition rate (without adding background concentration) is below the DAT, the predicted impacts are considered to be insignificant

As prescribed in Federal Land Managers' Air Quality Related Values Work Group (FLAG) guidance (USFS et al. 2011), an exceedance of the DAT does not necessarily indicate impact, but further consider of acid deposition is required.

Carlsbad Caverns contains protected portions of the northern Chihuahuan Desert ecosystem which contains woodland, shrubland, and grassland vegetation types that can be sensitive to nitrogen deposition due to fertilization of non-native species. The NPS has identified two species of invasive grass found within the park, *Bromus rubens* (red brome) and *Avena fatua* (Wild Oats). Research has shown that additional growth can be stimulated at or above 3.0 kg/ha-yr (Rao et al. 2010) to levels that could present an increased risk of wildfire. This coincides with the FLAG guidance cumulative threshold value of 3.0 kg/ha-yr for nitrogen deposition.

The National Atmospheric Deposition Program (NADP) has developed deposition maps based on a combination of monitoring networks supplemented by mesoscale modeling using the Community Multiscale Air Quality (CMAQ) model. This data shows deposition levels from 2.7 kg/ha-yr to 3.5 kg/ha-yr (NADP, 2014). However, these are modeled values based on a coarse-grid (12 km resolution) CMAQ model, and actual deposition levels in Carlsbad Cavern National Park have not been monitored. The annual predicted nitrogen deposition impacts from the project (Arcadis, 2016b) indicate that predicted impacts from proposed production and transmission activities would be well below the DAT, peaking at 0.0036 kg/ha-yr. The proposed action would be at or slightly above the DAT, ranging from 0.0063 to 0.0086 kg/ha-yr, for a period of 8 years during drilling operations. Cumulative average impact over 20 years would be 0.0046, just below the DAT.

There is no clear evidence that Carlsbad Cavern National Park is currently impacted due to nitrogen deposition. The range of predicted deposition vary as low as 90% of critical load to exceeding critical load. The mesoscale modeling is subject to high levels of uncertainty and the modeled values have not been verified by monitored values. As such, BLM does not believe that the contribution of deposition just above the screening threshold would contribute significantly to deposition levels in Carlsbad Caverns National Park. Potential impacts to Guadalupe Mountains National Park were below the screening threshold. Based on these data, BLM cannot assert that the proposed action would have a significant impact on nitrogen deposition. However, BLM is sensitive to the concerns of Federal Land Managers to be protective of the park system and would implement mitigation measures as a precautionary measure to alleviate impacts.

Impacts on Visibility in Class I Areas

CALPUFF was used to evaluate impacts on visibility on nearby Class I areas. **Table 3.2-10** provides results of the visibility analysis for the proposed action. The results show minimal impacts to visibility from the proposed action with a maximum of 1 day greater than 0.5 deciview (dv) above the annual average and 4 days greater than the 20 percent best natural background days at Carlsbad Cavern National Park (Arcadis 2016b).

Table 3.2-10 CALPUFF Modeled Results for Impacts to Visibility in Class I Areas from the Proposed Action

Class I Area	# days with Visibility Change > 0.5 dV[1]	
	Annual Avg	20% Best
Carlsbad Cavern National Park	1	4
Guadalupe Mountains National Park	0	0

Notes:
1 USFS et al. 2010

Cumulative Impacts

Greenhouse Gases and Climate Change

The primary sources of GHG associated with oil and gas exploration and production are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). While sources of GHG from oil and gas activities may contribute to global climate change, it is not currently possible to correlate the degree of impact from these sources to any specific climate-related effect. Climate change analyses are complex and comprised of several factors, including but not limited to GHG emissions, land use management practices, mesoscale meteorology, and albedo effects. The tools necessary to quantify climatic impacts presently are unavailable. Consequently, impact assessment of specific effects of anthropogenic activities cannot be determined and specific levels of significance have not yet been established. Therefore, the climate change analysis for the purpose of this document is limited to accounting and disclosing GHG emissions that may contribute to climate change, and putting them in context of current inventories.

The ARTSD (URS 2013) evaluated GHG emissions from the RFD in context of the New Mexico GHG Inventory. **Table 3.2-11** summarizes GHG contribution from the proposed action as a percentage of both the RFD and the New Mexico inventory. The proposed action constitutes 436 of the RFD's 10,117 proposed wells (4.3%), but only contributes 2.2% of the GHG from the RFD. As such, the proposed action's impact to climate change shows a reduction in GHG relative to the level of activity compared to the ARTSD.

Table 3.2-11 Comparison of Maximum Annual Emissions of Criteria and Hazardous Air Pollutants from the Proposed Action to ARTSD (in tons per year)[1]

Activity	Greenhouse Gas			
	CO_2	CH_4	N_2O	CO_2e^2
Drilling and Completion	44,460	1.8	0.4	44,611
Production	66,088	8.6	0.7	66,504
Transmission	130,349	6.6	1.3	130,910
Total Proposed Action	240,897	17.0	2.4	242,024
CFO RMP[3]	11,547,017	46,191	208	12,763,776
% of CFO RMP	2.1	<0.1	1.1	2.2
% of New Mexico Inventory[4]				0.4

Notes:

1 Arcadis 2016b

2 Carbon dioxide equivalents (CO_2e) are calculated based on the Global Warming Potential of each pollutant from Table A-1 of 40 CFR §98 (CO_2 =1 CO_2e, 1 CH_4 = 25 CO_2e, 1 N_2O = 298 CO_2e

3 RMP AQTSD, Table 5-1 2028 Project GHG Emissions as Percentage of State Annual Inventory for RFDOTB; CO2e revised for updated GWP (See Note 2)

4 Based on *Inventory of New Mexico Greenhouse Gas Emissions: 2000-2007* (NMED 2010b)

Ozone

As part of the ARTSD (URS 2013) detailed photochemical modeling was performed to examine the ozone forming potential of the RFD in the CFO Planning Area. The proposed action lays within this planning area and the impacts from the proposed action were a part of the foreseen development analyzed in the RMP.

The emissions modeled in the Reasonable Foreseeable Development On The Books (RFDOTB) scenario and the proposed action are presented in **Table 3.2-12**. The ARTSD analyzed a future year scenario looking at the modeled ozone impacts of 10,117 producing wells. The proposed action represents a total of 436 producing wells by the end of the development. On a well count basis, the proposed action represents 4.3 percent of the foreseen new production. On an emissions basis, the proposed action represents 7.4% of the CO emissions, 8.3% of the NOx emissions and 2.1 percent of the VOC emissions. Thus, the emissions from the proposed action are a small fraction of the emissions foreseen in the RMP.

The RMP presents several different ozone metrics. On a relative basis, the full impact of the RFDOTB case is to increase the forecast design value by 0.001 ppm (URS 2013). Other absolute change metrics showed impacts of the RFDOTB case of from 0.0 to 3.0 percent. The conclusion of the ARTSD (URS 2013) was that the "Ozone impacts attributable to CFO Project and cumulative emissions are not expected to cause or contribute to violations of the ozone NAAQS" and "the two alternatives show little to no change from the future year base case". Since the emissions increases from the proposed action are a small fraction of the emissions that simulated these impacts, the project impact will be a correspondingly small percentage.

Since the ARTSD was completed the ozone standard has been lowered from 0.075 ppb to 0.070 ppb.[2] Recommendations for ozone designations for the new standard are currently being prepared and will be submitted to EPA by October 1, 2016 with formal designations to by October 1, 2017. The 2012-2014 8-hour ozone design value near the project area is 0.071 ppm at the Carlsbad monitor (AIRS ID 350151005).[3] Final guidance does not exist on application, analysis, or interpretation of single project ozone impact analysis. Thus, the analysis and interpretation of the results is handled on an ad-hoc, case-by-case basis. It is anticipated that the ozone impact of the project would be quite small and would not significantly contribute to or cause a violation of the new 0.070 ppm ozone standard.

Table 3.2-12 CFO Oil and Gas RMP Reasonably Foreseeable Development and Proposed Action Well Counts and Emissions Comparison

Parameter / Pollutant	CFO RMP[1]	Proposed Action	% of CFO RMP
Wells	10,117[2]	436	4.3
NO_x (tpy)	8885.0[3]	744.1[4]	8.3
CO (tpy)	6072.0[3]	453.5[4]	7.4
VOC (tpy)	35,797.0[3]	763.4[4]	2.1

Notes:
1 Activity and emissions level based on the RFDOTB mitigation scenario
2 ARTSD (URS 2013), Table 1-1 Total Active BLM O&G Wells in RFD Year 20
3 ARTSD (URS 2013), Table 4-11 CFO Project Emissions Alternative RFDOTB
4 See **Table 3.2-6**

Mitigation Measures and Residual Impacts

The ARTSD (URS 2013) inventory used for comparison accounts for "on the books" controls for all proposed future activity. **Table 3.2-13** provides a comparison of the applicant committed environment protection measures (ACEPM) for air quality and new regulations promulgated since the issuance of the ARTSD to the management actions of the existing RMP. Based on this comparison, the combination of the ACEPM and new regulations meet or exceed the "on the books" management actions described in the RMP.

Table 3.2-13 Comparison of Applicant Committed Environmental Protection Measures and New Regulations for Air Quality to "On the Books" Management Actions in the ARTSD for CFO RMP Revision

Source Type	CFO RFDOTB[1]	ACEPM/New Regulations
Goals	Manage oil and gas activities to comply with all local, State, Tribal, and Federal laws, regulations, standards and implementation plans.	The proposed action will comply with all local, State, Tribal, and Federal laws, regulations, standards and implementation plans.

2 https://www.epa.gov/ozone-pollution/2015-national-ambient-air-quality-standards-naaqs-ozone

3 https://www3.epa.gov/airtrends/pdfs/Ozone_DesignValues_20122014_FINAL_08_03_15.xlsx. Accessed July 13, 2016 Table 1. County Status.

Table 3.2-13 Comparison of Applicant Committed Environmental Protection Measures and New Regulations for Air Quality to "On the Books" Management Actions in the ARTSD for CFO RMP Revision

Source Type	CFO RFDOTB[1]	ACEPM/New Regulations
	Manage oil and gas activities to protect air quality and, within the scope of BLM's authority, minimize emissions that cause or contribute to violations of air quality standards or that negatively impact air quality related values (AQRV). Manage oil and gas activities to minimize emissions of GHG.	The proposed action does not cause or contribute to a violation of NAAQS or AQRV. The proposed action reduces the emissions of GHG per well when compared to the ARTSD CFO RMP Revision.
Objectives	Manage oil and gas activities to meet ambient air quality standards.	The proposed action does not cause or contribute to a violation of NAAQS or AQRV.
Level of development	Emission would reflect development of approximately 16,000 oil and gas wells (6,400 BLM and 9,600 non-BLM).	The level of development of the proposed action is within the scope of development analyzed by the ARTSD for CFO RMP Revision.
Drill Rig Engines	Drill rig and frac pump engines would meet New Mexico and EPA requirements.	Drill rig and frac pump engines meet the New Mexico and EPA requirements based on date of engine manufacture or installation. The proponent will transition nonroad engines associated with drilling, fracturing, and completion to Tier 4 (or equivalent) by 2020.
Well Completion and Testing	Following EPA New Source Performance Standards for the Oil and Gas Industry, beginning January 1, 2015, operators will be required to capture the natural gas associated with hydraulically fractured natural gas well completions, which can be accomplished by green completion practices. This would be required unless the need for exemption is documented.	On June 3, 2016, EPA promulgated changes to the 2012 NSPS and new NSPS for Oil and Gas Production (Subpart OOOOa)[2]. The new rules require reduced emission completions for oil wells in addition to hydraulically fractured gas wells. Therefore, completion controls would be more stringent than the ARTSD for CFO RMP Revision.
Construction Activities and Fugitive Dust Control	No similar action	The proposed action would include the use of watering and best management practices to reduce emissions from surface disturbance and wind erosion.
Tanks	Oil tanks, condensate tanks, and produced water tanks would be required to meet applicable EPA NSPS (2012) emission standards such that new storage tanks with VOC emissions of 6 tons per year or more must	The proposed action would comply with 2012 and 2016 NSPS which require controls of 95% or greater on tanks emitting more than 6 tons per year of VOC.

Table 3.2-13 Comparison of Applicant Committed Environmental Protection Measures and New Regulations for Air Quality to "On the Books" Management Actions in the ARTSD for CFO RMP Revision

Source Type	CFO RFDOTB[1]	ACEPM/New Regulations
	reduce VOC emissions by at least 95 percent.	
Compressor Engines	New and modified centrifugal and reciprocating compressors at gas gathering and boosting stations, well sites and gas processing plants will be required to meet EPA NSPS (2012) and New Mexico Environment Department (NMED) requirement and standards.	The proposed action would comply with the 2016 NSPS which requires reciprocating compressors to reduce emissions of VOC and methane from reciprocating compressors by replacing the rod packing every 26,000 hours or route rod packing emissions to a closed vent system. These controls are more stringent than the management actions of the ARTSD for CFO RMP Revision.
Glycol Dehydrators	Glycol dehydrators located at well sites, gathering and boosting stations, gas processing plants, and natural gas transmission stations will required to meet applicable EPA National Emission Standards for Hazardous Air Pollutants (NESHAP) for Oil and Gas Production (2012)	The proposed action would comply with the NESHAP for Oil and Gas as applicable.
Air Monitoring	No similar action	The proposed action does not include provisions for new or enhanced monitoring of air quality.
Pump and Compressor Electrification	No similar action	The proposed action does not include the electrification of pumps or compressors to reduce emission.
Pneumatic Controllers	Pneumatic controllers at gas gathering and boosting stations, well sites and gas processing plants will be required to meet EPA NSPS (2012) requirements. This would be required unless the need for exemption can be documented.	The proposed action would comply with the 2016 NSPS which requires all pneumatic controllers to be low-bleed and pneumatic diaphragm pumps will be routed to a control device or return vent gas to the process. These provisions are more stringent than the ARTSD for CFO RMP Revision.
Gas Processing Plants	New and modified natural gas sweetening units at gas processing plants will be required to meet EPA (2012) requirements.	The proposed action does not include the construction and operation of natural gas processing plants.
Equipment Leaks	No mitigation for equipment leaks was specified.	The proposed action will be required to the meet the 2016 NSPS which include requirements of Leak Detection and Repair (LDAR) using optical gas imaging or hand-hand analyzer at well sites and compressor stations. This

Table 3.2-13 Comparison of Applicant Committed Environmental Protection Measures and New Regulations for Air Quality to "On the Books" Management Actions in the ARTSD for CFO RMP Revision

Source Type	CFO RFDOTB[1]	ACEPM/New Regulations
		requirement is more stringent than the ARTSD for CFO RMP Revison.

Notes:
1 ARTSD (URS 2013), Table 2-1 for Alternative RFD On-the-Books Controls (RFDOTB)
2 See 81 FR 107 published June 3, 2016

Once operations cease and the area is reclaimed, there would be no continued emissions of air pollution above background levels. No residual impacts to air quality from the proposed action are anticipated since reclamation and revegetation would stabilize exposed soil and control fugitive emissions. As vegetation becomes established, particulate levels should return to what is typical for an arid environment. Air quality would revert to its original state.

Additional Mitigation and Conditions of Approval

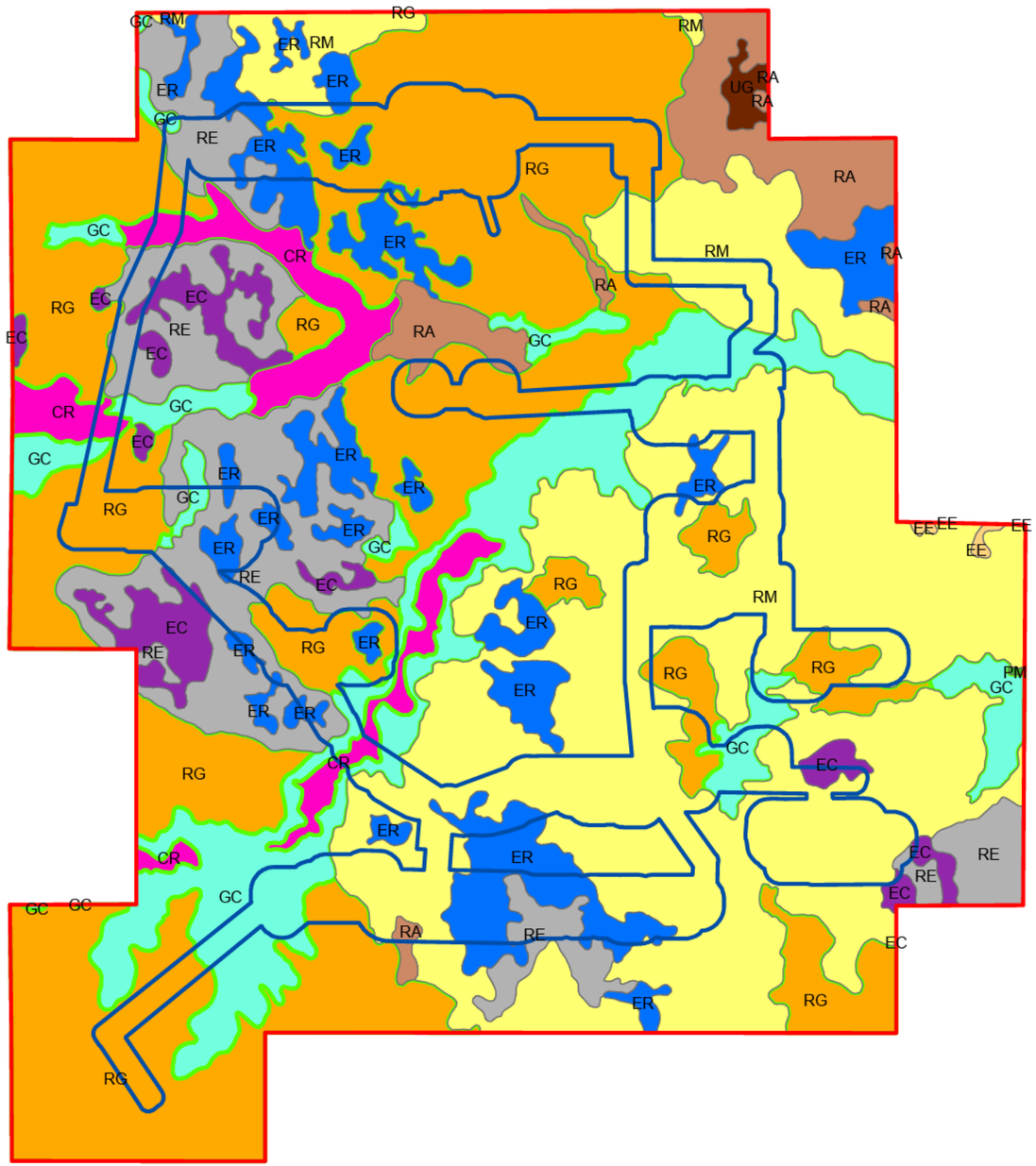
In order to ensure that the proponent's impacts are consistent with the operating parameters considered in the analysis, BLM is requiring the following mitigation measures be implemented. These mitigations measures will be Conditions of Approval for an application for a permit to drill (APD) requested under this MDP.

- All project activities including equipment emissions shall meet or exceed all state and federal standards for air quality as regulated by the New Mexico Environment Department Air Quality Bureau and the U.S. Environmental Protection Agency.
- The operator will implement a drill and completion rig schedule where Tier 4 (or equivalent) drill and completion rigs are phased in. The operator will not exceed four drill rigs at one time and will be 100% compliant with Tier 4 (or equivalent) standards in 2020.
- During the drilling phase, the operator will emit NOx emissions of 262.95 tons per year (tpy) or less from nonroad (mobile sources) between Year 1 and Year 3 and 220.7 tpy or less from nonroad (mobile sources) for the remainder of the drilling phase.
- The operator will emit 213.6 tpy or less of NOx emissions during production operations, as defined in the emission inventory analyzed in the Environmental Assessment. The operator will submit emissions and/or parameters with an Application for Permit to Drill or annual emissions inventory that show the NOx emissions are within the limits of the air quality analysis within the Environmental Assessment.

3.3. Soils

Affected Environment

Soils within the area of analysis were mapped for the soil survey of Eddy County, New Mexico (Soil Conservation Service 1971). As shown on **Figure 3.3-1**, multiple mapped soil units are present, and can be assigned to one of three general categories: loamy, shallow, or gypsum (**Table 3.3-1**; BLM 2014a). These categories represent groups of soils with different physical characteristics as well as different capabilities for producing native plants.



LEGEND:

- EA Area of Analysis
- MDP Project Area

NRCS Soils

- Ector stony loam (EC)
- Ector extremely rocky loam (EE)
- Ector-Reagan association (ER)
- Pima silt loam (PM)
- Reagan loam (RA)
- Reagan-Upton association (RE)
- Reeves-Reagan loams (RM)
- Upton (UG)

Nominated Gypsum Soils Area of Critical Environmental Concern

- Cottonwood-Reeves loams, overflow (CR)
- Gypsum land-Cottonwood complex (GC)
- Reeves-Gypsum land association (RG)

Notes:

-USDA Natural Resources Conservation Service Soil layer for Eddy County, NM obtained from BLM

-CR, GC, and RG soil map units are part of nominated Gypsum Soils Area of Critical Environmental Concern

Projection:
WGS 1984

NORTH

0 6,800 13,600 Feet

CHEVRON HAYHURST MDP EA

FIGURE 3.3-1
Soil Resources

ANALYSIS AREA: Eddy County, New Mexico

Date: 7/5/2016 | Prepared By: BW

DIV/GROUP: ENV/MDV DB: webb LD: PIC: PM: TM:
PROJECT PATH: Z:\GISPRO_ECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment\Final\Figure3.3-1_SoilResources.mxd DATE: 6/6/2016 10:02:11 PM

This page intentionally left blank.

Water erosion hazards are highest in areas of moderate to steep slopes where vegetation or soil crusts have been removed. Wind erosion hazards are generally highest for disturbed loamy or silty soils. For all soil types, careful management is needed to maintain a cover of desirable forage plants and to control erosion by water and wind. Reestablishing native plant cover could take three to five years due to unpredictable rainfall and high temperatures. Most soils within the project area have low reclamation potential and are poor sources of reclamation material, meaning that revegetation and stabilization are very difficult and costly in most cases (Soil Survey Staff 2015).

Table 3.3-1 Soil Map Units

Soil Map Unit Abbreviation – Name	Slope (%)	General Category	Water Erosion Hazard	Wind Erosion Hazard	Source of Reclamation Material	Percent of MDP Project Area
CR – Cottonwood-Reeves loams, overflow*	0-3	Gypsum	Slight	Moderate	Poor	1.2
EC – Ector stony loam	0-9	Shallow	Moderate	Moderately Low	Poor	0.7
ER – Ector-Reagan association	0-9	Shallow (Ector) (70%) / Loamy (Reagan) (30%)	Moderate	Moderately Low	Poor	8.5
GC – Gypsum land-Cottonwood complex*	0-3	Gypsum	Severe	High	Poor	8.9
RA – Reagan loam	0-3	Loamy	Slight	Low	Fair	0.4
RE – Reagan-Upton association	0-9	Loamy (Reagan) (75%) / Shallow (Upton) (25%)	Slight	Low	Fair	9.6
RG – Reeves-Gypsum land complex*	0-3	Loamy (Reeves) (60%) / Gypsum (40%)	Slight	Moderate	Poor	29.4
RM – Reeves-Reagan loams	0-3	Loamy	Slight	Moderate	Poor	41.3

Notes:
Other soil map units are present within the EA area of analysis but are not within the MDP project area and would not be affected under any alternative and are not included in the description of the affected environment.

Wind erosion hazard based on the following wind erodibility groups (WEGs): WEG 1-2 (high); WEG 3 (moderately high); WEG 4-5 (moderate); WEG 6 (moderately low); WEG 7-8 (low).

WEG for soil map unit GC is not rated; erosion hazard from BLM (2014a).

* = soil map unit is part of nominated Gypsum Soils Area of Critical Environmental Concern.

Sources: BLM 2014a; Soil Conservation Service 1971; Soil Survey Staff 2015

Microbiotic soil crusts are found throughout the CFO planning area and are expected to occur within the project area, but have not been documented. These include cyanobacteria and squamulose and gelatinous lichens. While abundant in some areas, microbiotic soil crusts are scattered throughout the project area. These soil crusts are important in binding loose soil particles together to stabilize the soil surface and reduce erosion. They also function in the nutrient cycle by fixing atmospheric nitrogen, contributing to soil organic matter, and maintaining soil moisture. In addition, they can act as a living mulch, which discourages the establishment of annual/invasive weeds. Structurally they form an uneven, rough carpet that reduces raindrop impact and slows surface runoff. Below the surface, lichen and moss rhizines, fungal hyphae, and cyanobacterial filaments act to bind the soil surface particles just below and at the surface. Horizontally, they occur in nutrient-poor areas between plant clumps. Because they lack a waxy epidermis, they tend to leak nutrients into the surrounding soil. Vascular plants such as grasses and forbs can then utilize these nutrients (Belnap et al. 2001).

Shallow

These soils are shallow to very shallow, well-drained, calcareous, stony and rocky loams over limestone and caliche. Topography ranges from nearly level ridgetops to side slopes to cliffs and escarpments. Permeability is moderate, water-holding capacity is very low to low, and runoff is rapid after soils become saturated. Shallow soils are subject to water erosion, but the stones and rock outcrops help to stabilize

the soils on nearly level to gently sloping areas. These soils typically have scattered populations of squamulose lichens and a few crustose lichens, while gelatinous lichens and cyanobacteria are occasionally present primarily in the pockets of deeper soils.

Gypsum

Gypsum type soils have a loamy surface layer, with gypsiferous materials starting at a depth of 1 to 10 inches. They are found on gently undulating uplands, with steep, broken gypsum outcrops occurring in places. Permeability varies from very low to moderate, water-holding capacity is very low to low, and runoff rapid to very rapid. Soil fertility and the rooting zone are limited by the underlying gypsiferous material. These soils are subject to severe erosion once the vegetative cover is lost. These areas have good populations of squamulose lichens, a few crustose and gelatinous lichens, and cyanobacteria, which are present throughout the top 2 millimeters of the soil.

Soil map units CR, GC, and RG constitute the nominated Gypsum Soils Area of Critical Environmental Concern (ACEC) due to the presence of fragile microbiotic soil crust, high erosion potential when the crust is disturbed, and poor revegetation potential. These soils tend to be located along the banks and sidewalls of draws and in drainage bottoms. The BLM CFO has identified the Southern Gypsum Soil Area. This 62,800-acre area is characterized by gypsum soils with low organic matter content, sparse vegetation, rapid to very rapid runoff, very low to low water-holding capacity, and high salinity that limits plant rooting. These soils are also subject to severe erosion if the vegetative cover is lost (BLM 2014a). Within this area, some off-road travel activities are restricted, but no specific management designations have been prescribed (BLM 1988). The nominated Gypsum Soils ACEC and Southern Gypsum Soil Area are shown on Figure 3.3-1.

Loamy

Generally, loamy type soils are deep, well-drained, moderately dark colored, and calcareous. These soils typically occur on gently undulating plains and in the broader valleys of the hills and mountains. Permeability is moderate, water-holding capacity is moderate to high, and runoff is likely after prolonged or heavy rains. Careful management is needed to maintain a cover of desirable forage plants and to control erosion. Reestablishing native plant cover could take three to five years due to unpredictable rainfall and high temperatures. There is a potential for wind and water erosion due to the erosive nature of these soils once the cover is lost. These soils generally have cyanobacteria throughout the area, while squamulose, crustose, and gelatinous lichens are occasionally present.

Impacts from the Proposed Action

Direct and Indirect Impacts

Construction-related impacts to soil resources may include compaction and degradation of factors necessary to support vegetation. There is a potential for wind and water erosion due to the erosive nature of some project area soils once the cover is lost, particularly within gypsum type soils. Based on the layout of project components presented in the MDP and APDs, approximately 530 acres of short-term impacts are expected in soils within the Nominated Gypsum Soils ACEC, particularly the Reeves-Gypsum land complex. Approximately 63 acres of short-term disturbance would be in soils with a severe water erosion hazard (i.e., Gypsum land-Cottonwood complex). Long-term impacts due to soil erosion could occur in areas where reclamation is difficult and where establishment of vegetation takes longer than expected.

Microbiotic soil crusts are expected to occur within the project area and may be impacted by surface disturbances, also contributing to increased potential for erosion. Recovery rates for microbiotic soil crusts are generally slow, specifically for lichen and moss, which can take 45 to 250 years, respectively (Belnap and Gillette 1997). Long-term effects would occur from surface disturbances in areas of microbiotic soil crusts. There is potential for soil contamination due to spills or leaks. Soil contamination from spills or leaks can result in decreased soil fertility, less vegetative cover, and increased soil erosion.

Impacts to soil resources are reduced by standard practices such as utilizing existing surface disturbance, minimizing surface disturbances, minimizing vehicular use, placing parking and staging areas on caliche surfaced areas, reclaiming the areas not necessary for production, and quickly establishing vegetation on the reclaimed areas.

With implementation of design features and reclamation, short-term impacts to soil resources would be moderate and long-term impacts would be minor. These features include caliche surfacing, interim reclamation, reclamation monitoring, topsoil stockpiling, segregation, and erosion prevention through the use of soil retention blankets in areas of high wind or water erosion.

Cumulative Impacts

The CIA for soils is the same as described in Section 3.1 (Figure 3.1-1). Soil types within the CIA have similar overall soil properties to those within the EA analysis area. These general properties include high gypsum concentrations in some components, poor suitability as reclamation material, slight water erosion hazards (but severe in gypsum soils), and moderate wind erosion hazards.

Project construction would result in the temporary disturbance of approximately 1,808 acres of soils. This represents approximately 22 percent of the total estimated disturbance from past, present, and reasonably foreseeable future activities within the CIA. Based on the total amount of disturbance within the CIA, minor to moderate cumulative impacts to soil resources are expected. When considering the low reclamation suitability of soils within the CIA, reclamation and reestablishment of vegetation for all past, present, and reasonably foreseeable future activities are likely to be only partially successful. Minor adverse cumulative impacts to soil resources are expected under the proposed action.

Mitigation Measures and Residual Impacts

Anticipated impacts to soil resources would be less than significant; therefore, no mitigation measures are required for the MDP or 12 submitted APDs. Additional mitigation may be required on an individual APD or ROW basis as determined by the BLM. For example, where roads are proposed in gypsum soil areas, the CFO may require the use of dust abatement measures to mitigate potential impacts to gypsum soils. The CFO has analyzed impacts from the use of dust abatement in a separate programmatic EA (DOI-BLM-NM-P020-2015-0231-EA). The need for dust abatement to mitigate impacts would be determined in future ROW applications that are submitted for gypsum soil areas. Other examples of potential additional mitigation include the potential identification of large expanses of microbiotic soil crusts during onsite reviews that may require additional avoidance measures. Impacts to microbiotic soil crusts, including increased erosion rates and loss of other soil functions, would be reduced through interim and final reclamation; however, damaged soil crusts would take up to 250 years to recover and would represent a residual impact. Overall residual impacts to soil resources with implementation of design features and mitigation that may be required for individual APDs or ROWs are expected to be less than significant.

3.4. Caves and Karst

Affected Environment

The area of analysis for cave and karst resources is the Carlsbad Underground Water Basin, as defined by the New Mexico Office of the State Engineer (NMOSE) (**Figure 3.4-1**). The project area is located in gypsum karst terrain, a landform that is characterized by underground drainage through solutionally enlarged conduits. Gypsum karst terrain may contain sinkholes, sinking streams, caves, and springs. Sinkholes leading to underground drainages and voids are common. These karst features, as well as occasional fissures and discontinuities in the bedrock, provide the primary sources for rapid recharge of the groundwater aquifers of the region.

The BLM categorizes all areas within the CFO as having either low, medium, high, or critical cave potential based on geology, occurrence of known caves, density of karst features, and potential impacts to freshwater aquifers. The southern portion of the project area occurs within a medium karst zone and all other portions are within a high karst zone. A medium karst zone is defined as an area in known soluble

rock types but may have a shallow insoluble overburden. These areas may contain isolated karst features such as caves and sinkholes. Groundwater recharge may not be wholly dependent on karst features but the karst features still provide the most rapid aquifer recharge in response to surface runoff. A high karst zone is defined as an area in known soluble rock types and contains a high frequency of significant caves and karst features such as sinkholes, bedrock fractures that provide rapid recharge of karst aquifers, and springs that provide riparian habitat.

Field notes from baseline surveys (Arcadis 2016) and onsite inspections indicate that cave and karst features are present within or near the project area. Locations of these features are illustrated on **Figure 3.4-2**. Karst features were identified within approximately 100 meters of the proposed APD Group 1 well pad access road and pipeline alignment during the onsite inspection (**Figure 2.1-3**). The majority of features identified during baseline surveys were closed depressions or fissures that may represent surface expressions of underground features. These features may represent preferential flow pathways by which surface waters could reach groundwater and are areas where surface openings may develop in the future. Collapsed sinkholes and similar features (e.g., mammal burrows that collapsed due to water intake) with observed surface openings were also identified.

Sinkholes and cave entrances collect water and can accumulate rich organic materials and soils. This, in conjunction with the stable microclimate near cave entrances, supports a greater diversity and density of plant life, which provides habitat for a greater diversity and density of wildlife such as raptors, rodents, mammals, and reptiles.

The interior of the caves support a large variety of troglobitic, or cave environment-dependent species. The troglobitic species have adapted specifically to the cave environment due to constant temperatures, constant high humidity, and total darkness. Many of the caves in this area contain fragile cave formations known as speleothems.

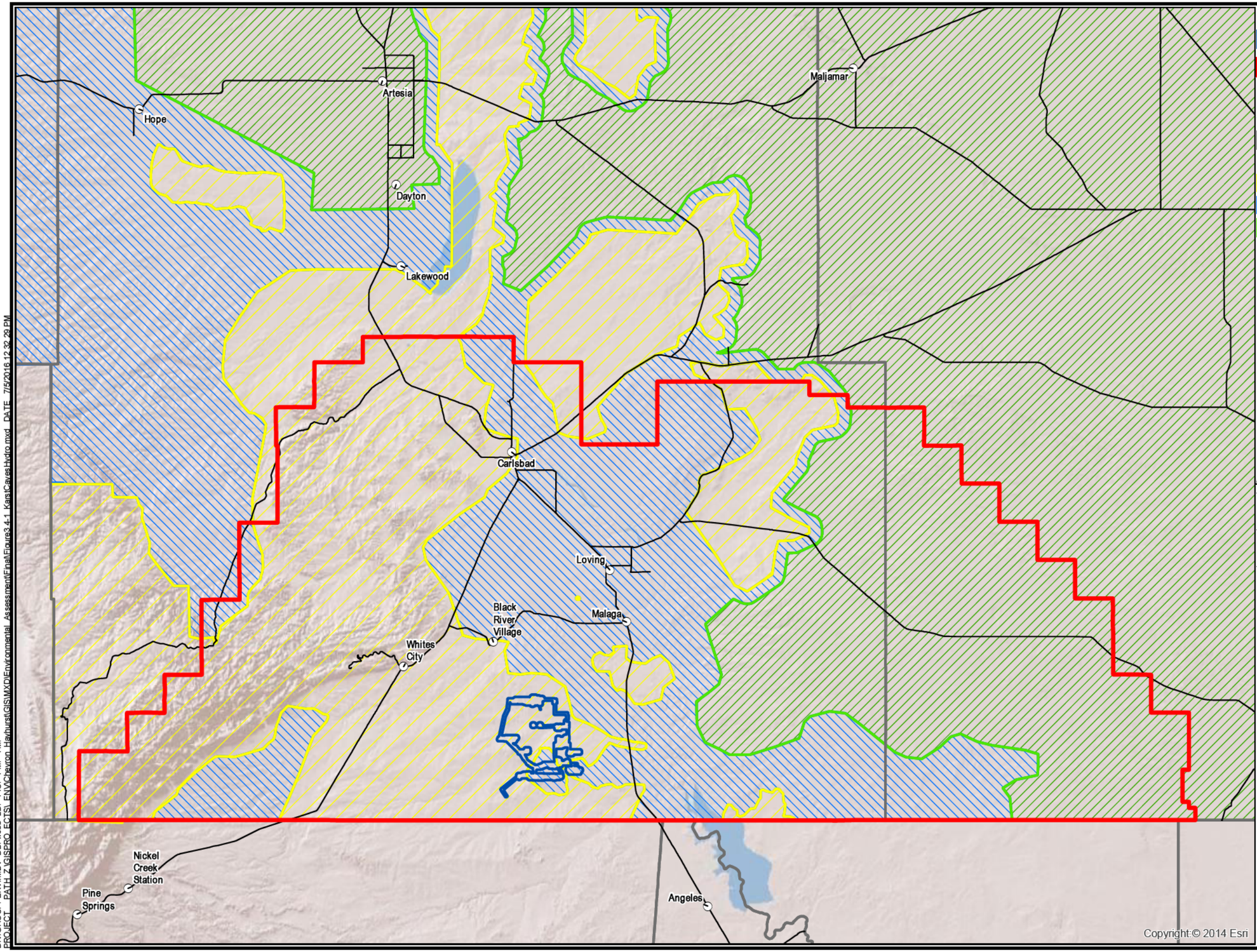
Impacts from the Proposed Action

Direct and Indirect Impacts

Cave and karst features provide direct conduits leading to groundwater. These conduits can quickly transport surface and subsurface contaminants directly into underground water systems and freshwater aquifers without filtration or biodegradation. In addition, contaminants spilled or leaked into or onto cave/karst zone surfaces and subsurfaces may lead directly to the disruption, displacement, or extermination of cave species and critical biological processes. In extreme or rare cases, a buildup of hydrocarbons in cave systems due to surface leaks or spills could potentially cause underground ignitions or asphyxiation of wildlife or humans within the cave.

In cave and karst terrains, rainfall and surface runoff is directly channeled into natural underground water systems and aquifers. Changes in geologic formation integrity, runoff quantity/quality, drainage course, rainfall percolation factors, vegetation, surface contour, and other surface factors can negatively impact cave ecosystems and aquifer recharge processes. Blasting, heavy vibrations, and focusing of surface drainages can lead to slow subsidence, sudden collapse of subsurface voids, and/or cave ecosystem damage. A more complete discussion of the impacts of oil and gas drilling is provided in the Dark Canyon Environmental Impact Statement (BLM 1992).

The BLM maintains up-to-date locations and surveys of known cave and karst features, and multiple cave and karst features were identified during baseline surveys (Arcadis 2016a). Project activities will be located away from these features whenever possible. Drilling pads, roads, utilities, pipelines, and flowlines will be routed around cave and karst features at an adequate distance to mitigate adverse impacts. Wellbore engineering plans will incorporate required cave and aquifer protection protocols.



LEGEND:

- MDP Project
- Area of Analysis for Caves, Karst, and Subsurface Hydrology
- Cities
- Major Highways
- County Boundary

Karst Occurence Potential

- High Potential Karst
- Medium Potential Karst
- Low Potential Karst

Notes:

-Impact analysis for some resources utilizes a different Area of Analysis as illustrated on resource-specific figures
-Data sources: Karts occurrence potential (BLM 2014a); Carlsbad Underground Water Basin (Office of the State Engineer, 2007).
-The cave and karst area of analysis is the Carlsbad Underground Water Basin, as designated by the NM Office of the State Engineer.

Projection:
WGS 1984

NORTH

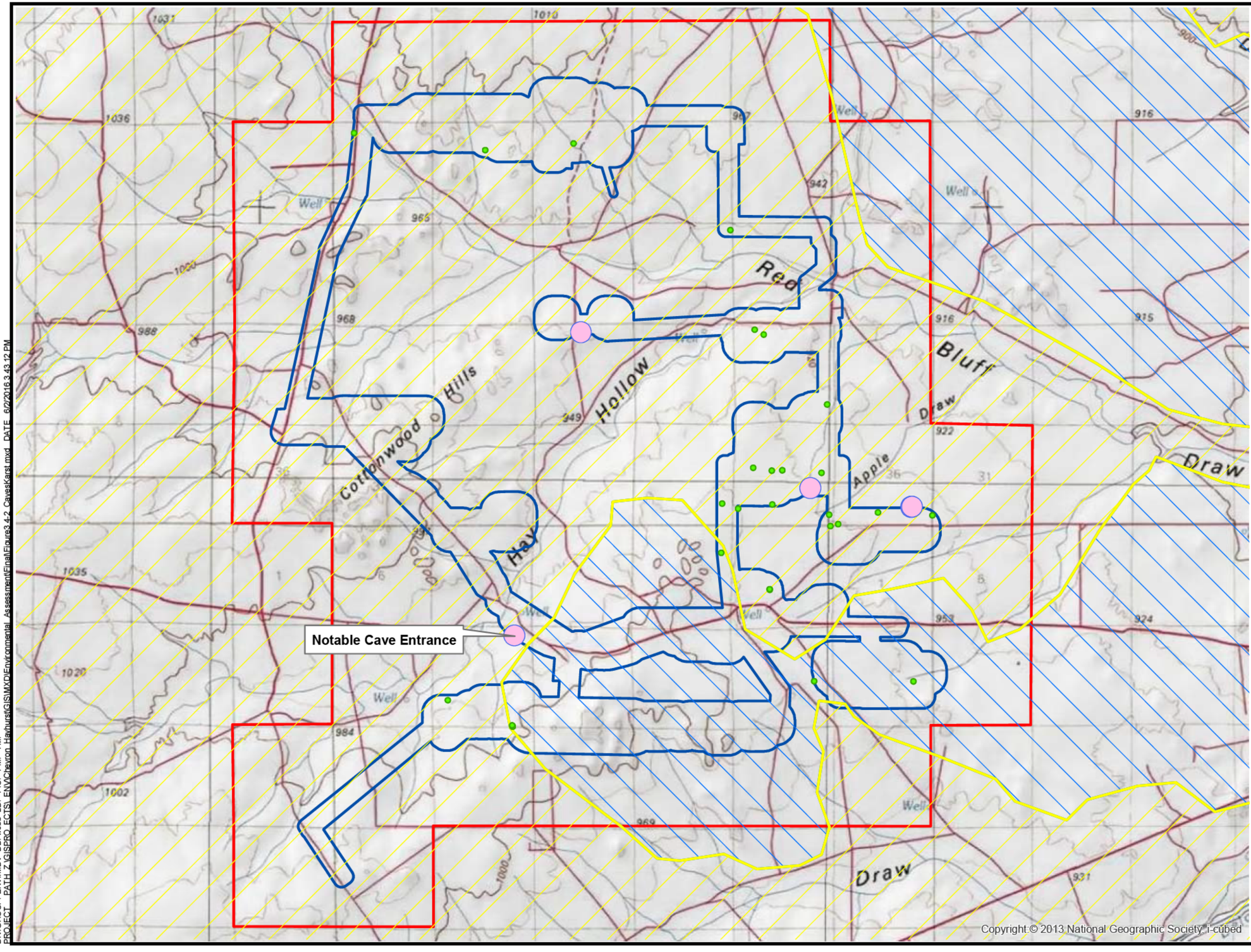
0 9 18 Miles

CHEVRON HAYHURST MDP EA

FIGURE 3.4-1
Caves, Karst, and Subsurface Hydrology

ANALYSIS AREA: Eddy County, New Mexico
Date: 7/5/2016 | Prepared By: BW

DIV/GROUP: ENV/MDV DB: webb LD: PIC: PM: TM:
PROJECT PATH: Z:\GIS\PRO_ECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment\Final\Figure3.4-1_KarstCaves\Hydro.mxd DATE: 7/5/2016 12:32:29 PM



LEGEND:

- MDP Project Area
- Area of Analysis
- Features without Surface Openings (50 meter buffer)
- Features with Surface Openings (200 meter buffer)

Karst Occurence Potential

- High Potential Karst
- Medium Potential Karst

Projection:
WGS 1984

NORTH

0 6,000 12,000 Feet

CHEVRON HAYHURST

FIGURE 3.4-2
CAVE AND KARST FEATURES

ANALYSIS AREA: Eddy County, New Mexico

Date: 6/6/2016 | Prepared By: BW

DIV/GROUP: ENV/MDV DB: webb LD: PIC: PM: TM:
PROJECT PATH: Z:\GIS\PRO_ECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment\Final\figure3.4-2_CavesKarst.mxd DATE: 6/2/2016 3:43:12 PM

Highly sensitive cave and karst areas with critical freshwater aquifer recharge concerns may have a number of special surface and subsurface planning and construction requirements based upon the risk of adverse impacts created by a specific location or process. Due to the presence of identified karst features within the Project Area, the proposed action is subject to mitigation measures designed to adequately protect known and potential cave/karst resources.

Construction Impact Analysis

The construction of roads, pipelines, well pads, and utilities can impact bedrock integrity and reroute, impede, focus, or erode natural surface drainage systems. Increased silting and sedimentation from construction can plug downstream sinkholes, caves, springs, and other components of aquifer recharge systems and result in adverse impacts to aquifer quality and cave environments. Any contaminants released into the environment during or after construction can impact aquifers and cave systems.

A possibility exists for slow subsidence or sudden surface collapse of a sinkhole, cave passage, or void during road, well pad, pipeline, ancillary facility, powerline, and other construction operations. This would cause associated safety hazards to operators of equipment, and the potential for increased negative environmental impact. Opening a new entrance into a cave system can change air flow patterns, temperatures, insurgencies, mineral development, and biological community and may cause other undetermined effects on the cave ecosystem. These subsidence processes can be triggered or enhanced by intense vibrations and rerouting or refocusing of surface drainages.

Roads and road drainage turnouts can direct or funnel runoff water into cave entrances or sinkholes. Contaminants from spills and general road runoff (such as oil and other petroleum products, salt water, and other debris) can be transported directly into the cave systems, causing negative effects on the cave environment and ecosystem. Because cave ecosystems are extremely fragile and easily disturbed, the negative effects to the cave's biological components may include disruption of some of its species. Because karst terrains and cave systems are directly and integrally linked to groundwater recharge, contaminants spilled on roads or leaking pipelines in these areas may lead directly to groundwater contamination.

Buildup of toxic or combustible fumes in caves and cave entrances from spills on roadways may harm wildlife and cave visitors and, in extreme cases, lead to asphyxiation or rapid ignition in the rare event that the fumes are ignited by visitors.

Encountering a void would also have adverse impacts on the stability of a power pole and may result in the subsequent failure of that pole. Slow subsidence or sudden collapse of sinkholes may also leave pipelines hanging and increase their possibility of leaking or failure.

Blasting will not be used as a construction method.

Drilling Impact Analysis

During drilling, previously unknown cave and karst features could be encountered. If a void is encountered while drilling and a loss of circulation occurs, lost drilling fluids can directly contaminate groundwater recharge areas, aquifers, and groundwater quality. Drilling operations can also lead to sudden collapse of underground voids. Cementing operations may plug or alter groundwater flow, potentially reducing the water quantity at springs and water wells. Inadequate subsurface cementing, casing, and cave/aquifer protection measures can lead to the migration of oil, gas, drilling fluids, and produced saltwater into cave systems and freshwater aquifers.

Production Impact Analysis

Production facilities such as tank batteries, pump-jacks, compressors, transfer stations, and piping may fail and allow contaminants to enter caves and freshwater systems. Downhole casing and cementing failures can allow migration of fluids and/or gas between formations and aquifers. Facilities may also be subject to slow subsidence or sudden collapse of the underlying bedrock.

Plugging and Abandonment Impact Analysis

Failure of a plugged and abandoned well can lead to migration of contaminants to karst resources and freshwater aquifers. While this action does not specifically approve plugging and abandonment procedures, the operator should be made aware that additional or special Conditions of Approval may apply at that time.

Cumulative Impacts

The CIA for subsurface hydrology is the Carlsbad Underground Water Basin (**Figure 3.4-1**) as well as the portions of the Red Bluff Draw watershed and Gyp Draw-Delaware River subwatershed that extend into Texas. High to moderate potential for cave and karst resources is present throughout the majority of the CIA, similar to that described for the EA area of analysis (Stafford et al. 2008).

The types impacts of past, present, and reasonably foreseeable future actions would be similar to those described for the proposed action and include potential groundwater contamination and hydrocarbon releases into cave atmospheres, leading to dangerous conditions. Containment ponds associated with some older wells are a risk of contaminant leakage, as are the multiple pipelines, tank batteries, and related facilities present within the CIA.

Dye trace studies conducted by BLM within the CIA have shown connectivity between karst aquifers and lost circulation zones encountered during oil and gas well drilling. These results indicate that past oil and gas operations have likely introduced an unknown quantity of multiple potential contaminants to karst aquifers within the CIA. The extent to which karst aquifer water quality and associated riparian and cave biological communities have been affected has not been determined.

Most ongoing and future oil and gas operations within the CFO are or will be required to incorporate design features, mitigation measures, or conditions of approval to conduct operations within karst areas. These provisions would not apply to oil and gas leases on private or state lands. Past, present, and reasonably foreseeable future actions are likely to contribute to adverse cumulative impacts on cave and karst resources, including groundwater quality and associated ecosystems.

Mitigation Measures and Residual Impacts

Any industrial activities that take place upon or within karst terrains or freshwater aquifer zones have the potential to create both short-term and long-term negative impacts to freshwater aquifers and cave systems. While a number of mitigation measures can be implemented to mitigate many impacts, it is still possible for impacts to occur from containment failures, well blowouts, accidents, spills, and structural collapses. Many of these impacts would likely have long-term, residual effects to resource conditions such as groundwater quality and cave ecosystem functionality. It is therefore necessary to implement long-term monitoring studies to determine if current mitigations measures are sufficient enough to prevent long-term or cumulative impacts.

To mitigate or lessen the probability of impacts associated with the drilling and production of oil and gas wells in karst areas, the guidelines listed in Appendix 3, Practices for Oil and Gas Drilling and Production in Cave and Karst Areas, as approved in the Carlsbad Resource Management Plan Amendment of 1997, page AP3-4 through AP 3-7 will be followed. Many of the mitigation measures provided in the 1997 RMP Amendment have been incorporated into the proposed action as design features and are not considered mitigation measures. Avoidance of known cave and karst features would be prioritized during APD and ROW review. Implementation of mitigation measures is expected to reduce short-term, long-term, and residual impacts to cave and karst resources to less than significant levels.

Additional mitigation is required for the karst features identified closer than 200 meters from the proposed APD Group 1 access road and flowlines. Prior to surface disturbances for construction of the access road, pipeline, flowline, or utility line, straw wattles would be placed along the north side of the area to be disturbed, within and a minimum of 50 feet on either side of the drainage that leads to the karst features.

Road Construction

Roads will be routed around sinkholes and other karst features to avoid or lessen the possibility of encountering near surface voids and to minimize changes to runoff or possible leaks and spills from entering karst systems. Turnout ditches and drainage leadoffs will not be constructed in such a manner as to increase or decrease the natural flow of water into or out of cave or karst features. The CFO will be informed immediately if any subsurface drainage channels, cave passages, or voids are penetrated during construction and no further construction will be done until clearance has been issued by the Authorized Officer. Special restoration stipulations or realignment may be required.

Pipeline Construction

To avoid or lessen the potential of subsidence or collapse of karst features, toxic or combustible gas buildup, or other possible impacts to cave and karst resources from buried pipelines, alignments may be rerouted to avoid karst features. The CFO will be informed immediately if any subsurface drainage channels, passages, or voids are intersected by trenching, and no pipe will be laid in the trench at that point until clearance has been issued by the Authorized Officer. Special restoration stipulations or realignment may be required at such intersections, if any. Leak detection systems, back flow eliminators, and differential pressure shut-off valves may be required to minimize the impacts of leaking or ruptured pipelines. To eliminate these extreme possibilities, good record keeping is needed to quickly identify leaks for their immediate and proper treatment.

Powerline Construction

Smaller powerlines will be routed around sinkholes and other karst features to avoid or lessen the possibility of encountering near surface voids and to minimize changes to runoff or possible leaks and spills from entering karst systems. Larger powerlines will adjust their pole spacing to avoid cave and karst features. The CFO will be informed immediately if any subsurface drainage channels, cave passages, or voids are penetrated during construction and no further construction will be done until clearance has been issued by the Authorized Officer. Special restoration stipulations or realignment may be required.

Drilling Mitigation

Federal regulations and standard Conditions of Approval applied to all APDs require that adequate measures are taken to prevent contamination to the environment. Due to the extreme sensitivity of the cave and karst resources in the Project Area, additional drilling, casing, and cementing procedures to protect cave zones and freshwater aquifers may be required for APDs covered under the MDP on a case-by-case basis.

Production Mitigation

In addition to the leak detection programs for surface facilities and containment ponds provided under the Proposed Action, additional leak detection Conditions of Approval may be applied on a case-by-case basis for production activities covered under the MDP.

Plugging and Abandonment Mitigation

Upon well abandonment in high cave karst areas additional plugging conditions of approval may be required. The BLM will assess the situation and work with the operator to ensure proper plugging of the wellbore.

3.5. Watershed

Affected Environment

Surface Hydrology

The surface hydrology area of analysis is characterized by relatively flat to gently sloping terrain dissected by ephemeral tributaries to the Pecos River (**Figure 3.5-1**). Somewhat steeper, hilly terrain is present in

the western portion of the Project Area in the Cottonwood Hills, where relief is up to about 200 feet. The main drainage within the Project Area is Red Bluff Draw, which collects runoff from North and South Hackberry Draws, Cottonwood Draw, Apple Draw, Hay Hollow Draw, and other unnamed drainages prior to its confluence with the Pecos River. Minor, unnamed drainages in the southern portion of the Project Area flow southward to Owl Draw, which is tributary to the Delaware River. The confluences of Red Bluff Draw and the Delaware River with the Pecos River are both east of State Highway 285, approximately 4 and 6 miles east of the Project Area, respectively.

Water quality and quantity is influenced by physical, chemical, and biological reactions that occur as water moves over and through the land surface toward streams and into aquifers. The rate at which water moves through the watershed strongly affects these reactions. The area is located in the semi-arid southwest on the northern edge of the Chihuahuan Desert, where annual precipitation averages 10.5 inches with the greatest rainfall occurring as monsoonal storms in late summer (July through September). About half of the annual precipitation is received during this period via brief, intense storms that can cause large amounts of runoff and potential flooding (Pecos Valley Water Users Organization [Pecos Valley WUO] 2001). Temporary ponded water may be present in drainages after heavy rains. An impoundment present in the Hay Hollow drainage in T25S, R27E, Section 28 SESE typically contains water throughout the year and is likely seep- or spring-fed. No other seeps, springs, or playas were identified during baseline surveys of the Project Area (Arcadis 2016a).

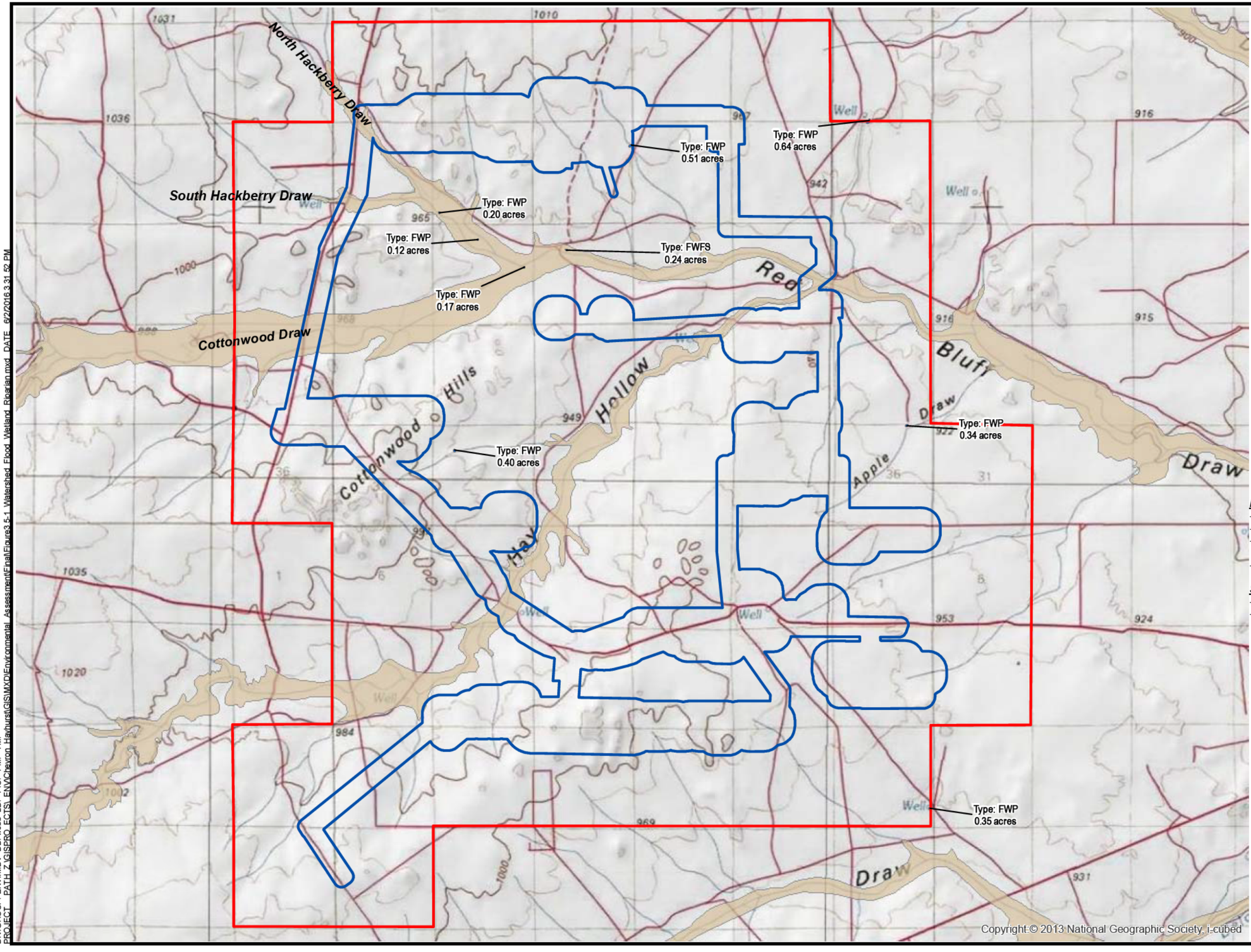
The reach of the Pecos River which Project Area drainages are tributary is impaired for two designated uses. The warm water aquatic life designated use is impaired by elevated levels of polychlorinated biphenyls (PCBs) in fish tissue and low dissolved oxygen levels. The source of PCBs is unknown and low dissolved oxygen levels are tentatively linked to discharge of groundwater with low oxygen. The irrigation designated use is impaired by elevated levels of dissolved boron, which may be linked to brine springs upstream of the Project Area near Malaga Bend (NMED 2014b).

Subsurface Hydrology

The area of analysis for subsurface hydrology is the same as for cave and karst resources (**Figure 3.4-1**). The Project Area is located in the Carlsbad Groundwater Basin, which encompasses approximately 2,347 square miles of southeastern New Mexico. No EPA-designated sole source aquifers are present within the area of analysis (U.S. Department of Agriculture [USDA] 2016). Groundwater uses within the basin include agriculture; public water supply for Carlsbad, Loving, and other towns; and industrial uses. Groundwater supplies within the basin are obtained from aquifers within underlying sedimentary units including the Dockum Group, Rustler Formation, Castile Formation, Carlsbad and Capitan Limestones, and Delaware Mountain Group. Shallow groundwater is also present in some alluvium and terrace deposits.

The Project Area is underlain by bedrock of the Permian Rustler, Salado, and Castile Formations. Formations comprising the Capitan Reef aquifer are absent. In general, the uppermost bedrock consists of the Rustler Formation in the northern and eastern portions of the Project Area; the Salado Formation in the northwestern, western, central, and southern portions; and the Castile Formation in the southwest. Within the Project Area, none of these formations has sufficient porosity and permeability to yield productive water supply wells, except where karst features are present. Water is withdrawn from the Castile Formation north of the Project Area, where it may be in hydrologic contact with alluvial aquifers (Barroll et al. 2004). Groundwater recharge is from local precipitation entering through playas, sinkholes, and swallets (disappearing streams). Precipitation in the vicinity of the project area primarily falls as rainfall during the summer and fall monsoon (Western Regional Climate Center 2016).

The Carlsbad Groundwater Basin is estimated to contain approximately 12.6 million acre-feet of groundwater within the top 100 feet of all combined aquifers (Pecos Valley WUO 2001). Sustainable groundwater yields for the basin are estimated to be at least 25,000 acre-feet per year, with potential to sustain up to approximately 93,000 acre-feet for short periods (Pecos Valley 2001).



LEGEND:

- MDP Project
- Area of Analysis for Watershed, Floodplains, Wetlands, and Riparian Areas
- National Wetland Inventory Wetlands
- FEMA 100-Year Floodplain

Notes:
-FWP = Freshwater Pond wetland
-FWFS = Freshwater Forested/Shrub wetland
-Area of analysis for these resources is the same as the Project Area
-No riparian areas identified within area of analysis

Source data:
-Wetlands - USFWS 2016
-Floodplains - FEMA 2010

Projection:
WGS 1984

NORTH

0 6,000 12,000 Feet

CHEVRON HAYHURST

FIGURE 3.5-1
WATERSHED, FLOODPLAINS, WETLANDS, AND RIPARIAN AREAS

ANALYSIS AREA: Eddy County, New Mexico
Date: 6/2/2016 | Prepared By: BW

DIV/GROUP: ENV/MDV DB: webb LD: PIC: PM: TM:
PROJECT PATH: Z:\GIS\PRO_ECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment\Final\Figure3.5-1_Watershed_Flood_Wetland_Riparian.mxd DATE: 6/2/2016 3:31:52 PM

This page intentionally left blank.

Basin-wide recharge estimates are not established; however, recharge for some individual aquifers within the basin are estimated as follows. Annual recharge is estimated to be 10,000 to 20,000 acre-feet for the Capitan Reef aquifer and an average of 8,000 acre-feet for the Pecos Valley alluvial aquifer. Irrigation seepage is also estimated to recharge approximately 36,000 acre-feet to the Pecos Valley alluvial aquifer each year. Leakage of water from Lake Avalon is estimated to recharge approximately 15,000 acre-feet each year to the Capitan Reef and Pecos Valley aquifers (NMOSE 2016). Alluvial aquifers and the Capitan Reef aquifer within the basin exhibit short-term fluctuations in water level due to precipitation and withdrawal rates. The Capitan Reef aquifer has shown a slight historical decline. Long-term trends in alluvial water levels are inconsistent. Both aquifers appear to recover quickly during periods of normal precipitation (Pecos River WUO 2001).

Basin-wide estimates of allocated withdrawals in 1996 indicate that approximately 93,500 acre-feet of water rights are recorded or permitted in the basin (Pecos Valley WUO 2001). Of that total, about one-half were supplemental to surface water rights (i.e., only to be used during drought conditions when surface water resources are limited). More recent estimates of water withdrawals for the region have been conducted on a county basis and are not distinguished by groundwater basin. County-wide withdrawals are expected to be much higher than for the Carlsbad Groundwater Basin alone, but provide a picture of distribution of water use by category. For water year 2010 in Eddy County, agriculture (109,738 acre-feet), public water supply (15,465 acre feet), and mining/oil and gas (9,303 acre-feet) comprised approximately 97 percent of all groundwater withdrawals (NMOSE 2016).

Several relatively shallow water wells have been drilled in or near the Project Area that are used primarily to support stock watering. Well yields in the Project Area and vicinity are low (typically less than 5 gallons per minute). Well depths range up to 351 feet, but most are less than 100 feet deep (Arcadis 2016a). Groundwater quality data for the area are limited. However, high sulfur and saline conditions are expected to be present based on regional water quality data and the presence of halite and gypsum/anhydrite in local bedrock (Pecos Valley WUO 2001).

Impacts from the Proposed Action

Direct and Indirect Effects

Surface Hydrology

Ephemeral surface water from local rain events will wash down-slope through the area of the proposed action. Localized decreases in vegetative surface cover combined with the caliche covering well pads, roads, and other surface facilities could result in decreased infiltration rates and increased runoff volume and velocity. This causes increased erosion, topsoil loss, and sedimentation. Water diversions (e.g., lead-off ditches, water bars), use of BMPs (e.g., straw wattles) at outlets, low water crossings, and culverts as needed would decrease the potential for erosion and sediment transport along roads. Potential sedimentation in local ephemeral drainages may occur but is not expected to contribute to downstream conditions that have caused impaired designated uses of the Pecos River. Proposed project activities would occur at least 1.25 miles from the seep- or spring-fed impoundment in the Hay Hollow drainage and are not expected to impact discharge or water quality.

Water quality can be adversely affected following the occurrence of an undesirable event such as a leak or spill. Due to typically high concentrations of dissolved solids, spills of produced water or recycled water can have adverse impacts on watershed resources.

Standard practices and design features provided in the MDP and MDP SUPO are expected to reduce potential impacts to surface hydrology. These features include utilizing a closed loop system with no reserve pits, berming, or other secondary containment production facilities; utilizing leak detection systems; utilizing existing surface disturbance; minimizing total surface disturbance; minimizing vehicular use; surfacing parking and staging areas with caliche; and reclaiming areas not necessary for production and quickly reestablishing vegetation on the reclaimed areas. Overall impacts to surface hydrology would be minor.

Subsurface Hydrology

As described in Section 3.4, cave and karst features provide direct conduits leading to groundwater and can transport contaminants into underground water systems and freshwater aquifers. Potential impacts to subsurface hydrology and groundwater associated with caves and karst are also described in Section 3.4.

Implementation of the proposed water recycling system would reduce the overall water demand compared to similar projects that would rely solely on groundwater resources for completion and other activities. Withdrawal of groundwater for use in project construction, drilling, completion, and reclamation would affect local groundwater aquifers. A total of approximately 3,770,000 bbl of freshwater would be required for construction, dust control, and hydrostatic testing over the life of the project, with an additional maximum of approximately 3,050,000 bbl required for drilling in karst zones. Over the life of the project, the maximum total withdrawal of fresh groundwater for these purposes would be approximately 6,820,000 bbl of water, or 880 acre-feet. Assuming withdrawal of the 880 acre-feet is equally distributed over the 17-year drilling phase of the project (i.e., through 2033), approximately 400,000 bbl (or approximately 52 acre-feet) would be withdrawn from local aquifers each year. This withdrawal rate is considered conservative (high), as some freshwater use for dust control and reclamation would occur after drilling operations have completed. Annual withdrawal of 52 acre-feet of groundwater from the Carlsbad Groundwater Basin would represent approximately one-twentieth of one percent of all permitted or recorded water rights in the basin and approximately one-tenth of one percent of non-supplemental water rights (Pecos Valley WUO 2001).

All freshwater utilized for the proposed action would be obtained from existing, permitted water sources, and no new water wells would be installed. NMOSE is responsible for reviewing and adjudicating all groundwater withdrawals within the subsurface hydrology area of analysis. Adjudications must, in general, ensure that other groundwater users are not impaired and that no additional depletions will occur on fully appropriated streams or streams with flows needed to fulfill interstate compact obligations, including the Pecos River. Therefore, obtaining freshwater from permitted sources is expected to have minor impacts on the availability of groundwater.

Required volumes of non-freshwater would be obtained from the proposed water recycling system, or from local vendors for the initial SWD well. Once completed, the proposed recycling system is expected to provide sufficient water for all project activities that do not require freshwater. As described above for freshwater, all groundwater sources in New Mexico must be permitted and adjudicated by NMOSE. Water sources in Texas are not similarly adjudicated, however. Compared to the volume of declared groundwater within CFO planning area water basins (BLM 2014a; Pecos Valley WUO 2001), project-related water withdrawal is expected to contribute to minor impacts on groundwater availability from the Capitan Reef and Rustler aquifers and minor impacts to discharge and associated streamflow.

Cumulative Impacts

The CIA for surface hydrology is shown on **Figure 3.1-1**. The CIA for subsurface hydrology is the same as described for cave and karst resources and consists of the Carlsbad Underground Water Basin (**Figure 3.4-1**) as well as the portions of the Red Bluff Draw watershed and Gyp Draw-Delaware River subwatershed that extend into Texas.

The types of impacts to surface and subsurface hydrology from past, present, and reasonably foreseeable future actions would be similar to those described for the proposed action.

Surface Hydrology

The proposed action is expected to contribute to minor cumulative impacts on surface hydrology within the CIA. Impaired designated beneficial uses within the Pecos River are either attributed to groundwater discharge with low oxygen or high dissolved boron concentrations or to unknown PCB sources. PCBs may be found associated with natural gas pipeline leaks or effluent from the discharge of condensate (Oregon Department of Environmental Quality 2003). However, the use and discharge of PCBs are highly regulated. As a result, reasonably foreseeable future actions are not expected to cumulatively contribute

to increased PCB concentrations in the Pecos River or to other impairments. Past, present, and reasonably foreseeable future actions are expected to contribute to minor amounts of sedimentation within the CIA, at levels consistent with current conditions. Overall cumulative impacts to surface hydrology are expected to be minor.

Subsurface Hydrology

The proposed action is expected to contribute to minor to moderate cumulative impacts to local freshwater aquifers and minor impacts within the Capitan Reef and Rustler aquifers. No EPA-designated sole source aquifers are present within the CIA of analysis (USDA 2016).

Total water consumption for reasonably foreseeable future actions is estimated as follows. As presented in T**able 3.1-1**, 638 oil and gas wells are projected to be drilled within the CIA through 2034. NMOCD data for well completion operations in Eddy and Lea counties during 2013 indicate that a mean of 28,930 bbl of water was used per well for completion operations (BLM 2014b). (This average value is higher than for the proposed action because the proposed action would utilize recycled water for the majority of well completions.) Based on this average, completion of 638 wells, including the proposed action wells, would require approximately 18.5 million bbl (2,380 acre-feet) of water, all of which is assumed to be withdrawn from local aquifers.

Similarly, if the proposed action use of 380,000 bbl of water per well for drilling operations is applied to all 638 reasonably foreseeable wells, an estimated total of approximately 242 million bbl (31,248 acre-feet) of water would be required for well drilling. Together with the above water requirements for completion activities, approximately 33,628 acre-feet of water are conservatively estimated to be required for reasonably foreseeable drilling and completion activities through 2034 within the CIA. Over the course of 19 years (2016-2034), this total withdrawal would average approximately 1,769 acre-feet per year. Additional water would be utilized for construction of related infrastructure, dust control, revegetation, and other purposes that are not quantified here.

Estimated withdrawal of 1,769 acre-feet of water per year would represent less than one-one hundredth of one percent of all stored groundwater within the Carlsbad Groundwater Basin. These withdrawals would represent approximately two percent of all permitted or recorded water rights in the basin and approximately four percent of non-supplemental water rights (Pecos Valley WUO 2001). The estimated withdrawal rate is also much less than known recharge rates for aquifers in the Carlsbad Groundwater Basin (NMOSE 2016).

Future recharge rates to Carlsbad Groundwater Basin aquifers may be affected by climate change. Climate models generally project decreased precipitation, along with increased temperatures, for the American Southwest, including the CIA (Maloney et al. 2014). However, specific precipitation projections for the region do not correspond well with historical regional observations and are not considered to be reliable precipitation forecasts (Kirtman et al. 2013). The lack of consistency among models is partly due to low precipitation totals and significant year-to-year variation in the region (Kennedy 2013). Therefore, although regional decreases in precipitation, along with increased temperatures and evaporation rates, may occur (e.g., Bureau of Reclamation 2013), quantification of climate impacts on recharge rates and groundwater availability within the CIA is not included in this analysis.

Water withdrawals for reasonably foreseeable future actions within the New Mexico portion of the CIA would be overseen by the NMOSE as described for the proposed action. Withdrawals within the Texas portion of the CIA would be at the discretion of the landowner and are not overseen by the state or a county conservation district. As such, there is higher potential for cumulative impacts due to water withdrawals in the Texas portion of the CIA. However, the only major bedrock aquifer present within the Texas portion of the CIA is the Rustler aquifer, which is limited to outcrops in the northeastern corner of Culberson County (Texas Water Development Board 2011). The Rustler aquifer in southeastern New Mexico contributes to Pecos River streamflow via upward discharge through alluvium and is similarly expected to contribute to flow within the Delaware and Pecos Rivers of Texas (Texas Department of

Water Resources 1978). However, due to the limited extent of the Rustler aquifer within the CIA, withdrawals are expected to be minimal.

Based on current water regulations, projected cumulative water withdrawals from Carlsbad Groundwater Basin aquifers, overall storage, estimated recharge rates (where available), and existing water rights, cumulative water withdrawals for past, present, and reasonably foreseeable future actions are expected to have negligible to minor impacts on water availability within the basin. Cumulative withdrawals would be minor in comparison to withdrawals for irrigation expected to continue to occur in other parts of the basin (NMOSE 2016). Negligible impacts to discharge from the Rustler aquifer to the Pecos River are expected, largely due to the limited extent of the Rustler aquifer within the CIA.

Mitigation Measures and Residual Impacts

With implementation of design features provided in the MDP, MDP SUPO, and APDs, anticipated impacts to watershed resources would be less than significant. Any water erosion that may occur due to the construction of well pads, access roads, or other project components during the life of the project would be quickly corrected and proper measures would be taken to prevent future erosion. Additional mitigation may be required on an individual APD or ROW basis as determined by the BLM. No residual impacts to watershed resources are anticipated.

3.6. Floodplains, Wetlands, and Riparian Areas

Affected Environment

Floodplains

Within the area of analysis, floodplains are ephemeral and are up to approximately 0.5 miles wide. Floodplains provide important water sources for animals and plants in the Chihuahuan Desert. For administrative purposes, the Federal Emergency Management Agency (FEMA)-designated 100-year floodplain serves as the basis for floodplain management within the Project Area. As shown on **Figure 3.5-1**, designated floodplains within the Project Area are located along the following drainages: North and South Hackberry Draw, Cottonwood Draw, Red Bluff Draw, and Hay Hollow (FEMA 2010).

Wetlands and Riparian Areas

Within the area of analysis, the USFWS National Wetlands Inventory (USFWS 2016a) identifies 3.4 acres of wetlands. Most of these (2.9 acres) are in the form of freshwater pond wetlands, with lesser amounts (0.5 acres) of freshwater forested/shrub wetland. One freshwater pond wetland is located within the Project Area boundary in T25S, R27E, Section 16 and was confirmed by baseline surveys (Arcadis 2016a) to represent an ephemeral dirt-bermed pond created to support grazing. All other National Wetlands Inventory-recorded wetlands within the area of analysis occur in bottomland drainages and are 0.5 miles or more downgradient from the Project Area. Baseline surveys by Arcadis (2016) did not identify any additional wetlands or riparian areas within the Project Area.

Impacts from the Proposed Action

Direct and Indirect Effects

No permanent aboveground facilities would be constructed within FEMA-designated 100-year floodplains. Temporary direct impacts to floodplains would occur during construction of access roads, flowlines, and pipelines. No direct impacts to wetlands or riparian areas would occur under the proposed action. Indirect effects such as sedimentation due to runoff from project roads or facilities could occur but are expected to be negligible as a result of implementation of project design features and the downstream distances from project features to wetlands and riparian areas.

Standard practices or design features of the proposed project that minimize impacts to the watershed and water quality include utilizing a closed loop system with no reserve pits, berming production facilities,

utilizing existing surface disturbance, minimizing total surface disturbance, minimizing vehicular use, surfacing parking and staging areas with caliche, and reclaiming the areas not necessary for production and quickly reestablishing vegetation on the reclaimed areas.

Cumulative Impacts

The CIA for floodplains, wetlands, and riparian areas is the same as described in Section 3.1 (**Figure 3.1-1**). Riverine wetlands and riparian areas are prevalent along the Delaware River; otherwise, the majority of the CIA is similar to the EA area of analysis, with isolated wetland and riparian areas occurring in some drainages or associated with springs.

The types of impacts from past, present, and reasonably foreseeable future actions would be similar to those described for the proposed action. Overall, it is expected that negligible, short-term impacts to floodplains, wetlands, and riparian areas would occur within the CIA. The proposed action is expected to contribute to negligible cumulative impacts, primarily in the short-term during construction activities prior to reclamation.

Mitigation Measures and Residual Impacts

With implementation of design features provided in the MDP, MDP SUPO, and APDs, anticipated impacts to floodplains, wetlands, and riparian area resources would be less than significant. Additional mitigation may be required on an individual APD or ROW basis as determined by the BLM. No residual impacts to floodplains, wetlands, or riparian areas are anticipated.

3.7. Vegetation

Affected Environment

The area of analysis is located within the Chihuahuan Basins and Playas Level IV ecoregion. The Chihuahuan Basins and Playas ecoregion has deep depressions filled with sediment that form flat to rolling basins surrounding major rivers. Streams are ephemeral in this area, and annual precipitation ranges from 9 to 13 inches annually. The temperature/moisture regimes are characterized as thermic/aridic, ustic aridic. The dominant land cover type in the ecoregion is shrub/scrub. Vegetation communities within the area of analysis vary based on soil properties. Plant community information was developed using the data available from the Soil Survey of Eddy County, New Mexico and the associated ecological site descriptions (Soil Conservation Service 1971; Natural Resource Conservation Service 2006). The BLM uses the ecological site descriptions and other site-specific information to classify the geographical regions into one of the three vegetative communities described below. A species list developed from baseline environmental surveys (Arcadis 2016a) is included as **Appendix E**. Special status vegetation species (e.g., federal- or state-listed threatened and endangered species) are discussed in Section 3.10.

Loamy Soil Type Plant Communities

Loamy soil types typically are dominated by grasslands made up of warm season, mid- and short-grasses. There is a fair scattering of shrubs and half-shrubs throughout the landscape. Forb production fluctuates greatly from season to season and year to year. Gramas (*Bouteloua spp.*) hairy woollygraass (*Erioneuron pilosum*), threeawns (*Aristida spp.*), muhlys (*Muhlenbergi*a spp.) dropseeds (*Sporobolus spp.*), tobosa (*Pleuraphis mutica*), and burrograss (*Scleropogon brevifolius*) are the dominant grasses. The most common shrubs in the area are tarbush (*Flourensia cernua)*, creosote (*Larrea tridentata)*, honey mesquite (*Prosopis glandulosa*), cactus (*Opuntia spp.*), and yucca (*Yucca spp.*). Common forbs include filaree (*Erodium spp*.), croton (*Croton spp.)*, bladderpod (*Lesquerella spp.*), and globemallow (*Sphaeralcea spp.*).

Shallow Soil Type Plant Communities

Shallow soil types are typically dominated in the understory by warm season, mid- and short-grasses. Typical grasses include gramas, tridens, dropseeds, threeawn, and green sprangletop (*Leptochloa dubia*). The shrub overstory consists primarily of cactus, catclaw (*Mimosa aculeaticarpa var. biuncifera)*, yucca, sumac (*Rhus spp.*), juniper (*Juniperus spp.*) and broom snakeweed (*Gutierrezia sarothrae)*. A large variety of forbs, including croton, bladderpod, buckwheat (*Eriogonum spp.*), and globemallow, can be found, with large fluctuations from season to season based on rainfall. Curlyleaf muhly (*Muhlenbergia setifolia*), bristly wolfstail (*Lycurus setosus*), sotol (*Dasylirion leiophyllum*), agaves (*Agave lechuguilla*), sacahuista (*Nolina texana*), and piñon (*Pinus spp.*) may be present in limited areas, but are typically confined to limestone hills.

Gypsum Soil Type Plant Communities

Common grasses found in gypsum soil types include gramas, gyp dropseed (*Sporobolus nealleyi*), and alkali sacaton (*Sporobolus airoides*). The shrub component is made up of four-wing saltbush (*Atriplex canescens)*, mormon tea (*Ephedra spp.*), spiny althorn (*Koeberlinia spinosa*), javelin bush (*Condalia ericoides*), and sumac. Forbs include jimsonweed (*Datura stramonium*), scarlet beeblossom (*Oenothera suffretescens*), globemallow, and croton. Shrubs and forbs are a minor component of the plant community.

Impacts from the Proposed Action

Direct and Indirect Impacts

Construction of the proposed action would remove approximately 1,808 acres of vegetation: 1,394 acres of loamy soil type plant communities, 156 acres of shallow soil type plant communities, and 258 acres of gypsum soil type plant communities. These impacts would last as long as the well is productive. However, interim reclamation would be conducted within six months of well completion and would reduce the long-term impacts. Once a well is plugged and abandoned, the well pad would be reclaimed and revegetated. It is expected that revegetation would be complete within three to five years, depending on rainfall. The use of proper seed mix (Seed Mixture #1/Loamy Sites; Seed Mixture #3 Shallow Soil Types; and/or Seed Mixture #4 Gypsum Sites), good seed bed preparation, and proper seeding techniques should reduce impacts to vegetation. It is expected that impacts to vegetation would be short term (approximately three to five growing seasons).

In addition to the removal of vegetation for project infrastructure, vegetation could also be indirectly affected by dust caused by construction and operation of the proposed action. Near roads and construction sites, dust can coat surrounding vegetation and disrupt photosynthesis, respiration, and transpiration of plants, ultimately leading to decreased vegetation productivity (Coffin 2007; Trombulak and Frissell 2000). In turn, this can decrease vegetation quality and viability beyond the actual footprint of direct disturbance.

Impacts to vegetation could also occur from unintentional releases of hazardous wastes or other liquid wastes associated with hydraulic fracturing. If such release occurred, nearby vegetation could be killed. Mitigation and regulations associated with containment of hazardous waste and spill prevention measures is discussed in Section 3.16.

Impacts to vegetation would be reduced by standard practices such as utilizing existing surface disturbance, minimizing surface disturbance from well pad and access roads, utilizing steel tanks instead of reserve pits, minimizing vehicular use, placing parking and staging areas on caliche surfaced areas, and reclaiming the areas not necessary for production and quickly establishing vegetation on the reclaimed areas.

Cumulative Impacts

The CIA for vegetation is the same as that generally described for all resources in Section 3.1. The vegetation communities found within the Project Area are typical of those found within the CIA.

The proposed action will impact approximately 1,808 acres of vegetation, which represents a small percentage of the total vegetation within the CIA, approximately 1 percent. The types of primary direct and indirect impacts within the CIA are similar to those described for the proposed action, as oil and gas projects comprise the majority of past, current, and future activities in the CIA. Vegetative disturbance due to past and present oil and gas activities within the CIA is approximately 4,863 acres, and reasonable foreseeable future activities are anticipated to disturb approximately 3,479 acres. The proposed project would result in an additional 22 percent of vegetative disturbance within the CIA. Most vegetative disturbance would be reclaimed within six months following the completion of the last well on any given pad. In addition, a number of described standards would limit impacts to vegetation. Therefore, the proposed action is expected to contribute to negligible to minor impacts on vegetation in the CIA. Impacts are expected to be short-term, primarily occurring during construction, drilling, and maintenance activities throughout the CIA.

Mitigation Measures and Residual Impacts

With implementation of design features provided in the MDP, MDP SUPO, and APDs, anticipated impacts to vegetation would be less than significant. Additional mitigation may be required on an individual APD or ROW basis as determined by the BLM. While design features would reduce impacts, residual impacts could occur from potential erosion, dust, trampling, or ineffective reestablishment.

3.8. Noxious Weeds and Invasive Plants

Affected Environment

New Mexico's Noxious Weed Act of 1963 (76-7-23 to 76-7-30 NMSA 1978), Noxious Weed Control Act (76-7-1 to 76-7-22 NMSA 1978), and Noxious Weed Management Act (76-7D-1 to 76-7D-6 NMSA 1978) provide direction to the New Mexico Department of Agriculture (NMDA) to develop the noxious weed list for the state, identify methods of control, and educate the public about noxious weeds. The NMDA also coordinates weed management between landowners. The BLM currently identifies four plant species within the CFO on the New Mexico Noxious Weed List, Noxious Weed Management Act of 1998. These species are African rue (*Peganum harmala)*, Malta starthistle *(Centaurea melitensis)*, Russian olive *(Elaeagnus angustifolia)*, and salt cedar *(Tamarix spp.)*. African rue and Malta starthistle populations have been identified throughout the CFO and mainly occur along the shoulders of highway, state and county roads, lease roads, and well pads (especially abandoned well pads). The CFO has an active noxious weed monitoring and treatment program, and partners with county, state, and federal agencies and industry to treat infested areas with chemical and monitor the counties for new infestations.

Populations of African rue were identified along existing roads and ROWs within the Project Area during baseline surveys (Arcadis 2016a). In addition, non-native salt cedar was identified along some draws and drainages.

Impacts from the Proposed Action

Direct and Indirect Effects

Any surface disturbance could increase the possibility of establishment of new populations of invasive, non-native species. The construction of the proposed action may contribute to the establishment and spread of African rue and Malta starthistle. The main mechanism for seed dispersion would be by equipment and vehicles that were previously used and/or driven across noxious weed infested areas. Noxious weed seed could be carried to and from the HDA by construction equipment and transport vehicles. Noxious weed introductions could indirectly impact vegetation by reducing habitat quality or changing the trophic structure. The potential for noxious weeds to spread would be highest in newly

disturbed areas. Once established, weeds could displace native plant species and change the structure of the habitat (Evangelista et al. 2011, DiTomaso 2000). Noxious weeds could also indirectly affect ecosystem function by changing species composition and the physical environment by altering burn cycles and erosion rates (Evangelista et al. 2011, DiTomaso 2000).

Cumulative Impacts

The CIA for noxious weeds and invasive plants is the same as that generally described for all resources in Section 3.1.

The primary direct and indirect impacts in the CIA would be similar to those described for the proposed action, as oil and gas projects comprise the majority of past, current, and future activities in the CIA. Past and present oil and gas activities make up approximately 4,863 acres of disturbance in the CIA, and reasonable foreseeable future activities, including the proposed action, are anticipated to disturb approximately 3,479 acres.

Noxious weed populations would likely increase to some degree in the short term, as additional well, linear corridor, and facility sites are disturbed. A number of described standards would limit and potentially decrease to manageable levels noxious weed populations in the proposed disturbed areas over the long-term. The use of these measures would likely result in improved weed management. Therefore, the proposed action is expected to contribute to negligible to minor impacts on short-term impacts to noxious weed and invasive plant communities in the CIA. These minor impacts are expected to occur during construction, drilling, and maintenance activities throughout the CIA. However, long-term positive minor impacts may occur due to the implementation of the noxious weed and invasive plant mitigation measures. Therefore, the activities associated with the project would not contribute to the long-term increase in noxious weed populations in the region and no increase in cumulative impacts would be expected.

Mitigation Measures and Residual Impacts

Chevron would be held responsible if noxious weeds become established within the areas of operations. Weed control will be required on the disturbed land where noxious weeds exist both prior to construction and throughout construction, operation, and restoration. These areas include the roads, pads, associated pipeline corridor, and adjacent lands that may be affected by the establishment of weeds due to the proposed action. Chevron would consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies. Chevron, in coordination with the BLM, may develop a noxious weed plan to include recommendations and guidelines for noxious weed and invasive species management throughout the Project Area and to minimize the spread of weeds to adjacent areas.

With implementation of these mitigation measures and design features provided in the MDP, MDP SUPO, and APDs, anticipated impacts from noxious weed propagation would be less than significant. Additional mitigation may be required on an individual APD or ROW basis as determined by the BLM. With the implementation of mitigation measures and design features, residual impacts from noxious weeds are not anticipated.

3.9. Wildlife

Affected Environment

The analysis area occurs in the Chihuahuan Deserts Level III Ecoregion. This desert ecoregion extends from the Madrean Archipelago in southeast Arizona to the Edwards Plateau in south-central Texas. It is the northern portion of the southernmost desert in North America that extends more than 500 miles south into Mexico. Outside major river drainages, such as the Rio Grande and Pecos River, the landscape is largely internally drained (Griffith et al. 2006). As described in Section 3.3, vegetation types in the analysis area vary based on soil properties and chemical makeup.

The aforementioned landscape and vegetation characteristics of the analysis area can provide habitats for a variety of wildlife including large mammals, small mammals, birds, and herpetofauna (amphibians and reptiles). Baseline surveys (Arcadis 2016a) and available literature suggest that wildlife species with potential to occur in the study area may include, but are not limited to, those presented below in **Table 3.9-1**.

Table 3.9-1 Wildlife Species with Potential or Known to Occur in the Analysis Area[1]

Common Name	Scientific Name
Mule deer	*Odocoileus hemionus*
Pronghorn antelope	*Antilocapra americana*
Coyote	*Canis latrans*
Common gray fox	*Urocyon cinereoargenteus*
Red fox	*Vulpes vulpes*
Northern raccoon	*Procyon lotor*
American badger	*Taxidea taxus*
Mexican ground squirrel	*Spermophilus mexicanus*
Yellow-faced pocket gopher	*Cratogeomys castanops*
Kangaroo rat species	*Dipodomys sp.* (*D. merriami, D. ordii, and D. spectabilis* are possible)
Hispid cotton rat	*Sigmodon hispidus*
Woodrat species	*Neotoma sp.* (*N. Leucodon* and *N. micropus* are possible)
Long-tailed weasel	*Mustela frenata*
Desert cottontail	*Sylvilagus auduboni*
Black-tailed jackrabbit	*Lepus californicus*
Western spotted skunk	*Spilogale gracilis*
Striped skunk	*Mephitis mephitis*
Feral pig	*Sus scrofa*
Collared peccary	*Pecari tajacu*
Mexican free-tailed bat	*Tadarida brasiliensis mexicana*
Pallid bat	*Antrozous pallidus*
Western pipistrelle	*Pipistrellus hesperus*
Big brown bat	*Eptesicus fuscus*
Hoary bat	*Lasiurus cinereus*
Pocketed free-tailed bat	*Nyctinomops femorosaccus*
Eastern red bat	*Lasiurus borealis*
Western small-footed myotis	*Myotis ciliolabrum melanorhinus*
California myotis	*Myotis californicus*
Yuma myotis	*Myotis yumanensis yumanensis*

Notes:
1 Several ground squirrel, mouse, rat, and shrew species have potential to occur in the analysis area (BLM 2014a).
Sources: BLM 2014a, Arcadis 2016a, DesertUSA 2016

The greater CFO contains a large concentration of limestone caves, many of which serve as important roosting and nursery habitat for bats (BLM 2014a). One cave and a number of other karst features (including one large collapsed sinkhole, two small and collapsed sinkholes, three collapsed mammal holes, and a number of closed depressions and fissures) have been identified within the Project Area ROW (Arcadis 2016a). No roosts or hibernacula were identified in the Project Area during baseline surveys (Arcadis 2016a); however, there is potential for bats to roost in the aforementioned cave. Further, there are likely other karst features within the analysis area that provide suitable roosting habitat. Carlsbad Caverns, located approximately 8 to 20 miles west of the analysis area, supports a maternity roost of approximately one million Mexican free-tailed bats and provides habitat for several other species including the BLM sensitive cave myotis and fringed myotis (U.S. Geological Survey 2016). Roosting bats at Carlsbad Caverns may forage within the analysis area as they have been documented foraging more than 56 kilometers (35 miles) from Carlsbad Caverns (Best and Geluso 2003). Further, these bats may migrate through and forage in the analysis area on their way to and from wintering grounds in Mexico.

Baseline surveys and available literature suggest that a variety of avian species have potential to pass through, nest in, and/or winter in the analysis area. Some avian species with potential to occur in the analysis area may include, but are not limited to, those presented below in **Table 3.9-2**.

Table 3.9-2 Avian Species with Potential or Known to Occur in the Analysis Area

Common Name	Scientific Name
Raptors	
Swainson's hawk	*Buteo swainsoni*
Ferruginous hawk	*Buteo regalis*
Red-tailed hawk	*Buteo jamaicensis*
Harris' hawk	*Parabuteo unicinctus*
Rough-legged hawk	*Buteo lagopus*
Cooper's hawk	*Accipiter cooperii*
Northern harrier	*Circus cyaneus*
American kestrel	*Falco sparverius*
Prairie falcon	*Falco mexicanus*
Peregrine falcon	*Falco peregrinus*
Bald eagle	*Haliaeetus leucocephalus*
Golden eagle	*Aquila chrysaetos*
Great-horned owl	*Bubo virginianus*
Burrowing owl	*Athene cunicularia*
Barn owl	*Tyto alba*
Western screech owl	*Otus kennicotti*
Mississippi kite	*Ictinia mississippiensis*
Turkey vulture	*Cathartes aura*
Other Migratory Birds	
Black-chinned sparrow	*Spizella atrogularis*
Blue-throated hummingbird	*Lampornis clemenciae*
Brewer's sparrow	*Spizella breweri*
Cactus wren	*Campylorhynchus brunneicapillus*
Cassin's sparrow	*Aimophila cassinii*
Chestnut-collared longspur	*Calcarius ornatus*
Common nighthawk	*Chordeiles minor*
Fox sparrow	*Passerella iliaca*
Grace's warbler	*Dendroica graciae*
Gray vireo	*Vireo vicinior*
Greater roadrunner	*Geococcyx californianus*
Lark bunting	*Calamospiza melanococrys*
Lewis's woodpecker	*Melanerpes lewis*
Loggerhead shrike	*Lanius ludovicianus*
Long-billed curlew	*Numenius americanus*
Mccown's longspur	*Calcarius mccownii*
Painted bunting	*Passerina ciris*
Pinyon jay	*Gymnorhinus cyanocephalus*
Rock wren	*Salpinctes obsoletus*
Rufous-crowned sparrow	*Aimophila ruficeps*
Scaled quail	*Callipepla squamata*
Sonoran yellow warbler	*Dendroica petechial* ssp. *Sonorana*
Varied bunting	*Passerina versicolor*
Virginia's warbler	*Vermivora virginiae*
Williamson's sapsucker	*Sphyrapicus thyroideus*

Sources: Arcadis 2016a, USFWS 2016b, Garber and Young 2005

Field baseline survey data indicate that there are a number of raptor nests (including 12 hawk nests and 18 burrowing owl burrows) within the Project Area (Arcadis 2016a). Trees within the Project Area are limited; therefore, raptor nests (other than burrows, which seem to be more concentrated along the northern ROW buffers) are limited in location to these trees or large brush and yucca plants (Arcadis 2016a). This is expected to be the case for the analysis area as a whole. A number of outcroppings have been identified within the Project Area, which could provide suitable nesting habitat for falcons; however, no falcon nests have been confirmed in the area (Arcadis 2016a). Field baseline surveys also indicate the presence of several non-raptor bird nests along the proposed project footprint (Arcadis 2016a).

Herpetofauna documented in the analysis area during baseline surveys include ornate box turtle (*Terrapene ornata*), Texas horned lizard (*Phrynosoma comutum*), round-tailed horned lizard (*Phrynosoma modestum*), whiptails (*Aspidoscelis* spp.), gophersnake (*Pituophis catenifer*), and western diamondback rattlesnake (*Crotalus atrox*) (Arcadis 2016a). Herpetofauna often depend on water sources for breeding and survivorship. Permanent water sources are limited in the analysis area, but numerous human-made water sources (e.g., wells and troughs) have been installed within the boundaries of the BLM CFO. These are important to all wildlife in the desert ecosystem as they provide readily available water and areas of sanctuary. No designated wildlife water sources are located within the analysis area; however, one Wildlife Habitat Project Avoidance is located in the analysis area and minimally intersects the buffer area for the ROW in Sections 3 to 4 of Township 26 South, Range 27 East.

Impacts from the Proposed Action

Direct and Indirect Effects

At the programmatic level, direct impacts of the proposed action to wildlife may include, but are not limited to, possible mortality, habitat degradation and fragmentation, and exposure to chemicals. The primary indirect impacts to wildlife could include avoidance of the analysis area and behavioral/physiological changes as a result of habitat loss/fragmentation, noise, and human presence. These direct and indirect impacts are described further below and would also be applicable at the site-specific level (i.e., the 12 APDs submitted with the MDP [APD Group 1 and APD Group 2]), albeit on a smaller scale.

Wildlife could be susceptible to mortality from collision with or trampling by vehicles and equipment, particularly during construction. At the programmatic level, Chevron would use existing county and lease roads as well as new resource roads during construction, drilling, and completion operations. Vehicle collisions with wildlife may occur along proposed access roads and may be more likely to occur in the short-term, during construction, when traffic would be highest (telemetry and SCADA equipment would be used to remotely monitor oil and gas wells during operations to reduce traffic to and from well locations). Posted speed limits would be followed and minimize collision impacts with wildlife (30 to 40 mph is adequate in most cases [Wyoming Game and Fish Department 2010]). To the greatest extent practical, traffic would also be limited during high wildlife use hours (within three hours of sunrise and sunset).

Birds, including raptors, and their nests may be at risk of morality or degradation during construction. Birds may also abandon nests or alter breeding behavior in the vicinity of construction and operations activities. To mitigate for these impacts, ground-breaking activities will be timed to occur outside the avian nesting season (March to late June), if possible. Note that the BLM CFO generally requires a 50-meter buffer during the non-nesting season (September 1 to February 28) for inactive raptor nests. Should construction activities need to occur during the nesting season, Chevron will perform a pre-construction wildlife survey to identify new nests and verify the status of previously identified nests. No surface disturbance will be allowed within 200 meters of active bird (raptor and non-raptor) nests, or construction activity will be delayed up to 90 days (or a combination of both). Chevron will only consider construction within 200 meters of a nest if it is confirmed to be inactive, the proposed construction activity is of short duration (e.g., fence or pipeline installation), and construction will not result in continuing activity in proximity to the nest.

Birds may also be susceptible to collision and electrocution with the proposed 12.47 kV powerlines at the programmatic and site-specific levels (although on a much smaller scale at the site-specific level).

Powerlines would be located within the same ROWs as roads and pipelines so as to not contribute to additional habitat loss/fragmentation. The powerlines would be constructed to APLIC standards to minimize collisions and electrocutions (e.g., installing bird flight diverters on the top grounding wire, separating conductors by more than the wingspan or height of a landing or perching bird, and grounding hardware or equipment cases and locating them in proximity to energized conductors). Smaller wildlife, including birds and bats, may also be at risk of mortality by getting trapped (or exposed to chemicals) in open-topped tanks or open-vent exhaust stacks. To mitigate for these types of impacts, Chevron will net, screen, or cover all open-topped tanks until they are removed or no longer contain harmful substances. Further, Chevron would construct, modify, equip, and maintain all open-vent exhaust stacks on production equipment to prevent birds and bats from entering and to discourage perching, roosting, and nesting.

Oil and gas extraction activities under the proposed action could expose wildlife to hazardous chemicals. Hydraulic fracturing fluids could contain chemicals such as acids, salts, surfactants, biocides, and corrosion inhibitors. These or other chemicals may seep from leaks in boreholes, spill from tanks and trucks, or be placed into containment ponds along with other fluids. Impacts of exposure of contaminants to wildlife under the proposed action are expected to be reduced through implementation of a variety of design features as described in Section 2.1.

Under the proposed action, approximately 1,808 acres of wildlife habitat would be removed in the short term, and 782 acres would be removed in the long term. At the site-specific level, 106 acres of wildlife habitat would be removed over the short term and 63 acres would be removed over the long term. Loss of habitat and fragmentation associated with roads and infrastructure under the proposed action may influence wildlife to avoid the area in and around the HDA MDP, and to a lesser extent, the 12 APDs submitted with the MDP. When wildlife are displaced due to habitat loss and fragmentation, they can move into areas of lower habitat value or quality, and/or areas that are already occupied at their carrying capacity. Habitat fragmentation by roads can also increase accidental roads kill (Jankowitz and Gruber 2007). Most habitat disturbance and associated impacts would be short term and would be reclaimed in the interim. Chevron would complete interim reclamation within six months following the completion of the last well on any given pad. Chevron would meet with the BLM to devise an appropriate seed mix, free of noxious weeds, and reclamation plan to best restore the land to preexisting conditions. Final reclamation for long-term habitat disturbance would occur when a well pad is no longer producing. At that point, habitat-related impacts on wildlife are expected to cease.

Wildlife may avoid new noises and human activity associated with the proposed action at both the programmatic and site-specific level. Sawyer et al. (2009) found that during the first five years of natural gas development on the Pinedale Anticline in Wyoming, the amount of predicted winter mule deer avoidance generally increased with a decreased distance to well pads (the researchers predicted that deer use would be half the normal deer use within an average distance of 1.2 miles from well pads). Results of a five-year study of pronghorn antelope in the same region indicate reduced usage and abandonment of small habitat parcels, and avoidance of areas of highly concentrated oil field development (Blickley and Patricelli 2010). Schaub et al. (2008) monitored noise impacts on foraging bats and found that foraging areas near highways and other sources of intense, broadband sound degraded their suitability as bat foraging areas. Impacts of noise associated with the proposed action could also include masking and behavioral disruptions, particularly for nesting birds. Masking may occur when the perception of a sound is affected by the presence of background noise. Many animals use acoustic signals to attract and retain mates, settle territorial disputes, promote social bonding, and alert other individuals to predators (Blickley and Patricelli 2010). Presence of noise could also work to the advantage of some wildlife. For example, one study found that birds nesting near noisy natural gas pads had higher nesting success, likely due to the reduced presence of the most common nest predator, the western scrub jay (Quinn et al. 2006). Wildlife exposure to noise could also result in chronic effects, including elevated stress levels and associated physiological responses (Blickley and Patricelli 2010). To minimize impacts to wildlife associated with noise, Chevron would not use blasting during construction and would install exhaust mufflers on fixed equipment so as to not exceed 75 decibels measured at 30 feet from the source of the noise.

Artificial night lighting associated with the proposed action could affect nocturnal species, such as birds and bats, by triggering unnatural periods of attraction or repulsion that could lead to impacts on foraging and reproductive behavior, biological clocks, predator-prey interactions, movement and dispersal patterns, community structure, and interactions among and within species (The Nature Conservancy 2016, Longcore and Rich 2016). Birds have been shown to alter the timing of morning choruses and reproductive patterns in response to artificial lighting (Miller 2005; Kempenaers et al. 2010). There is also growing evidence of artificial light impacts on bats such as avoidance of lighted areas which could alter flight routes and habitat use (Longcore and Rich 2016; Kuijper et al. 2008; Patriarca and Debernardi 2010). Such impacts could affect bat populations, notably populations at the nearby Carlsbad Caverns National Park, in the analysis area at both a programmatic- and site-specific level. To minimize impacts of artificial lighting on nocturnal wildlife, Chevron would use minimal light necessary for site safety, security, and operations; would direct light downward on fixed equipment; would use low-pressure sodium lamps, such as yellow LED lighting, to reduce sky glow; and would use full cutoff shielding on mounted lights during production to reduce sky glow from upward pointing light. Water-dependent wildlife such as fish and some herpetofauna are not expected to be impacted under the proposed action as there would be minor direct impacts on surface waters, specifically wetlands and streams (Section 3.5). The BLM also requires that activities within 200 meters from an artificial wildlife water source be limited and short term in nature; therefore, the proposed action is not expected to disrupt wildlife use or activities of these water sources. In summary, the analysis area (at both the programmatic and site-specific level) is not known to include any state or federal wildlife management areas, refuges, parks or recreation areas, BLM areas of critical environmental concern, major bird or mammal migration corridors, or critically important habitats such as playas, extensive wetlands or riparian areas, and critical winter and breeding areas. For these reasons, previously described impacts under the proposed action are expected to be limited to individual or small groups of wildlife. Through implementation of described design features and mitigation measures, the proposed action is expected to have a negligible to minor impact on wildlife, with most impacts being short term until interim reclamation and some impacts being long term until final reclamation.

Cumulative Impacts

The CIA for wildlife is the same as described in Section 3.1 (**Figure 3.1-1**). The CIA is applicable to this discussion as it is expected to encompass the daily movements of wildlife (aforementioned large and small mammals, birds, and herpetofauna) that could occur in the analysis area and be affected by the proposed action. Oil and gas industry-related actions are the most prevalent activities within the CIA; therefore, the following discussion focuses on associated impacts.

As described previously, the proposed action may result in negligible to minor direct impacts on wildlife including mortality/collision, habitat degradation/fragmentation, and exposure to chemicals. The primary indirect impacts could include avoidance of the proposed action and behavioral/physiological changes as a result of habitat loss/fragmentation, noise, and human presence. Past, present, and future activities within the CIA are generally the same or similar as those described for the proposed action; therefore, impacts to wildlife within the CIA as a whole are expected to be similar. Past and present oil and gas activities make up approximately 4,863 acres of disturbance in the CIA, and reasonable foreseeable future activities, including the proposed action, are anticipated to disturb approximately 3,479 acres.

Within the CIA, previous, current, and future oil and gas exploration, road construction, and utility line construction have or will result in habitat loss and wildlife displacement, to which the proposed action could contribute. The proposed action would contribute to a minor, short-term loss of wildlife habitat (approximately 1,808 acres). Most habitat disturbance from linear features would be reclaimed immediately and well pads would be reclaimed in the interim, within six months following the completion of the last well on any given pad. Some wildlife habitat, for instance raptor nest habitat, would be avoided altogether; therefore, the proposed action would contribute to negligible impacts in the CIA in these cases.

Noise and human disturbances within the CIA are likely to be temporary and negligible, present only during construction, drilling, and maintenance activities. Past, current, and proposed actions in the CIA are less concentrated west of the proposed action; therefore, wildlife may more readily displaced to

habitats in this area (if not outside the CIA). As noted previously, displacement of wildlife can result in competition for available resources, but this competition is expected to be short term, lasting until disturbed areas are reclaimed.

Road and utility lines are present or will be constructed in the CIA. The proposed action, through reduced travel speeds during construction, remote monitoring during operations, and implementation of APLIC standards, is expected to contribute to negligible wildlife mortality and collisions in the CIA. Such is true for potential exposure to chemicals as all open tanks and ponds with hazardous materials would be covered, fenced, or otherwise mitigated to negate use by wildlife.

Overall, it is expected that wildlife may be susceptible to minor, short-term impacts of habitat removal/fragmentation, mortality/collision, avoidance, and exposure to chemicals in the CIA. The proposed action is expected to contribute to negligible to minor impacts on wildlife, primarily in the short term during construction, drilling, and maintenance activities.

Mitigation Measures and Residual Impacts

With implementation of design features provided in the MDP, MDP SUPO, and APDs, anticipated impacts to wildlife would be less than significant. These design features conform to BLM CFO management standards and generally follow New Mexico Department of Game and Fish (NMDGF) Oil and Gas Development Guidelines (Jankowitz and Gruber 2007). Additional mitigation may be required on an individual APD or ROW basis as determined by the BLM. Residual impacts could still occur after implementation of the design features and may include loss of habitat from ineffective reestablishment of vegetation and displacement.

Pond Stipulations:

Fencing: Ponds shall have 8-foot game fencing installed around the perimeter, outside of the bottom berm. The fence bottom shall be keyed-in around the perimeter of the pond site and include the use of 2-foot silt fencing to prevent access of smaller animals.

Wildlife Protection: Typical bird deterrent options include molded decoy owls and noise-making streamers. Wildlife protection measures, including those for migratory birds, shall be monitored at least monthly to ensure deterrents are effective. Additional bird deterrent options include sound-activated devices that mimic predatory calls. These deterrents would be monitored on a periodic basis and enhanced as necessary to ensure effectiveness.

Avian Nest Stipulations:

Chevron would protect raptor nests on special, natural habitat features – such as trees, large brush, cliff faces, and escarpments – by not allowing surface disturbance within up to 200 meters of active nests or by delaying activity for up to 90 days, or a combination of both.

Prior to initiating construction activities, Chevron or the BLM would perform a wildlife survey to identify raptor nests in the proximity and to determine if the raptor nests are active. Chevron would contact a BLM Wildlife Biologist if any raptor nests within 200 meters of the construction site are active.

Avian Power line Protection Stipulation:

Power lines shall be constructed and designed in accordance to standards outlined in "Suggested Practices for Avian Protection on Power lines: The State of the Art in 2006" Edison Electric Institute, APLIC, and the California Energy Commission 2006. The holder shall assume the burden and expense of proving that pole designs not shown in the above publication deter raptor perching, roosting, and nesting. Such proof shall be provided by a raptor expert approved by the Authorized Officer. The BLM reserves the right to require modification or additions to all power line structures placed on this right-of-way, should they be necessary to ensure the safety of large perching birds. The holder without liability or expense shall make such modifications and/or additions to the United States.

3.10. Special Status Species, including Threatened and Endangered Species

Affected Environment

Federally Listed Species

Under the Endangered Species Act (ESA), the BLM is mandated to conserve and protect federally listed threatened, endangered, candidate, and proposed species (federal threatened and endangered [T&E] species) and designated critical habitat on public land. There are 11 federal T&E wildlife species listed for Eddy County. Some species are also designated as sensitive by the BLM State Director and require special management consideration to promote their conservation and reduce the need for future listing under the ESA. All federal candidate species, proposed species, and species delisted for five years or less are considered BLM sensitive species (BLM 2014a). **Table 3.10-1** lists USFWS T&E and BLM sensitive species along with their potential to occur in the analysis area. Those species listed for Eddy County or the CFO but not expected to occur within the analysis area are summarized in **Table 1.7-1** and not discussed further in this EA.

Table 3.10-1 USFWS T&E and BLM Sensitive Species Listed for Eddy County[1] and CFO

Species	Listing Status[2]	Habitat	Occurrence in Analysis Area[3]
Mammals			
Cave myotis (*Myotis velifer incautus*)	NMSO	This is a desert and lower elevation grassland species, but it has been collected from juniper-pinyon woodlands; roosts in caves (BISON-M 2016); roosting bats not observed in Project Area (Arcadis 2016a); bats may forage in the area.	May occur
Fringed myotis (*Myotis thysanodes thysanodes*)	NMSO	Commonly roosts in caves and abandoned mines; forages in a variety of habitats ranging from mountain pine to desert scrub, but seems to prefer grassland areas at intermediate elevations (BISON-M 2016); roosting bats not observed in Project Area (Arcadis 2016a); bats may forage in the area.	May occur
Long-legged myotis (*Myotis volans interior*)	NMSO	Summers in New Mexico; has an ecoregion association of Chihuahuan desert tarbush creosote and a life zone association of lower Sonoran mesquite creosote (BISON-M 2016) roosting bats not observed in Project Area during baseline surveys (Arcadis 2016a); bats may forage in analysis area.	May occur
Guadalupe pocket gopher (*Thomomys bottae guadalupensis*)	NMSO	Found in the Upper Pecos and Upper Pecos Black River basins; lives in underground burrows in nearly every habitat within New Mexico so long as sufficient tuberous roots and plant material are available and soil is suitable for digging tunnels; in desert habitats, occurs in close association with clumps of lechuguilla, yucca, sotol, catclaw, and cacti (BISON-M 2016); suitable habitat is present in the analysis area.	May occur
Pale Townsend's big-eared bat (*Corynorhinus townsendi pallescens*)	NMSO	Found in Upper Pecos and Upper Pecos Black River basins; found during day mostly in caves or mine tunnels, but at night they rest in abandoned buildings; in summer, occur widely in New Mexico and can be found in a variety of habitats (BISON-M 2016); may forage in analysis area, no roosting bats observed during baseline surveys (Arcadis 2016a).	May occur
Spotted bat (*Euderma maculatum*)	NMSO	Can be found in the Upper Pecos and Upper Pecos Black River basins; dwells in cliffs and diurnally roosts in cracks and crevices of canyons and cliffs; rocky cliffs are necessary to provide suitable roosting habitats (BISON-M 2016); no bats observed roosting in Project Area (Arcadis 2016a); bats may forage in the analysis area.	May occur

Table 3.10-1 USFWS T&E and BLM Sensitive Species Listed for Eddy County[1] and CFO

Species	Listing Status[2]	Habitat	Occurrence in Analysis Area[3]
Western small-footed bat (*Myotis ciliolabrum melanorhinus*)	NMSO	This species shows little geographic variability in New Mexico, and the center of distribution seems to be in the ponderosa pine zone, although they can occur as low as desert and as high as the spruce-fir zone (BISON-M 2016); also utilizes a variety of riparian habitats (BISON-M 2016); may forage in analysis area.	May occur
Yuma myotis bat (*Myotis yumanensis yumanensis*)	NMSO	Found in Upper Pecos and Black River basins; known to occur at Carlsbad Caverns; roosts in caves and buildings; forages in a variety of habitats including those associated with Chihuahuan desert communities (BISON-M 2016); roosting bats not observed in Project Area during baseline surveys (Arcadis 2016a), but may forage in the analysis area.	May occur
Birds			
Baird's sparrow (*Ammodramus bairdii*)	NMSO	Migrants or vagrants; use shortgrass prairies, including desert grasslands; habitat available in analysis area.	May occur
Burrowing owl (*Athene cunicularia hypugaea*)	NMSO	Nest within burrows (typically) built by smaller mammals; burrows are often associated with prairie dog colonies (BISON-M 2016); active burrows have been documented in analysis area (Arcadis 2016a).	Known to occur
Sprague's pipit (*Anthus spragueii*)	C	A wintering population occurs in southern New Mexico; prefers dry, open grasslands (NMPIF 2016b); may use grassland habitat in analysis area.	May occur

Notes:
1 Sources: USFWS 2016b; NMRPTC 1999a,b,c,d
2 C = Candidate for Federal Listing; NMSO = BLM CFO Sensitive Species. Note, some species are also listed as T&E by the state of New Mexico. These species are discussed in subsequent sections.
3 Known to occur, may occur, or not expected. *Species that are not expected to occur in the analysis area are identified in **Table 1.7-1** and are not discussed further.

Additional information on the listing status, life history, and current distribution information for USFWS T&E and BLM sensitive species that may occur in the analysis area is provided below.

In addition, information on the listing status, life history, and current distribution information for federal T&E species that may occur in the Project Area is provided below.

BLM Sensitive Bats

BLM sensitive bats include the following: Big Free-Tailed Bat (*Nyctinomops macrotis*), Cave Myotis (*Myotis velifer incautus*), Fringed Myotis (*Myotis thysanodes thysanodes*), Long-Legged Myotis (*Myotis volans interior*), Pale Townsend's Big-Eared Bat (*Corynorhinus towndendii pallescens*), Spotted Bat (*Euderma maculatum*), Western Small-Footed Myotis (*Myotis ciliolabrum melanorhinus*), and Yuma Myotis (*Myotis yumanensis yumanensis*).

All bat species listed in **Table 3.9-1** are listed as BLM sensitive species; none are USFWS T&E species. Distributions of these species range over a large geographic area and a variety of habitats, but all species have been documented in or are suspected to occur in the CFO (BLM 2014a). The greater CFO contains a large concentration of limestone caves, many of which serve as important roosting and nursery habitat for bats (e.g., Carlsbad Caverns), including the BLM sensitive species listed above (BLM 2014a). In the analysis area, one cave has been identified as well as some closed sinkholes, closed mammal holes, and a number of depressions and fissures. No bats or roosting activities have been identified using karst features in the analysis area. BLM sensitive bat species known to roost elsewhere in the CFO (e.g., Carlsbad Caverns) may forage within the analysis area. Further, sensitive bat species may stop over within the analysis area during migration to and from wintering grounds in Mexico.

BLM Sensitive Birds

BLM sensitive birds include Baird's Sparrow (*Ammodramus bairdii*) and Burrowing Owl (*Athene cunicularia hypugaea*).

Baird's sparrows were historically noted as common or abundant within limited breeding range on the northern Great Plains. Despite their abundance on breeding grounds, there are relatively few historical records of the sparrow on migratory routes in the central and southern Great Plains, and their winter range is poorly delineated (Wiggins 2006). In New Mexico, Baird's sparrows migrate in the eastern and extreme southern areas of the state and are considered rare to uncommon. They use a variety of habitats, including desert grasslands, and tend to arrive the first week of August and leave by November (BISON-M 2016). Suitable habitat is predominantly present throughout desert grassland in the analysis area, although the species has not been observed in the analysis area (Arcadis 2016a). If present, the bird is only expected to temporarily stop over within the analysis area to forage or rest during migration.

Burrowing owls breed in North America and spend their nonbreeding time primarily south of the United States; they can winter south to Guatemala and El Salvador. In New Mexico, they are uncommon to fairly common in open grassland areas, particularly adjacent to prairie dog towns (BISON-M 2016). Burrowing owls utilize small dens in the ground as their nesting sites, typically abandoned by small burrowing mammals such as prairie dogs, coyotes, foxes, ground squirrels, and badgers (BLM 2014a). Suitable habitat and active burrowing owl burrows were identified throughout the Project Area during baseline surveys (Arcadis 2016a [Figure 10]).

USFWS T&E Bird - Sprague's Pipit (*Anthus spragueii*)

Sprague's pipit is recognized as a candidate for federal listing under the ESA. An endemic grassland species of the northern Great Plains, Sprague's pipit breeds in southern portions of Alberta, Saskatchewan, and Manitoba, eastern Montana, and North Dakota. It winters from southeast Arizona east across most of Texas to Louisiana and Mississippi, and south in Mexico. In New Mexico, Sprague's pipit winters sporadically in southern desert grasslands, primarily in the lower Pecos River Valley, Otero Mesa, and the Animas Valley (NMPIF 2016b). They are generally present in southern New Mexico from October to early April (NMPIF 2016b).

Sprague's pipit prefer dry, open grasslands. Native grass species are preferred over prairie exotics. Wintering habitat may consist of taller grass than in areas typically used for breeding (i.e., intermediate grass height). Wintering areas may have grasses taller than 1 foot and greater than 60 percent grass canopy cover (Jones 2010; NMPIF 2016b). Shrub cover has been known to have a strong negative influence on pipit abundance (Panjabi et al. 2010).

Sprague's pipits were not observed within the Project Area during field surveys (Arcadis 2016a). Grass height in the area (documented as short- to mid-height [Arcadis 2016a]) may not be suitable for use by wintering Sprague's pipits. Further, shrubs are a major component of some grass communities in the Project Area (Arcadis 2016a); therefore, the analysis area may not offer optimum wintering habitat for Sprague's pipits but may be used opportunistically as foraging/stopover habitat.

State-Listed Species

The NMDGF is directed under the New Mexico Wildlife Conservation Act (WCA) to develop recovery plans for species listed by the state of New Mexico as threatened or endangered. The current list of state threatened and endangered wildlife includes 37 mammal, bird, herpetofauna, and fish species for Eddy County (BISON-M 2016). These species, along with their state listing status, habitat, and occurrence within the analysis area, are presented in **Table 3.10-2**. Those species listed for Eddy County but not expected to occur within the HDA are not discussed further in this EA.

Table 3.10-2 State T&E Species Listed for Eddy County, New Mexico[1,2]

Species	NM WCA Listing Status[3]	Habitat[4]	Occurrence in Analysis Area[5]
Mammals			
Spotted bat (*Euderma maculatum*)	ST (also NMSO)	See information in **Table 3.10-1**.	May occur
Birds			
Baird's sparrow (*Ammodramus bairdii*)	ST (also NMSO)	See information in **Table 3.10-1**.	May occur
Common ground-dove (*Columbina passerina*)	SE	Rare visitor to southern New Mexico; uses open stands of creosote bush and large succulents; suitable habitat present in analysis area.	May occur
Gray vireo (*Vireo vicinior*)	ST	Most often found in juniper woodlands and foothills/mesas with oaks and well-developed grasses; rare breeder in the state; grasslands with some juniper found in the analysis area.	May occur
Peregrine falcon (*Falco peregrinus*)	ST	Found in a variety of habitats, typically forested, and nest on cliff escarpments; may nest on karst associated rock walls/cliffs in analysis area. May also fly through the area to neighboring habitats.	May occur
Varied bunting (*Passerina versicolor*)	ST	Summers in small numbers in Eddy County; prefers dense stands of mesquite and associated growth in canyon bottoms; may use mesquite stands in analysis area.	May occur
Amphibians and Reptiles			
Gray-banded kingsnake (*Lampropeltis alterna*)	SE	Only specimen collected in New Mexico is from Carlsbad Caverns National Park; species uses Chihuahuan deserts with abundant limestone outcroppings; suitable habitat present in analysis area.	May occur
Mottled rock rattlesnake (*Crotalus lepidus lepidus*)	ST	Pine-oak forests, mesquite-grasslands, and deserts; suitable habitat present in analysis area.	May occur

Notes:
1 Source: Biota Information System of New Mexico Report County Federal/State Species Status for Eddy County (BISON-M 2016).
2 Source: NMAC. Title 19. Chapter 21. Part 2. 8. List of New Mexico State Endangered Plant Species.
3 NMSO = BLM CFO Sensitive Species; SE = State Endangered; ST = State Threatened
4 Habitat information obtained from Biota Information System of New Mexico website (BISON-M 2016).
5 Known to occur, may occur, or not expected. *Species that are not expected to occur in the analysis area are identified in **Table 1.7-1** and not discussed further in this section.

Additional information on the listing status, life history, and current distribution information for state-listed species that may occur in the analysis area (spotted bat, birds [Baird's sparrow, common ground-dove, gray vireo, peregrine falcon, and varied bunting], and herpetofauna [gray-banded kingsnake and mottle rock rattlesnake]) is provided below.

State T&E Mammals – Spotted Bat (*Euderma maculatum*)

The spotted bat is listed as a state threatened mammal by the NMDGF and is also a BLM CFO sensitive species. Only a patchy distribution is known for this species, which has been deduced from about 100 scattered specimens. From late spring to early fall, spotted bats have been captured as far north as British Columbia and through most of the western states, including New Mexico. They are known to range south along the Sierra Madre in central Mexico (NMDGF 2007).

The rarity of this bat and the diverse habitats in which it has been seen have caused confusion about its preferences. In New Mexico, spotted bats are known only from about 20 locations in western and southern portions of the state. At almost all of these sites, bats were captured in mist nets over water, so information about their roosts is speculative. However, since most capture sites had rock cliffs within 1 mile, and there are almost no records of spotted bats roosting in caves, it is assumed that cracks and crevices in cliffs and canyons are their refuges (NMDGF 2007).

Due to the rarity of spotted bats documented in New Mexico, and the uncertainty about/variety in habitat use, the potential for this species to occur in the analysis area is only speculative and based on their known occurrence in Eddy County and potential to roost in cracks and cliffs (which are limited, but associated with karst features, including one cave, in the analysis area [Arcadis 2016a]). No roosts or individual spotted bats were observed in the Project Area during baseline field surveys (Arcadis 2016a). The species could opportunistically forage in or stop over in the analysis area during migration.

State T&E Birds

State T&E birds include Baird's Sparrow (*Ammodramus bairdii*), Common Ground-Dove (*Columbina passerina*), Gray Vireo (*Vireo vicinior*), Northern Aplomado Falcon (*Falco femoralis septentrionalis*), Peregrine Falcon (*Falco peregrinus*), and Varied Bunting (*Passerina versicolor*).

Information on the Baird's Sparrow (state threatened and BLM CFO sensitive species) is presented above under the federally listed T&E section.

The common ground-dove occurs from southeastern California to southern Texas and southward into Latin America. In New Mexico, the dove is a very local, mainly warm season (April to September) visitor to the southernmost part of the state, including presently at San Simon Cienaga and sparingly in the lowermost Rio Grande and Pecos valleys. The dove is typically found in agricultural and developed areas, although it may use open stands of creosote bush and large succulents in Chihuahuan deserts. Suitable habitat is present, although the species has not been observed in the analysis area (Arcadis 2016a). If present, the bird is only expected to rarely and temporarily stop over within the area to forage or rest during migration.

Gray vireos summer from southern California to western Oklahoma, and southward locally to northern Baja California, southern Arizona, southern New Mexico, western Texas, and northern Coahuila. In New Mexico, the bird occurs rarely during the summer in arid juniper woodlands on foothills and mesas, often associated with oaks with a well-developed grass component. Gray vireos are medium-sized passerines (BISON-M 2016). There is a well-developed grass component with some scattered juniper in the analysis area that this species may utilize; however, no gray vireos have were observed during baseline surveys (Arcadis 2016a).

Peregrine falcons breed throughout much of North America and spend their winters primarily south of the Mexico border. In New Mexico, they occur in upper montane areas, lower montane areas, grassland areas, and desert scrubs (dominated by mesquite, yucca, and cactus). They are found in various forest types, but in the Chihuahuan deserts, they can use open stands of creosote bush and large succulents. This species also nests on cliff walls (BISON-M 2016). No peregrine falcons or cliff nests on karst features were observed in the area during baseline field surveys (Arcadis 2016a). They may, however, transiently migrate through the analysis area.

Varied buntings range from the southwestern United States southward to Guatemala, summering in the United States from southern Arizona to southern Texas. In New Mexico, the species summers in two widely separated areas: Carlsbad Caverns National Park area and in Guadalupe Canyon and vicinity. Vagrants have been reported elsewhere in the south, including Eddy County (BISON-M 2016). Varied buntings are found in Chihuahuan desert scrub habitat and seem to prefer dense stands of mesquite and associated growth in canyon bottoms. Canyons are absent within the analysis area, but varied buntings could potentially utilize mesquite shrubs in the area, especially near karst features. No varied buntings were documented during baseline surveys (Arcadis 2016a).

State T&E Amphibians and Reptiles

State-listed T&E herpetofauna with potential to occur in the Project Area include gray-banded kingsnake (state endangered) and mottled rock rattlesnake (state threatened).

Gray-banded kingsnakes could be expected to occur throughout limestone broken rock-Lozier associated with Otero, Eddy, and southwestern Chaves counties in New Mexico. Habitat requirements include typical Chihuahuan desert habitat with abundant limestone outcroppings (BISON-M 2016). Karst features and associated outcroppings within the analysis area may provide suitable habitat for the gray-banded kingsnake; however, no individuals have been observed (Arcadis 2016a).

Mottled rock rattlesnakes occur from southeastern Arizona and southern New Mexico southward in the highlands to Jalisco and San Luis Potosi. The species is known only from the southern Guadalupe Mountains in Eddy and possibly Otero counties. Key habitats include Walnut and Gunsight canyons and Carlsbad Caverns National Park (BISON-M 2016). The snake uses a variety of habitats, including pine-oak forests, mesquite-grasslands, and deserts. No mottled rock rattlesnakes have been observed in the analysis area (Arcadis 2016a). However, suitable habitat is present in the form of mesquite grasslands and deserts.

Impacts from the Proposed Action

Direct and Indirect Impacts

Federally Listed Species

As summarized in **Table 3.9-1**, there are several BLM sensitive species (all birds or bats) and one USFWS T&E species (Sprague's pipit [Candidate]) that has potential to occur in the analysis area based on their known occurrences in the CFO and/or Eddy County. Potential impacts to these species from the proposed action are described below.

BLM Sensitive Bats - Big Free-Tailed Bat (Nyctinomops macrotis), Cave Myotis (Myotis velifer incautus), Fringed Myotis (Myotis thysanodes thysanodes), Long-Legged Myotis (Myotis volans interior), Pale Townsend's Big-Eared Bat (Corynorhinus townddendii pallescens), Spotted Bat (Euderma maculatum), Western Small-Footed Myotis (Myotis ciliolabrum melanorhinus), and Yuma Myotis (Myotis yumanensis yumanensis)

Baseline surveys for the project indicate that roosting habitats for bats (caves, mines, tree cavities, etc.) are limited in the analysis area (Arcadis 2016a). The proposed action would proactively avoid surface disturbance within 200 meters of caves, sinkholes, and mammal holes and 50 meters of depressions and fissures. Therefore, no direct disturbance to potential bat roosting habitat is expected. Therefore, any effects of the proposed action on bats are expected to be limited to foraging or migrating individuals, rather than larger roosting populations like those that occur elsewhere in the CFO (e.g., Carlsbad Caverns [BLM 2014a]). Impacts to bats, at both a programmatic and site-specific level, would be the same as those described for wildlife/bats in Section 3.9. In summary, foraging and/or migrating bats may be susceptible to direct impacts such as collision with vehicles and infrastructure and exposure to chemicals. Chevron plans to reduce these impacts by following posted speed limits, minimizing traffic during evening to early morning hours when bat activity would be highest, constructing open-vent exhaust stacks on production equipment, and installing effective exclosure systems on all secondary containment systems to prevent wildlife (including bat) exposure to contaminants (e.g., fencing, netting, expanded metal mesh, lids, and grate covers [maximum mesh size of 1.5 inches]).

Bats may also be subject to indirect impacts associated with new noise and artificial lighting under the proposed action. Schaub et al. (2008) monitored noise impacts on foraging bats and found that foraging areas near highways and other sources of intense, broadband sound degraded their suitability as foraging areas. Some bat species also appear to be sensitive to artificial lighting and avoid lighted areas by changing flight routes and habitat use (Longcore and Rich 2016; Kuijper et al. 2008; Patriarca and Debernardi 2010). To reduce noise and artificial lighting impacts, Chevron would not blast during construction, would install exhaust mufflers on fixed equipment, would use minimal light necessary, would use low-pressure sodium lamps (yellow LED lighting) to reduce glow, would properly shield mounted lights via full cutoff method (during production) to reduce glow, and would use directional lighting on fixed equipment to minimize light pollution. Anticipating that these mitigation measures would be implemented,

the proposed action, at both the programmatic and site-specific level, may have minor impacts on foraging and/or migrating bats.

BLM Sensitive Birds - Baird's Sparrow (Ammodramus bairdii) and Burrowing Owl (Athene cunicularia hypugaea)

The Baird's sparrow, if present, is only expected to temporarily stop over within the analysis area to forage or rest during migration. Therefore, impacts of the proposed action on this species are expected to be limited to such individuals (the bird is not known to breed in New Mexico [BISON-M 2016]). At the programmatic level, the proposed action would result in the short-term loss of 1,808 acres of suitable stopover desert grassland habitat and the long-term loss of 782 acres. At the site-specific level, short-term habitat loss would be 106 acres and long-term loss would be 63 acres.

The burrowing owl is known to nest in the analysis area (Arcadis 2016a [Figure 10]). While the project has been designed to avoid direct impacts to known burrows, the proposed action, at the programmatic level, would result in the short-term loss of 1,808 acres of usable grassland habitat and the long-term loss of 782 acres. At the site-specific level, short-term habitat loss would be 106 acres and long-term loss would be 63 acres.

Direct and indirect impacts on the Baird's sparrow and burrowing owl would be the same as those described for wildlife/birds in Section 3.9. In summary, the birds may be susceptible to the following direct impacts under the proposed action: collision with or trampling by vehicles and equipment, collision with or electrocution by aboveground powerlines, exposure to chemicals, and loss of habitat and degradation to nests or burrows.

To reduce these impacts, Chevron would implement design features described in Section 2.1.

Potential indirect impacts on birds include displacement as a result of habitat loss/fragmentation, noise, and artificial lighting. Noise impacts could also include masking and behavioral disruptions, particularly for nesting birds (Blickley and Patricelli 2010). Presence of noise could also work to the advantage of birds. For example, one study found that birds nesting near noisy natural gas pads had higher nesting success, likely due to the reduced presence of common nest predators (Quinn et al. 2006). Wildlife exposure to noise could also result in chronic effects, including elevated stress levels and associated physiological responses (Blickley and Patricelli 2010). To minimize impacts to birds and other wildlife associated with noise, Chevron would not blast during construction and would install exhaust mufflers on fixed equipment so as to not exceed 75 decibels measured at 30 feet from the source of the noise.

Artificial night lighting associated with the proposed action could affect nocturnally active birds by triggering unnatural periods of attraction or repulsion (The Nature Conservancy 2016). Birds have been shown to alter the timing of morning choruses and reproductive patterns in response to artificial lighting (Miller 2005; Kempenaers et al. 2010). To minimize impacts of artificial lighting on nocturnal wildlife, Chevron would use directional lighting on fixed equipment. The lighting would be installed in a way that minimizes light pollution and protects visual resources, while ensuring adequate light for safe and reliable production operations.

Overall, through implementation of previously described design features, proposed action impacts on Baird's sparrow and burrowing owl are expected to be minor, and primarily short term during construction (although some impacts, such as some habitat loss and fragmentation, would occur over the long term).

USFWS T&E Bird - Sprague's Pipit (Anthus spragueii)

Should the Sprague's pipit occur in the analysis area (the species has not been confirmed in the area to date and habitat quality within the analysis area is marginal), impacts of the proposed action, at both the programmatic and site-specific level, would be limited to wintering individuals using tall grass in desert grassland habitat. At the programmatic level, 1,808 acres of potential foraging habitat would be lost in the short term and 782 acres in the long term. At the site-specific level for APD Group 1 and Group 2,

106 acres of potential foraging habitat would be lost in the short term and 63 acres over the long term. Direct and indirect impacts on the Sprague's pipit would be the same as those described above for the Baird's sparrow. With implementation of previously discussed design features, the proposed action is expected to have minor impacts, if any, on the Sprague's pipit.

State-Listed Species

As mentioned in the affected environment section (**Table 3.9-2**), some bats, birds, and herpetofauna listed by the State of New Mexico as T&E species may occur in the analysis area. Potential impacts to all of these species would be the same as those previously described for federally listed species and general wildlife (in Section 3.9). Overall, impacts on these species are expected to range from negligible to minor (due to a variety of design features that would be implemented to protect wildlife and habitats) and most impacts would occur in the short term during construction.

Cumulative Impacts

The CIA for special status species is the same as described in Section 3.1 (**Figure 3.1-1**). The CIA is applicable to this discussion as it is expected to encompass the daily movements of special status species that could occur in or near the analysis area and be affected by the proposed action. As described previously, BLM sensitive bats, BLM sensitive birds, USFWS T&E species (Sprague's pipit, and a number of state-listed wildlife species have potential to occur in or near the analysis area and therefore the CIA.

The types of primary direct and indirect impacts in the CIA would be similar to those described for the proposed action, as oil and gas projects comprise the majority of past, current, and future activities in the CIA. Past and present oil and gas activities make up approximately 4,863 acres of disturbance in the CIA, and reasonably foreseeable future activities, including the proposed action, are anticipated to disturb approximately 3,479 acres.

For BLM sensitive bats, past, present, and foreseeable actions outside the analysis area are expected to contribute to impacts on foraging, migrating, and roosting bats (particularly where activities occur closer to Carlsbad Caverns, other areas with caves and abandoned mines, and treed areas near water sources). The proposed action is anticipated to contribute to negligible impacts on bats. This is because baseline surveys for the project indicate a lack of roosting habitat in the analysis area. Therefore, any impacts from the proposed action are expected to be limited to foraging bats and their habitats. A number of previously described design features would facilitate negligible impacts on bats in the CIA.

The proposed action is also expected to contribute to negligible impacts on sensitive BLM birds (Baird's sparrow and burrowing owl) and the USFWS T&E bird (Sprague's pipit) in the CIA. This is because a number of design features will be implemented to reduce or avoid impacts to these birds and their habitats (e.g., burrowing owl nests would be avoided through implementation of non-disturbance buffers, APLIC standards would be implemented to reduce collisions and electrocutions, directional lighting would be installed, etc.). Birds may avoid the proposed action in the short term and move to other habitats within the CIA. Past, present, and future activities in the CIA would contribute to reduced habitat/fragmentation, which could result in increased competition for resources among displaced and resident birds. These impacts are expected to be short term in the CIA, occurring primarily during construction, maintenance, and drilling activities (until successful reclamation).

The Texas hornshell, although not expected to occur in the analysis area, is known to occur in the Black River within the CIA, located approximately 2.9 miles northwest of the proposed action. The proposed action is not expected to contribute to impacts on this species as tributaries in the analysis area primarily drain south/southeast to Red Bluff Draw, which flows east to the Pecos River. Therefore, the Black River is not expected to be impacted by the proposed action.

As mentioned in the affected environment section (**Table 3.10-2**), there are a number of state-listed wildlife species that may occur in the analysis area and therefore the CIA. A number of previously

described design features would limit impacts to state-listed wildlife. Therefore, the proposed action is expected to contribute to negligible to minor impacts on state-listed wildlife and their habitats in the CIA. Impacts are expected to be short term, primarily occurring during construction, drilling, and maintenance activities throughout the CIA.

Mitigation Measures

With implementation of design features provided in the MDP, MDP SUPO, and APDs, anticipated impacts to special status species would be less than significant. The following mitigation measures will be implemented to minimize impacts on non-raptor avian special status species and their nests. These measures conform to BLM CFO management standards and generally follow NMDGF Oil and Gas Development Guidelines (Jankowitz and Gruber 2007). Additional mitigation may be required on an individual APD or ROW basis as determined by the BLM. Residual impacts could still occur after implementation of the design features and may include loss of habitat from ineffective reestablishment of vegetation and displacement.

3.11. Range

Affected Environment

The Project Area is located in a rural area with a mixture of open rangeland used for livestock grazing, grasslands, and extensive oil and gas development. Livestock grazing within the analysis area includes grazing of domestic cattle and horses. The most common livestock operations in the Project Area are cattle and calf operations.

The BLM is responsible for managing livestock grazing on BLM-managed lands in the CFO Resource Management Planning Area. The CFO manages livestock grazing on 1,947,890 federal acres within the planning area (BLM 2014a). Within the BLM-administered livestock grazing allotments in the analysis area, BLM manages 105,307 acres for the grazing of domestic cattle and horses.

The boundaries of the grazing allotments, range improvements, and range study plots are depicted on **Figure 3.11-1** and listed in **Table 3.11-1**. There are eight grazing allotments and eleven range study plots within the Project Area. All eight allotments are yearlong cow-calf rotation operations and two allotments also include horses.

Table 3.11-1 Grazing Allotments, Range Improvements, and Range Study Plots within Analysis Area

Allotment Name	Allotment Number	Total Acres	AUMs		Range Improvements		Range Study Plots within the Analysis Area
			Cattle	Horse	Windmills/ Water Supply	Fences, Troughs, and Corrals	
Big Hackberry	78087	20,652	1,676		Water wells and storages Water pipelines	Barbed wire fences Troughs and corrals	Hackberry – 2
Cottonwood Hills	78104	10,318	1,549		Water wells and storages Water pipelines	Retention dam Barbed wire fences	East Hay Hollow – 1 East Hay Hollow – 2 West Hay Hollow – 3 West Hay Hollow – 4
China Draw	78094	22,838	564		Water wells and storages Water pipelines	Barbed wire fences Troughs and corrals	None identified
Lower Reed Well	78102	4,463	673	21	Water wells and storages Windmill Water pipelines	Barbed wire fences Troughs and corrals	Big – 1 Big – 2 Big – 3
Red Bluff Draw	78101	7,332	72		Water well and storage	Barbed wire fences Troughs	None identified
Delaware River West	78142	19,846	504		Water wells and storages	Barbed wire fences Troughs	Polk-1

Table 3.11-1 Grazing Allotments, Range Improvements, and Range Study Plots within Analysis Area

Allotment Name	Allotment Number	Total Acres	AUMs		Range Improvements		Range Study Plots within the Analysis Area
			Cattle	Horse	Windmills/ Water Supply	Fences, Troughs, and Corrals	
Tecolote Peak	78103	9,574	1,056	48	Water wells and storages Water pipelines	Barbed wire fences Troughs	North – 1
Hay Hollow	78107	10,284	1,200		None identified	Hay hollow interior Fence	Big – 1
Total Acreage		**105,307**	**7,294**	**69**			

Source: BLM 2014a
Total acres for each allotment calculated from GIS files.

The amount of forage required by one animal unit (cow with calf pair) for one month is referred to as an Animal Unit Month (AUM). Based on the total acreage of the allotments and total number of AUMs within the Project Area as listed in **Table 3.11-1**, the rangeland within the Project Area averages 14 acres per AUM.

The number of livestock permitted for each grazing allotment is determined by quantitative measurements of the amount of forage present and to provide for plant recovery to enhance rangeland health. When rangelands are not meeting standards or resource objectives, changes in grazing management are implemented to improve rangeland health, such as adjusting permitted livestock numbers (AUMs), adding additional waters and fences, or providing rest in certain pastures during the growing season. Drought conditions and rangeland wildfires are also a threat to rangeland health (BLM 2014a).

Range improvements in the Project Area include water wells, water delivery systems (pipelines, windmills, storage tanks, and water troughs), fences, feed troughs, corrals, and retention dams. In addition, there is one windmill located within the Lower Reed Well Allotment. Noxious weeds, which can affect range quality, are described in Section 3.8, Noxious Weeds and Invasive Plants.

There are four range study plots located within the Cottonwood Hills Allotment, three within the Lower Reed Well Allotment, and one range study plot within the Tecolote Peak, Big Hackberry, Delaware River West, and Hay Hollow Allotments, as shown on **Figure 3.11-1**. There are no range study plots within the China Draw and Red Bluff Draw allotments.

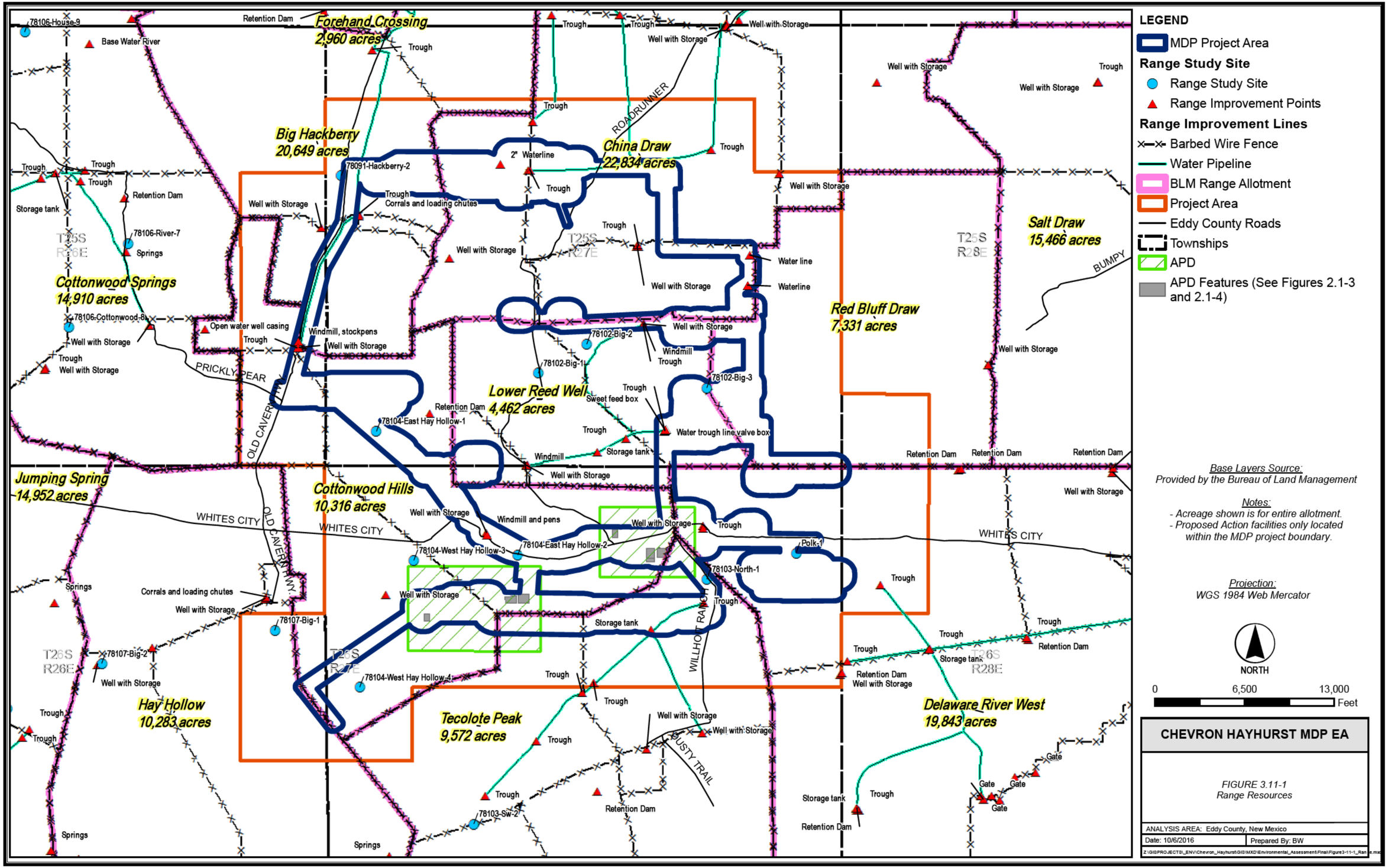
Impacts from the Proposed Action

Direct and Indirect Impacts

The loss of 1,808 acres of vegetation would not substantially affect the AUMs authorized for livestock use in this area. There could be occasional livestock injuries or deaths due to accidents such as collisions with vehicles, falling into excavations, and ingesting plastic or other materials present at the work site. If further development occurs, the resulting loss of vegetation could reduce the AUMs authorized for livestock use in this area.

Under the proposed action, a total of 1,808 acres of short-term surface disturbance would occur within the eight grazing allotments shown on **Figure 3.11-1**. The proposed action as shown on **Figure 2.1-1**, **Figure 2.1-2**, **Figure 2.1-3**, and **Figure 2.1-4** is not likely to impact the range study plots. Following interim reclamation, approximately 782 acres would be disturbed for the life of the project. Under the proposed action, long-term loss of potential forage would represent a reduction of about 1.7 percent of the total acreage of the grazing allotments within the Project Area (105,307 acres) and a 1.8 percent reduction in the AUMs authorized for livestock use in these grazing allotments.

The disturbance associated with the proposed pipelines and roads would expand existing road improvements. Some of these areas may be difficult to reclaim. If reclamation succeeded in these areas, grasses and forbs could begin to provide vegetative cover and forage, possibly as soon as three years after reclamation, if reclamation was protected from livestock grazing.



LEGEND

- MDP Project Area

Range Study Site

- Range Study Site
- Range Improvement Points

Range Improvement Lines

- Barbed Wire Fence
- Water Pipeline
- BLM Range Allotment
- Project Area
- Eddy County Roads
- Townships
- APD
- APD Features (See Figures 2.1-3 and 2.1-4)

Base Layers Source:
Provided by the Bureau of Land Management

Notes:
- *Acreage shown is for entire allotment.*
- *Proposed Action facilities only located within the MDP project boundary.*

Projection:
WGS 1984 Web Mercator

NORTH

0 6,500 13,000 Feet

CHEVRON HAYHURST MDP EA

FIGURE 3.11-1
Range Resources

ANALYSIS AREA: Eddy County, New Mexico

Date: 10/6/2016 | Prepared By: BW

Z:\GIS\PROJECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment\Final\Figure3-11-1_Range.mxd

This page intentionally left blank.

In addition to the loss of forage, there may be occasional livestock injuries or deaths due to accidents such as collisions with vehicles, falling into excavations, and ingestion of plastic or other materials present at the work site. An increase in vehicle traffic and other human activity could disturb cattle and cause them to move away from productive allotment areas. The proposed action includes several measures to reduce vehicular traffic, which would also reduce impacts to range management.

Impacts to vegetation could also occur from unintentional releases of hazardous wastes or other liquid wastes associated with hydraulic fracturing. If such release occurred, livestock could potentially ingest contaminated vegetation and result in livestock death. Mitigation and regulations associated with containment of hazardous waste and spill prevention measures is discussed in Section 3.16.

In accordance with the BLM CFO Standard COAs, the proposed action would avoid damage to range improvements if practicable. If range improvements are damaged, they would be repaired immediately. These measures would reduce potential impacts to range resources.

Livestock Water Pipelines

Since some of the proposed access roads may travel within 20 feet of buried livestock water pipelines, the pipelines could be damaged during the life of the access roads. The pipelines may be compressed or punctured during construction or heavy vehicle traffic, which would decrease the water flow to water troughs in the area that provide water for livestock.

If a freshwater pipeline or drinking trough is damaged, livestock could run out of water, resulting in stress or death. For the 12 APDs submitted with the MDP (**Figure 2.1-3** and **Figure 2.1-4**), no water pipelines are anticipated to be crossed and no troughs, storages, or water wells impacted by the proposed facilities. Potential impacts to livestock water resources for MPD features would be analyzed during an APD or ROW submittal.

Disturbances to structures that provide water to livestock, such as windmills, pipelines, drinking troughs, and earthen reservoirs would be avoided to the extent possible. Prior to crossing any livestock water pipelines, the private surface landowner or the grazing allotment holder would be notified. Freshwater pipelines, troughs, and windmills would be safeguarded and maintained at all times.

Fence Crossings

The operator would notify the landowner or grazing allotment holder prior to crossing any fences. To reduce impacts to range resources, including livestock and vegetation, Chevron would implement design features including bracing and tying off on both sides of the passageway with H-braces prior to cutting the fence, installing and maintaining appropriately sized cattle guards, and installing wire gates in the fence opening during infrastructure installation to prevent livestock from crossing the fence. The gate would be in place during construction inactivity. Once the work is completed and roads are abandoned, the fences would be restored to its prior condition, or better.

For the 12 APDs submitted with the MDP (**Figure 2.1-3** and **Figure 2.1-4**), one pasture fence and five allotment fences may be crossed by proposed facilities. If a range improvement, such as a fence, is damaged and not immediately repaired and the BLM or grazing allottee is not immediately notified, livestock could move from one pasture/allotment to the next. Impacts to livestock and grazing operations would include added cost in time and money to gather and move the livestock.

Boundary fences and cross fences would be safeguarded and maintained at all times. Fences would not be cut without prior approval of the Authorized Officer. Prior to crossing any fences, the private surface landowner or the grazing allotment holder would be notified. Upon completion of operations, fences would be restored to their original condition or better. Fences and other existing infrastructure would also be returned to their pre-construction condition as approved by landowners and/or land management agencies.

Cumulative Impacts

The CIA for range resources is the CIA as defined in Section 3.1. Past, present, and reasonably foreseeable future actions in the CIA include oil and gas exploration and development, utility construction, mineral (non-hydrocarbon) exploration and extraction, livestock grazing, recreation, and off-road travel. Oil and gas exploration and development is the most prevalent activity within the CIA and is expected to continue to be over the life of the proposed action. When added to the disturbance associated with the proposed action, the total cumulative surface disturbance is estimated to be 8,342 acres, some of which is on BLM-administered grazing allotments, within the 165,927-acre CIA. The proposed roads, well pads, and other long-term facilities associated with the proposed action would displace forage available for livestock for the life of the project (up to 45 years). The cumulative loss of rangeland would represent approximately 5 percent of the rangeland in the CIA.

Cumulative impacts to range resources would fluctuate with the gradual abandonment and reclamation of wells. It is likely that reclamation activities would occur throughout the CIA during the life of the project; therefore, there would be little or no net increase in the visibility of oil and gas-related components and activities despite an increase in total surface disturbance within the CIA. As new wells are drilled, other wells would be abandoned and reclaimed, reducing impacts to range resources in terms of total cumulative acres disturbed at any given point in time. As the oil field plays out, the cumulative impacts would be reduced as more areas are reclaimed and fewer areas are developed.

Projected vehicle traffic would increase the risk for livestock collisions, wildland fire, and the spread of noxious weeds and invasive species. Reclamation of disturbed areas and the use of BMPs for erosion control would reduce impacts to overall rangeland health. Revegetation efforts would restore the amount of available forage available for livestock grazing in the majority of the CIA. Impacts to vegetation from reclamation efforts resulting from road and well pad construction would include short-term alterations to native plant composition but would ultimately contribute to stable plant communities comparable to pre-disturbance plant densities through time.

Cumulative impacts to livestock and grazing operations would include increased disturbances to range improvements, potentially including damage to fences (allotment boundary and cross fences), windmills, water pipelines, drinking troughs, earthen reservoirs and water wells used by livestock. Fence damages would result in added cost in time and money. Disturbances to structures that provide water to livestock would increase the risk of livestock health issues.

With implementation of design features provided in the MDP, MDP SUPO, and APDs, impacts to range resources would be minor under the proposed action. When considering past, present, and reasonably foreseeable future actions, and the probability for successful reclamation and reestablishment of vegetation, cumulative impacts to range resources are expected to be minor.

Mitigation Measures and Residual Impacts

With implementation of design features provided in the MDP, MDP SUPO, and APDs, anticipated impacts to range resources would be less than significant. The following additional mitigation requirements would be implemented to further reduce potential impacts to range resources. Additional mitigation may be required on an individual APD or ROW basis as determined by the BLM

Removal or alteration of existing range improvements (e.g., fences, cattle guards) would not be allowed without prior approval of the Authorized Officer.

Temporary Fence Crossing Requirement

All gates would remain in place during construction inactivity. Once the work is completed, the fence would be restored to its prior condition or better. The operator shall notify the private surface landowner or the grazing allotment holder prior to crossing any fences.

Livestock Watering Requirement

Structures that provide water to livestock, such as windmills, pipelines, drinking troughs, and earthen reservoirs, would be avoided by moving the proposed action or paying to relocate the structure. The operator must contact the allotment holder prior to construction to identify the locations of water pipelines. The operator must take measures to protect water pipelines from compression or other damages. If a pipeline is damaged or compromised in any way near the proposed project as a result of oil and gas activity, the operator is responsible for repairing the pipeline immediately. The operator must notify the BLM office (575-234-5972) and the private surface landowner or the grazing allotment holder if any damage occurs to structures that provide water to livestock.

Following implementation of the design features and mitigation, residual impacts may remain and include the permanent reduction (1.8 percent) in the AUMs authorized for livestock use in grazing allotments and possible ineffective reclamation, resulting in a loss of forage.

3.12. Cultural and Historical Resources

Affected Environment

The HDA falls within the Southeastern New Mexico Archaeological Region. Aboriginal cultural traditions represented in this region include (Railey 2012): Paleoindian (ca.11,500 through 7,000 B.C.), Archaic (ca. 6,000 B.C. through A.D. 500), Ceramic (ca A.D. 500 through 1400), and Post-Formative Native American (ca. A.D. 1400 to Present). Sustained historic Euroamerican presence in the area began in approximately A.D. 1865. The Spanish had passed through the region beginning in the mid-1500s, but did not establish any permanent settlements. Beginning in around A.D. 1865, cattle ranches developed in the region, and cattle drives to move cattle to railheads or mining districts also passed through the region. Beginning in the 1920s, oil and gas exploration and development also expanded into the region. Sites representing all of these periods are known to occur in the region. A more complete discussion of the cultural context of the MDP area is presented in the baseline cultural resource inventory (Boggess et al. 2016).

Lone Mountain Archaeology (Boggess et al. 2016) completed a cultural resources survey and based the survey area on the design and layout of the proposed action, as envisioned before the cultural resource inventory. They then added a survey buffer of 1,000 feet around pad and other facility locations and 200 feet to each side of 120-foot-wide linear ROWs. The irregular and overlapping block areas were squared off into rectangular survey blocks. As a result, Lone Mountain Archaeology surveyed 11 block areas and 35 miles of 520-foot-wide corridor outside these blocks for a total of approximately 7,649 acres. This cultural resource survey area is approximately 21 percent of the total EA analysis area for cultural and historical resources. Records searches of the cultural resource survey area and a 0.25-mile buffer through the State of New Mexico Archaeological Records Management Section and the BLM Carlsbad Field Office conducted before the field survey identified 45 previously recorded sites (Boggess et al. 2016). Sixteen of these previously recorded sites were located with the cultural resource survey area.

The baseline cultural resources inventory (Boggess et al. 2016) identified 37 cultural resource sites in the cultural resource survey area. The 37 sites comprised 16 previously recorded sites that were updated and 21 new sites. Subsequently, McCormack et al. (2016) conducted cultural resource inventory of an additional 424 acres. This additional inventory identified three new sites and updated documentation on seven previously recorded sites. A total of 19 sites in the combined survey area are recommended eligible for the NRHP, and four sites are unevaluated. Sites that are eligible for the NRHP or potentially eligible (e.g., status undetermined) are considered historic properties.

The historic properties in the cultural resource survey area include 22 aboriginal sites of unknown affiliation and one historic Euroamerican feature. The aboriginal sites are considered eligible under National Register Eligibility Criterion D for their potential to yield information important in prehistory or history. The historic Euroamerican feature is unevaluated for eligibility.

Native American Religious Concerns

The BLM consults with Native American tribes regarding traditional cultural properties (TCPs), sacred sites, and traditional use areas that may be affected by land-use planning or federal undertakings. During the oil and gas leasing process, Native American consultation is conducted to identify TCPs, sacred sites, and traditional use areas whose continued use may be incompatible with oil and gas or other land-use authorizations. Knowledge of sacred sites and traditional use areas is culturally sensitive and may not be disclosed to the BLM until there is an adverse effect or tangible threat to those traditional concerns. In addition, these culturally sensitive sites may not be apparent to archaeologists or other cultural resource specialists performing surveys in advance of proposed projects.

Impacts from the Proposed Action

Direct and Indirect Effects

Twenty-three historic properties have been identified within the APE of the proposed project. The project would avoid or mitigate all impacts to historic properties. There would be no adverse impact to historic properties. An avoidance and mitigation plan would be prepared before any ground-disturbing activity. Avoidance measures may include exclusionary fencing for historic properties near project activities or monitoring of project activities near sensitive areas. The avoidance and mitigation plan will also include procedures for the treatment of unanticipated discoveries. If any skeletal remains that might be human or any associated funerary objects are discovered by any project activities, all project activities in the area of the discovery will be stopped, and the BLM will be notified promptly. If any historic properties cannot be avoided, a treatment plan for mitigation of adverse effects would be prepared.

Impacts to cultural resources could also occur from unintentional releases of hazardous wastes or other liquid wastes associated with hydraulic fracturing. If such release occurred, nearby cultural resources could be impacted. Mitigation and regulations associated with containment of hazardous waste and spill prevention measures is discussed in Section 3.16.

Cumulative Impacts

The CIA for cultural resources is the same as described in Section 3.1 (**Figure 3.1-1**).The proponent would avoid or mitigate all historic properties. If there are no unanticipated discoveries of cultural resources during the undertaking, the project would have no adverse effect to historic properties. Any historic properties that cannot be avoided and any unanticipated discoveries would be mitigated under a mitigation plan approved by the BLM. Given the avoidance of known historic properties and the implementation of mitigation and design measures for unanticipated discoveries, the proposed action would not contribute to cumulative impacts to historic properties.

Mitigation Measures and Residual Impacts

Chevron shall be responsible to avoid or mitigate all known NRHP eligible and potentially eligible cultural resources within the areas of operations. These areas of operation include the roads, pads, associated pipeline corridor, and adjacent land affected due to this action. Chevron shall cease activities and notify the BLM within 24 hours of any unanticipated discoveries including but not limited to possible human remains. With implementation of these mitigation measures and design features provided in the MDP, MDP SUPO, and APDs, anticipated impacts to cultural resources would be less than significant. Additional mitigation may be required on an individual APD or ROW basis as determined by the BLM. No residual impacts are anticipated following the implementation of design features and mitigation.

3.13. Paleontology

Affected Environment

Paleontological resources are any fossilized remains, traces, or imprints of organisms, preserved in or on the earth's crust, that are of paleontological interest and that provide information about the history of life on earth. Fossil remains may include bones, teeth, tracks, shells, leaves, imprints, and wood. Paleontological resources include not only the actual fossils but also the geological deposits that contain them and are recognized as non-renewable scientific resources protected by federal statutes and policies.

The primary federal legislation for the protection and conservation of paleontological resources occurring on federally administered lands are the Paleontological Resources Preservation Act of 2009, the Federal Land Policy and Management Act of 1976, and the National Environmental Policy Act of 1970 (NEPA). The BLM has also developed policy guidelines for addressing potential impacts to paleontological resources (BLM 1998, 2008b, 2009). In addition, paleontological resources on state trust lands are protected by state policy from unauthorized appropriation, damage, removal, or use.

The Potential Fossil Yield Classification (PFYC) is a tool the BLM uses to predict the likelihood of a geologic unit to contain paleontological resources. The PFYC is based on a numeric system of 1 through 5, with PFYC 1 carrying little likelihood of containing paleontological resources, whereas a PFYC 5 value is a geologic unit that is known to contain abundant scientifically significant paleontological resources.

All Project Area bedrock is Permian in age (about 299 to 251 million years old) and considered PFYC Class 2 geologic units, with the exception of the lower Rustler Formation (e.g., Culebra Member), which is Class 3 (BLM 2013). Previous geologic mapping and field observations indicate that bedrock consists of the upper Castile Formation, Salado Formation, and lower Rustler Formation (King 1949; New Mexico Bureau of Geology and Mineral Resources [NMBGMR] 2003). The Castile and Salado Formations are generally composed of evaporates, such as anhydrite and halite, which are typically devoid of fossils (NMBGMR 2003). The lowermost Rustler Formation is composed of about 120 feet of siltstone, gypsum, and very fine-grained sandstone. These deposits are in turn overlain by approximately 30 feet of dolomite and 115 feet of gypsum (Vine 1963). No fossils are known from the Rustler Formation of New Mexico, but mollusk fossils (e.g., brachiopods, pelecypods, gastropods) have been identified in the lower Rustler Formation in Culberson County, Texas within dolomite, siltstone, and limestone units (Walter 1953). The lower Rustler Formation may be exposed in isolated, topographically high parts of the area of analysis. Quaternary alluvial deposits are likely Holocene or upper Pleistocene (NMBGMR 2003) and are also considered PFYC 2 deposits. Occurrences of Ice Age mammals have been recovered from Pleistocene and younger deposits, including deposits associated with the Black River (Morgan and Lucas 2005).

Paleontological surveys of the Project Area have not been required or conducted; no paleontological resources were opportunistically observed during other baseline surveys (Arcadis 2016a).

Impacts from the Proposed Action

Direct and Indirect Effects

Direct impacts would result in the immediate physical loss of scientifically significant fossils and their contextual data. Impacts indirectly associated with ground disturbance could subject fossils to damage or destruction from erosion, as well as creating improved access to the public and increased visibility, potentially resulting in unauthorized collection or vandalism. However, not all impacts of construction are detrimental to paleontology. Ground disturbance can reveal significant fossils that would otherwise remain buried and unavailable for scientific study. In this manner, ground disturbance can result in beneficial impacts. Such fossils can be collected properly and curated into the museum collection of a qualified repository, making them available for scientific study and education.

The Project Area contains PFYC 2 (low potential) bedrock deposits, isolated PFYC 3 (moderate potential), and PFYC 2 Quaternary deposits. A pedestrian survey for paleontological resources was not considered necessary. Because of the low potential for scientifically significant paleontological resources to be present within the Project Area, impacts to paleontological resources are expected to be negligible.

Cumulative Impacts

The CIA for paleontology is the same as described in Section 3.1 (**Figure 3.1-1**). Geologic units present at the surface within the CIA are generally the same as within the EA analysis area. Outcrops of the Rustler Formation are more prevalent, but still uncommon in the CIA. The Bell Canyon Formation, which marks the top of the Delaware Mountain Group, is present in the western portion of the CIA. The Bell Canyon Formation is considered a PFYC Class 2 geologic unit based on isolated occurrences of vertebrate fossils (Hunt et al. 2006).

Proposed Action

Due to the low potential for scientifically significant paleontological resources to be present within the dominant surficial geologic units of the CIA, cumulative impacts of past, present, and reasonably foreseeable future actions are expected to be negligible.

Mitigation Measures and Residual Impacts

If fossils are found, the operator shall cease activities in the immediate area of the discovery and notify the BLM within 24 hours. Because discovery often occurs during construction with heavy equipment, damage to paleontological resources may occur prior to implementation of mitigation. Any impacts to paleontological resources would be permanent, and hence residual; however, because of the low potential for these resources to be present, less than significant residual impacts to paleontological resources are anticipated.

3.14. Visual Resource Management

Affected Environment

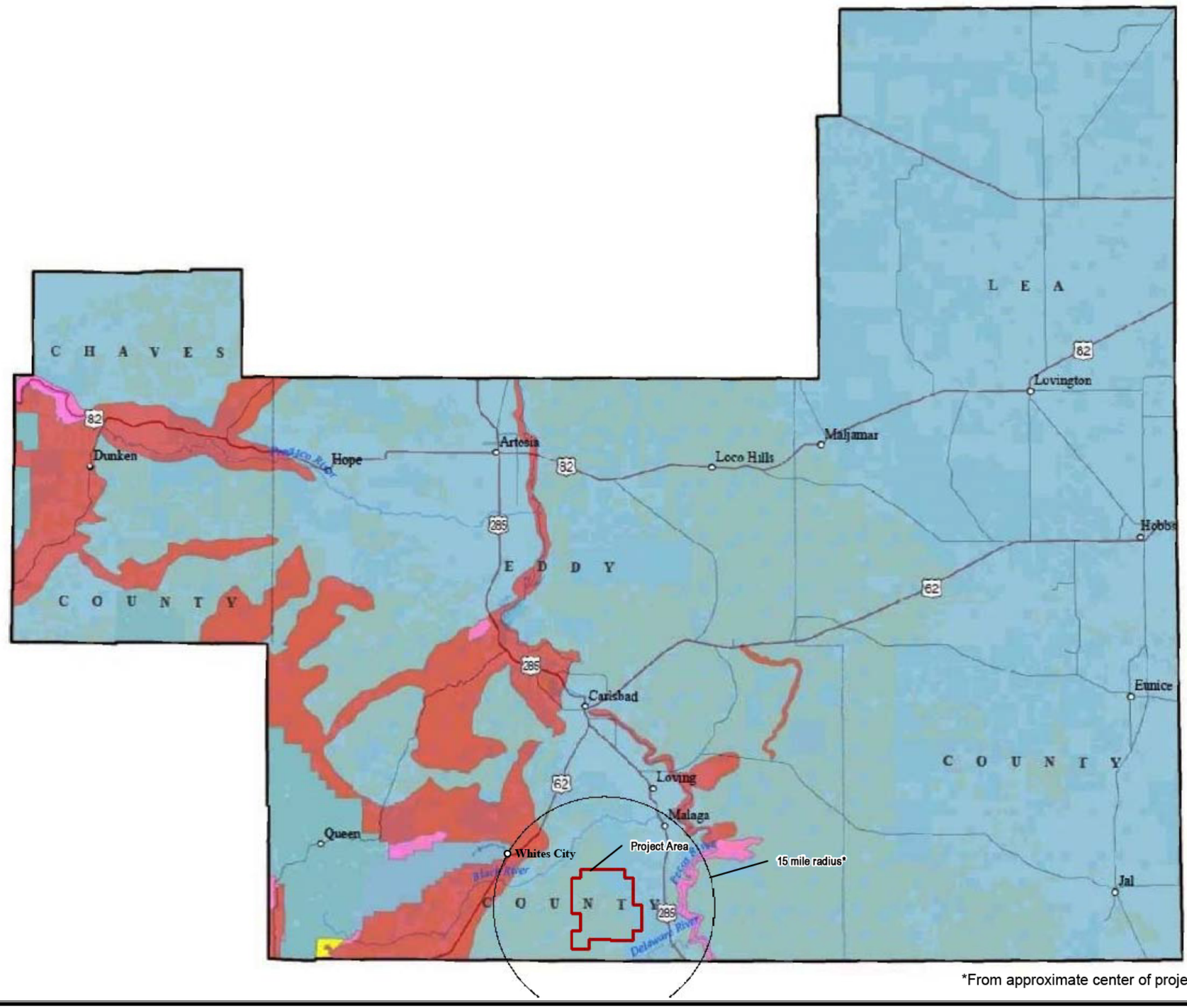
The CFO is responsible for protection of scenic landscapes to consider scenic values before allowing uses that may have negative visual impacts. Scenic resources are typically evaluated using the BLM Visual Resource Management (VRM) system, along with a qualitative assessment of dark sky considerations as discussed in the following subsections.

BLM Visual Resource Management System

The BLM uses the VRM system to identify and classify visual resources on BLM-administered as described in BLM Manual 8400 (BLM 1984). The VRM system classifies land based on visual appeal, public concern for scenic quality, and visibility from travel routes or observation points. Factors typically considered when measuring public concern for visual resources include type of users, amount of public use, public interest, adjacent land uses, and viewing distance. The system is based on the premise that public lands have a variety of visual values, and these values mandate different levels of management and provide a means to evaluate proposed projects to ensure that visual management objectives are met.

Management of visual resources is guided by the approved 1988 BLM CFO RMP (BLM 1988), as amended by the 1997 Carlsbad Approved Resource Management Plan Amendment (BLM 1997). The RMP established objectives for managing visual or scenic values within the CFO Resource Management Planning Area by designating the Planning Area as one of the following four VRM classes as shown on **Figure 3.14-1**.

- Class I: The level of change to the characteristic landscape should be very low and must not attract attention. Class I provides for natural ecological changes; however, it does not preclude very limited management activity.



Source:
BLM 2014
Analysis of the Management Situation
for the Bureau of Land Management
Carlsbad Field Office
September 2014

NORTH

10 5 0 10 Miles

CHEVRON HAYHURST MDP EA

FIGURE 3.14-1
Visual Resource Management Classes

ANALYSIS AREA: Eddy County, New Mexico

Date: 6/2/2016 | Prepared By: BW

Z:\GIS\PROJECT\0_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment\Final\Figure3-14-1_VRM.mxd

This page intentionally left blank.

- Class II: The level of change to the characteristic landscape should be low. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the landscape.
- Class III: The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer.
- Class IV: The level of change to the characteristic landscape can be high. Management activities may dominate the view and be a major focus of the viewer's attention. However, every attempt should be made to minimize the impact of these activities through careful location; minimal disturbance; and repeating basic elements of form, line, color, and texture found in the predominant natural features of the landscape.

The degree of visual modification allowed is specific for each VRM class. However, the goal of the VRM system is to minimize the visual impacts of all surface-disturbing activities regardless of the class in which they occur.

The Project Area is located within a BLM-designated VRM Class IV area as shown on **Figure 3.14-1**. Within the CFO Resource Management Planning Area, approximately 1,853,780 acres of BLM-managed land parcels are designated as VRM Class IV (BLM 2014a).

The objective for VRM Class IV areas is to provide for management activities which require major modifications of the existing character of the landscape; therefore, the level of change to the characteristic landscape resulting can be high. Within a VRM Class IV area, management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location; minimal disturbance; and repeating the basic landscape elements of color, form, line and texture.

The Project Area is relatively flat and largely undeveloped. Areas identified in the vicinity of the Project Area that may have views of the Project Area include the existing roads, primarily Whites City Road, Old Cavern Highway, Roadrunner Road, and Willhoit Ranch Road. The existing vegetation within the Project Area is primarily grasses and sagebrush shrubland with a variety of grasses, shrubs, forbs, and cacti in various shades of yellow, brown, and green. The land form topography is rolling to flat terrain with scattered hilltops visible in the distance.

The existing landscape character reflects influences of human activities. Current modifications to the landscape character have resulted from existing roads, fences, well pads, pipelines, powerlines, tank batteries, frac ponds, salt water disposal (SWD) wells, and large oil storage facilities within the Project Area.

Vertical elements in the surrounding landscape include cylindrical water storage tanks and troughs; windmills; along with pumpjacks and aboveground oil storage tanks associated with the existing oil and gas production facilities in various colors of shale green, tan, and black. Linear features are present in the form of oil and gas access roads, overhead powerlines, and fences. Colors are tans and browns from the sandy soils and light and medium greens from the vegetation.

The BLM Manual 8410-1, Visual Resource Inventory, defines distance zones for the visibility of visual resources, typically during daylight hours, as follows:

- Foreground/Middleground: 0 to 5 miles
- Background: >5 to 15 miles
- Seldom Seen Area: Beyond 15 miles

The Special Land Designations within a 15-mile radius from the approximate center of the Project Area (within the background distance zone) are shown on **Figure 3.15-1**. The Nominated Gypsum Soils and Chihuahuan Desert Rivers Areas of Critical Environmental Concern (ACECs) is located within the Project Area. Scenic values identified for the nominated ACECs include portions of the Pecos, Black, and Delaware Rivers, which provide unique scenic values that are enhanced by topographic and riparian

diversity not commonly found in the CFO planning area. In addition, the Guadalupe Escarpment provides a dramatic background with sheer, rugged peaks that extend 2,000 feet above the desert floor. The Pecos, Black, and Delaware Rivers and the Guadalupe Escarpment are not located in the vicinity of the Project Area.

There are no other ACECs, BLM-designated Scenic Area Special Management Areas (SMAs), Wild and Scenic Rivers (eligible, suitable, or designated), Wild or Scenic River Corridors, or Scenic Byways in the vicinity of the Project Area (BLM 2014a). Scenic areas within a 15-mile radius from the approximate center of the Project Area include the Dark Canyon Scenic Area SMA, located 19 miles to the west; the Guadalupe Escarpment Scenic Area Zone 2 SMA, approximately 9 miles to the west; and the Pecos River Corridor 14 miles to the northwest. Portions of the Project Area, primarily artificial lighting of existing facilities, may be visible in the background distance zone from some of these scenic areas. The VRM system includes effects of artificial lighting on night skies as described in the following subsection.

Dark Skies

The dark night skies of many parts of the western United States are valued by residents and visitors to the region and are a tourist amenity in some areas. Low light pollution conditions, or dark skies, is one of the most important properties for viewing stars, constellations, and other astronomical features, such as comets.

Carlsbad Caverns National Park, Guadalupe Mountains National Park, and the Living Desert Zoo and Gardens State Park share boundaries with the CFO. The Carlsbad Caverns National Park is located approximately 9 miles west-northwest of the Project Area on the other side of the Guadalupe Escarpment Scenic Area Zone 2.The McDonald Observatory in Texas is located 90 aerial miles south of the CFO Planning Area. All of these facilities advertise the pristine beauty of night skies and hold special viewing events.

Air quality studies conducted at Carlsbad Caverns National Park show visibility from the park to be up to 170 miles on a clear day. This radius would encompass the entire CFO Planning Area and the McDonald Observatory. The National Park Service has retrofitted its lighting to help protect the night sky and has scientists monitoring light pollution levels at several parks across the country.

Existing sources of artificial night time light in the vicinity of the Project Area include traffic along existing roads (White City Road, Old Cavern Highway, Roadrunner Road, Willhoit Ranch Road, and U.S. Highway 62/180); rural residences; and the communities of Carlsbad, Loving, Malaga and White City as shown on **Figure 3.14-1**.

The Project Area is remote, rural, and isolated from major communities, and there are very few existing stationary light sources in the vicinity. Thus, the ambient light level in the Project Area is low during the night, and the sky is considered to be very dark. The very low ambient light level allows visibility of astronomical features.

Impacts from the Proposed Action

Direct and Indirect Impacts

Implementation of the proposed action would cause some short-term and long-term visual impacts to the natural landscape. Short-term impacts would occur during construction and operations and prior to interim reclamation. Impacts to visual resources due to fugitive dust and other project-related emissions are described in Section 3.2 – Air Resources.

During the construction period, the removal of vegetation, grading, and project-related activities would detract from the visual quality of the landscape in the immediate vicinity of the proposed facilities. Impacts to visual quality would result from the presence of workers, construction equipment (drill rigs and other heavy equipment), vehicle traffic, vehicle lights, and the bustle of activities and associated dust. Although

slopes and vegetative screening would likely obscure direct views of some project-related activities and facilities, vehicle lights and dust raised by vehicle movements may be visible many miles away.

Some project-related facilities and activities would be visible to casual observers traveling (by vehicle) on White City Road and other roads in the Project Area. The potential viewers (casual observers) of the Project Area would be local residents and ranchers, visitors, and motorists traveling through in the Project Area. Direct views of the project facilities would typically be limited to areas in the immediate vicinity of the facilities and activities and short-term during the time it took to drive past the facilities.

Interim reclamation, conducted within 6 months after well completion, would reduce the area of ground disturbance by recontouring and revegetating. The areas planned for interim reclamation would be recontoured to the original contour if feasible, or if not feasible, to an interim contour that blends with the surrounding topography as much as possible. Following interim reclamation, total long-term disturbance is estimated to be 782 acres for the life of the project, primarily resulting from the proposed facilities displacing existing vegetation.

Long-term impacts would be visible to the casual observer throughout the life of the wells. These include the introduction of storage tanks, piping, pumpjacks, pads, and roads, which would result in visible contrasts to form, line, color, and texture relative to the existing surrounding landscape. Removal of vegetation during construction would expose bare soils lighter in color and smoother in texture than the existing surrounding vegetation. The surfacing of these areas with caliche materials would cause further contrasts, which would be visible to local residents and visitors to the area.

BLM Visual Resource Management System

The BLM's Visual Contrast Rating System, as described in the BLM Manual H-8431 (BLM 1986), was used to describe and analyze the effects of the proposed action on visual resources. As part of the analysis process, the visual impacts of a typical well were analyzed. The basic elements (form, line, color, and texture) of a typical well were then compared to those of the existing surrounding landscape to quantify the degree of contrast of the proposed action components relative to the existing and surrounding landscape and to assess whether the contrasts would meet BLM management objectives for VRM Class IV areas.

Based on the expected degree of contrast under the proposed action, the project-related activities are anticipated to dominate the view in some localized areas; however, every attempt would be made to coordinate with the BLM to minimize the impacts of these activities through careful selection of infrastructure locations; minimizing ground disturbances; and repeating the basic landscape elements of color, form, line, and texture.

Given that the Project Area is located in an area designated as VRM Class IV by the BLM, where major modification of the existing landscape may occur and existing oil and gas facilities are present, the introduction of additional oil and gas facilities under the proposed action would be consistent with the BLM management objectives for VRM Class IV areas.

Recontouring for final reclamation would consist of returning the pads, material storage piles, cut- and fill-slopes, and storm water control features to natural contours that blend with adjacent undisturbed areas, as specified in the final reclamation plan or final reclamation plat approved by the BLM. Requirements for seedbed preparation, soil amendments, seed, seeding procedures, mulching, erosion control fencing, security, and monitoring would be as specified for interim reclamation.

Some areas may be difficult to reclaim. If reclamation succeeded in these areas, grasses and forbs could begin to provide vegetative cover, which would reduce visual impacts, possibly as soon as 3 years after reclamation. Upon successful revegetation, visual impacts would be minimal.

Short- and long-term impacts would be minimized by best management practices such as color selection, reducing cut and fill, screening facilities with natural features and vegetation, interim reclamation, and contouring roads along natural changes in elevation.

Dark Skies

During night hours, the proposed action would have a substantially different type of impact on visual resources relative to the visual effects during day hours. Most of the form, line, color, and texture elements of the proposed facilities and activities would not be visible from publically accessible areas during the night. However, lights would be used on project equipment and vehicles during night time activities, and stationary lights would be positioned at various locations within the Project Area.

Drilling operations would require night lighting on a 24-hour basis. Night lighting typically consists of low-pressure sodium vapor fixtures arranged around the site so equipment can be safely operated during darkness. Permanent lighting may be installed for safety and security. Flaring would only occur during emergencies.

Night time lighting generally results in two forms of visual impacts:

- Sky glow (also known as artificial sky glow, light domes, or fugitive light) which is the brightening of the night sky from light scattered in the atmosphere)
- Glare resulting from the direct shining of light.

Both of these forms can impact the natural landscape and limit the visibility of faint dark sky features in the night. In most areas, project-related lights are anticipated to seem quite dim to the casual observer; however, visual impacts could be perceived as sky glow at long distances. Sky glow may be visible in some remote areas many miles from the Project Area.

The Project Area includes dark sky areas that are optimal for viewing stars and constellations because there are few existing light sources in the area, and the ambient light level is low. Under the proposed action, illumination of the night sky would be increased in some areas, and the number of visible astral and stellar features may be reduced. The effects of project-related lights may adversely affect the visual character of some dark sky areas.

Local residents and visitors may experience bright glares from the lighting used during oil and gas operations while driving down roadways within the Project Area. Bright glares could represent a safety hazard to motorists. These effects would typically be limited to areas in the immediate vicinity of the project facilities and short-term, occurring only during the time it took to drive past the facilities.

Cumulative Impacts

The CIA for visual resources is the CIA as defined in Section 3.1. Past, present, and reasonably foreseeable future actions in the CIA include oil and gas exploration and development, utility construction, mineral (non-hydrocarbon) exploration and extraction, livestock grazing, recreation, and off-road travel. Oil and gas exploration and development is the most prevalent activity within the CIA and is expected to continue to be over the life of the proposed action. When added to the disturbance associated with the proposed action, the total cumulative surface disturbance is estimated to be 8,342 acres within the 165,927-acre CIA. Cumulative effects to visual resources would occur as a result of additional industrial components and activities and an increase in the areal extent of oil and gas infrastructure within the CIA. The proposed action long-term facilities (such as roads and well pads) would constitute a visual intrusion for the life of the project (up to 45 years); however, the individual footprints for the project facilities would be relatively small.

The introduction of roads and well pads, along with the visual effects associated with the cumulative disturbances and removal of vegetation, would represent noticeable contrasts in form, line, color, and texture relative to native vegetation and topography within the CIA. Reclamation of disturbed areas in the

CIA would reduce the visual contrast in the disturbed areas with adjacent vegetation. Any newly reclaimed or unreclaimed linear features would continue to represent a visual contrast with the adjacent vegetation, but would not be as obvious a visual impact as the proposed oil and gas-related activities themselves. In time, the reclaimed and seeded areas would be less visible. BMPs, such as requiring that oil and gas infrastructure be painted with colors to blend with the overall landscape, would minimize some of these contrasts.

The proposed action is anticipated to have cumulative impacts on the night sky during operation because lighting would occur in some relatively remote locations within the CIA. Implementation of BMPs for light fixtures would minimize the potential for sky glow and glare. Past, present, and reasonably foreseeable future oil and gas-related projects within the CIA would be expected to require numbers and types of light sources for operation similar to those required for the proposed action. Lights associated with the proposed action are anticipated to be widely separated from the other activities within the CIA, such that the intensity or concentration of light sources in any given area would not increase to a level producing regional light pollution. Upon completion of reclamation, light sources associated with the proposed project would be permanently removed from the Project Area and the CIA.

The cumulative effects of the proposed action on the visual resources of the CIA would be long-term; however, the degree of contrast of the proposed project activities would comply with the objectives of BLM VRM Class IV. With implementation of design features provided in the MDP, MDP SUPO, and APDs, impacts to visual resources would be minor under the proposed action. When considering past, present, and reasonably foreseeable future actions, and the probability for successful reclamation and reestablishment of vegetation, cumulative impacts to visual resources are expected to be minimal.

Mitigation Measures and Residual Impacts

With implementation of design features provided in the MDP, MDP SUPO, and APDs, anticipated impacts to visual resources, including night skies, would be minor. Additional mitigation for visual resources includes the following:

- Chevron would use minimal light necessary for site safety, security, and operations.
- Light should be directed downward or only where needed.
- Low-pressure sodium lamps, such as yellow LED lighting (3,000 Kelvin or less) or equivalent, would be used to reduce sky glow and wildlife impacts.
- Properly shielded and mounted light fixtures would be used to reduce sky glow from upward pointing light, as well as trespass from light falling outside of desired area of illumination. Full cutoff shielding would be used during production.

An exception to this mitigation is during the use of temporary light plants during construction, as lighting during this phase is necessary for safety.

Other paint colors may be required by the BLM if onsite inspections determine that shale green is not the appropriate color. Additional mitigation may be required on an individual APD or ROW basis as determined by the BLM. Residual impacts following the implementation of design features, and mitigation may include long-term impacts from the visibility to the casual observer throughout the life of the wells and associated infrastructure and glare during the evening drilling operations.

3.15. Special Land Designations

Affected Environment

Public lands with Special Land Designations within a 15-mile radius from the approximate center of the Project Area are shown on **Figure 3.15-1**. Land management in the CFO Planning Area is guided by the approved 1988 BLM CFO RMP (BLM 1988), as amended by the 1997 Carlsbad Approved RMP

Amendment (BLM 1997).The Planning Area for the RMP revision encompasses 6,257,412 acres, not all of which are public lands (BLM 1997). This acreage includes all of Eddy and Lea Counties and a portion of Chaves County.

Special Land Designations are designed to protect watersheds, scenic and natural values, wildlife habitat, streams, and other natural values. A variety of management activities may be used to implement the management prescriptions for areas with Special Land Designations. These generally include posting boundaries, installing information signs, conducting inventory and monitoring of resources and their uses, acquiring access where appropriate, acquiring additional lands from willing parties as necessary to meet management objectives, and resolving unauthorized uses.

An ACEC is defined as an area within public lands where special management attention is required to protect and prevent irreparable damage to important historical, cultural, and scenic values; fish and wildlife and other natural systems or processes; and life and safety from natural hazards. ACEC designation indicates that significant value or resources exist that must be accommodated for future management actions and land use proposals. ACEC nominations that meet the relevance and importance criteria are incorporated in appropriate RMP alternatives. Two ACECs have been nominated for designation within the Project Area (Gypsum Soils ACEC and Carlsbad Chihuahuan Desert Rivers ACEC) as shown on **Figure 3.15-1**. Both Nominated ACECs meet relevance and importance criteria for the following resources: historic, cultural, scenic, fish, wildlife, and natural systems or processes (including karst, paleontological, riparian, soils, and special status plants), and natural hazards.

SMAs are considered land use authorization avoidance areas because they contain resource values that pose special constraints for, and can result in denial of, applications for land uses that cannot be designed to be compatible with management objectives and prescriptions. The Project Area is within SMA 25, Southern Gypsum Soil Area. This SMA is addressed in Section 3.3, Soils. There are no other SMAs in the vicinity of the Project Area.

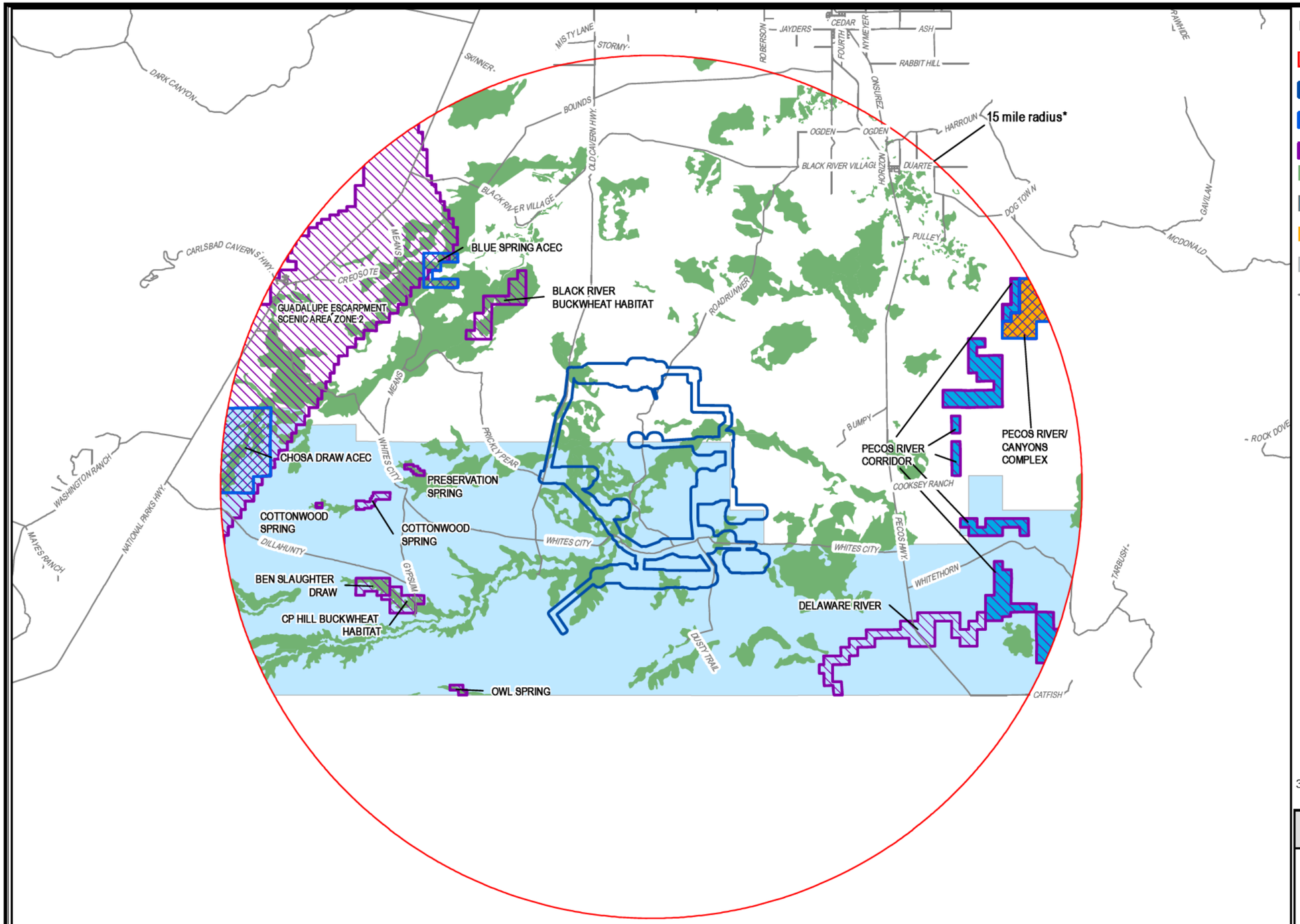
There are two Special Recreation Management Areas and two Off Road Vehicle Recreation Areas within the CFO Planning Area, neither of which are in the vicinity of the Project Area. There are no Outstanding Natural Areas, Research Natural Areas, or Scenic or Backcountry Byways in the vicinity of the Project Area.

Impacts from the Proposed Action

Direct and Indirect Impacts

Impacts resulting from proposed project activities would occur within the boundaries of the Nominated Gypsum Soils and Carlsbad Chihuahuan Desert Rivers ACECs. Relevant and important values for both Nominated ACECs could be affected. Impacts to each of the potentially affected values are described elsewhere within this EA. In summary, with the implementation of proposed design features and BLM-required mitigation measures for each resource, impacts to these resources would be less than significant and would not affect values, resources, systems, processes, or hazards to the point where the Nominated ACECs would no longer be eligible for nomination.

There are no other BLM-designated special land designation areas within the Project Area; therefore, the proposed action would have no direct impacts to other ACEC, SMAs, or other special land designation areas. Indirect effects may include noise, visual effects from the removal of vegetation and night lighting associated with construction activities and facility lights, and short-term traffic delays on some of the roads in the vicinity of the Project Area. Night lighting of project facilities may be visible in the background distance zone from some of the ACECs, scenic areas, or other special land designation areas many miles away from the project. Impacts to visual resources are analyzed in Section 3.14.



*From approximate center of project area

LEGEND

- Special Land Designation Area of Analysis
- MDP Project
- Areas of Critical Environmental Concern
- Special Management Area
- Nominated Gypsum Soils
- Special Recreation Management Area
- Research Natural Area
- Nominated Carlsbad Chihuahuan Desert Rivers ACEC
- County Roads

Notes:

1. *Only the Special Land Designations located within 15-mile radius from approximate center of project area are shown.*
2. *There are no Wilderness Areas, Wilderness Study Areas, Scenic Area Special Management Areas, Special Recreation Management Areas, Off Highway Vehicle Recreation Areas, Research Natural Areas or Outstanding Natural Areas within the EA Area of Analysis.*

Source:
BLM 2014
Analysis of the Management Situation for the Bureau of Land Management Carlsbad Field Office September 2014

NORTH

3.5 1.75 0 3.5 Miles

CHEVRON HAYHURST MDP EA

FIGURE 3.15-1
Special Land Designations

ANALYSIS AREA: Eddy County, New Mexico

Date: 6/2/2016 | Prepared By: BW

Z:\GIS\PROJECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment Final\Figure3-15-1_SpecialLandDesignations.mxd

This page intentionally left blank.

Cumulative Impacts

The CIA for special land designation areas is the CIA defined in Section 3.1. Relevant and important values for the Nominated Gypsum Soils and Carlsbad Chihuahuan Desert Rivers ACECs are expected to sustain some level of cumulative impacts over time. Cumulative impacts would fluctuate with the gradual abandonment and reclamation of wells. As new wells are drilled, other wells would be abandoned and reclaimed, reducing impacts to the Nominated ACECs in terms of total cumulative acres disturbed at any given point in time. As the oil field plays out, the cumulative impacts would be reduced as more areas are reclaimed and fewer areas are developed.

With implementation of design features provided in the MDP, MDP SUPO, and APDs, impacts to the Nominated ACECs would be minor under the proposed action. When considering past, present, and reasonably foreseeable future actions, and the probability for successful reclamation and reestablishment of vegetation, cumulative impacts to special land designation areas are expected to be minor.

Mitigation Measures and Residual Impacts

With implementation of design features provided in the MDP, MDP SUPO, and APDs, anticipated impacts to special land designations or Nominated ACEC designations would be less than significant. Therefore, no additional mitigation measures are required for approval of the MDP. Additional mitigation may be required on an individual APD or ROW basis as determined by the BLM. Potential residual impacts to values associated with the Nominated ACECs are described in other resources sections (cultural and historic resources, wildlife, and visual resources management).

3.16. Wastes – Hazardous and Solid

Affected Environment

The affected environment for hazardous materials includes air, water, soil, and biological resources that could be affected by an accidental release of hazardous materials during transportation to and from the Project Area, storage, and use in construction and operations. Sensitive areas for hazardous materials releases include, but are not limited to, areas adjacent to water bodies; locations above or that drain to aquifers; and areas where humans or wildlife would be directly impacted such as parks, recreation sites, cave/karst terrain, and T&E and sensitive species habitat.

The BLM requires that all NEPA documents list and describe any hazardous and/or extremely hazardous materials that would be produced, used, stored, transported, or disposed of as a result of a proposed project. Many industry practices for use of materials commonly used for oil and gas projects are mandated by various federal and state laws and regulations, as well as the BLM standard lease terms and stipulations that would accompany any authorization resulting from this analysis. Pertinent federal laws dealing with hazardous material contamination are as follows:

- The Oil Pollution Act (Public Law 101-380), August 18, 199) prohibits discharge of pollutants into waters of the U.S., which by definition includes any perennial stream or any tributary stream, including any ephemeral drainage that conveys water to a perennial stream.
- CERCLA provides for liability, compensation, cleanup, and emergency response for hazardous substances released into the environment. It also provides national, regional, and local contingency plans. Petroleum, including crude oil, natural gas, natural gas liquids, liquefied natural gas and synthetic gas, is exempt from CERCLA regulations.
- RCRA regulates the use of hazardous substances and the disposal of hazardous wastes from the time they are produced until their disposal. On January 6, 1988, EPA determined that most oil and gas exploration, development, and production wastes would not be regulated as hazardous wastes under RCRA.
- Hazardous Materials Transportation Uniform Safety Act of 1990 provides for safe transport of hazardous material in intrastate, interstate, and foreign commerce.

- 49 U.S. Code Chapter 51 Transportation of Hazardous Material regulates the transportation, including security, of hazardous material in intrastate, interstate, and foreign commerce.
- 49 CFR parts 171 through 180: Hazardous Material Transportation Regulations provides procedures and policies, material designations, and packaging requirements and operational rules for hazardous material transportation.
- 49 CFR 171.8 Hazardous material provides the definition of hazardous material, “a substance or material that the Secretary of Transportation has determined is capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and has designated as hazardous under section 5103 of Federal hazardous materials transportation law (49 U.S.C. 5103).”
- 43 CFR 3162.1 General Requirements state the operating rights owner or operator, as appropriate, shall comply with applicable laws and regulations; with the lease terms, Onshore Oil and Gas Orders, Notice to Lessee; and with other orders and instructions of the authorized officer. These include, but are not limited to, conducting all operations in a manner which ensures the proper handling, measurement, disposition, and site security of leasehold production; which protects other natural resources and environmental quality; which protects life and property; and which results in maximum ultimate economic recovery of oil and gas with minimum waste and with minimum adverse effect on ultimate recovery of other mineral resources.
- 43 CFR 3162.5-1 Environmental Obligations requires that the operator conduct operations in a manner which protects the mineral resources, other natural resources, and environmental quality. It also requires the operator to exercise due care and diligence to assure that leasehold operations do not result in undue damage to surface or subsurface resources or surface improvements. All produced water must be disposed of by injection into the subsurface, by approved pits, or by other methods which have been approved by the authorized officer. Upon the conclusion of operations, the operator shall reclaim the disturbed surface in a manner approved or reasonably prescribed by the authorized officer. All spills or leakages of oil, gas, produced water, toxic liquids, or waste materials, blowouts, fires, personal injuries, and fatalities shall be reported by the operator in accordance with these regulations and as prescribed in applicable order or notices. The operator shall exercise due diligence in taking necessary measures, subject to approval by the authorized officer, to control and remove pollutants and to extinguish fires. An operator's compliance with the requirements of the regulations in this part shall not relieve the operator of the obligation to comply with other applicable laws and regulations.
- Onshore Order #6 Hydrogen Sulfide Operations protects public health and safety and those personnel essential to maintaining control of the well. This Order identifies the BLM’s national requirements and minimum standards of performance expected from operators when conducting operations involving oil or gas that is known or could reasonably be expected to contain hydrogen sulfide (H_2S) or which results in the emission of sulfur dioxide (SO_2) as a result of flaring H_2S. This Order also identifies the gravity of violations, probable corrective action(s), and normal abatement periods.

Use and/or production of hazardous materials connected to the project could be related to drilling materials, cementing and plugging materials, hydraulic fracturing materials, production products (natural gas, condensates, produced water), fuels and lubricants, pipeline materials, combustion emissions, and miscellaneous materials.

Illegal dumping of oil and gas wastes (fluid and solid waste) has been documented in the BLM CFO Planning Area, particularly the Black River region (BLM 2016b). Documented industrial waste dumps in the Black River watershed contained: high salinity produced water; waste oil; produced oil (including gasoline and diesel range components); drilling fluids/cuttings/pit liners; BTEX (benzene, toluene, xylene); H2S gas (entrained in dumped fluids), frac sand; hydraulic fracturing fluids; waste water (predominantly contaminated rinsate from tanker truck); truck fluids (hydraulic fluids and motor oil); and miscellaneous leaks and spills from transported chemical containers. Illegal dumping of oil and gas wastes is creating

surface disturbances, public roadway hazards, environmental degradation, and natural and cultural resource damage across the region. There are a number of oil and gas industry state and federal regulatory mandates for proper waste stream containment and disposal from “cradle to grave;” some of these regulations are listed above. Oil and gas operators are responsible for the actions and activities of company personnel as well as contractors and contract personnel.

Hydraulic Fracturing

Chemicals serve many functions in hydraulic fracturing, from limiting the growth of bacteria to preventing corrosion of the well casing. Chemicals are needed to ensure that the hydraulic fracturing job is effective and efficient. Typically, fracturing fluid consists of about 99 percent water and sand, with about 1 percent chemical additives. The number of chemical additives used in a typical fracture treatment varies depending on the conditions of the specific well to be fractured. The predominant solutions currently in use for fracture treatments are water-bearing fracturing fluids mixed with friction-reducing additives (Groundwater Protection Council 2009). The chemicals used in hydraulic fracturing operations are typically transported in concentrated bulk and diluted at the project site. A typical fracture treatment uses very low concentrations of three to dozens of additive chemicals, depending on the characteristics of the water and the formation being fractured. Each component serves a specific, engineered purpose (see https://fracfocus.org/chemical-use/what-chemicals-are-used for examples of the more commonly used additives).

Impacts from the Proposed Action

Direct and Indirect Effects

Potentially harmful substances used in well construction, drilling, completion, production, and other operations would be trucked to and from the Project Area as required and kept onsite in limited quantities, stored under appropriate conditions (e.g., stored out of direct sunlight). No hazardous substance, as defined by 40 CFR 355 would be used, produced, stored, transported, or disposed of in amounts above threshold quantities. Waste generated by construction activities would not be exempt from hazardous waste regulations under the oil and gas exploration and production exemption of RCRA. Wastes exempt from hazardous waste classification under RCRA include those associated with well production and transmission of oil and natural gas through the gathering lines and the hydrocarbons themselves. These wastes may also be subject to state hazardous or non-hazardous waste regulations or other federal regulations such as hazardous materials transportation regulations and the National Pollutant Discharge Elimination System. Some wastes exempt from hazardous waste classification under RCRA can still be harmful to human health and the environment if not properly managed. Chevron would comply with all appropriate federal, state, and local regulatory requirements to minimize impacts to the environment or human health and safety. Chevron’s methods for handling waste is described in **Appendix B** (Surface Use Plan).

Chevron would comply with the reporting requirements under Title III of the Superfund Amendments and Reauthorization Act for materials used in quantities of 10,000 pounds or more such as produced hydrocarbons, ethylene glycol (antifreeze), lubricants, and amine compounds. No chemicals used in construction meet the criteria to be considered an acutely hazardous material/substance or would be present in quantities that would exceed criteria. In addition, no extremely hazardous substance, as defined in 40 CFR 355, would be produced, used, stored, transported, or disposed of during construction or operation of the facilities in amounts above threshold permissible quantities.

H_2S is a naturally occurring byproduct of oil and gas development in the vicinity of the Project Area. H_2S is both an irritant and a chemical asphyxiant with effects on both oxygen utilization and the central nervous system. In 1993, EPA found that there is a potential for human and environmental exposure from routine emission of H_2S from oil and gas wells; however, there was insufficient evidence to suggest that these exposures were a significant threat. While there are no national ambient air quality stands for H_2S, the state of New Mexico has set standards for H_2S (BLM 2016a). Chevron is not anticipating to encounter

H_2S, but would be required to meet any NMED H_2S air permit requirements. Chevron has also developed an H_2S Contingency Plant in the event that H_2S is encountered.

Waste, including fluid and solid, produced during drilling and completion operations would be collected in a container and disposed of properly at a state approved disposal facility. Following drilling and completion operations, solid waste, chemicals, salts, frac sand, and other waste material would also be removed and disposed of properly at a state approved disposal facility. Potential unplanned releases could have serious effects on human health and environment. Many common industrial processes use chemicals that would be hazardous in large enough quantities or if not handled properly. Similarly, drilling and hydraulic fracturing chemical additives are safe when properly handled, but could otherwise be hazardous.

Because numerous chemicals could be present on a well site, the potential exists for spills and leaks. The BLM regulations require prevention of spills and leaks (to the extent possible), reporting of undesirable events (via Notice to Lessees 3-A), emergency response to stop the release at the source, clean up measures to state and federal standards, and surface reclamation of impacted areas. Causes and sources of undesirable events are multiple and variable. Small spills may happen at faulty pipe connections; large spills might occur as the result of a major well failure. Spills may result from human error (e.g., vehicle collisions, improper handling or equipment operation/installation), while others could stem from equipment failure (e.g., broken pipe, damaged pit liner, leaking tank) or acts of nature (Fletcher 2012). Equipment failure and corrosion tend to be common causes of spills (Wenzel 2012). Regular inspection and maintenance by the operator can mitigate the potential for adverse events and impacts.

The cause of an undesirable event, the extent of the event, the hazard rating of the involved material(s), response and cleanup times, and cleanup effectiveness play critical roles in determining the overall impacts. Spill volumes and types vary, and small spills occur with greater frequency. Secondary containment and recovery of small spills minimizes potential impacts.

With the use and production of solid and hazardous wastes, potential exists for accidental contamination of surface water or groundwater. An accident could occur that would result in a release of such materials directly or indirectly into surface waters or in a way that posed a potential threat for transport to groundwater. For example, improper casing and cementing could result in contamination of groundwater resources (see Environmental Consequences – Hydrology). Hazardous substances could also contaminate soil and damage or kill nearby vegetation or wildlife, as well as react with other chemicals and/or naturally occurring elements; ignite or explode; result in air pollution; cause evacuation of personnel and/or nearby residences, and become a major public health hazard.

Public concerns have been raised nationwide regarding the human health impacts of the chemicals used during well development, particularly during hydraulic fracturing. Chemicals used in hydraulic fracturing have been found to affect the skin, eyes, and other sensory organs; the respiratory and gastrointestinal systems; as well as brain/nervous system; immune and cardiovascular system; kidneys; endocrine system; and also cause cancer and mutations (Colborn et al. 2011). These chemicals could be released through an accidental spill and result in impacts to the environment and human health. The New Mexico Department of Health and the EPA are responsible for assessing and authorizing chemical use. Individuals most susceptible to any potential impacts from chemicals are those directly involved with handling them. Worker chemical exposure risks are mitigated by compliance with chemical safety and OSHA regulations as well as safe operating procedures implemented operators, third-party contractors, and by the Occupational Health and Safety Administration. Because active oil and gas development activities (e.g., drilling through completion phases) are closed to the public, public health and safety risk is generally limited to exposure to air, water, and other emissions that could migrate outside the Project Area. These impacts have been described in their respective sections of this analysis.

Cumulative Impacts

Implementation of the proposed action, in combination with past, present, and reasonably foreseeable future actions (including ongoing oil and gas development), would continue to increase the quantities of

hazardous substances used, the potential for spills or accidents, and the amounts of wastes generated. With continued compliance with regulatory requirements, and implementation of similar design features for other projects within the CFO, cumulative impacts would be less than significant.

Mitigation Measures and Residual Impacts

With implementation of design features provided in the MDP, MDP SUPO, and APDs, anticipated impacts due to the accidental release of hazardous and non-hazardous substances are expected to be less than significant. If successfully implemented, the proposed water treatment and recycling system could be used to recycle water from other operators and reduce the volume of produced water to be disposed of through injection within the CIA.

Safety measures and precautions are included in the proposed action as design features to ensure hazardous wastes are not released into the environment. For example, Chevron would install and maintain an impervious secondary containment system for any tank or barrel containing hazardous, poisonous, flammable, or toxic substances sufficient to contain the contents of the tank or barrel and any drips, leaks, and anticipated precipitation. Additionally, the proposed action would be subject to compliance with any applicable federal, state, county, municipal, and local permits, including all necessary environmental clearances and permits.

In the event of any reportable release of a hazardous substance to the environment, EPA regulations require the responsible party to implement an SPCC Plan (and/or a Federal Response Plan) and take responsibility for cleanup and damages. Should the operator fail to comply with spill obligations, a third-party emergency cleanup contractor could be activated by the BLM and paid for by the operator. Compliance with hazardous waste laws and regulations, standard lease stipulations, contingency plans, and emergency response resources would be expected to adequately mitigate any potential hazardous or solid waste issues associated with the proposed action.

Oil and gas operators, including third-party contractors, are required to adhere to all federal, state, and local regulations regarding the proper handling, storage, and disposal of all hazardous and non-hazardous wastes. Once a waste is taken to a disposal facility, facility operators are also required to comply with all federal and state regulations regarding proper handling and disposal of the waste. Analysis of the potential for contamination at these sites is beyond the scope of this analysis, and regulation of such facilities is overseen by state agencies. In New Mexico, injection operations related to oil and natural gas production are regulated under the provisions of the Oil and Gas Act, NMSA 1978, Sections 70-2-1 et seq. and the Water Quality Act, NMSA 1978, Sections 74-6-1 et seq.

Additional mitigation measures may be identified for individual APDs based on the results of onsite inspections. Residual impacts from the accidental release of hazardous and non-hazardous substances are expected to be less than significant.

This page intentionally left blank.

4. SUPPORTING INFORMATION

4.1. Consultation/Coordination

Prior to the onsite meetings for APD Group 1 and Group 2, submitted with the MDP, letters were sent to the allotment permittees providing notification of the onsite and inviting the permittees to attend the onsite. No response was received, and no permittees attended the onsite. Prior to any future onsite meetings, notification letters will be sent to allotment permittees.

Identification and evaluation of historic properties and land assessments and resolution of adverse effect was determined through consultation between the BLM and New Mexico SHPO pursuant to the regulations (36 CFR 800 et seq.) implementing Section 106 of the NHPA of 1966 as amended (54 U.S.C. 306108 et seq.), the NAGPRA (U.S. Code 25, §3001, et seq.).

4.2. List of Preparers and Reviewers

This EA was prepared by the BLM Carlsbad Field Office. Technical assistance for the preparation of the EA was provided by Arcadis U.S., Inc. The following individuals were responsible either for the preparation or review of the EA.

Bureau of Land Management, Carlsbad Field Office

Name	Title	Resource/Responsibility
Paul Murphy	Natural Resource Specialist	Project Lead
TBD	Assistant Field Manager	EA Review
Todd Bowen	Planning & Environmental Coordinator	EA Review
Ross Klein	New Mexico State Office, Natural Resource Specialist	EA Review
Robert Gomez	Supervisory Realty Specialist	EA Review
Solomon Arreola	Realty Specialist	EA Review
Bob Ballard	Supervisory Natural Resource Specialist	EA Review
Stan Allison	Cave/Karst Resource Specialist	Caves and Karst
Steve Daly	Soil Conservationist	Soil Resources; Vegetation; Noxious Weeds and Invasive Plants; Watershed; Floodplains, Wetlands, and Riparian Areas; Range
Cassie Brooks	Wildlife Biologist	Wildlife; Special Status Species, including T&E Species
Deanna Younger	Recreation Specialist	Visual Resource Management, Special Land Designation
Stephanie Bergman	Archaeologist	Cultural and Historical Resources; Paleontology
Terry Gregston	Environmental Protection Specialist	Wastes – Hazardous and Solids
David Herrell	New Mexico State Office, Natural Resource Specialist	Air Resources; Watershed; Floodplains, Wetlands, and Riparian Areas
Forrest Cook	Colorado State Office, Air Resource Specialist	Air Resources
Marissa Garner	Cartographic & Geographic Information Systems Specialist	Geographic Information Systems

Arcadis U.S., Inc.

Name	Resource/Responsibility
Rachel Cruz	Project Manager
Jason Adams, PG	Assistant Project Manager; Soils; Watershed; Caves and Karst; Floodplains, Wetlands and Riparian Areas; Paleontology; Wastes – Hazardous and Solid
Eric Hodek	Air Resources
Cary Ellmers	Air Resources
Dennis McNally (Alpine Geophysics, LLC)	Air Resources
Jocelyn Finch	Vegetation; Noxious Weeds and Invasive Species; Wildlife; BLM Special Status Species, including Threatened and Endangered
Kelly Portue	Vegetation; Noxious Weeds and Invasive Species; Wildlife; BLM Special Status Species, including Threatened and Endangered
Kathryn Cloutier	Range; Visual Resource Management; Special Land Designations
Carl Späth, PhD	Cultural and Historic Resources
Brian Webb	Geographic Information Systems
Carrie Womack	Document Control and Preparation, Project Record

4.3. References

Arcadis U.S., Inc. (Arcadis). 2016a. Environmental Field Survey – Hayhurst Development Area. Prepared for Chevron U.S.A., Inc. May 27, 2016. 114 p.

Arcadis. 2016b. Air Quality Technical Support Document for Chevron's Hayhurst Master Development Plan. Draft.

Barroll, P., D. Jordan, and G. Ruskauff. 2004. The Carlsbad Area Groundwater Flow Model. Prepared by New Mexico Office of the State Engineer. January 2004. 164 pages including appendices.

Belnap, J., J.H. Kaltnecker, R. Rosentreter, J. Williams, S. Leonard, and D. Eldridge. 2001. Biological Soil Crusts: Ecology and Management. U. S. Department of Interior, Bureau of Land Management and U. S. Geological Survey. Technical Reference 1730-2. 118p.

Belnap, J. and D.A. Gillette. 1997. Disturbance of Biological Soil Crusts: Impacts on Potential Wind Erodibility of Sandy Desert Soils in Southeastern Utah. Land Degradation & Development. 8: 355-362.

Best, T.L. and K.N. Geluso. 2003. Summer Foraging Range of Mexican Free-Tailed Bats (*Tadarida Brasiliensis Mexicana*) from Carlsbad Cavern, New Mexico. The Southwestern Naturalist 48(4): 590-596.

Biota Information System of New Mexico (BISON-M). 2016. Report County Federal/State Species Status for Eddy County. [Web Page]. Located at http://www.bison-m.org/. Accessed: February 2, 2016.

Blickley, J.L. and G.L. Patricelli. 2010. Impacts of Anthropogenic Noise on Wildlife: Research Priorities for the Development of Standards and Mitigation. Journal of International Wildlife Law & Policy, 12:274-292.

Boggess, D., B. McCormack, K. Boggess, and A. Murray. 2016. Class III Cultural Resource Survey for the Chevron Hayhurst Development Area MDP Project, Eddy County, New Mexico. Lone Mountain

Archaeological Services, Inc., Albuquerque, NM. Prepared for Chevron North America, Exploration and Production Company, Houston, TX. 54 pages and appendices.

Bohannon, P. 2009. The RCRA Exploration & Production Exemption. Bohannon Legal PLLC. [Web Page]. Located at http://bohannonlegal.com/pauls-oil-gas-manual-the rcra-ep-exemption/. Accessed: April 5, 2016.

Bureau of Land Management (BLM). 1984. Visual Resource Management. BLM Manual 8400. April 1984.

BLM. 1986. Visual Resource Contrast Rating. BLM Manual 8431. January 1986.

BLM. 1988. Carlsbad Resource Management Plan. Bureau of Land Management, Roswell District, New Mexico. September 1988.

BLM. 1992. Dark Canyon Draft Environmental Impact Statement. BLM New Mexico State Office and BLM Roswell District Office, Carlsbad Resource Area. August 1992.

BLM. 1997. Carlsbad Approved Resource Management Plan Amendment and Record of Decision. Carlsbad Resource Area, Roswell District Office, New Mexico. October 1997.

BLM. 2007. Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development – The Gold Book. BLM/WO/ST-06/021+3071/REV 07. Bureau of Land Management. Denver, Colorado. 84 pp.

BLM. 2008a. National Environmental Policy Act. Handbook H-1790-1. January 2008. 184 p.

BLM. 2008b. Paleontological Fossil Yield Classification (PFYC) System for Paleontological Resources on Public Lands. Instructional Memorandum 2008-009. October 15, 2007. 11 p.

BLM. 2009. Assessment and Mitigation of Paleontological Resources. Instructional Memorandum 2009-011. October 10, 2008.

BLM. 2012. Reasonable Foreseeable Development (RFD) Scenario for the BLM New Mexico Pecos District. Final Report.

BLM. 2013. Ochoa Mine Draft Environmental Impact Statement. Carlsbad Field Office. August 2013.

BLM. 2014a. Analysis of the Management Situation for the Bureau of Land Management Carlsbad Field Office. September 2014. 312 p.

BLM. 2014b. Update to the Reasonable Foreseeable Development (RFD) for the BLM Pecos District, SENM. Final Report. November 2014. 27pp.

BLM. 2015. Hydraulic Fracturing White Paper. BLM New Mexico State Office, Division of Fluid Minerals. June 24, 2015. 19 pages.

BLM. 2016a. Air Resources Technical Report for Oil and Gas Development. New Mexico, Oklahoma, Texas, and Kansas. BLM New Mexico State Office. January 2016. 71 pp.

BLM. 2016b. Summary Report: Incidents of Illegal Industrial Dumping in the Black River Region. June 2016. 58 pp.

Bureau of Reclamation (BOR). 2013. West-Wide Climate Risk Assessment: Upper Rio Grand Impact Assessment. BOR, Sandia National Laboratories, and U.S. Army Corps of Engineers, Albuquerque District. 138 pages including appendices.

Carman, S.M. 2007. Texas Hornshell Popenaias popeii Recovery Plan. New Mexico Department of Game and Fish, Conservation Services Division, Santa Fe, New Mexico.

Cedar Lake Ventures (Cedar Lake), Inc. 2016. WeatherSpark - Average Weather for Carlsbad, NM, USA. [Web Page]. Located at https://weatherspark.com/averages/29937/Carlsbad-New-Mexico-United-States. Accessed: February 12, 2016.

Coffin, A. 2007. From roadkill to road ecology: A review of the ecological effects of roads. Journal of Transport Geography 15:396-406.

Colborn et al. 2011. Natural Gas Operations from a Public Health Perspective. Human and Ecological Risk Assessment. 17:1039-1056.

Council on Environmental Quality (CEQ). 1997. Considering Cumulative Effects under the National Environmental Policy Act. January 1997. 64 pages plus appendices.

DesertUSA. 2016. Bats in the Desert and the Southwest. [Web Page]. Located at http://www.desertusa.com/animals/bats.html. Accessed: February2, 2016.

DiTomaso, J. 2000. Invasive weeds in rangelands: Species, impacts, and management. Weed Science 48:255-265.

Environmental Protection Agency (EPA). 1990. Overview of the Clean Air Act and Air Pollution. [Web Page]. Located at https://www.epa.gov/clean-air-act-overview. Accessed: February 12, 2016.

EPA. 2011. National Air Toxics Assessment, 2011 NATAAssessment for Cancer, Neurological and Respiratory Risks for Eddy and Lea Counties in New Mexico. [Web Page]. Located at https://www.epa.gov/national-air-toxics-assessment. Accessed: March 7, 2016.

EPA. 2015. Counties Designated “Nonattainment” for Clean Air Act’s National Ambient Air Quality Standards (NAAQS). [Web Page]. Located at https://www3.epa.gov/airquality/greenbook/mapnpoll.html. Accessed: February 12, 2016.

EPA. 2016. Ambient Air Quality Standards [Web Page]. Located at https://www.epa.gov/criteria-air-pollutants/naaqs-table. Accessed: February 12, 2016.

Evangelista, P.H., A.W. Crall, and E. Bergquist. 2011. Invasive Plants and their Response to Energy Development. Pages 115-129 *in* Naugle, D.E. ed. Energy Development and Wildlife Conservation in Western North America. Island Press, Washington, D.C. 344 pages.

Federal Emergency Management Agency (FEMA). 2010. Flood Insurance Rate Map 35015C1825D. Eddy County, New Mexico and Incorporated Areas. Effective June 4, 2010.

Fletcher, S. M. 2012. Risk Assessment of Groundwater Contamination from Hydraulic Fracturing Fluid Spills in Pennsylvania. *Thesis (M.S.)*. Massachusetts Institute of Technology, Engineering Systems Division, Technology and Policy Program. [Web Page]. Located at http://hdl.handle.net/1721.1/72885. Accessed: April 21, 2016.

Garber, G. and S. Young. 2005. Common Raptors and other Large Birds of New Mexico. Prepared for New Mexico Avian Protection Working Group. 23 pages.

Griffith, G.E., J.M. Omernik, M.M. McGraw, G.Z. Jacobi, C.M. Canavan, R.S. Schrader, D. Mercer, R. Hill, and B.C. Moran. 2006. Ecoregions of New Mexico (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,400,000).

Groundwater Protection Council (GWPC). 2009. Modern Shale Gas Development in the United States: A Primer. Prepared for the U.S. Department of Energy, Office of Fossil Energy, and National Energy Technology Laboratory (NETL). DE-FG26-04NT15455. Oklahoma City, OK. [Web Page]. Located at http://energy.gov/sites/prod/files/2013/03/f0/ShaleGasPrimer_Online_4-2009.pdf. Accessed: April 21, 2016.

Hunt, R.K., V.L. Santucci, and J. Kenworthy. 2006. A Preliminary Inventory of Fossil Fish from National Park Service Units. In: Lucas, S.G., Spielmann, J.A., Hester, P.M., Kenworthy, J.P. and V.L Santucci (eds), Fossils from Federal Lands. New Mexico Museum of Natural History Bulletin 34. Pp. 63-69.

Jankowitz, R. and M. Gruber. 2007. Oil and Gas Development Guidelines, Conserving New Mexico's Wildlife Habitats and Wildlife. New Mexico Department of Fish and Game, State Game Commission. 39 pages.

Jones, S.L. 2010. Sprague's Pipit (*Anthus spragueii*) conservation plan. U.S. Department of Interior, Fish and Wildlife Service, Washington, D.C. 56 pages.

Kempenaers, B., P. Borgstroem, P. Loes, E. Schlicht, and M. Valcu. 2010. Artificial Night Lighting Affects Dawn Song, Extra-Pair Siring Success, and Lay Date in Songbirds. *Current Biology* 20 (19): 1735–1739.

Kennedy, C. 2013. Precipitation Changes over North America: Do the Models Agree? National Oceanic and Atmospheric Administration. [Web page.] Located at https://www.climate.gov/print/119751. September 26, 2013. Accessed: July 6, 2016.

King, P.B. 1949. Regional Geologic Map of Parts of Culberson and Hudspeth Counties, Texas. United States Geological Survey Oil and Gas Investigations Preliminary Map 90. 1 sheet. Scale 1:50,000.

Kirtman, B., S.B. Power, G.J. Boer, R. Bojariu, I. Camilloni, F.J. Doblas-Reyes, A.M. Fiore, M. Kimoto, G.A. Meehl, M. Prather, A. Sarr, C. Schar, R. Sutton, G.J. van Oldenborgh, G. Vecchi, and H.J. Wang. 2013. Near-term Climate Change: Projections and Predictability. In: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Stocker, T.F., D. Quin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschun, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Kuijper, D., J. Schut, D. Van Dullemen, H. Toorman, N. Goossens, J. Ouwehand, and H.J.G.A. Limpens. 2008. Experimental evidence of light disturbance along the commuting routes of pond bats (Myotis dasycneme). *Lutra* 51 (1): 37–49.

Lang, B.K. 2001 (*as cited in Carman 2007*). Status of the Texas hornshell and native freshwater mussels (Unionoidea) in the Rio Grande and Pecos River of New Mexico and Texas. New Mexico Department of Game and Fish, Completion Report, E-38, submitted to the Division of Federal Aid, U. S. Fish and Wildlife Service, Albuquerque, New Mexico.

Lang, B.K. 2004 (*as cited in Carman 2007*). Artificial culture and captive rearing of the Texas hornshell. New Mexico Department of Game and Fish, Completion Report, E-51, submitted to the Division of Federal Aid, U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

Lang, B.K. 2005 (*as cited in Carman 2007*). Texas hornshell, Popenaias popeii (Bivalvia: Unionoida), population monitoring. New Mexico Department of Game and Fish, Performance Report, T-30-P-1, submitted to the Division of Federal Aid, U. S. Fish and Wildlife Service, Albuquerque, New Mexico.

Lang, B.K. 2006 (*as cited in Carman 2007*). Texas hornshell, Popenaias popeii (Bivalvia: Unionoida), population monitoring. New Mexico Department of Game and Fish, Annual Performance Report, T-30-P-1 to the Federal Assistance Division, U. S. Fish and Wildlife Service, Albuquerque, NM.

Longcore T. and C. Rich. 2016. Artificial night lighting and protected lands: Ecological effects and management approaches. Natural Resource Report. NPS/NRSS/NSNS/NRR—2016/1213. National Park Service. Fort Collins, Colorado.

Maloney, E.D., S.J. Camargo, E. Chang, B. Colle, R. Fu, K.L. Geilw, Q. Hu, X. Jiang, N. Johnson, K.B. Karnauskas, J. Kinter, B. Kirtman, S. Kumar, B. Langenbrunner, K. Lombardo, L. Long, A. Mariotti, J.E. Meyerson, K. Mo, J.D. Neelin, Z. Pan, R. Seager, Y. Serraw, A. Seth, J. Sheffield, J. Thibeault, S.P. Xie, C. Wang, B. Wyman, and M. Zhao. 2014. North American Climate in CMIP5 Experiments – Part III: Assessment of 21st Century Projections. Journal of Climate. Vol 27. Pp. 2230-2270.

McCormack, Beth, Douglas Boggess, and Amber Murray. 2016. Class III Cultural Resource Survey for the Chevron Hayhurst Development Area MDP Add-on, Eddy County, New Mexico. Lone Mountain Archaeological Services, Inc., Albuquerque, NM. Prepared for Chevron North America, Exploration and Production Company, Houston, TX. NMCRIS NO. 135812. 32 pages including appendices.

Miller, M.W. 2005. Apparent effects of light pollution on singing behavior of American robins. *Condor* 108 (1): 130–139. November 4.

Morgan, G.S. and S.G. Lucas. 2005. Pleistocene Vertebrate Faunas in New Mexico from Alluvial, Fluvial, and Lacustrine Deposits. In: Lucas, S.G., Morgan, G.S., and K.E. Zeigler (eds.), New Mexico's Ice Ages. New Mexico Museum of Natural History and Science Bulletin No. 28. Page 185-248.

National Climatic Data Center (NCDC). 2014. Hourly Recorded Wind Speed and Direction in Carlsbad, NM (Cavern City Air Park). [Web Page]. Located at http://www.ncdc.noaa.gov/. Accessed: December 2015.

National Oceanic and Atmospheric Administration (NOAA). 2011. Data Tools: 1981-2010 Normals, for Carlsbad, NM. [Web Page]. Located at https://www.ncdc.noaa.gov/cdo-web/datatools/normals. Accessed: February 12, 2016.

Natural Resource Conservation Service (NRCS). 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.

New Mexico Administrative Code (NMAC). 2016.Title 19. Chapter 21. Part 2. 8. List of New Mexico State Endangered Plant Species.

New Mexico Bureau of Geology and Mineral Resources (NMBGMR). 2003. Geologic Map of New Mexico. Scale 1:500,000.

New Mexico Department of Game and Fish (NMDGF). 2007. Wildlife Notes: spotted bat. [Web Page]. Located at http://www.wildlife.state.nm.us/download/education/conservation/wildlife-notes/mammals/spotted-bat.pdf. Accessed: February 3, 2016.

New Mexico Environment Department (NMED). 2014a. Air Monitoring Web Site – Design Concentrations for Various Pollutants [Web Page]. Located at https://www.env.nm.gov/aqb/monitor/airmonitoringnetwork.html. Accessed: February 12, 2016.

NMED. 2014b. 2014-2016 State of New Mexico Clean Water Act Section 303(d)/Section 305(b) Integrated Report. November 18, 2014.

NMED. 2016. Ambient Air Quality Standards. [Web Page]. Located at: https://www.env.nm.gov/aqb/. Accessed: February 12, 2016.

New Mexico Office of State Engineer (NMOSE). 2016. DRAFT 2016 Region 10 - Lower Pecos Valley Regional Water Plan. [Web page.] Located at http://www.ose.state.nm.us/Planning/RWP/region_10.php. Accessed: July 6, 2016.

New Mexico Oil Conservation Division (NMOCD). 2016. Well Search results for Eddy County, including Plugged Wells. [Web Page]. Located at https://wwwapps.emnrd.state.nm.us/ocd/ocdpermitting/Data/Wells.aspx. Accessed: May 12, 2016.

New Mexico Partners in Flight (NMPIF). 2016a. Least Tern (*Sterna antillarum*). [Web Page]. Located at http://www.nmpartnersinflight.org/leasttern.html. Accessed: February 2, 2016.

NMPIF. 2016b. Sprague's Pipit (*Anthus spragueii*). Species Profile. [Web Page]. Located at http://www.nmpartnersinflight.org/spraguespipit.html. Accessed: February 2, 2016.

New Mexico Rare Plant Technical Council (NMRPTC). 1999a. Echinocereus fendleri var. kuenzleri (Kuenzler's Hedgehog cactus). [Web Page]. Located at http://nmrareplants.unm.edu/rarelist_single.php?SpeciesID=70. Accessed: March 12, 2014.

NMRPTC. 1999b. Escobaria sneedii var. leei (Lee's Pincushion cactus). [Web Page]. Located at http://nmrareplants.unm.edu/rarelist_single.php?SpeciesID=56. Accessed: March 12, 2014.

NMRPTC. 1999c. Cirsium wrightii (Wright's Marsh Thistle). [Web Page]. Located at http://nmrareplants.unm.edu/rarelist_single.php?SpeciesID=52. Accessed: March 12, 2014.

NMRPTC. 1999d. Amsonia tharpii (Tharp's blue-star). [Web Page]. Located at http://nmrareplants.unm.edu/rarelist_single.php?SpeciesID=9. Accessed: March 12, 2014.

NMRPTC. 1999e. Coryphantha robustispina ssp. Scheeri (Mulee, needle mulee, beehive cactus, pineapple cactus, Scheer pincushion). [Web Page]. Located at http://nmrareplants.unm.edu/rarelist_single.php?SpeciesID=55. Accessed: February 2, 2016.

NMRPTC. 1999f. Hexalectris nitida (Shining crested coralroot, Glass Mountain crested coralroot). [Web Page]. Located at http://nmrareplants.unm.edu/rarelist_single.php?SpeciesID=99. Accessed: February 2, 2016.

New Mexico Statute Annotated (NMSA). 1978. Oil and Gas Act, Sections 70-2-1 et seq. Water Quality Act, Section 74-6-7 et seq.

Nico, L. and P. Fuller. 2016. Gambusia nobilis. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. Revision Date: 8/23/2011. [Web Page]. Located at http://nas.er.usgs.gov/queries/FactSheet.aspx?speciesID=851. Accessed: February 2, 2016.

Oregon Department of Environmental Quality (ODEQ). 2003. Fact Sheet: Sources of Polychlorinated Biphenyls. [Web Page]. Located at http://www.deq.state.or.us/lq/cu/nwr/PortlandHarbor/docs/SourcePCBs.pdf. Accessed: May 27, 2016.

Panjabi, A.O., G. Levandoski, and R. Sparks. 2010. Wintering bird density and habitat use in Chihuahuan desert grasslands. Unpublished report I-MXPLAT-08-02. Rocky Mountain Bird Observatory, Brighton, Colorado.

Patriarca, E. and P. Debernardi. 2010. Bats and light pollution. EUROBATS. Centro Regionale Chirotteri, Turin.

Pecos Valley Water Users Organization (Pecos Valley). 2001. Lower Pecos Valley Regional Water Plan. Prepared for New Mexico Interstate Stream Commission Regional Water Planning Program. July 2001.

Quinn, J.L., M.J. Whittingham, S.J. Butler, and W. Cresswell. 2006. Noise, predation risk compensation and vigilance in the chaffinch Fringilla coelebs. Journal of Avian Biology 37:601–608.

Railey, J.A. 2012. The Human Landscape in Southeastern New Mexico: A Class I Overview of Cultural Resources Within the Bureau of Land Management's Carlsbad Field Office Region. SWCA Environmental Consultants, Albuquerque, New Mexico.

Sawyer, H.H., R. Nielson, and D. Strickland. 2009. 2007 Final Report for the Sublette Mule Deer Study (Phase II): Long-term monitoring plan to assess potential impacts of energy development on mule deer in the Pinedale Anticline Project Area. Western Ecosystems Technology, Inc. Cheyenne, WY. USA.

Schaub, A., J. Ostwald, and B. M. Siemers. 2008. Foraging bats avoid noise. *Journal of Experimental Biology* 211 (19): 3174–3180.

Soil Conservation Service (SCS). 1971. Soil Survey, Eddy Area, New Mexico. March 1971.

Soil Survey Staff (SSS). 2015. Web Soil Survey. [Web Page]. Located at Natural Resources Conservation Service. Located at: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx. Accessed: December 16, 2015.

Stafford, Kevin W., Laura Rosales-Lagarde, and Penelope J. Boston. 2008. Castile evaporite karst potential map of the Gypsum Plain, Eddy County, New Mexico and Culberson County, Texas: A GIS methodological comparison. *Journal of Cave and Karst Studies* 70 (1): 35-46.

Texas Commission on Environmental Quality (TCEQ). 2014. Air Monitoring Web Site – Design Concentrations for Various Pollutants. [Web Page]. Located at https://www.tceq.texas.gov/airquality/monops/sites/mon_sites.html. Accessed: February 12, 2016.

Texas Department of Water Resources (TDWR). 1978. Geohydrology of Major Johnson Springs and Carlsbad Springs, New Mexico. TDWR Report LP-23. 22 pages plus figures.

Texas Railroad Commission (TRRC). 2016. Digital map data for Culberson County (FIPS 109). Accessed via FTP: May 17, 2016.

Texas Water Development Board (TWDB). 2011. Aquifers of Texas. TWDB Report 380. 172 pages.

The Nature Conservancy. 2016. Artificial Lighting. [Web Page]. Located at http://www.nature.org/ourinitiatives/regions/northamerica/areas/centralappalachians/recommended-shale-practices-artificial-lighting.pdf. Accessed: April 5, 2016.

Trombulak, S.C. and C.A. Frissell. 2000. Review of ecological effects of roads on terrestrial and aquatic communities. Conservation Biology 14(1):18-30.

U.S. Department of Agriculture (USDA). 2016. Sole Source Aquifer Recharge Area. USDA Rural Development. [Web page]. Located at http://www.rd.usda.gov/files/TX_21SoleSourceAquiferRechargeArea.pdf. Accessed: July 5, 2016.

U.S. Department of Defense (DOD) and U.S. Fish and Wildlife Service (USFWS). 2010. Northern Aplomado Falcon Factsheet. [Web Page]. Located at https://webcache.googleusercontent.com/

search?q=cache:4bRgPrkQZgcJ:https://www.fws.gov/endangered/esa-library/pdf/aplomado_falcon_fact_sheet.pdf+&cd=1&hl=en&ct=clnk&gl=us. Accessed: February 2, 2016.

U.S. Forest Service (USFS), National Park Service (NPS) and U.S. Fish and Wildlife Service (USFWS). 2010. Federal land managers' air quality related values work group (FLAG): phase I report – revised (2010). Natural Resource Report NPS/NRPC/NRR – 2010/232. National Park Service, Denver, Colorado.

USFS, NPS, USFWS. 2011. Federal land managers' interagency guidance for nitrogen and sulfur deposition analyses: November 2011. Natural Resource Report NPS/NRSS/ARD/NRR – 2011/465. National Park Service, Denver, Colorado.

U.S. Fish and Wildlife Service (USFWS). 2009. Piping Plover (Charadrius melodus). 5-Year Review: Summary and Evaluation. 214 pages.

USFWS. 2016a. National Wetlands Inventory. [Web Page]. Located at http://www.fws.gov/wetlands/Data/Data-Download.html. Accessed: February 10, 2016.

USFWS. 2016b. Chevron Hayhurst EA – T&E Species List, Eddy County. IPaC Trust Resource Report. iPaC v2.3.2. [Web Page]. Located at https://ecos.fws.gov/ipac/. Accessed: February 1, 2016.

USFWS. 2016c. Mexican Spotted Owl (Strix occidentalis lucida). [Web Page]. Located at https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B074. Accessed: February 2, 2016.

USFWS. 2016d. Southwestern Willow Flycatcher (Empidonax traillia extimus). [Web Page]. Located at https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B094. Accessed: February 2, 2016.

USFWS. 2016e. Yellow-billed Cuckoo (Coccyzus americanus). [Web Page]. Located at https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=B06R. Accessed: February 2, 2016.

U.S. Geological Survey (USGS). 2016. Cave Roosting Bats of the Southwest. [Web Page]. Located at http://sbsc.wr.usgs.gov/cprs/research/projects/caves/bats.asp. Accessed: February 2, 2016.

URS Group Inc. (URS). 2013. Air Resources Technical Support Document. Carlsbad Field Office, Oil and Gas Resource Management Plan Revision. April 25, 2013.

Van Pelt, W.E., S. Kyle, J. Pitman, D. Klute, G. Beauprez, D. Schoeling, A. Janus, and J. Haufler, 2013. The Lesser Prairie-Chicken Range-wide Conservation Plan. Western Association of Fish and Wildlife Agencies. Cheyenne, Wyoming, 367 pages.

Vine, J.D. 1963. Surface Geology of the Nash Draw Quadrangle, Eddy County, New Mexico. United States Geological Survey Bulletin 1141-B. 46 pages.

Walter, J.C. 1953. Paleontology of Rustler Formation, Culberson County, Texas. Journal of Paleontology. Vol. 27, No. 5. Pp. 679-702.

Wenzel, C. 2012. A Case Study—Hydraulic Fracturing Geography: The Case of the Eagle Ford Shale, TX, USA. *Thesis (M.S.).* Texas State University-San Marcos, Department of Geography. [Web Page]. Located at https://digital.library.txstate.edu/handle/10877/4247. Accessed: April 21, 2016.

Western Regional Climate Center (WRCC). 2016. Carlsbad Caverns New Mexico (291480) – Monthly Climate Summary. [Web page.] Located at http://www.wrcc.dri.edu/cgi-bin/cliRECtM.pl?nm1480. Accessed: July 6, 2016.

Wiggins, D.A. 2006. Baird's Sparrow (*Ammodramus bairdii*): A Technical Conservation Assessment. [Web Page]. Located at http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5182050.pdf. Accessed: February 6, 2016.

Wyoming Game and Fish Department (WGFD). 2010. Recommendations for Development of Oil and Gas Resources within Important Wildlife Habitats. Version 6.0. Wyoming Game and Fish Department. Cheyenne, Wyoming. 244 pages.

Xcel Energy, Inc. (Xcel). 2016a. Power for the Plains – China Draw-Yeso Hills 115 kV Transmission Line Project. [Web Page]. Located at http://www.powerfortheplains.com/projects/china-draw-yeso-hills/index.asp. Accessed: May 12, 2016.

Xcel. 2016b. Power for the Plains – Kiowa-North Loving-China Draw 345 kV Transmission Line Project. [Web Page]. Located at http://www.powerfortheplains.com/projects/kiowa-north-loving/index.asp. Accessed: May 12, 2016.

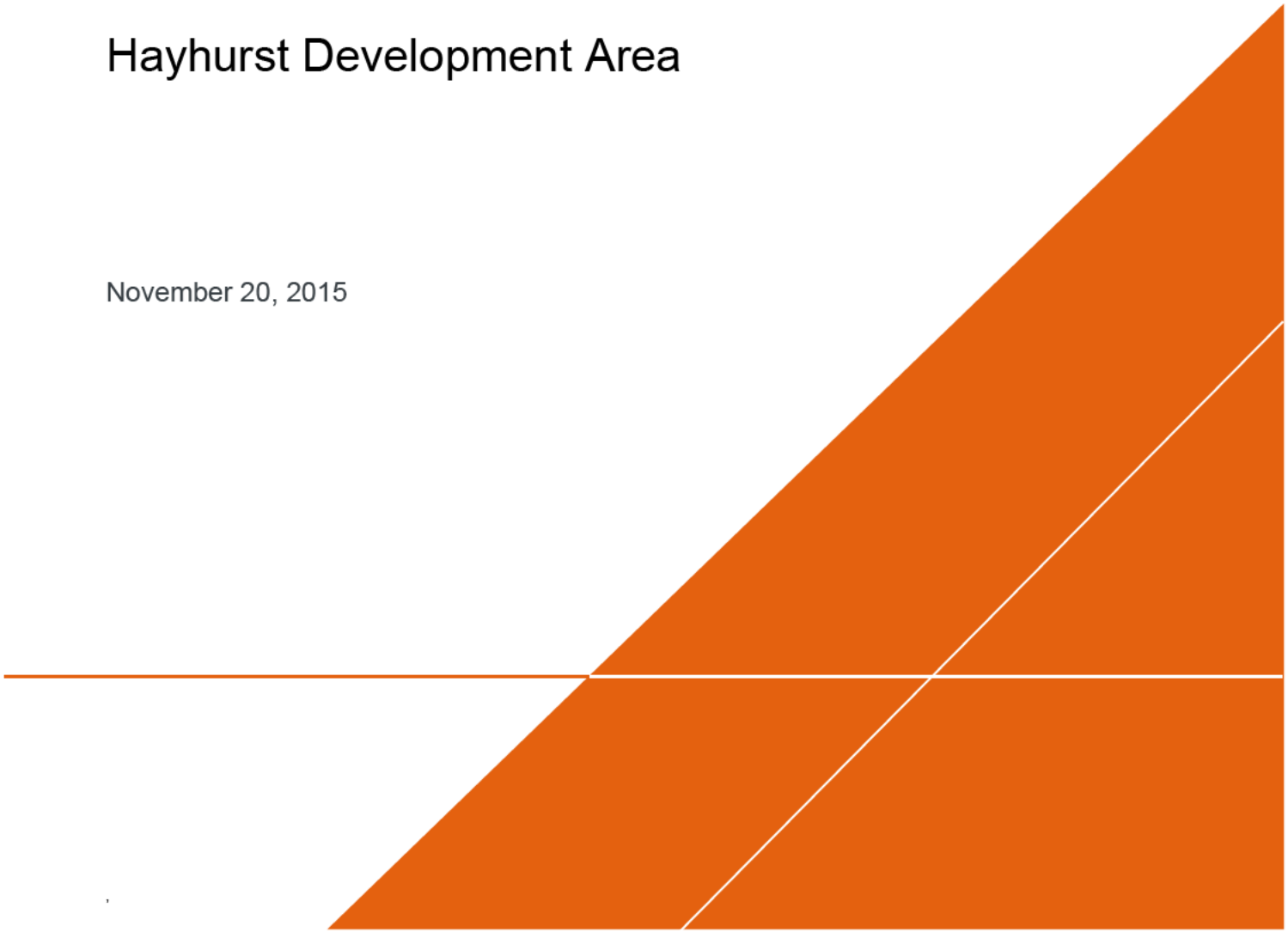
ARCADIS Design & Consultancy for natural and built assets

Chevron U.S.A. Inc.

ENVIRONMENTAL FIELD SURVEY

Hayhurst Development Area

November 20, 2015



ENVIRONMENTAL FIELD SURVEY

Hayhurst Development Area

Jennifer Van Curen

Environmental Scientist

Ethan Jahnke

Project Scientist

Priscilla V. Yelvington

Project Manager

Prepared for:

Sean Cheben

Project Manager

Chevron U.S.A. Inc.

1400 Smith Street

Houston, Texas 77002

Prepared by:

Arcadis U.S., Inc.

2929 Briarpark Drive

Suite 300

Houston

Texas 77042

Tel 713 953 4800

Fax 713 977 4620

Our Ref.:

B0048782.0000

Date:

November 20, 2015

This document is intended only for the use of the individual or entity for which it was prepared and may contain information that is privileged, confidential and exempt from disclosure under applicable law. Any dissemination, distribution or copying of this document is strictly prohibited.

CONTENTS

Acronyms and Abbreviations vi

1 Introduction 1-1

1.1 Project Area 1-1

1.2 Methods 1-1

1.3 Key Constraint Findings 1-2

2 Visual Resource Management 2-1

2.1 Survey Findings and Mitigation 2-1

3 Range 3-1

3.1 Survey Findings and Mitigation 3-1

4 Soil 4-1

4.1 Soil Type Descriptions 4-1

4.1.1 Shallow 4-1

4.1.2 Gypsum 4-2

4.1.3 Loamy 4-2

4.2 Survey Findings and Mitigation 4-3

5 Vegetation 5-1

5.1 Vegetation Types 5-1

5.1.1 Shallow Soil Type Plant Communities 5-1

5.1.2 Gypsum Soil Type Plant Communities 5-1

5.1.3 Loamy Soil Type Plant Communities 5-1

5.2 Survey Findings and Mitigation 5-1

6 Noxious Weeds 6-1

6.1 Survey Findings and Mitigation 6-1

7 Wildlife 7-1

7.1 Survey Finding and Mitigation 7-1

8 Special Status Species 8-1

8.1 Texas Hornshell Mussel 8-1

8.2 Wild Gypsum Buckwheat 8-1
8.3 Survey Findings and Mitigation 8-1
9 Areas of Critical Environmental Concern 9-1
9.1 Survey Findings and Mitigation 9-1
10 Paleontological 10-1
10.1 Survey Findings and Mitigation 10-1
11 Karst 11-1
11.1 Survey Findings and Mitigation 11-1
12 Hydrology 12-1
12.1 Surface Hydrology 12-1
12.2 Floodplain 12-1
12.3 Wetland and Riparian Areas 12-2
12.4 Subsurface Hydrology 12-2
12.4.1 Shallow Geology 12-2
12.4.2 Carlsbad Basin 12-3
12.5 Survey Findings and Mitigation 12-3
13 Cultural 13-1
13.1 Survey Findings and Mitigation 13-1
14 Other observations 14-1
14.1 Existing and Former Operations 14-1
14.2 Slopes 14-2
15 Recommendations 15-1
15.1 Soils 15-1
15.2 Vegetation and Wildlife 15-1
15.3 Special Status Species 15-1
15.4 Karst 15-1
15.5 Hydrology 15-1

TABLES

Table 1. Affected Allotments, Range Improvements, and Range Studies 3-1

Table 2. Soils within Chevron's Proposed Project Area 4-1

Table 3. Vascular Plant List for the Hayhurst Development Area 5-2

Table 4. Noxious Weeds Within Chevron's Proposed Project Area 6-1

Table 5. Wildlife Observed Within the HDA 7-1

Table 6. Plugged Wells within the HDA 14-1

FIGURES

Figure 1. Environmental Field Survey Area

Figure 2. Existing Development

Figure 3. Key Constraint Findings

Figure 4. Visual Resource Management Classes

Figure 5. Range Allotments

Figure 6. Range Resources

Figure 7. Habitat or Shade Trees

Figure 8. Soil Resources

Figure 9. Noxious Weeds

Figure 10. Raptor Nests and Burrows

Figure 11. Migratory & Non-Migratory Bird Nests

Figure 12. Wildlife Habitat Project

Figure 13. Special Status Species – Aquatic & Plants

Figure 14. Special Status Species

Figure 15. Areas of Critical Environmental Concern

Figure 16. Gypsum Soils

Figure 17. Paleontological Potential Fossil Yield Classifications

Figure 18. Karst Occurrence Zones

Figure 19. Karst Potential Zones

Figure 20. Collapsed Sinkholes

Figure 21. Depressions / Fissures

Figure 22. Rock or Gyp Outcroppings

Figure 23. Surface Hydrology Topographic Map

Figure 24. Surface Hydrology

Figure 25. Geologic Resources

Figure 26. Regional Aquifers

Figure 27. Groundwater Wells

Figure 28. Slope Constraints

Figure 29. Hilltops or Steep Slopes

APPENDICES

Appendix A – Visual Contrast Rating

Appendix B – Glossary

Appendix C – References

Appendix D – Resumes

ACRONYMS AND ABBREVIATIONS

CCA	Candidate Conservation Agreement
CCAA	Candidate Conservation Agreement with Assurances
ACEC	Area of Critical Environmental Concern
APD	Application for Permit to Drill
AUM	Animal Unit Month
BLM	Bureau of Land Management
CFO	Carlsbad Field Office
Chevron	Chevron U.S.A. Inc.
cm	centimeter
COA	Condition of Approval
CTB	Central Tank Battery
CWA	Clean Water Act
EA	Environmental Assessment
EIS	Environmental Impact Study
FEMA	Federal Emergency Management Agency
FLPMA	Federal Land Policy and Management Act
gpm	gallons per minute
HDA	Hayhurst Development Area
MBTA	Migratory Bird Treaty Act
MDP	Master Development Plan
m	meter
mm	millimeter
NEPA	National Environmental Policy Act
NHD	National Hydrographic Dataset
NHPA	National Historical Preservation Act
NRHP	National Register of Historic Places
OSE	Office of the State Engineer
PFYC	Potential Fossil Yield Classification
RMP	Resource Management Plan

ROW	Right of Way
SHPO	State Historic Preservation Office
SWD	Salt Water Disposal
T&E	Threatened and Endangered
THM	Texas Hornshell Mussel
VRM	Visual Resource Management
WGB	Wild Gypsum Buckwheat
WSA	Wilderness Study Area

1 INTRODUCTION

An environmental field survey was completed as the initial step in the planning process for Chevron U.S.A. Inc.'s. (Chevron) creation of a Master Development Plan for the Hayhurst Development Area (HDA). The HDA is located southwest of Carlsbad, New Mexico and east of Whites City, New Mexico (Figure 1).

This report summarizes the existing resources, conditions, and concerns identified during the environmental field survey conducted between September 9 and October 2, 2015, and documents the potential impacts to those resources, what changes need to be made to lessen these impacts, and what mitigation will be needed to further reduce potential impacts. This report will be used in conjunction with all National Environmental Policy Act (NEPA) reviews of actual areas to be utilized by Chevron and in writing of the Environmental Assessment (EA). It will be updated should further surveys be completed in the HDA on behalf of Chevron.

During meetings with Chevron and the Bureau of Land Management (BLM) held on July 23rd and October 14th, 2015, several environmental resources located within the HDA were identified; including:

- Karst features,
- Wildlife and biologic concerns,
- Archeology,
- Proposed areas of critical environmental concern (ACEC) due to soil type, and
- Other development impacts.

The purpose of the environmental field survey was to evaluate multiple resources within the specific areas where Chevron's development is planned.

1.1 Project Area

Chevron is planning to develop and produce oil and gas from the HDA, which, when fully developed, will encompass approximately 436 oil and gas wells from the Wolfcamp, Harkey, and 1st-3rd Bone Springs formations (Figure 2). Chevron will require approximately 16 central tank batteries (CTB); eight compressor stations; six deep salt water disposal (SWD) wells; and four frac ponds designed for fresh, brackish, and recycled/reuse water. There are 17.5 sections within Township 25 South (T25S), Range 27 East (R27E) and Township 26 South (T26S), Range 27 East (R27E) encompassing federal, state, and private surface lands. Chevron is planning to place four or more wells on each well pad, resulting in 109 or fewer total well pads.

1.2 Methods

Prior to conducting field surveys, records of known resource issues, such as visual resources, raptor nests, karst features, soil types, and other pertinent biological information within the survey area was gathered from the BLM Carlsbad Field Office (CFO) and other resource databases. These features were plotted on maps along with the HDA to aid in locating resource features and habitat that could be affected by the activities associated with drilling and development within the proposed project area.

A team of Arcadis scientists (see Appendix D) conducted the surveys between September 9 and October 2, 2015. Survey protocol varied, but was guided based on previous discussions with the BLM CFO. The proposed project area was surveyed by foot with the aid of global positioning systems (GPS) and ESRI Collector applications. The area was

systematically searched by walking through the proposed project area/feature and right-of-way (ROW) buffer areas. To aid in navigation and data recording, a Trimble XT GPS receiver, using North American 1983 Datum and Universal Trans Mercator (UTM) coordinates in Zone 13 North, was connected to a smartphone with the ESRI Collector Application to record resource locations or other relevant resource features observed during the survey. In addition to GPS points collected at each 'finding', a picture was also collected and stored in-sync with the GPS point.

1.3 Key Constraint Findings

Multiple features were observed in the HDA that warrant avoidance to reduce potential impacts; these features are illustrated on Figure 3. All development should avoid or minimize the disturbance across the 100-year flood zones by 200 meters (m) and is represented on the figure as "200 m Avoid and Minimize". These areas should also be avoided to minimize impacts on the Texas Hornshell Mussel (THM) habitat. On the figure there are 200 m buffers for sinkholes and range improvements (water wells, water troughs, feed troughs, water storage tanks) that should be avoided to prevent disturbing livestock in the area. The smaller karst features are represented with 50 m buffers for reasonability of planning. The smaller karst features will require further investigation to definitively identify voids present in the subsurface. During the nesting season, active raptor nests should be avoided by 200 m. For this evaluation, the buffers on the figure are set at 50 m with a recommendation that surface disturbing activities be initiated in the non-nesting months when possible.

Additional constraints were observed; however, they were not seen as a key finding since certain design features can be utilized to mitigate the constraints. Recommendations regarding these constraints will be further explained in Section 15 of this report.

2 VISUAL RESOURCE MANAGEMENT

A Visual Resource Management (VRM) survey identifies visual scenic values and provides a means to evaluate proposed projects to confirm that visual management objectives are met. The process involves completing a visual contrast rating for the project area, determining if the project area is visible from travel routes or observation points, and measuring public concern for the scenic quality. The BLM offers this data for public consumption to better plan projects. A visual contrast rating was completed by Arcadis from Whites City Road and is provided in Appendix A.

There are four classes in VRM per the BLM Handbook on Visual Resource Inventory and they are comprised of the following:

- Class I – very minimal changes to the landscape. Activities should not be visible and must not attract attention. The objective is to preserve the existing character of the landscape.
- Class II – minimal changes to the landscape. Activities could be visible but should not attract attention. The objective is to retain the existing character of the landscape.
- Class III – moderate changes to the landscape. Activities will be visible and may attract attention, but the activity should not be the focus or dominate the view. The objective would be to partially retain the existing character of the landscape.
- Class IV – significant changes to the landscape. Activities will be visible, may attract attention, and may dominate the view. This class is still mitigated to minimize impacts to the landscapes and to account for foreseeable future activities.

2.1 Survey Findings and Mitigation

Chevron's proposed project occurs within a BLM designated VRM Class IV zone (Figure 4). The level of change to the characteristic landscape within this project area can be high based on the level of development. The infrastructure of the HDA may dominate the view; however, every attempt should be made to coordinate with the BLM to minimize the impact of these activities through careful location consideration, minimal disturbance, and repeating the basic landscape elements of color, form, line, and texture. Additionally, Chevron plans to proceed with build-out as needed and perform vigorous reclamation. This reclamation would include vegetating along the sides of roads for erosion mitigation, downsizing well pads to what is needed for daily operations, utilizing subsurface pipelines and seeding after installation is complete, reducing slopes (cuts and fills) and seeding to mitigate erosion, and seeding areas around pads where equipment tracking took place for rapid recovery of vegetation.

There are existing well pads, pipelines, powerlines, tank batteries, frac ponds, SWD facilities, and large oil storage facilities within the HDA. The newer sites were observed to be painted to blend with the surrounding area. At this time, disturbances blended well with the rough texture, horizontal and vertical lines, and hues of green colors. The visual impact of cleared land was decreased greatly through vigorous reclamation of pipeline and powerline corridors and downsizing of pads.

3 RANGE

There are seven allotments within the HDA and all are yearlong cow-calf deferred rotation operations. Range improvement projects such as windmills, water delivery systems (pipelines, storage tanks, and water troughs), earthen reservoirs, fences, and brush control projects are located within the allotments. In general, an average rating of the range land within this area is 6 acres per Animal Unit Month (AUM). In order to support one cow for one year, about 72 acres are needed; this equals about nine cows per section.

Table 1 provides a summary of the seven allotments within Chevron's proposed project area and Figure 5 depicts the boundaries of the allotments.

Table 1. Affected Allotments, Range Improvements, and Range Studies

Allotment Name	Windmills / Water Supply	Range Improvements	Range Studies
Big Hackberry - 78087	Water wells and storages Water pipelines	Barbed wire fences Troughs and corrals	
Cottonwood Hills - 78104	Water wells and storages Water pipelines	Retention Dam Barbed Wire Fences	East Hay Hollow – 1 East Hay Hollow – 2 West Hay Hollow – 3 West Hay Hollow – 4
China Draw - 78094	Water wells and storages Water pipelines	Barbed Wire Fences Troughs and corrals	
Lower Reed Well - 78102	Water wells and storages Windmill Water pipelines	Barbed Wire Fences Troughs and corrals	
Red Bluff Draw - 78101	Water well and storage	Barbed Wire Fences Troughs	
Delaware River West - 78142	Water wells and storages	Barbed Wire Fences Troughs	
Tecolote Peak - 78103	Water wells and storages Water pipelines	Barbed Wire Fences Troughs	North – 1

3.1 Survey Findings and Mitigation

The range studies listed in Table 1 will need to be avoided when determining placement of proposed development so that it does not occur in or impact these BLM range areas (Figure 6).

There are several range improvements in the HDA including water wells, troughs, storage tanks, windmills, and feed troughs (Figure 6). Livestock watering areas are located within Chevron's proposed project area, and will require a 200 m buffer to prevent any development from occurring within that buffer that may affect the livestock. Any damage

to structures that provide water to livestock throughout the life of Chevron's proposed project or caused by operations from the project, must be immediately corrected to help support rangeland use.

Impacts to ranching operations can be reduced by utilizing standard operating practices such as using existing surface disturbances, minimizing the well pad and access road total surface disturbance, using steel tanks instead of reserve pits, minimizing vehicular use, placing parking and staging areas on caliche surfaced areas, reclaiming the areas not necessary for production, and quickly establishing vegetation on the reclaimed areas. There are areas where Chevron's proposed project will need entry through a fence and cattle guards will need to be installed and maintained at permanent fence crossings. There will also need to be braces installed on both sides of temporary fence entries to protect the integrity of the fence line.

Some trees identified during the field survey provide shade for livestock and other wildlife habitat in the area; they should be avoided or mitigated if disturbance is necessary. The locations of these trees are depicted in Figure 7.

4 SOIL

Descriptions of soil characteristics and quality are based on visual, physical, chemical, and biological observations. Visual characteristics relate to erodibility due to sensitivity of soil structure. Soil is typically changed by wind or water exposure. Erodibility is also seen through the physical characteristics of the soil and the ability or inability of water to drain due to the solid particles and pore space. The chemical characteristics of soil are factors that promote or hinder vegetative growth due to soil-plant relations, availability of nutrients, and chemical properties of soil such as salinity, pH, contaminants, and physical characteristics. Biological characteristics of soil are exhibited through the living organisms within the soil. Healthy soil indicates that there is high activity of micro- and macro-organisms.

The soils within the HDA are listed in Table 2 and the general types of soils observed are described in Section 4.1. A map depicting the soils mapped within the HDA is provided in Figure 8.

Table 2. Soils within Chevron's Proposed Project Area

Soil Abbreviation and Name	Slope
CR – Cottonwood-Reeves Loams Overflow	0 to 3 percent slope
EC – Ector Stony Loam	0 to 9 percent slope
ER – Ector – Reagan association	0 to 9 percent slope
GC – Gypsum land – Cottonwood complex	0 to 3 percent slope
RA – Reagan loam	0 to 3 percent slope
RE – Reagan-Upton association	0 to 9 percent slope
RG – Reeves-Gypsum land complex	0 to 3 percent slope
RM – Reeves-Reagan loams	0 to 3 percent slope
UG - Upton-gravelly loam	0 to 9 percent slope

Note: Highlighted soils are within the proposed ACEC area.

4.1 Soil Type Descriptions

4.1.1 Shallow

Shallow soils are primarily of the Ector and Upton series with several other minor soil types. These soils are shallow to very shallow, well-drained, calcareous, stony and rocky loams over limestone and caliche. Topography ranges from nearly level ridgetops to side slopes to cliffs and escarpments. Permeability is moderate, water-holding capacity is very low to low, and runoff is rapid after soils become saturated. Shallow soils are subject to water erosion, but the stones and rock outcrops help to stabilize the soils on nearly level to gently sloping areas. Careful management is needed to maintain a cover of desirable forage plants and to control erosion. Reestablishing native plant cover could take 3 to 5 years due to unpredictable rainfall and high temperatures.

These soils typically have scattered populations of squamulose lichens and a few crustose lichens, while gelatinous lichens and cyanobacteria are occasionally present primarily in the pockets of deeper soils. These soil crusts are important in binding loose soil particles together to stabilize the soil surface and reduce erosion. Biological soil crusts can contribute positively to soil stability, fixing atmospheric nitrogen, nutrient contributions to plants, water infiltration,

and plant growth. They function in the nutrient cycle by fixing atmospheric nitrogen, contributing to soil organic matter, and maintaining soil moisture. In addition, they can act as living mulch which discourages the establishment of annual/invasive weeds. Structurally they form an uneven, rough carpet that reduces rain drop impact and slows surface runoff. Below the surface, lichen and moss rhizines, fungal hyphae, and cyanobacterial filaments all act to bind the soil surface particles just below and at the surface. Horizontally, they occur in nutrient-poor areas between plant clumps. Because they lack a waxy epidermis, they tend to leak nutrients into the surrounding soil. Vascular plants such as grasses and forbs can then utilize these nutrients.

4.1.2 Gypsum

Gypsum type soils have a loamy surface layer, with gypsiferous materials starting at a depth of 1 to 10 inches. They are found on gently undulating uplands, with steep, broken gypsum outcrops occurring in places. Permeability varies from very low to moderate, water-holding capacity is very low to low, and runoff rapid to very rapid. Soil fertility and the rooting zone are limited by the underlying gypsiferous material. These soils are subject to severe erosion once the vegetative cover is lost. Reestablishing native plant cover could take 3-5 years due to unpredictable rainfall and high temperatures.

These areas have good populations of squamulose lichens, a few crustose and gelatinous lichens, and cyanobacteria, which are present throughout the top 2 millimeters (mm) of the soil. These soil crusts are important in binding loose soil particles together to stabilize the soil surface and reduce erosion. They also function in the nutrient cycle by fixing atmospheric nitrogen, contributing to soil organic matter, and maintaining soil moisture. In addition, they can act as a living mulch which discourages the establishment of annual/invasive weeds. Structurally they form an uneven, rough carpet that reduces rain drop impact and slows surface runoff. Below the surface, lichen and moss rhizines, fungal hyphae, and cyanobacterial filaments all act to bind the soil surface particles just below and at the surface. Horizontally, they occur in nutrient-poor areas between plant clumps. Because they lack a waxy epidermis, they tend to leak nutrients into the surrounding soil. Vascular plants such as grasses and forbs can then utilize these nutrients.

4.1.3 Loamy

Generally, loamy type soils are deep, well-drained, moderately dark colored, and calcareous. These soils typically occur on gently undulating plains and in the broader valleys of the hills and mountains. Permeability is moderate, water-holding capacity is moderate to high, and runoff is likely after prolonged or heavy rains. Careful management is needed to maintain a cover of desirable forage plants and to control erosion. Reestablishing native plant cover could take 3 to 5 years due to unpredictable rainfall and high temperatures.

These soils generally have cyanobacteria throughout the area, while squamulose, crustose, and gelatinous lichens are occasionally present. These soil crusts are important in binding loose soil particles together to stabilize the soil surface and reduce erosion. Biological soil crusts can contribute positively to soil stability, fixing atmospheric nitrogen, nutrient contributions to plants, water infiltration, and plant growth. They function in the nutrient cycle by fixing atmospheric nitrogen, contributing to soil organic matter, and maintaining soil moisture. In addition, they can act as living mulch, which discourages the establishment of annual/invasive weeds. Structurally they form an uneven, rough carpet that reduces rain drop impact and slows surface runoff. Below the surface, lichen and moss rhizines, fungal hyphae, and cyanobacterial filaments all act to bind the soil surface particles just below and at the surface. Horizontally, they occur in nutrient-poor areas between plant clumps. Because they lack a waxy epidermis, they tend to leak nutrients into the surrounding soil. Vascular plants such as grasses and forbs can then utilize these nutrients.

There is a potential for wind and water erosion due to the erosive nature of these soils once the cover is lost. There is always the potential for soil contamination due to spills or leaks. Soil contamination from spills or leaks can result in decreased soil fertility, less vegetative cover, and increased soil erosion.

4.2 Survey Findings and Mitigation

The soils identified in Chevron's proposed project area are shallow, gypsum, and loamy soils. Some of the proposed project area is located within the proposed ACEC where sensitive gypsum soils are located. The ACEC areas are further discussed in Section 9 of this report.

An area that seems to have been affected by loss of vegetation and slow to no recovery is in Section 18 of T26S, R27E. An area north of an existing producing well (Owl 20504 JV-P Well No.5 [API 30-015-35435] operated by COG Operating LLC) has two areas where vegetation was lost for an unknown reason. There is some erosion damage from the drainage entering the area from the south where a reclaimed pit is located, but there is no evidence of contamination within the drainage area. There does seem to be some chlorides on the barren area, but the source is unknown. This area is of the GC soil classification and is located adjacent to the proposed ACEC gypsum soil.

It is recommended that water controls are added to the road upslope and water bars are placed between the reclaimed pit and this barren area after surface disturbance activities take place. The reclaimed pit to the south will need to have some erosion prevention added to the reclamation procedure to prevent the drainage from road disturbances from washing across this area of sensitive soils.

5 VEGETATION

Vegetation types will vary from area to area due to the soil properties and chemical makeup. Within the HDA, there were three different soil types with gypsum as the primary soil whether at the surface or beneath the other soils. This also allowed for many gypsum soil type vegetation to grow throughout the area. The HDA consisted of three soil types (shallow, gypsum, and loamy), and known plant communities within these soil types are described below.

5.1 Vegetation Types

5.1.1 Shallow Soil Type Plant Communities

The understory of the shallow soil type plant community is mostly made up of warm season, mid- and short-grasses. These include gramas, tridens, curlyleaf muhly, wolftail, dropseeds, threeawn, and green sprangletop. The shrub overstory consists primarily of viscid acacia, yucca, cactus, catclaw, and broom snakeweed. Forbs fluctuate seasonally with rainfall and may include croton, bladderpod, buckwheat, and globemallow.

5.1.2 Gypsum Soil Type Plant Communities

Potential plant communities observed in the gypsum soil type plant community would include gramas, gyp dropseed, and alkali sacaton. The shrub component is made up of four-wing saltbush, mormon tea, acacia whitethorn, spiny althorn, javelin bush, and sumac. Forbs include gyp weed, scarlet guara, globemallow and croton. Shrubs and forbs are a major component of the plant community around draws and drainages.

5.1.3 Loamy Soil Type Plant Communities

Loamy soil types tend to support grasslands with warm season, mid- and short-grasses, with a modest shrub and half-shrub density and a seasonal fluctuation of forb production. The dominant grasses include gramas, tridens, threeawns, muhlys, dropseeds, tobosa, and burrograss. The most common shrubs are tarbush, creosote, mesquite, cactus, and yucca. Forbs include filaree and croton.

5.2 Survey Findings and Mitigation

The vegetation in the area is typical to the types of terrain within the HDA. As the terrain changed, so did the vegetation with some overlap. This area is intermixed throughout with many different types of vegetation growing in different soil types and growing successfully. Vegetation seen throughout the surveyed area were three-awn, grama, burrograss, puff grass, acacia whitethorn, creosote, mesquite, cactus, and yucca.

During the environmental field survey, a variety of grasses, shrubs, forbs, and cacti were observed. Table 3 lists the vegetation observed within and adjacent to Chevron’s proposed project area.

Table 3. Vascular Plant List for the Hayhurst Development Area

Common Name	Scientific Name
CUPRESSACEAE BARTL. CYPRESS FAMILY	
One-Seeded Juniper	Juniperus monosperma (Engelm.) Sarg.
EPHEDRACEAE DUM. EPHEDREA FAMILY	
Torrey Ephedra, Mormon Tea	Ephedra torreyana S. Wats.
BERBERIDACEAE JUSS. BARBERRY FAMILY	
Agarito, Current-of-Texas, Algerita	Berberis trifoliolata Moric.
CACTACEAE JUSS. CACTUS FAMILY	
Nipple Beehive Cactus	Coryphantha macromeris
Purple Prickly Pear	Opuntia macrocentra
Rainbow Hedgehog Cactus	Echinovereus rigidissimus
Fendler's Hedgehog Cactus	Echinovereus Fendleri
Horse Crippler Cactus	Echinocactustexensis
Engelmann's Prickly Pear	Opuntia engelmannii Salm-Dyck.
Indian Fig Prickly Pear	Opuntia ficus-indica (L.) Mill.
Cane Cholla, Tree Cholla	Opuntia imbricate (HAW.) DC
Tasajillo, Pencil Cholla, Christmas Cholla	Opuntia leptocaulis DC.
CHENOPODIACEAE VENT. GOOSEFOOT FAMILY	
Fourwing Saltbush, Chamizo, Chamiza	Atriplex canescens (Pursh) Nutt.
Russian Thistle	Salsola kali L.
POLYGONACEAE JUSS. KNOTWEED FAMILY	
Havard's Buckwheat	Eriogonum havardii S. Watson.
TAMARICACEAE LINK. TAMARISK FAMILY	
Tamarisk, Salt Cedar	Tamarix sp. L.
CUCURBITACEAE GOURD FAMILY	
Coyote Melon, Buffalo Gourd	Cucurbita foetidissima
Deer-Apples, Slimlobe, Globeberry	Ibervillea tenuisecta
CAPPERACEAE JUSS. CAPER FAMILY	
Allthorn, Crown of Thorns, Spiny Allthorn	Koeberlinia spinose Zucc.
FABACEAE LINDL. LEGUME FAMILY	
Catclaw Acacia, Gregg Catclaw	Acacia greggii Gray.

Common Name	Scientific Name
Whitethorn Acacia	Acacia neovernicosa Isley
Honey Mesquite	Prosopis glandulosa Torr.
EUPHORBIACEAE JUSS. SPURGE FAMILY	
Bush Croton, Encinilla, Hierba Loca	Croton fruticulosus Engelm. ex Torr.
RHAMNACEAE JUSS. BUCKTHORN FAMILY	
Javelinabush	Condalia ericoides (Gray.) M.C. Johnst.
Graythorn, Lotebush	Ziziphus obtusifolia (Hook. ex T.&D.) Gray.
ANACARDIACEAE LINDL. SUMAC FAMILY	
Littleleaf Sumac, Desert Sumac	Rhus micorphylla Engelm. Ex Gray.
ZYGOPHYLLACEAE R. BR. CALTROP FAMILY	
Creosotebush, Gobernadora	Larrea tridentata (Sesse & Moc. ex DC.) Cov.
Peganum, African Rue	Peganum harmala L. HARMAL
Goathead, Puncturevine	Tribulus terrestris L.
VERBENACEAE J.St.-Hil. VERVAIN FAMILY	
Blue Verbena, Swamp Verbena	Verbena hastate L.
SCROPHULARIACEAE JUSS. FIGWORT FAMILY	
Big Bend Silverleaf, Big Bend Barometer Bush, Big Bend Cenizo	Leucophyllum minus Gray.
ASTERACEAE DUM. SUNFLOWER FAMILY	
Prairie Broomweed	Ampiachyris dracunculoides (DC.) Nutt.
White Sagebrush, Gray Sagewort, Prairie Sage	Artemisia ludoviciana Nutt.
Broom Snakeweed	Gutierrezia sarothrae (Pursh) Britt. & Ruby.
Guadalupe Goldenweed, Rubber Rabbitbrush	Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird.
Tarbush, Hojase	Flourensia cernua D.C.
Curlycup GumweedURLYCUP GUMWEED	Grindelia squarrosa (Pursh) Dunal
Coulter's Horseweed	Laennecia coulteri (A. GRAY) G.L.
Creeping Zinna, Threadleaf Glowwort	Sartwellia flaveriae A. Gray
Long-Stalk Greenthread	Theleperma longipes Gray.
POACEAE L. GRASS FAMILY	
Silver Bluestem	Bothriochloa laguroides (DC.) Herter.
Sideoats Grama	Bouteloua curtipendula (Michx.) Torr.

Common Name	Scientific Name
Gyp Grama	Bouteloua breviseta Vasey.
Red Grama	Bouteloua trifida S. Wats.
Alkali Sacaton, Wright's Dropseed	Sporobolus airoides (Torr.) Torr.
Gypgrass, Gypsum Dropseed	Sporobolus neallei Vasey
Tobosa	Hilaria mutica (Buckl.) Benth.
AGAVACEAE ENDL. AGAVE FAMILY	
Smooth Sotol, Desert Candle	Dasylirion leiophyllum Engelm. ex Trel.
Soaptree Yucca, Palmella, Soapweed	Yucca elata (Engelm.) Engelm.
Spanish Dagger, Torrey Yucca	Yucca torreyi Shafer.

The vegetation is very diverse throughout the proposed project area. There is an abundance of nesting areas for birds and habitat areas for mammals and herpetofauna species, with patchy and repetitive vegetation across the HDA. There were three different soils types at the surface, but all areas will have gypsum beneath. Shovel samples were taken within each area and regardless of soil type, gypsum was reached within 3 to 14 inches below ground surface.

The shallow soil areas were along slopes and hills and primarily contained grama grass with some annuals in large patches, broom snakeweed, and acacia whitethorn as the primary brush. Yucca grew abundantly in these areas.

The gypsum soils were in areas around draws and drainage bottoms and were heavily vegetated in alkali sacaton with grama grasses along tops of draws and where gypsum outcroppings occurred. Mesquite and acacia whitethorn are the primary brush in these areas and yuccas were abundant.

Loamy soils were found mostly across the plains and lower areas between hills and draws. These soils allow for quicker recovery of vegetation post-disturbance. These areas have an abundance of grama and three-awn grasses, although they also tended to be brushy with creosote as the primary brush. Yuccas were abundant in the loamy soil areas and cholla grew well.

There were a large number of yuccas that did not meet the BLM height recommendation of 5 foot or more for nesting, but were suitable for nesting and excellent habitat for herpetofauna. Several trees were found throughout the area that were used for shade for cattle and co-existing wildlife such as javalina and coyote. These trees and large yucca should be avoided if at all possible. If disturbance is required, mitigation may be needed. There were no other vegetation types of limited availability.

Mitigation for these areas will be to utilize the correct BLM seed mixture (BLM seed mix 1 for loamy soil areas, BLM seed mix 3 for shallow soil areas, and BLM seed mix 4 for gypsum soil areas) when reclaiming areas not needed for daily operations, and avoidance of existing nests for raptors as well as migratory and non-migratory birds. The nests present during the survey have been mapped to enable all surface disturbing activity to be planned outside of a buffer. It is recommended that a follow-up nesting survey be completed two weeks prior to any surface disturbance to determine the level of activity for nests within 200 m of the activity.

6 NOXIOUS WEEDS

There are four plant species within the BLM's Carlsbad Field Office (CFO) that are identified in the New Mexico Noxious Weed List Noxious Weed Management Act of 1998. These species are African rue, Malta starthistle, Russian olive, and salt cedar. African rue and Malta starthistle populations have been identified throughout the CFO and mainly occur along the shoulders of highway, state and county roads, lease roads and well pads (especially abandoned well pads). The CFO has an active noxious weed monitoring and treatment program, and partners with county, state, and federal agencies and industry to chemically treat infested areas and monitor the counties for new infestations.

Any surface disturbance can increase the possibility of establishment of new populations of invasive, non-native species. Construction may contribute to the establishment and spread of African rue and Malta starthistle. The main mechanism for seed dispersion would be via equipment and vehicles that were previously used and/or driven across noxious weed infested areas. Noxious weed seed could be carried to and from the project area by construction equipment and transport vehicles.

6.1 Survey Findings and Mitigation

Noxious weed inventories were conducted along the proposed rights-of-way (ROWs) during the environmental field survey. Because the HDA includes a number of existing oil and gas projects, existing surface disturbances are present in the general area. These previous disturbances have resulted in some populations of a State-listed noxious weed, African Rue, along the existing roads and ROWs and in existing plant communities in the vicinity of the HDA. Cover by noxious weeds in the area was less than 1% of the total plant cover.

Invasive, non-native species included Salt Cedar along the draws and some drainages. Adherence to standard surface-use Conditions of Approval (COAs) would minimize the spread of invasive, non-native species and reduce impacts from these species on other natural resources.

Table 4 lists the location of noxious weeds observed within the HDA. All plants found were African Rue located near new disturbances and along existing roads. All plants were in their first year as there were no visible signs of seed pods around the base of the plants and are shown in Figure 9.

Table 4. Noxious Weeds Within Chevron's Proposed Project Area

Name	Location	Latitude	Longitude
African Rue	On side of road	32.10852	-104.166864
African Rue	On pipeline ROW	32.107874	-104.194662
African Rue	On side of road in draw	32.117943	-104.197829

7 WILDLIFE

The HDA occurs in the Chihuahuan Desert habitat type. The Chihuahuan desert is one of the four most biologically rich and diverse desert ecoregions in North America. Numerous plant species live in this desert. The Chihuahuan Desert stretches from the southeastern corner of Arizona across southern New Mexico and west Texas to the Edwards Plateau in the United States. In New Mexico, Chavez and Eddy Counties, west of the Pecos River, consist largely or entirely of Chihuahuan Desert habitat type. The dominant plant species throughout the Chihuahuan desert is creosote bush. Depending on diverse factors such as type of soil, altitude, and degree of slope, creosote bush can be found in association with other woody and grass species.

The Chihuahuan Desert supports a large number of wide-ranging mammals, herpetofauna, and avian species. Mammals include but are not limited to: pronghorn antelope, mule deer, grey fox, collared peccary, bobcat, desert cottontail, black tailed jack rabbit, kangaroo rat, pocket mice, woodrats and deer mice. Herpetofauna include but are not limited to: Texas horned lizard, greater earless lizard, several species of spiny and whip tail lizards, and several species of venomous and non-venomous snakes. Avian species include but are not limited to the following: greater roadrunner, curve-billed thrasher, scaled quail, Scott's oriole, black-throated sparrow, phainopepla, Worthen's sparrow, and cactus wren. In addition, numerous raptors inhabit the desert and include the great horned owl, burrowing owl, Aplomado falcon, and red-tailed hawk.

The Migratory Bird Treaty Act (MBTA) includes guidance for the protection of native passerines (flycatchers and songbirds) as well as birds of prey, migratory waterbirds (waterfowl, wading birds, and shorebirds), and other species such as doves, hummingbirds, swifts, and woodpeckers. Within the context of the MBTA, "migratory" birds include non-migratory "resident" species as well as true migrants, essentially encompassing most native bird species. The nesting time period is of special importance as the ability to create a nest, incubate, and rear chicks to fledging is a vulnerable time period for birds, and disturbances to nesting activities can lead to larger consequences for individual birds. In addition, because birds are generally territorial during the nesting season, their ability to access and utilize sufficient food is limited by the quality and availability of the territory occupied. During non-breeding seasons, birds are generally non-territorial and able to feed across a larger area and wider range of habitats.

7.1 Survey Finding and Mitigation

Bird, mammal, and amphibian species observed directly or through secondary observations during the environmental field survey in the HDA are summarized in Table 5 below. Additional discussion regarding Threatened and Endangered (T&E) species is provided in Section 8 of this report.

Table 5. Wildlife Observed Within the HDA

Common Name	Scientific Name
Birds	
Burrowing Owl	Athene cunicularia Molina.
Rock Wren	Salpinctes obsoletus Say.
Cactus Wren	Campylorhynchus brunneicapillus Lafr.
Turkey Vulture	Cathartes aura L.
Swainsons Hawk	Buteo swainsoni Bon.

Common Name	Scientific Name
Loggerhead Shrike	Lanius ludovicianus L.
Scaled Quail	Callipepla squamata Vigors.
Greater Roadrunner	Geococcyx californianus Lesson.
Brewer's Sparrow	Spizella breweri Cassin.
Common Nighthawk	Chordeiles minor Forster, JR.
Mammals	
Coyote	Canis latrans Say.
Common Gray Fox	*Urocyon cinereoargenteus Schreber.
Northern Racoon	Procyon lotor Linnaeus.
American Badger	*Taxidea taxus Schreber.
Western Spotted Skunk	*Spilogale gracilis Merriam.
Feral Pig	*Sus scrofa Linnaeus.
Collared Peccary	Pecari tajacu Linnaeus.
Mule Deer	Odocoileus hemionus Rafinesque.
Mexican Ground Squirrel	Spermophilus mexicanus Erxleben.
Yellow-Faced Pocket Gopher	*Cratogeomys castanops Baird.
Kangaroo Rat Species	*Dipodomys sp. (D. merriami Merns, D. ordii Woodhouse, D. spectabilis Merriam are possible)
Hispid Cotton Rat	Sigmodon hispidus Say and Ord. *Neotoma sp. (N. Leucodon Merriam., N. micropus Baird. are possible)
Woodrat Species	*Neotoma sp. (N. Leucodon Merriam., N. micropus Baird. are possible)
Desert Cottontail	Sylvilagus audubonii Baird.
Black-Tailed Jackrabbit	Lepus californicus Gray.
Herpetofauna	
Ornate Box Turtle	Terrapene ornata Agassiz.
Texas Horned Lizard	Phrynosoma cornutum Harlan.
Round-Tailed Horned Lizard	Phrynosoma modestum Girard
Little Striped Whiptail	Cnemidophorus (Aspidoscelis) inornatus Baird
Gophersnake	Pituophis catenifer Blainville.
Western Diamond-Backed Rattlesnake	Crotalus atrox Baird and Girard.

* Species observed through secondary observations (i.e., scat, tracks, burrows, middens, etc.)

Chevron's proposed project could displace some raptors and other migratory birds over the life of the development and operation. There is an abundance of vegetation suitable for nesting raptors, so it is unlikely that Chevron's proposed project would greatly affect the available vegetation suitable for raptors to build nests. Therefore, while habitat loss and associated habitat fragmentation may affect a small number of individual migratory or resident birds, these impacts are likely to be insignificant at the population or species levels.

Construction activities undertaken during the nesting season could result in the destruction of active nests, including any eggs or young within the nests. To reduce these potential impacts, raptor and burrowing owl surveys were conducted to identify nests and burrows. All development can be planned around these areas to prevent disturbance of nesting areas for raptors and burrows for owls. Additional surveys of the identified nesting areas, and possible new nests constructed in the interim prior to the start of construction, should be completed at least two weeks prior to vegetation removal. The BLM CFO Resource Management Plan (RMP 1997) requires a 200 m buffer around active raptor nests during nesting season (estimated to be March 1 through August 31 pending weather conditions) and the BLM CFO generally requires a 50 m buffer during the non-nesting season around inactive raptor nests (estimated to be September 1 to February 28). It is recommended that surface disturbing activities be initiated in the non-nesting months when possible in order to minimize the possibility of disturbing raptors during nesting season. The recommendation that surface disturbing activities take place during the non-nesting season would allow construction activity to be adjacent (50 m) to inactive nests. Figure 10 depicts locations of observed raptor nests and burrowing owl holes.

Figure 11 shows all other nests in the area for residential (non-migratory) birds to avoid during nesting season. These should also have follow-up survey prior to vegetation removal to ensure there are no inhabitants.

Numerous wildlife water sources have been installed within the boundaries of the BLM CFO (discussed in Section 3 of this report). These wildlife water sources are important to all wildlife in the desert ecosystem as they provide readily available water and areas of sanctuary for wildlife species in the area. No wildlife water sources are located within Chevron's proposed project area; however, one Wildlife Habitat Project Avoidance is located directly north of the buffer area for the ROW in Section 3-4, T26S, R27E (Figure 12).

8 SPECIAL STATUS SPECIES

There are 17 T&E species listed within Eddy County, New Mexico; however, of those, only two have the potential to occur within the HDA based on habitat in the area (Figure 13).

8.1 Texas Hornshell Mussel

The THM is a bivalve mollusk; the outer shell surface appears olive green to dark brown and they may grow as long as 7 inches. Inside the shell is a muscular foot for movement, siphons for water exchange, gills, and the viscera.

The THM occurs in clays, silts, sands, and sand-cobbles accumulated in undercut riverbanks, crevices, shelves, and at the base of large boulders at depths of 0.8 to 4.5 feet and at flow rates of 0.78 to 29.5 inches per second, often in colonies and at the head or lower end of travertine runs (Carmen 2007). The species imbeds itself in softer bottoms, exposing only the siphonal areas in such situations. In rocky sites, it lodges itself in cracks and crevices. In the latter situation, the species is likely immobile, whereas it undoubtedly moves about in substrates such as mud and sand. The THM is known to thrive where there are no or low levels of pollutants, such as the Black River and Delaware River located in Southern Eddy County. A map showing the distribution of the THM in the HDA is provided in Figure 14.

8.2 Wild Gypsum Buckwheat

Wild Gypsum Buckwheat (WGB) is a small woody plant with dense clumps that reach 20 centimeters (cm). The leaves are dark green, thick, and fairly smooth. The leaves are approximately 1-3 cm wide and attached at the base. The small flower is white to yellow in color. WGB is found near the Black River in Sections 3-4 and 9-10 of T25S, R26E and in a drainage area leading into a draw west of the HDA in Sections 21-22 and 27-28 of T25S, R26E. Figure 14 shows the distribution of the WGB in the HDA.

8.3 Survey Findings and Mitigation

The environmental field survey of the HDA indicated no suitable habitat for the THM in Chevron's proposed project area. THM habitat is known to be along the Black River and has been introduced into the Delaware River. The tributaries or drainages in the area of the HDA tends to flow south to southeast to a main tributary that flows east. The Black River sets to the northwest 2.86 miles, the Pecos River sets 5.24 miles to the east, and the Delaware River is sets 4.04 miles to the southeast from the closest point of Chevron's proposed project area. The THM tributaries near the HDA with buffers from these tributaries are depicted in Figure 14. A 100 m tributary buffer shows the area to avoid or minimize the need for disturbance. This area will have maintained roads, off-road two tracks, or short term impacts such as buried pipelines, but no long-term disturbances such as well pads or facilities. The 200 m buffer area is shown to avoid or minimize impacts from well pads or facilities. This area also falls into the 100-year flood zone. Well pads do fall within this area, but best management practices along with the protection of the THM, will limit this access.

The environmental field survey of the HDA identified no WGB in Chevron's proposed project area. There are two WGB habitats near the Black River, located 2.86 miles northwest from the closest point of Chevron's proposed project area and southwest of Black River, located 3.1 miles west of closest point of Chevron's proposed project area. The WGB habitats near the HDA are depicted on Figure 14. WGB should not be impacted by the development of this proposed project.

9 AREAS OF CRITICAL ENVIRONMENTAL CONCERN

ACEC designation indicates to the public that the BLM recognizes that an area has significant value and has established special management measures to protect those values. It also serves as a reminder that significant value or resources exist that must be accommodated for future management actions and land use proposals. According to the BLM CFO RMP / Environmental Impact Study (EIS) for gypsum soils, the HDA has qualities or circumstances that make it fragile, sensitive, rare, irreplaceable, exemplary, unique, endangered, threatened, or vulnerable to adverse change (Figure 15).

During a meeting with the BLM, it was discussed that there was a proposed ACEC within the HDA. The proposed ACEC is covering an area mainly around the draws and drainages, containing three sensitive gypsum soils (Figure 16). These soils are known as CR, GC, & RG (Figure 8). These gypsum soils tend to be located along the banks and sidewalls of draws and in bottom of drainages. Erodibility and the inability to vegetate makes these soils extremely sensitive. Once disturbance is initiated, re-vegetating will take several years to accomplish, so soil disturbing activities and overgrazing can be a major concern. These areas are highly probable to contain dry sinkholes, and surface water is not attainable; furthermore, good quality groundwater is hard to locate. High temperatures and unreliable rainfall also contribute to the difficulty of revegetating.

9.1 Survey Findings and Mitigation

The gypsum soil ACEC areas should be avoided as much as possible during development. If avoidance cannot be attained, careful planning of disturbing activities, reclamation, and vigorous revegetating in areas not needed for daily activities should take place. These soils tend to be susceptible to wind erosion, especially when the seedbed is being prepared and the soil is bare. All areas that are reclaimed should be tracked or trodden in order to prevent the soils from wind erosion. These areas should be seeded with an alkali sacaton and 4-wing saltbush seed mix (BLM seed mix 4) to ensure quick recovery and erosion prevention. Since vegetation is difficult to establish, these areas should be seeded in the fall to take advantage of winter moisture and get a head start on annual weeds. If winter moisture is not available, these areas should be watered long enough to establish a good root. Quick revegetation will protect these sensitive soils from water erosion.

10 PALEONTOLOGICAL

The current classification system utilized by the BLM for assessing impacts to fossil resources is the Potential Fossil Yield Classification (PFYC) System. This system classifies geologic units based on the relative abundance of vertebrate fossils or scientifically important invertebrate and plant fossils and their sensitivity to adverse impacts. This classification is applied to a geologic formation, member, or other distinguishable unit. This classification system recognizes that although significant fossil localities may occasionally occur in a geologic unit, a few widely spaced localities do not necessarily indicate a higher class. The primary purpose of the PFYC System is to assess the possible impacts from surface disturbing activities and help determine the need for pre-disturbance surveys and monitoring during construction.

All bedrock geologic deposits within the HDA are considered PFYC 2. Bedrock in the project area is Permian in age (about 299 to 251 million years ago). Previous geologic mapping and field observations indicate that deposits include the upper Salado Formation and lower Rustler Formation (King 1949; NMBGMR 2003). The Salado Formation is generally composed of evaporites such as halite, which are typically devoid of fossils (NMBGMR 2003). The lowermost Rustler Formation is composed of about 120 feet of siltstone, gypsum, and very fine-grained sandstone. These deposits are in turn overlain by approximately 30 feet of dolomite and 115 feet of gypsum (Vine 1963). No fossils are known from the Rustler Formation of New Mexico, but mollusk fossils (e.g., brachiopods, pelecypods, gastropods) have been identified in the lower Rustler Formation in Culberson County, Texas within dolomite, siltstone, and limestone units (Walter 1953). Quaternary alluvial deposits are likely Holocene or upper Pleistocene (NMBGMR 2003) and are also considered PFYC 2 deposits.

10.1 Survey Findings and Mitigation

A specific paleontological survey of the project area was not conducted; however, no fossils were incidentally observed during the environmental field survey of the HDA. Although, this area is classified as a PFYC 2, if at any time fossils are discovered, all activities must stop and the BLM must be contacted within 24 hours. A BLM paleontological zoning map is provided as Figure 17.

11 KARST

The term karst describes distinct terranes that are attributable to high solubility of underlying bedrock. Common features of such terranes include sinkholes and caves, which are formed as the bedrock is dissolved by groundwater. Karst aquifers represent saturated bedrock where its permeability has been enhanced by dissolution processes. Such aquifers can be important sources of potable groundwater.

The HDA lies near the western end of the Delaware Basin, and is situated predominantly in a region referred to as the Gypsum Plain (Hill 1996). Bedrock cropping out beneath the proposed project area is predominantly the Castile Formation, although a relatively thin veneer of the overlying Rustler formation may be present in the western portion of the area. The Salado formation, which regionally occurs between the Rustler and Castile formations, is absent beneath the HDA. The bedrock geology of the proposed project area and the surrounding area is discussed in greater detail in Section 12 of this report.

The Castile and Rustler formations are highly soluble and karst development in them (i.e., sinkholes and associated caves) is well recognized, particularly in the Gypsum Plain. Stafford et al. (2008) prepared a karst potential map for the Castile Formation outcrop which includes the majority of the HDA. That map shows that karst development is distinctly clustered in the region. The two densest regions of karst development occur within approximately three miles of the western limits of the HDA (Figure18); however, most of the proposed project area is situated in an area where karst development is expected to be less intense. The northernmost of these two regions contains the second longest known gypsum cave in North America and is largely included in a BLM critical resource area that does not allow for surface occupancy (Stafford et al. 2008). Sinkholes play an important role in recharging groundwater to underlying aquifers by allowing rapid infiltration of precipitation during and following rainfall events. As such, mitigation measures would be required in development areas to prevent contaminants from entering sinkholes.

11.1 Survey Findings and Mitigation

Karst features were identified within the HDA. Included in these findings were one large collapsed doline (also known as sinkholes), one small collapsed doline, two mammal holes that collapsed due to water intake, and a number of closed depressions and fissures.

A 200 m buffer was placed around all collapsed sinkholes and a 50 m buffer was placed around all closed depressions and fissures. It is recommended that the closed depressions and fissures are investigated by a Karst Specialist from the BLM for categorizing the importance of these features. Mitigation can be completed to protect these features by placing all long term disturbances such as pads and facilities horizontally from features and berming all pads to prevent any contaminants from potentially reaching the feature. Monitoring these features and reporting to the BLM of any changes in the feature would then be required. Outcroppings were also identified during the survey due to the possibility of uncovering a void. There are no buffers for outcroppings, but careful attention around these outcroppings is warranted.

During construction activities, if a void occurs, all activities must stop immediately. The BLM should then be contacted within 24 hours to devise the best management plan to protect karst and human safety. These voids could occur in any area of the HDA. There were a number of outcroppings (rock and gyp) where voids are possible and close attention and further evaluation should be required for human safety.

During the meeting with the BLM in October 2015, it was recommended that geophysical surveys be performed to identify any shallow voids within the construction area. If any shallow voids should be discovered, the BLM should be

contacted prior to any construction activities to devise a plan to best manage these features. Karst potential is found to be medium in the southeastern portion of the project area and high in all other areas. The zoning of these potential karst levels is illustrated on Figure 19. A map showing observed karst sinkholes features is provided in Figure 20, observed closed depressions and fissures in Figure 21, and all outcroppings in Figure 22.

12 HYDROLOGY

Potential impacts due the construction and operation of Chevron's proposed project to water resources in the HDA were evaluated by comparing the location of these features (ponds, streams, wetlands, etc.) to the proposed surface disturbance. The analysis is based on the examination of Carlsbad BLM RMP 1988 and evaluation of data compared to the environmental field survey.

12.1 Surface Hydrology

Chevron's proposed project area is situated approximately 18 to 30 miles south of the City of Carlsbad and between State Highway 62/180 to the west and State Highway 285 to the east. This area is characterized by relatively flat to gentle sloping terrain dissected by tributary draws of the Pecos River (Figure 23).

Surface water within the HDA is affected naturally by geology, precipitation, and water erosion. The area is located in the semi-arid southwest on the northern edge of the Chihuahuan Desert, where annual precipitation averages 10.5 inches with the greatest rainfall occurring as monsoonal storms in late summer (July – September). About half of the annual precipitation is received during this period via brief, intense storms that can cause large amounts of runoff and potential flooding (Lower Pecos Valley Regional Water Plan 2001).

Southern Eddy County, including Chevron's proposed project area, lies within the Lower Pecos River Basin. The major stream flowing through this part of the county is the Pecos River. Surface water in the Lower Pecos River Basin comes from three main sources: inflow from the Upper Pecos River Basin, flood inflow from storm events, and groundwater base inflow. The Pecos River bisects Eddy County and runs through the center of the City of Carlsbad. The Pecos River is dammed by Brantley Dam and by Avalon Dam 10-miles northwest and 5-miles north of Carlsbad, respectively, and by Red Bluff Dam located just across the New Mexico – Texas State line.

Several Pecos River tributary draws, including Red Bluff Draw, North and South Hackberry Draws, Cottonwood Draw and Hay Hollow Draw all of which feed into Red Bluff Draw, and Owl Draw (which feeds into Delaware Draw) traverse the HDA and join the Pecos River east of State Highway 285. These are ephemeral streams that typically contain and carry water only for short periods of time following precipitation. Temporary ponded water has been observed along these draws for some time after heavy rains.

The Black River is a perennial stream and tributary of the Pecos River that is located west and northwest of the HDA. It flows to the northeast and joins the Pecos River east of State Highway 285 and northeast of Chevron's proposed project area.

Anthropogenic activities that currently affect surface water resources in the HDA include livestock grazing management and oil and gas development. Surface water flow direction for various parts of the HDA depends on the specific location relative to the nearby tributary draw of the Pecos River. At its closest point, the Pecos River is located approximately 5.5 miles east of the HDA. Flow in the tributary draws is generally to the northeast and east.

12.2 Floodplain

Executive Order 11988 (Floodplain Management) requires Federal agencies to take action to reduce the risk of flood loss; to minimize the impact of floods on human safety, health, and welfare; and to restore and preserve the natural and beneficial values served by floodplains. Floodplains are relatively low, flat areas of land that surround some rivers and waterbodies and convey overflows during flood events. Floodwater energy is dissipated as flows spread out over

a floodplain, and significant storage of floodwater can occur through infiltration and surficial storage in localized depressions on a floodplain.

Current management provides protection from permitted surface-disturbing activities within up to 200 m of the Federal Emergency Management Agency (FEMA) 100-year floodplain seen in Figure 24. Aboveground facilities should avoid floodplains and waterbodies to the maximum extent possible. Eddy County oil and gas ordinance does not require specific management practice, but does have a setback provision: “Drilling location requiring that oil and natural gas wells be located at least 300 feet away from a residence, mercantile establishment, school or church without written consent of the owner.” It should be noted that any oil or gas well in a floodplain must comply with Eddy County’s Flood Plain Management Ordinance (New Mexico County and Municipal Law).

12.3 Wetland and Riparian Areas

Wetlands are defined as “areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of wetland vegetation typically adapted for life in saturate soil condition” (USACE 1987). Section 404 of the Clean Water Act (CWA) provides for the protection of waters of the US through regulations of the discharge of dredged or fill materials. Wetlands occur in spaces between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water (Cowardin et al. 1979). Wetlands must have one or more of the following three attributes:

- At least periodically, the land supports predominantly hydrophytes;
- The substrate is predominantly undrained hydric soil; and
- The substrate is non-solid, is saturated with water or covered by shallow water at some time during the growing season of each year.

12.4 Subsurface Hydrology

12.4.1 Shallow Geology

The HDA is underlain by the Permian Castile and Rustler formations (Figure 25). The Castile Formation outcrops to the west of the project area in the Gypsum Hills. The Rustler formation outcrops to the east of the HDA (and east of the Pecos River in the Rustler Bluffs) and is underlain by the Castile Formation west of the river and the Salado Formation east of the river. The Rustler outcrop area extends to the north in a narrow band to the Chaves county line and the formation dips to the east. Strata belonging to the Triassic Dockum Group outcrops to the east of the Rustler outcrop. Alluvium occurs to the north and west of the project area along the Pecos River and the Black River. The Capitan Reef occurs to the west and northwest of the HDA.

Geologic units in the HDA and nearby that contain potentially usable groundwater are the Pecos Alluvium, Rustler Formation, and the Dockum Group. The western leg of the reef in Eddy County and Culberson County is very productive, but it occurs well to the west, northwest and north of the HDA.

Southeast of the Black River, gypsum of the Castile formation outcrops in the escarpment of the Gypsum Hills. Farther to the east near the Pecos River, the Castile Formation is overlain in places by redbeds, limestone and gypsum of the Rustler formation (Hendrickson and Jones 1952). East of the Pecos River, the Castile Formation is overlain by the Salado Formation.

12.4.2 Carlsbad Basin

The HDA occurs within the Carlsbad Groundwater Basin which encompasses approximately 2,347-square miles located in the southern region of Eddy County. This basin extends east into Lea County, south of Carlsbad to the state line and west to the Guadalupe Mountains. The Pecos River enters the basin in the northwest corner and exits the basin near the south-central part of the basin.

Groundwater uses include agriculture; public supply for Carlsbad, Loving, and other towns; and industrial uses, including mining for potash and salt. Groundwater supplies in the Carlsbad Basin are derived from underlying sedimentary formations, including the Delaware Mountain Group, the Carlsbad and Capitan Limestones, the Castile Formation, the Rustler Formation, and the Dockum Formation, as well as shallower alluvium and terrace deposits. The primary groundwater supplies come from Capitan and Carlsbad Limestone Reef Aquifer (Capitan Reef) and the shallow groundwater found in alluvium and terrace deposits. Irrigation wells have primarily been developed in the farming areas from Carlsbad south to Malaga, and along the Black and Delaware Rivers. Groundwater quality varies from good to poor (Figure 26).

Water Well and Water Quality Information – HDA

In the HDA, neither the Rustler Formation nor the Castile Formation has sufficient porosity and permeability development (aside from karst features) to yield productive water supply wells. Several relatively shallow water wells have been drilled in the area that are used primarily to support stock watering (Figure 27) and well yields are low – typically less than 5 gallons per minute (gpm). Water well depths range up to 351 feet, but most of the wells are less than 100 feet deep. No recent water level data for these wells have been found in the New Mexico Office of the State Engineer (OSE) database. In the outcrop area of the gypsum of the Castile Formation (near the Black River), the groundwater quality reflects high calcium and sulfate content derived from the gypsum and is undesirable for human consumption (Hendrickson & Jones 1952). The sulfate content increases from west to east toward the Pecos River and the chloride content of the water increases near the Pecos River, likely due to water from a brine aquifer at the base of the Rustler formation near Malaga Bend.

12.5 Survey Findings and Mitigation

Figure 24 (FEMA 100-year flood plain map) shows the 100-year flood plain in the HDA as delineated by FEMA. Except for original roads and ROW's, the HDA is not located in any new paths within the 100-year floodplain zones. These areas will need to be widened for temporary disturbance for buried pipelines, but this could be mitigated and completed during the dry season.

Some mitigation has taken place from previous actions by adding culverts or low water crossings. When new construction activities begin, these mitigation measures need to be carried through the new project work and/or protected to prevent damage during on-going construction.

Other mitigation measures would be to reclaim pipeline ROWs by mixing soil with straw or similar to increase the potential for the soil to bind in place, aid vegetation growth by protecting seed, holding moisture in the soil and reduce the likelihood of erosion. Rubble can be used to prevent soil erodibility where water movement could be present. Silt ponds should be placed in all low lying areas surrounding construction areas to capture any material run-off from roads or pads. Mineral material from pads and roads could cause vegetation loss due to change in soil chemistry. If native material is used, silt ponds will not be needed.

Monitoring should take place to ensure mitigation strategy is effective through-out the life of the project. If the mitigation strategy should become ineffective, an on-site with the BLM should be scheduled to devise the best management plan to protect the 100-year flood plain.

Small portions of the buffer zones for three development areas touch or slightly impinge on the 100-year flood plain for the North Hackberry Draw and the Hay Hollow Draw, but no installations (drilling pads, oil or saltwater tanks, etc.) will be located less than 200 m away from the 100-year flood plain.

Most of the identified water wells are not located within the survey area for the HDA. One well situated along Whites City Road in Section 2, T26S, R27E is located within the survey area but it is buffered for 200 m from any planned installations (Figure 27).

No wetlands were identified within the HDA; therefore, there would be no potential impacts to wetlands.

No riparian areas were identified within the HDA; therefore, there would be no potential impacts to riparian areas.

13 CULTURAL

Cultural resources are fragile and nonrenewable remains of prehistoric and historic human activity, occupation, or endeavor as reflected in districts, sites, structures, buildings, objects, artifacts, ruins, works of art, architecture, and natural features. Cultural resources comprise the physical remains themselves and the areas where significant human events occurred.

The National Historic Preservation Act (NHPA) of 1966 and the Archaeological Resource Protection Act of 1979 provide for the protection of significant cultural resources and traditional cultural properties. Section 106 of the NHPA describes the process that Federal agencies must follow to identify, evaluate, and coordinate their activities and recommendations concerning cultural resources. Significant cultural resources are defined as those listed on, or eligible for, listing on the National Register of Historic Places (NRHP) and are referred to as historic properties.

13.1 Survey Findings and Mitigation

Survey findings will remain confidential but will be supplied under separate cover to State Historic Preservation Offices (SHPO) and the BLM.

All cultural resources must be avoided. If any cultural resources are discovered while construction activities are taking place, construction activities must cease and the BLM will be contacted within 24 hours.

14 OTHER OBSERVATIONS

14.1 Existing and Former Operations

Several buried lines from different operators are in place or are in the process of being constructed and will need to be avoided or mitigated when crossing.

During the surveys, there were some plugged wells that may or may not have been reclaimed. The locations of these wells are listed in Table 6 below with constraints and mitigation that will need to take place.

Table 6. Plugged Wells within the HDA

Latitude	Longitude	Qtr.Qtr.-S-T-R	Constraint	Mitigation
32.05643	104.197579	NESW-9-26-27	P&A with former pit within the planned ROW.	Pit is to the north and should be avoided. It is recommended that this area should be fenced off to prevent spread of pit contaminants.
32.09266	104.15314	NE/NE-35-25-27	P&A with former pit at left edge of ROW buffer.	Pit is to the north and should be avoided. It is recommended that this area should be fenced off to prevent spread of pit contaminants.
32.106698	104.155914	NENE-26-25-27	P&A with former pit in left 200' of ROW buffer	Pit looks to be to the south and should be avoided. It is recommended that this area should be fenced off to prevent spread of pit contaminants.
32.106575	104.188614	NENE-28-25-27	P&A with former pit - reclaimed	Pit is unknown, but should be avoided to prevent spread of pit contaminants.
32.12085	104.154558	NENE-23-25-27	P&A with former pit at the left edge of planned ROW	Pit is to the north and should be avoided. It is recommended that this area should be fenced off to prevent spread of pit contaminants.
32.150922	104.167401	NWNW-23-25-27	P&A with former pit inside the left 400' ROW buffer	Pit is to the north and should be avoided. It is recommended that this area should be fenced off to prevent spread of pit contaminants.
32.125542	104.16869	SWSW-14-25-27	P&A with former pit inside the right center ROW buffer	Pit looks to be to the south and should be avoided. It is recommended that this area should be fenced off to prevent spread of pit contaminants.

Latitude	Longitude	Qtr.Qtr.-S-T-R	Constraint	Mitigation
32.132611	104.232618	SENW-18-25-27	P&A with former pit inside the right edge of ROW	Pit is unknown, but should be avoided to prevent spread of pit contaminants.
32.058778	104.145652	SENW-12-26-27	P&A with former pit inside the right edge of ROW	Pit is unknown, but should be avoided to prevent spread of pit contaminants.
32.054613	104.209766	NWSE-8-26-27	P&A with former pit inside the north edge of 1000' buffer	Pit is unknown, but should be avoided to prevent spread of pit contaminants.
32.139138	104.185301	SWSW-10-25-27	P&A with former pit inside the north edge of 1000' buffer	Pit is unknown, but should be avoided to prevent spread of pit contaminants.
32.139138	104.185301	NWNE-23-25-27	P&A with former pit inside the south edge of planned ROW	Pit is unknown, but should be avoided to prevent spread of pit contaminants.

14.2 Slopes

Other constraints that will need to be mitigated with design features in plan will be slopes (Figure 28) and hills (Figure 29). The mitigation would include developing around hills and through areas with less slope and reclamation of these areas to prevent erosional damage to lower lying areas.

15 RECOMMENDATIONS

With careful planning of well pads, facilities, SWD wells, frac ponds, and ROWs within this area of development, impacts will be low in sensitive areas and moderate in non-sensitive areas. Roads are in place for most of the project area with the majority maintained by the county, and the ROWs or corridors are in place for a portion of the proposed project area. Keeping the footprint of these corridors as small as possible is highly recommended as the overall amount of impact will drive the BLM approval process. The following provides a summary of the recommendations for each of the resources evaluated during the field event.

15.1 Soils

A 200 m buffer should keep most construction activity from damaging the sensitive gypsum soils surrounding the draws, but the construction that will need to be within the proposed gypsum ACEC will need to be kept to a minimum or be mitigated to have minimal impacts to these sensitive areas.

15.2 Vegetation and Wildlife

It is recommended that all surface disturbing activities within 200 m of active raptor nests occurs between the months of September 1 to February 28 (outside of nesting season) in order to avoid nesting raptors or birds. Nesting surveys should be completed two weeks prior to any surface disturbance to verify nests are not active with late or early bloomers. The BLM CFO generally requires a 50 m buffer during the non-nesting season (estimated to be September 1 to February 28) for inactive raptor nests. At the onsite inspections, Chevron could discuss the proposed activities and associated mitigation with the BLM Natural Resource Specialist to potentially allow the proposed activities to occur within 50 m of inactive raptor nests.

15.3 Special Status Species

BLM and Chevron should work closely to avoid all possible impacts to the THM. A Candidate Conservation Agreement (CCA) / Candidate Conservation Agreement with Assurances (CCAA) is currently in process to aid in the mitigation for the THM and participation is highly recommended. The largest threat to the THM is loss of water, decline in water quality, and low water crossings. Well siting will be important along with adequate spill containment measures, and erosion will need to be mitigated heavily in order to not impact the THM.

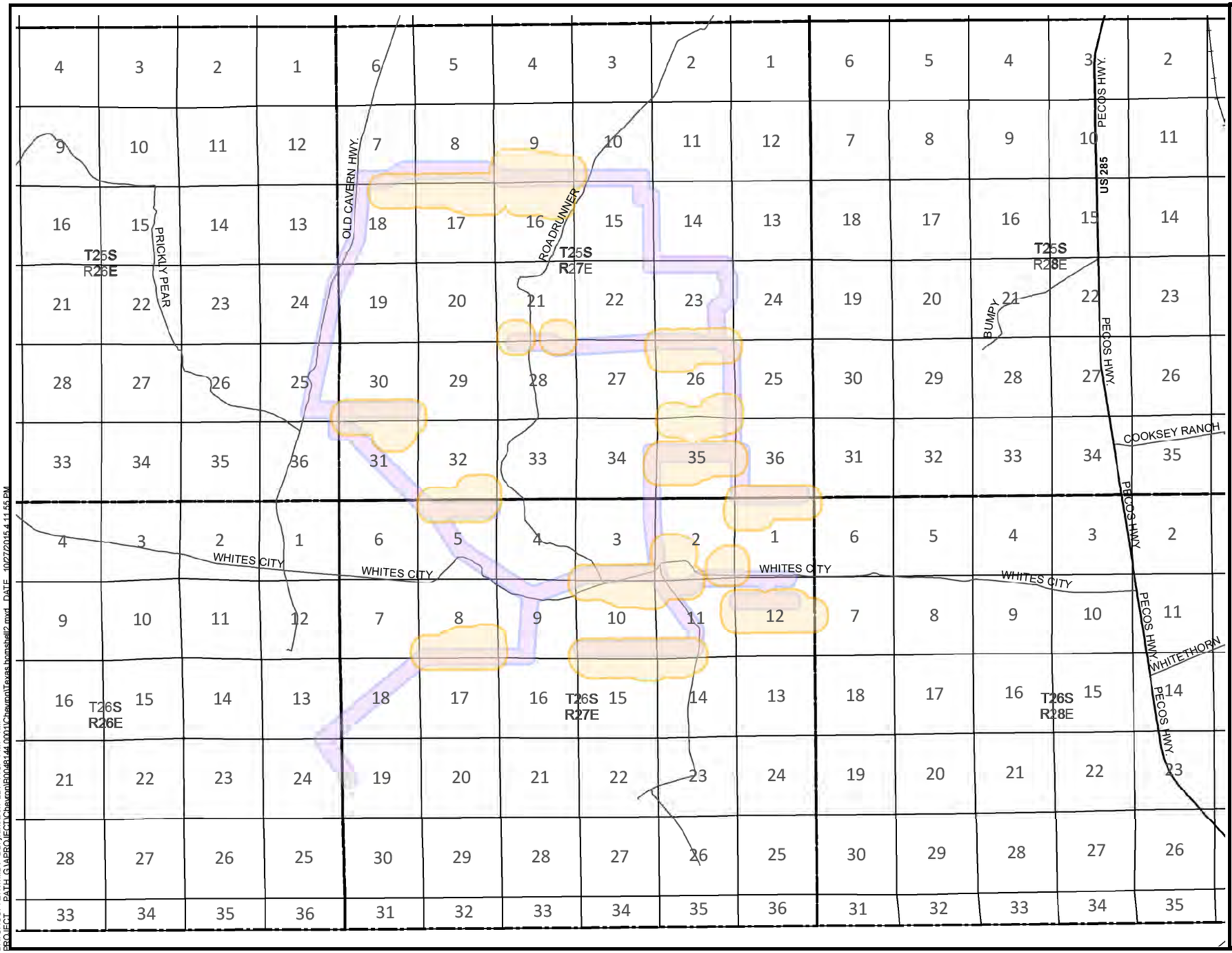
15.4 Karst

It is recommended that Chevron meet with the BLM to review the smaller karst features referred to as closed depressions and fissures. Various methods are available if the BLM decides they would like to have further evaluation of these areas. Depending on the depth of the desired evaluation, electro-resistivity, electro-magnetic, ground penetrating radar, and seismic technologies can be utilized. It is recommended that further evaluation is completed to maximize the efficiency of both Chevron and BLM efforts.

15.5 Hydrology

Early planning on the construction designs for crossing drainages is very important. These designs need to take into account that some of the draws can bring enough water to wash out a road or pad during peak rain seasons. These drainages should be allowed to pass through or reroute around unless the construction is at the start of a drainage. It is recommended that silt ponds be constructed to prevent any pad material washing down drainages.

FIGURES



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships

0 1 2

Miles

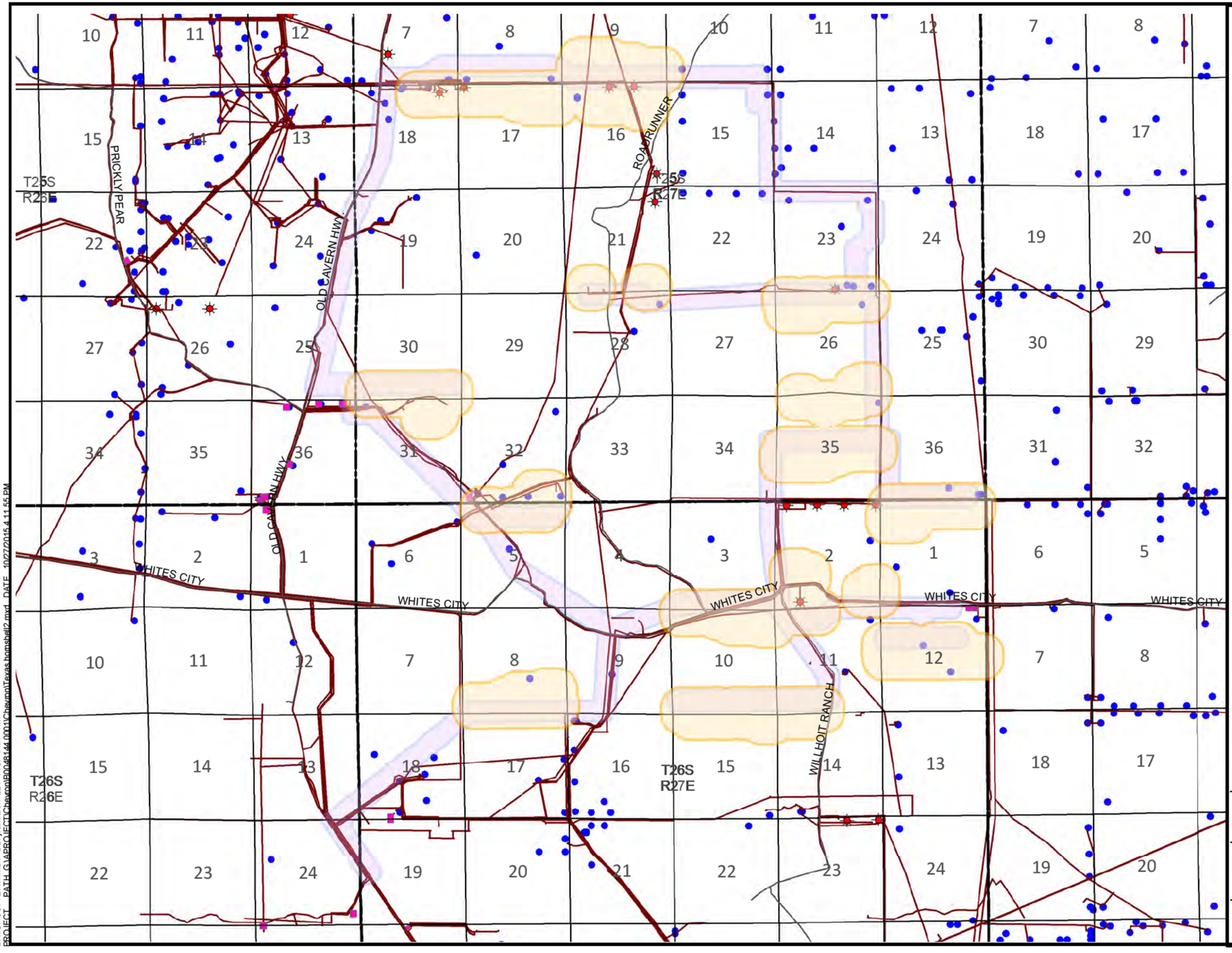
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

ENVIRONMENTAL FIELD SURVEY AREA

ARCADIS

FIGURE 1

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH: G:\APROJECT\Chevron\E00481440001\Chevron\Texas bomshell2.mxd DATE: 10/27/2015 4:11:55 PM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- Pads
- ROWs
- Chevron's Wells
- Completed Wells

0 1 2

Miles

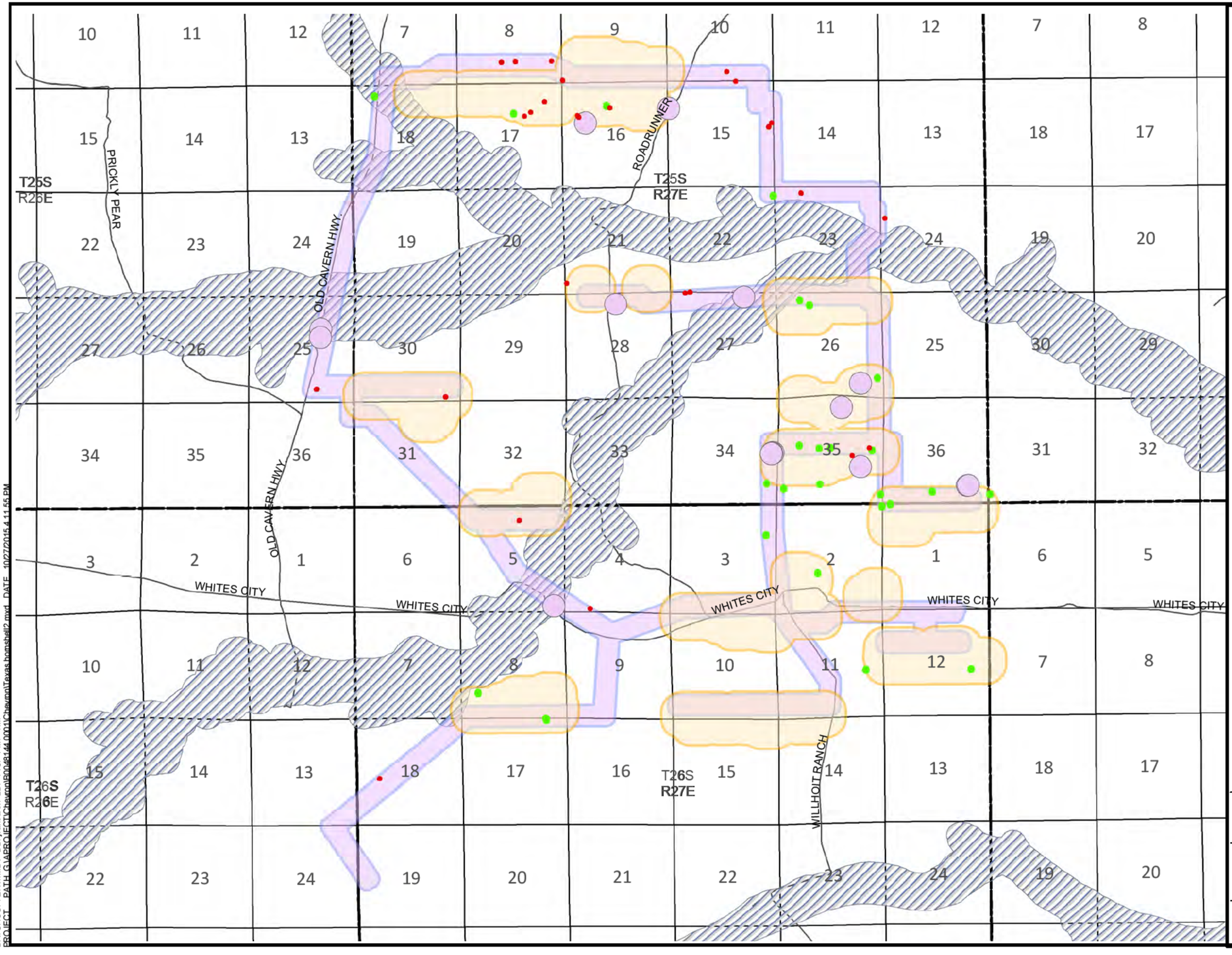
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

EXISTING DEVELOPMENT

ARCADIS

FIGURE 2

DIV/GROUP: ENV/IMDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH: G:\APROJECT\Chevron\B0048144.0001\Chevron\Texas bonnshell2.mxd DATE: 10/27/2015 4:11:55 PM



LEGEND

- Eddy County Roads
- Sections
- Townships
- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- 200 m Avoid & Minimize Buffer
- 200 m Sinkholes Buffer
- 25 m Raptor Buffer
- 50 m Closed Depressions Buffer

0 1 2

Miles

CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

KEY **CONSTRAINT** FINDINGS

ARCADIS

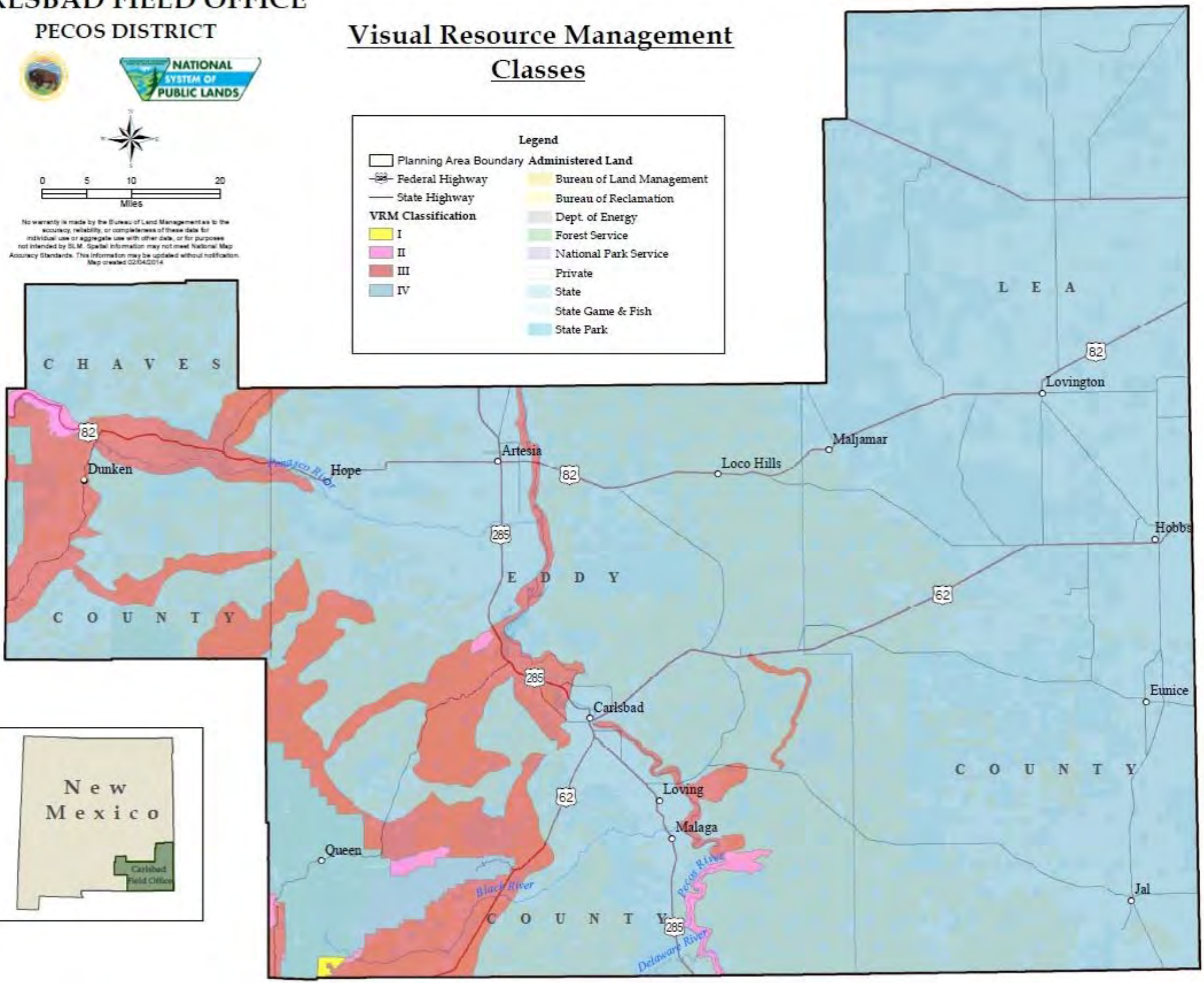
FIGURE 3

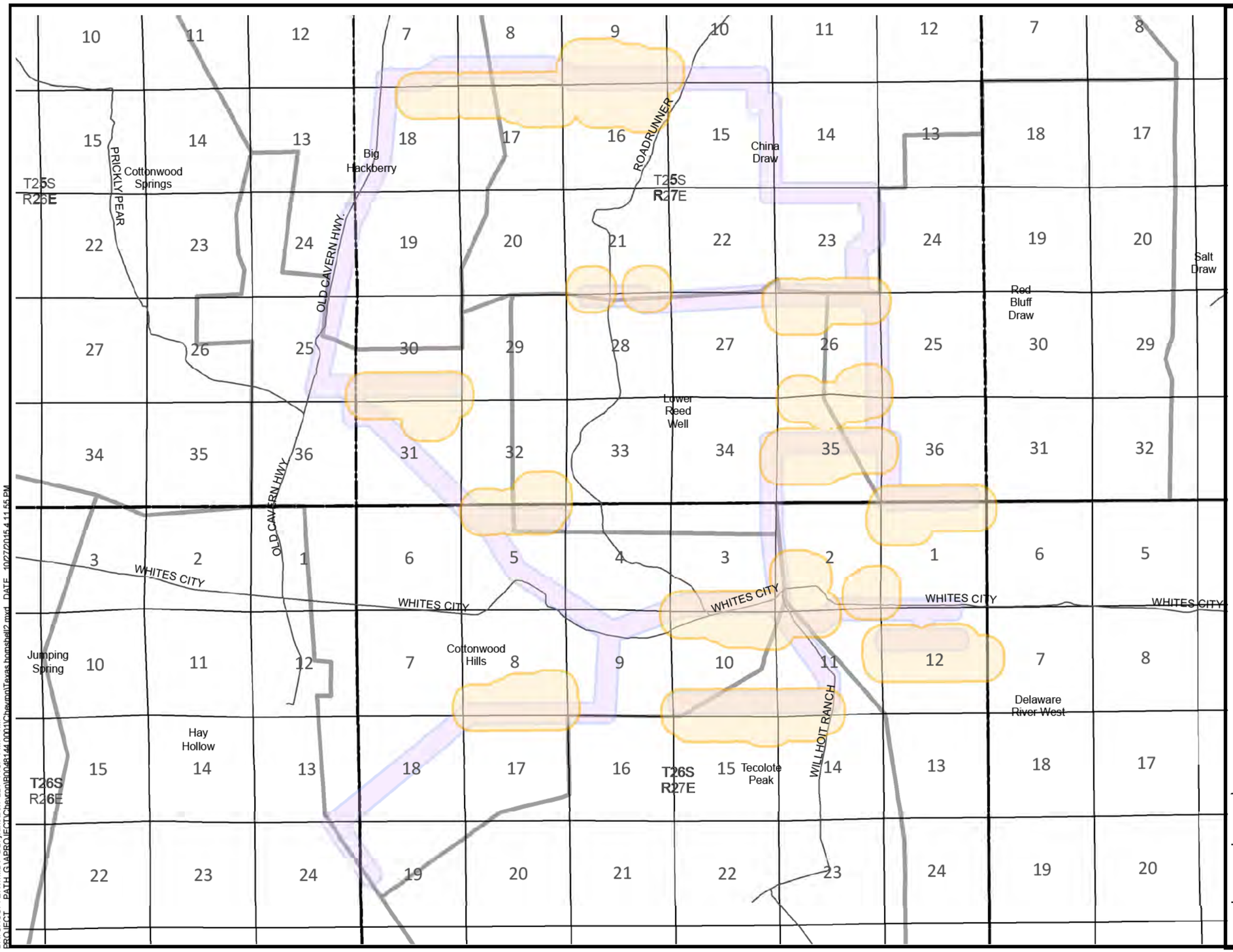
DIV/GROUP: ENV/MDV DB: jvarcuren LD: PIC: PM: TM:
PROJECT PATH: G:\APROJECT\Chevron\E00048144.0001\Chevron\Texas hornshell2.mxd DATE: 10/27/2015 4:11:55 PM

CARLSBAD FIELD OFFICE

PECOS DISTRICT

Visual Resource Management Classes





LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- Allotment Boundary

0 1 2

Miles

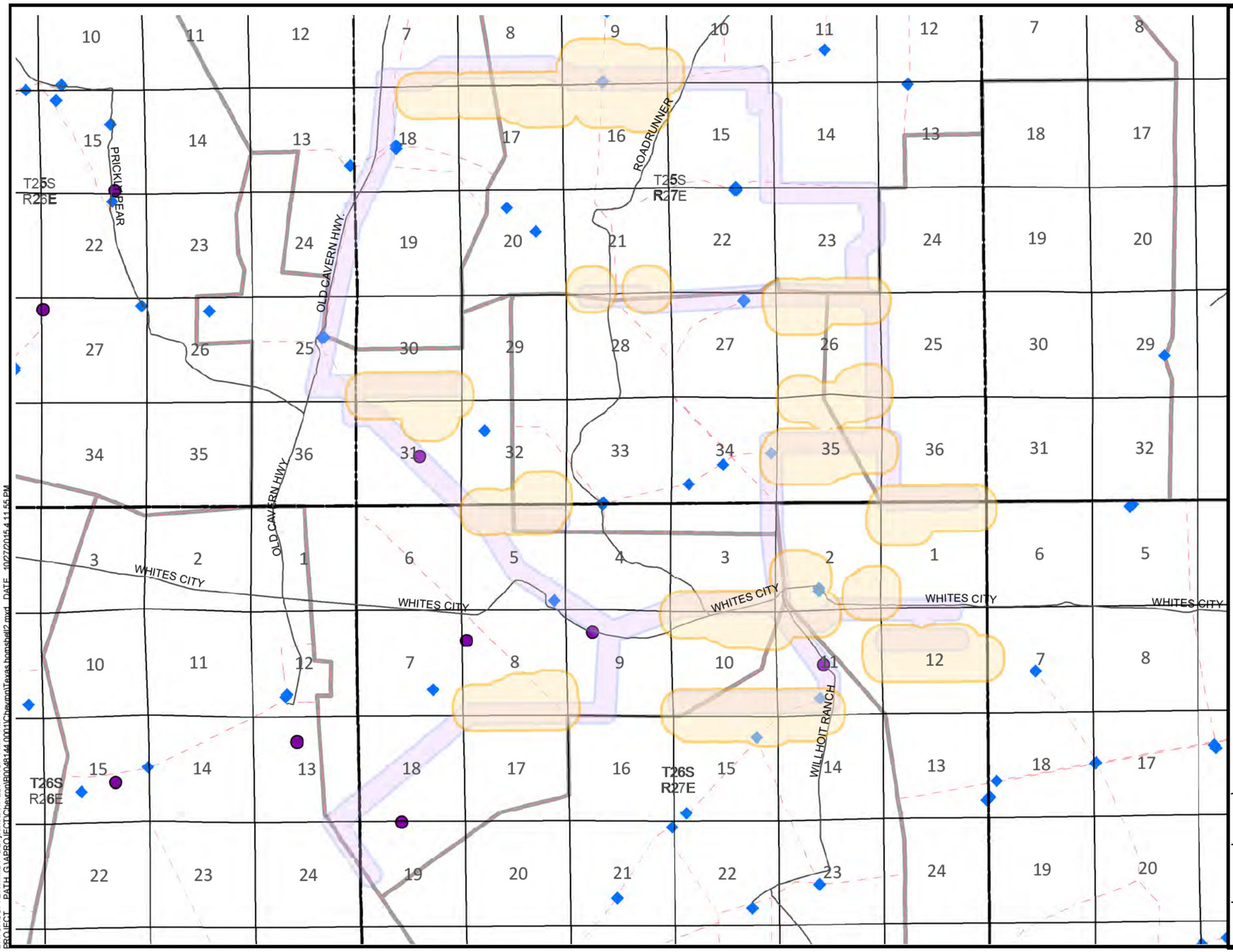
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

RANGE ALLOTMENTS

ARCADIS

FIGURE 5

DIV/GROUP: ENV/MDV DB: ivancuren LD: PIC: PM: TM:
PROJECT PATH: G:\AB\PROJECT\Chevron\B0048144.0001\ChevronTexas.bombshell2.mxd DATE: 10/27/2015 4:11:55 PM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- Allotment Boundary
- Water Lines
- Range Studies
- Water wells, troughs, and storage

0 1 2

Miles

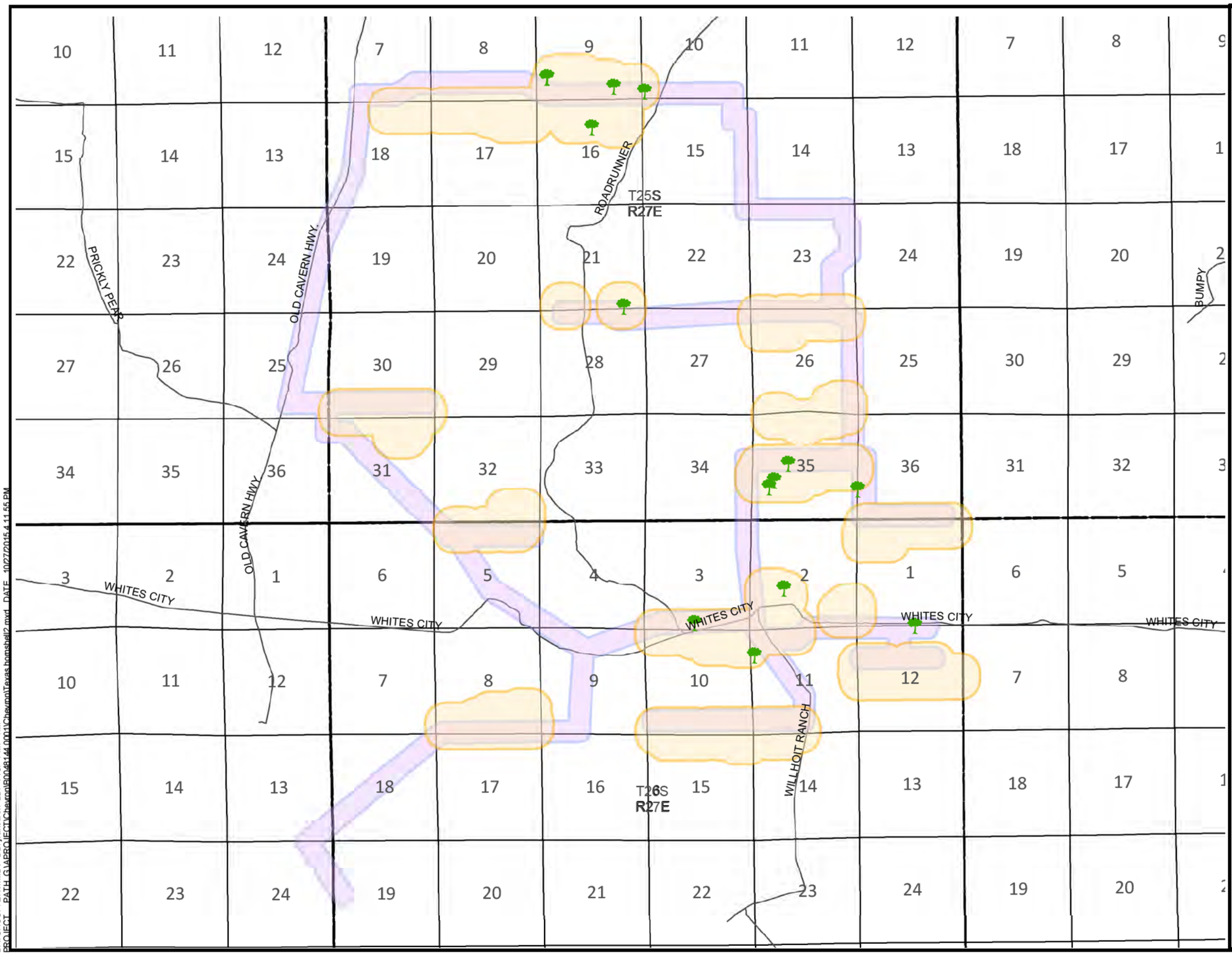
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

RANGE RESOURCES

ARCADIS

FIGURE 6

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH: G:\ARPROJECT\Chevron\B0048144.0001\Chevron\Texas hornshell2.mxd DATE: 10/27/2015 4:11:55 PM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- Tree

0 1 2

Miles

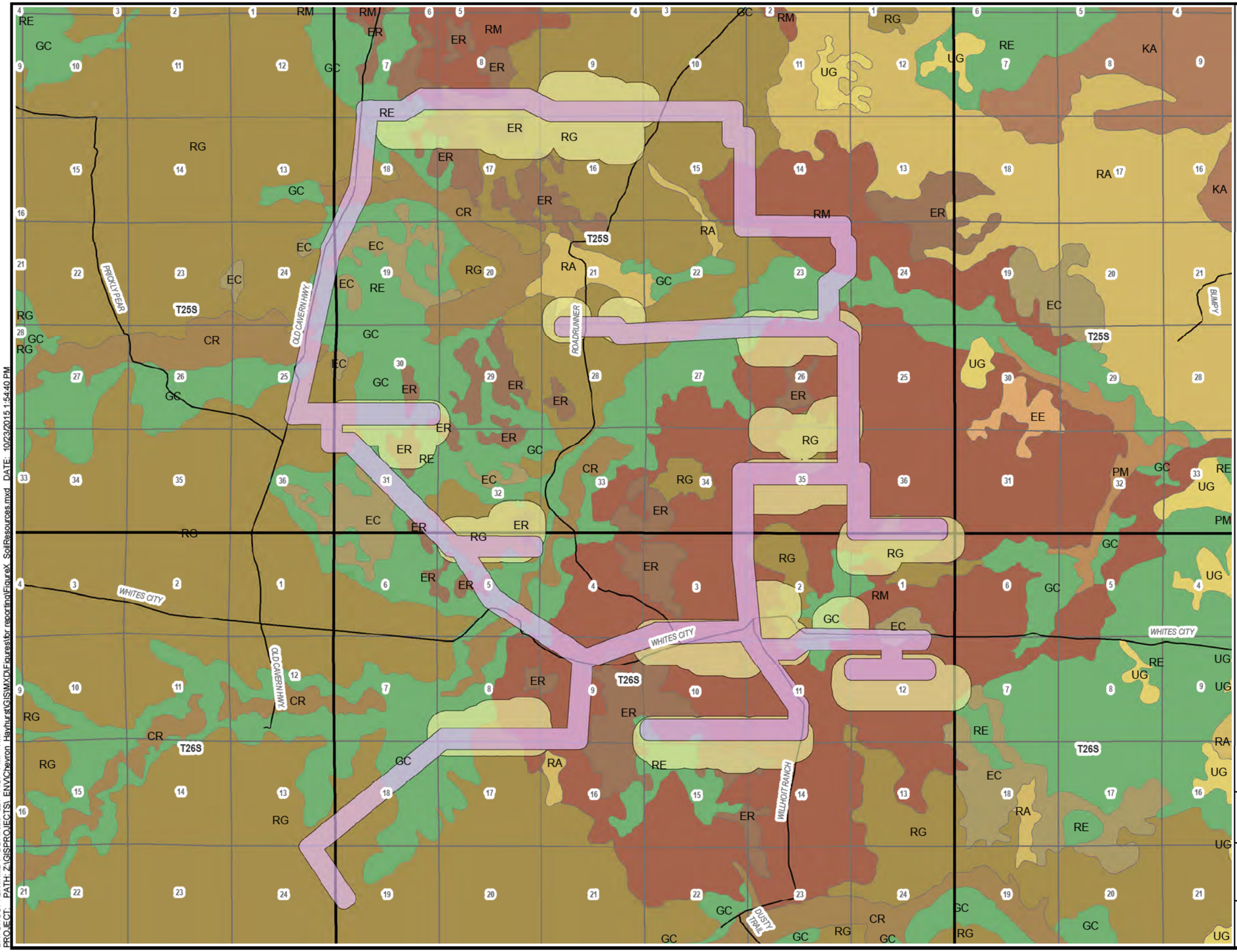
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

HABITAT OR SHADE TREES

ARCADIS

FIGURE 7

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH: G:\ABR\PROJECT\Chevron\B0008144.0001\Chevron\Texas hornshell2.mxd DATE: 10/27/2015 4:11:55 PM



LEGEND:

- 400 Ft ROW Buffer
- 1,000 Ft Feature Buffer
- Townships
- Sections
- County Roads

Eddy County Soil Data

- CR
- EC
- EE
- ER
- GC
- KA
- PM
- RA
- RE
- RG
- RM
- UG
- Gypsum

0 1 2

Mile

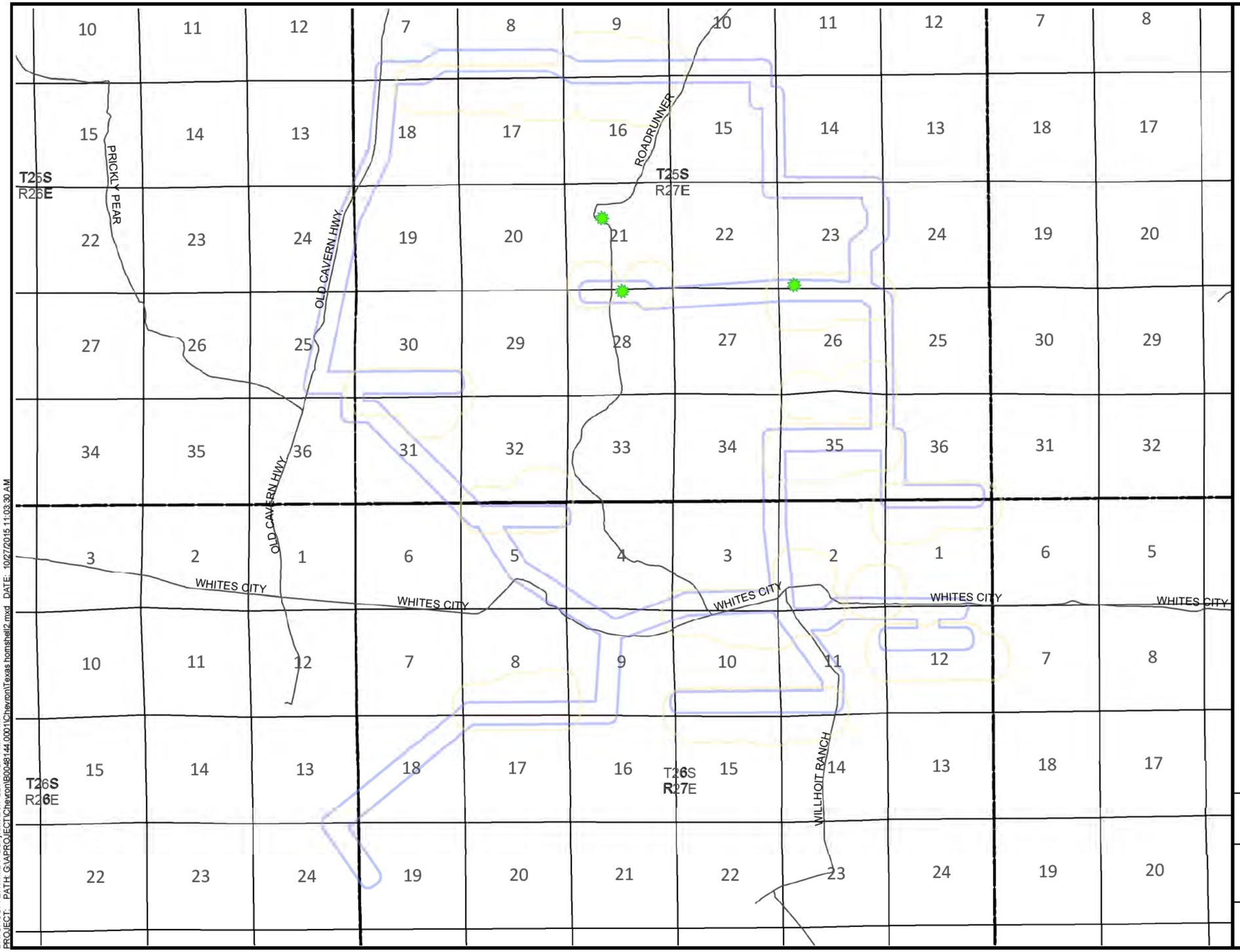
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

SOIL RESOURCES

ARCADIS

FIGURE 8

DIV/GROUP: ENV/MDV DB: webb LD: PIC: PM: TM:
PROJECT: PATH: Z:\GIS\PROJECTS_ENV\Chevron_Hayhurst\GIS\MXD\Figures\for reporting\FigureX_SoilResources.mxd DATE: 10/23/2015 1:54:40 PM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- Noxious Weed

0 1 2

Miles

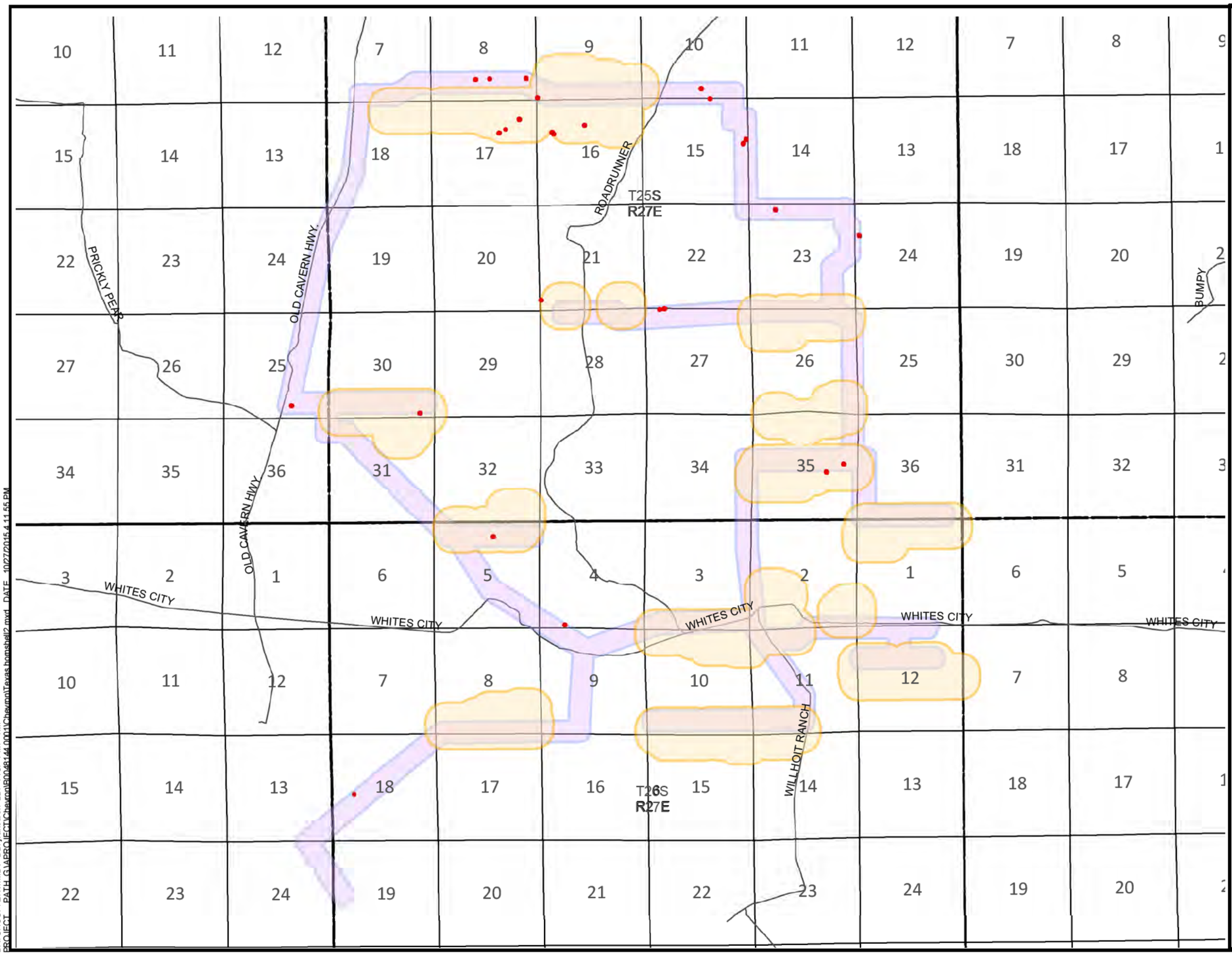
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEYS
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

NOXIOUS WEEDS

ARCADIS

FIGURE 9

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT: PATH: G:\APROJECT\Chevron\B0048144.0001\Chevron\Texas hornshell2.mxd DATE: 10/27/2015 11:03:30 AM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- 50m Raptor and Burrow Buffer

0 1 2

Miles

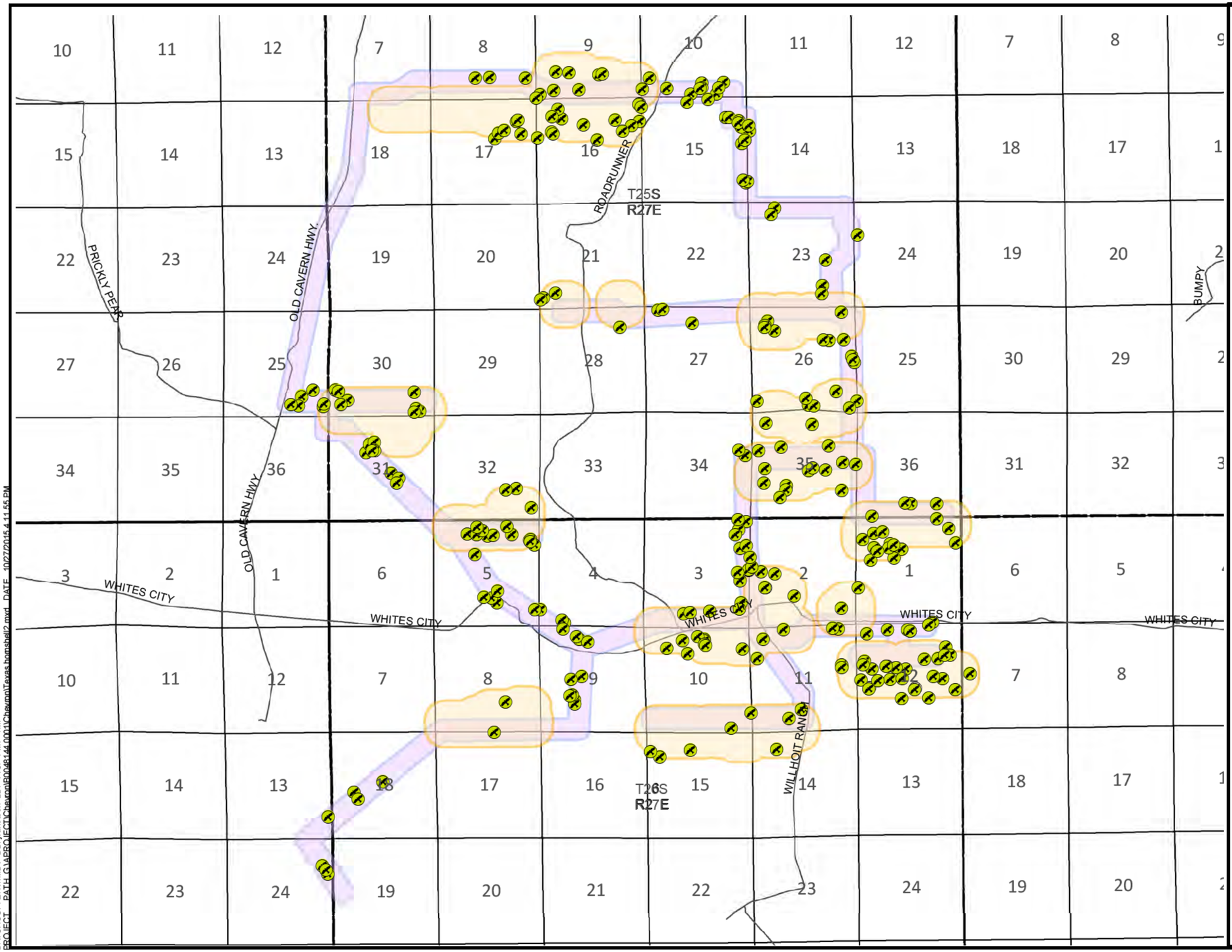
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

RAPTOR **NESTS AND BURROWS**

ARCADIS

FIGURE 10

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH: G:\ABR\PROJECT\Chevron\B0008144.0001\Chevron\Texas hornshell2.mxd DATE: 10/27/2015 4:11:55 PM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- Nests

0 1 2

Miles

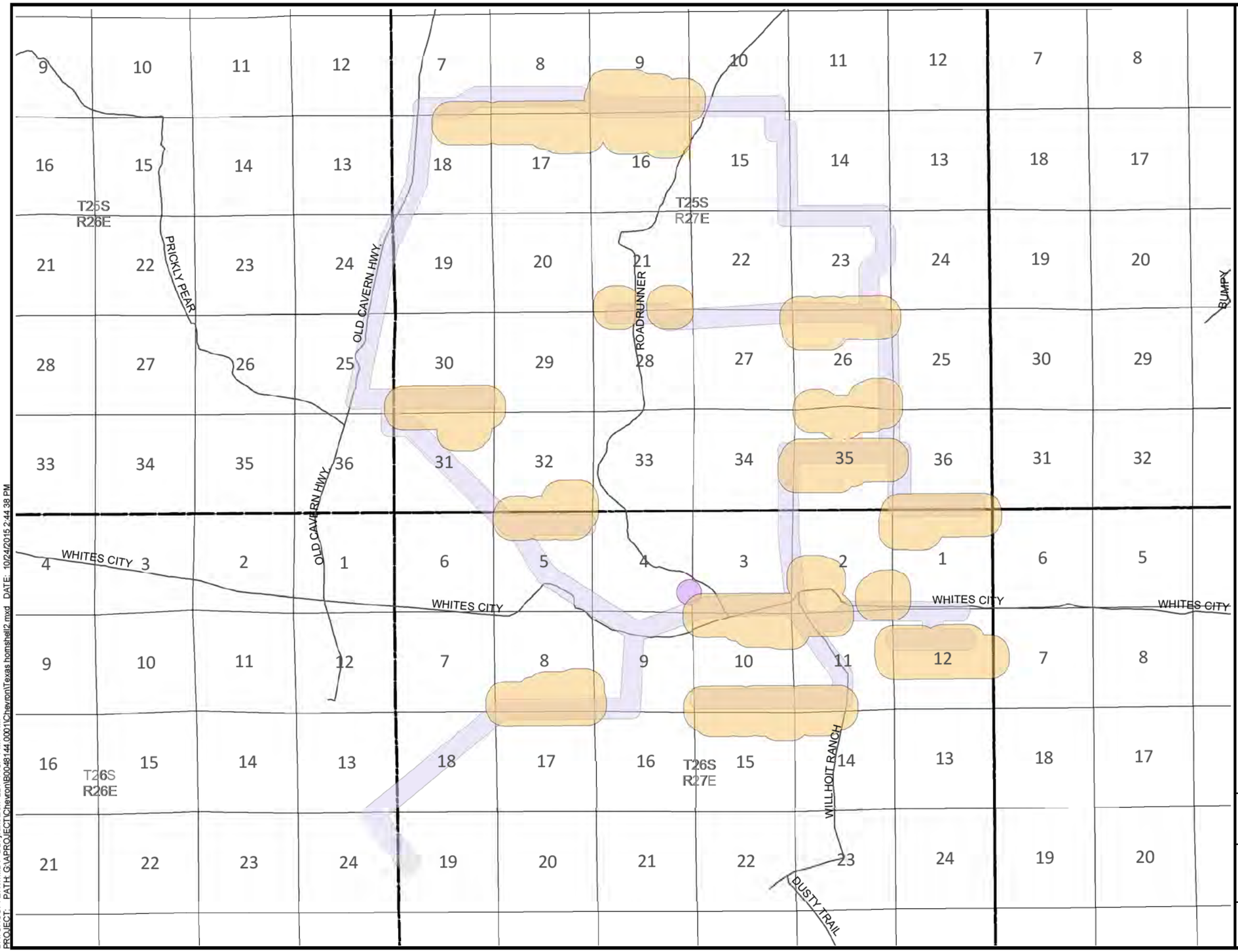
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

MIGRATORY & NON-MIGRATORY BIRD NESTS

ARCADIS

FIGURE 11

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH: G:\APROJECT\Chevron\B0048144.0001\Chevron\Texas hornshell2.mxd DATE: 10/27/2015 4:11:55 PM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- Wildlife Habitat Project

0 1 2

Miles

CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

WILDLIFE HABITAT PROJECT

ARCADIS

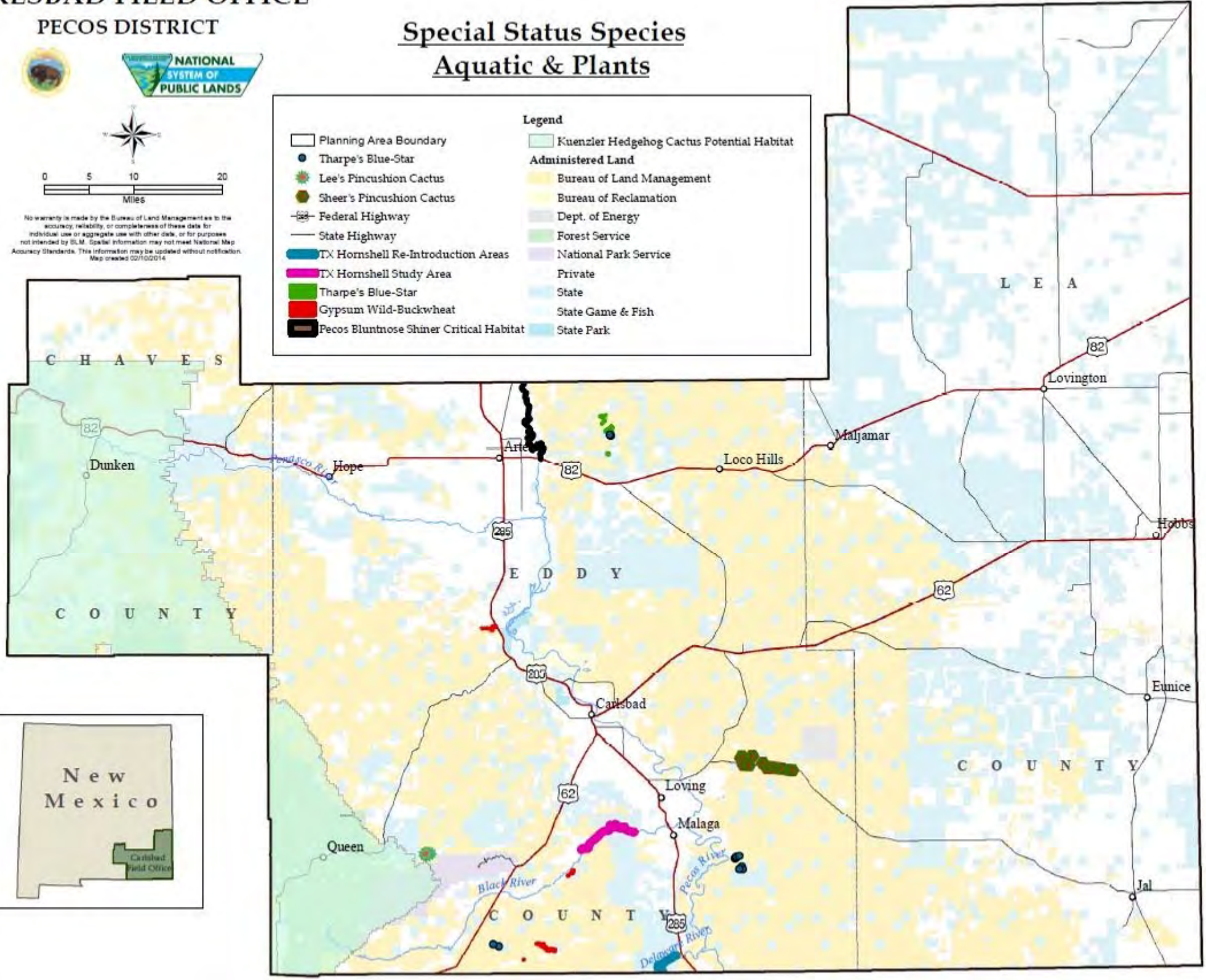
FIGURE 12

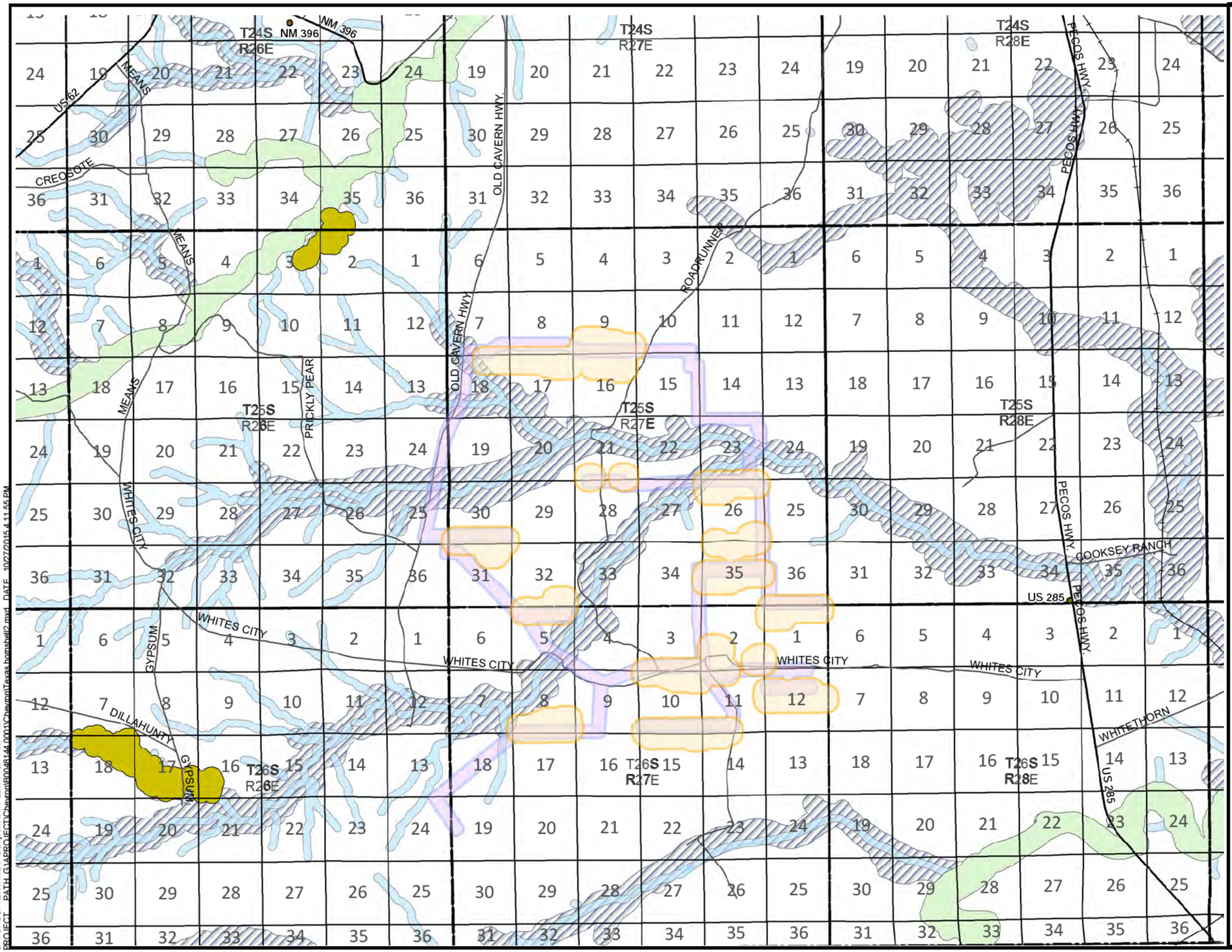
DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT: PATH: G:\APROJECT\Chevron\B0048144.0001\Chevron\Texas hornshell\2.mxd DATE: 10/24/2015 2:44:38 PM

CARLSBAD FIELD OFFICE

PECOS DISTRICT

Special Status Species
Aquatic & Plants





LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- 200m THM Exclusion
- 100 m Tributary Buffer
- 200m WGB Buffer
- 200m Avoid and Minimize

0 3.5

Miles

CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

SPECIAL STATUS SPECIES

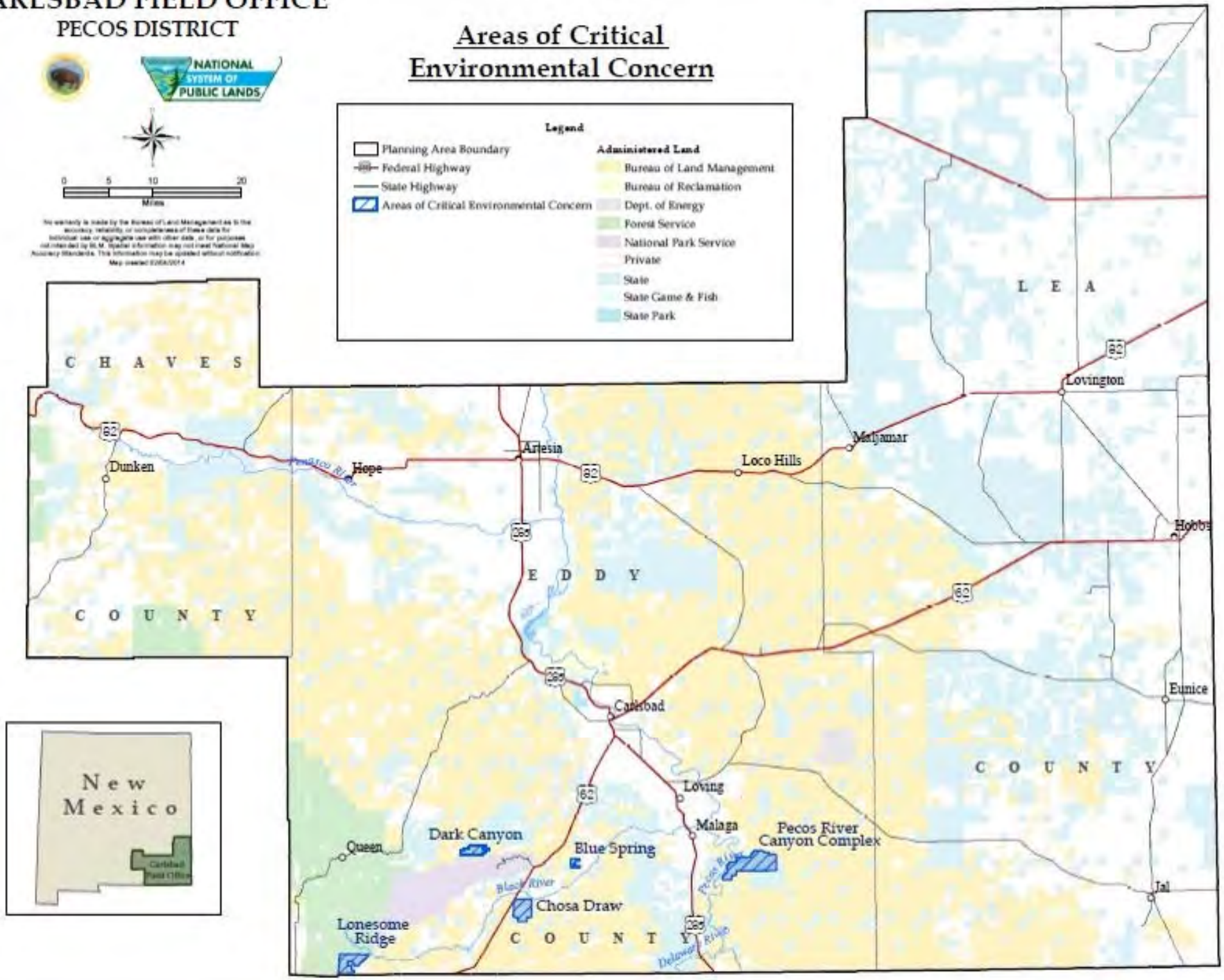
ARCADIS

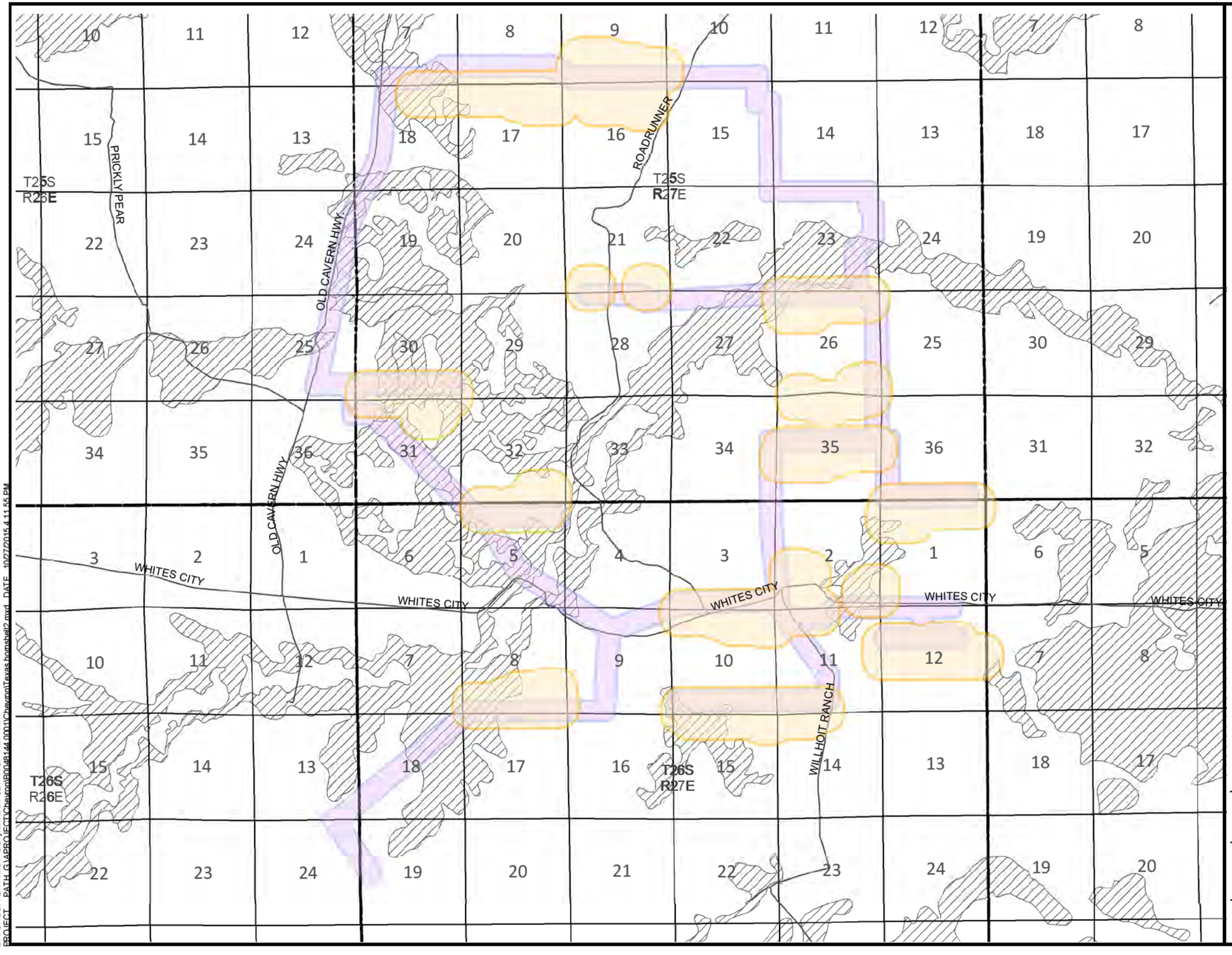
FIGURE 14

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH: G:\APROJECT\Chevron\B0048144.0001\Chevron\Texas bomshell2.mxd DATE: 10/27/2015 4:11:55 PM

CARLSBAD FIELD OFFICE
PECOS DISTRICT

Areas of Critical Environmental Concern





LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- Gypsum Soils

0 1 2

Miles

CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

GYPSUM SOILS

ARCADIS

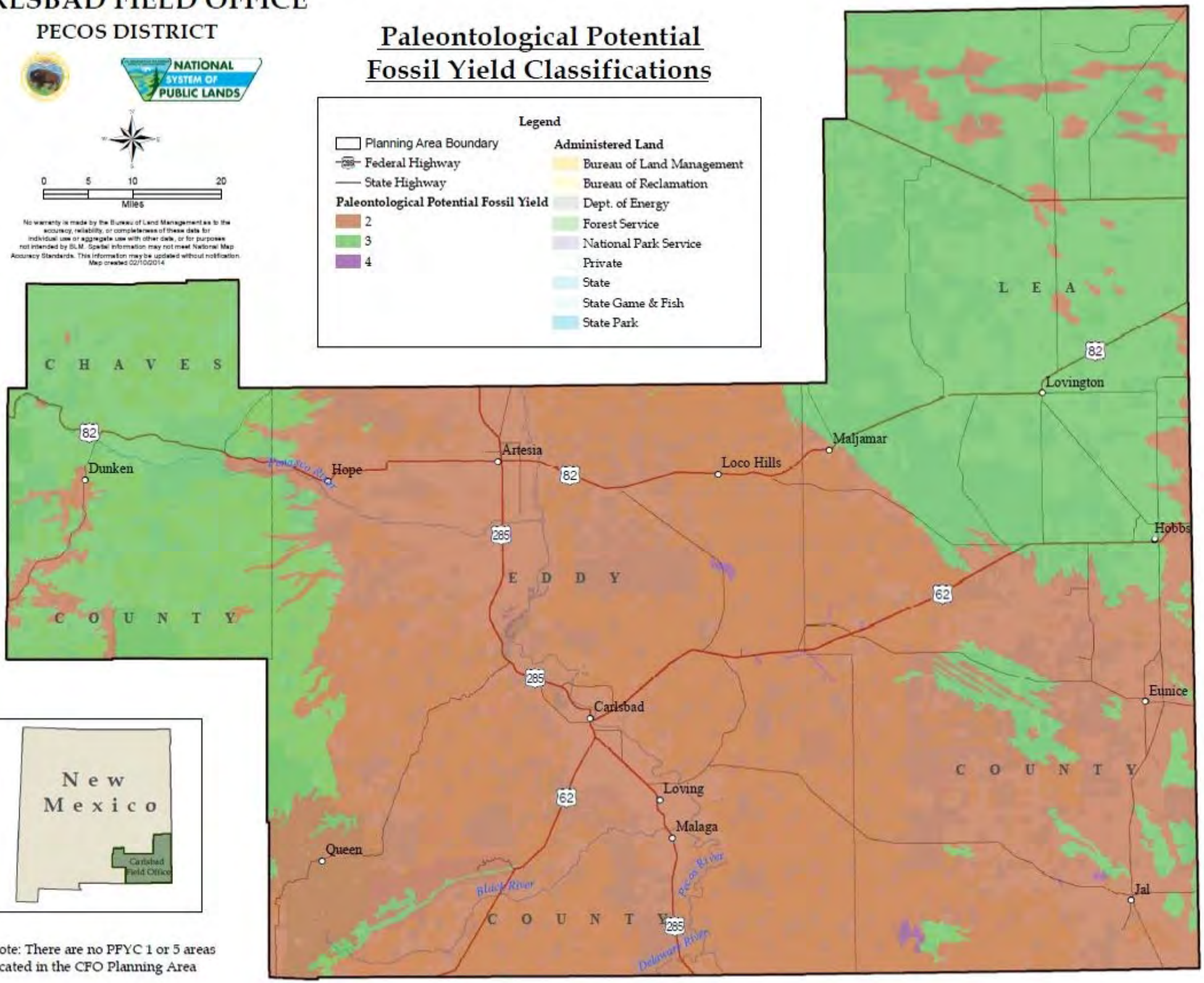
FIGURE 16

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH: G:\APROJECT\Chevron\E0046144.0001\Chevron\Texas hornshell2.mxd DATE 10/27/2015 4:11:55 PM

CARLSBAD FIELD OFFICE

PECOS DISTRICT

Paleontological Potential Fossil Yield Classifications

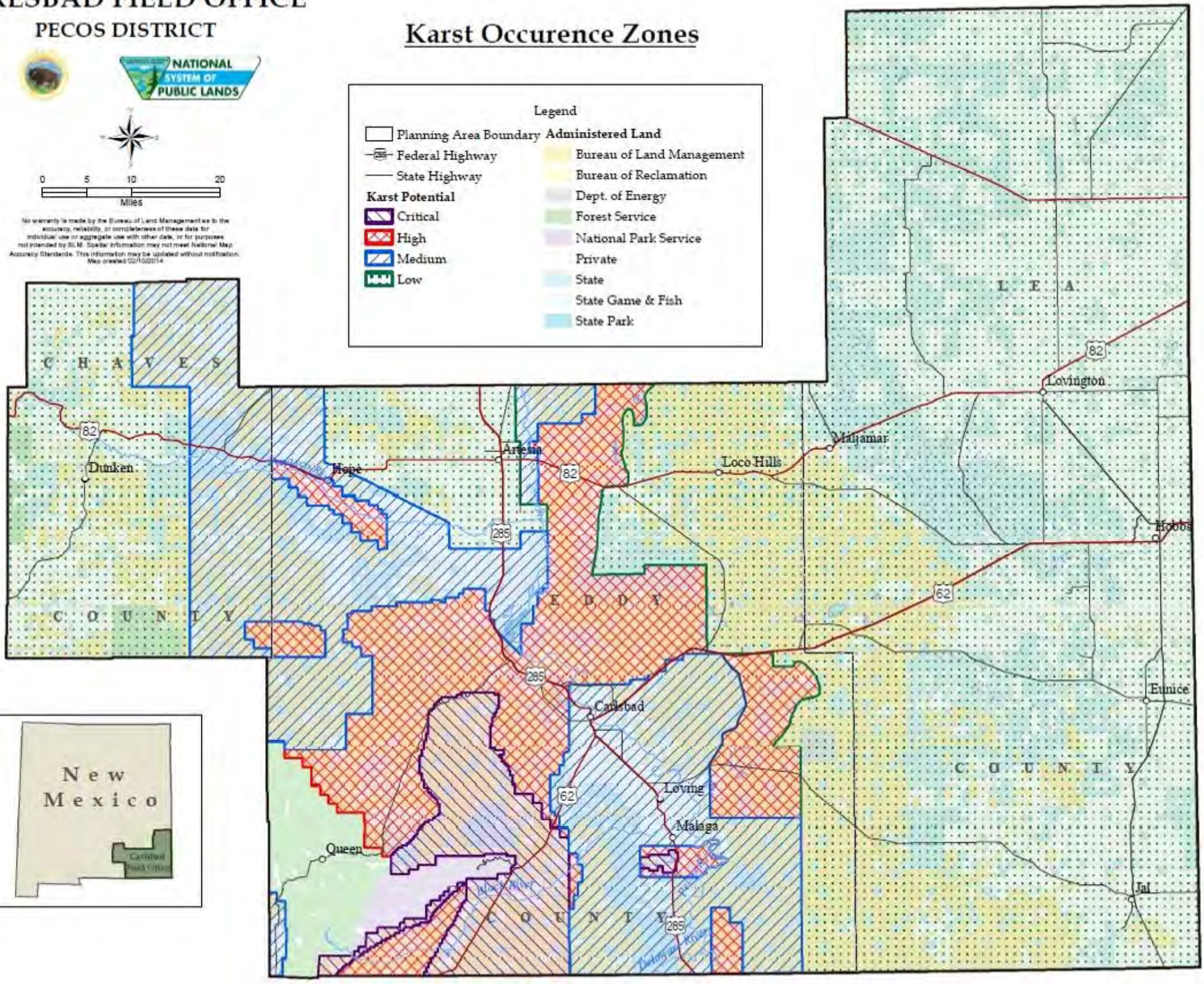


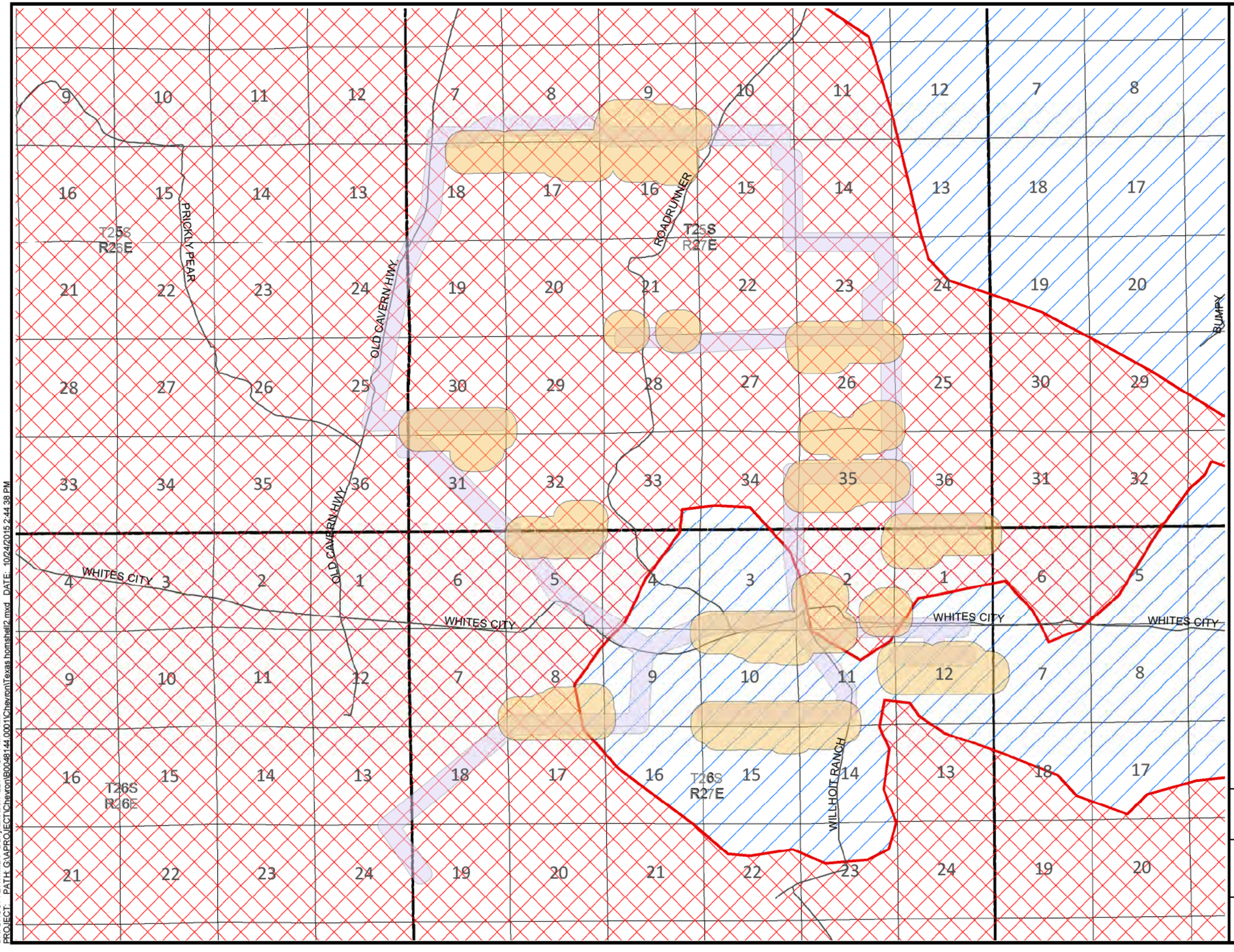
Note: There are no PFYC 1 or 5 areas located in the CFO Planning Area

CARLSBAD FIELD OFFICE

PECOS DISTRICT

Karst Occurence Zones





LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- High Potenital Karst
- Medium Potenitial Karst

0 1 2

Miles

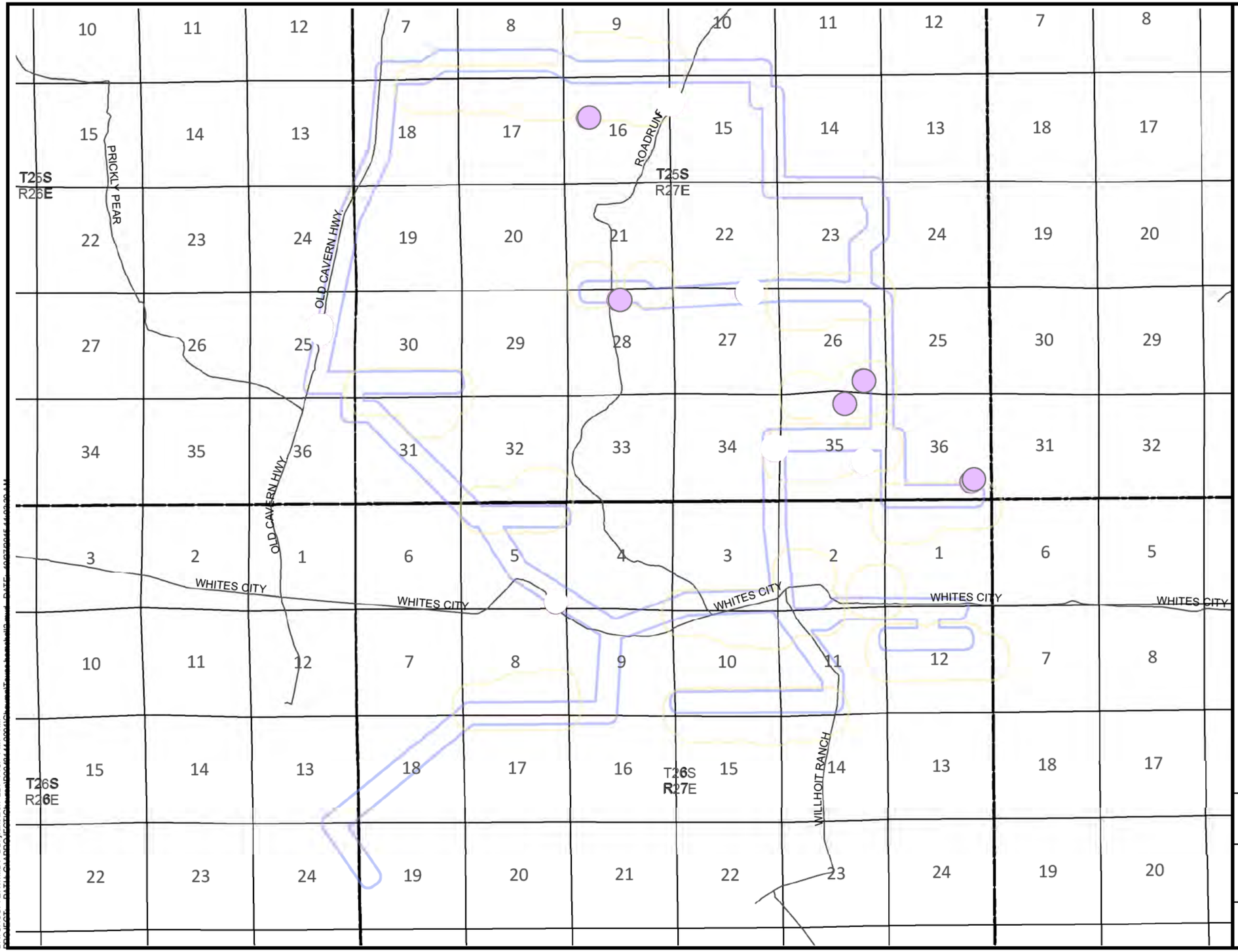
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

KARST **POTENTIAL ZONES**

ARCADIS

FIGURE
19

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT: PATH: G:\APROJECT\Chevron\B0048144.0001\Chevron\Texas hornshell2.mxd DATE: 10/24/2015 2:44:38 PM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- 200 m Buffer Sinkholes

0 1 2

Miles

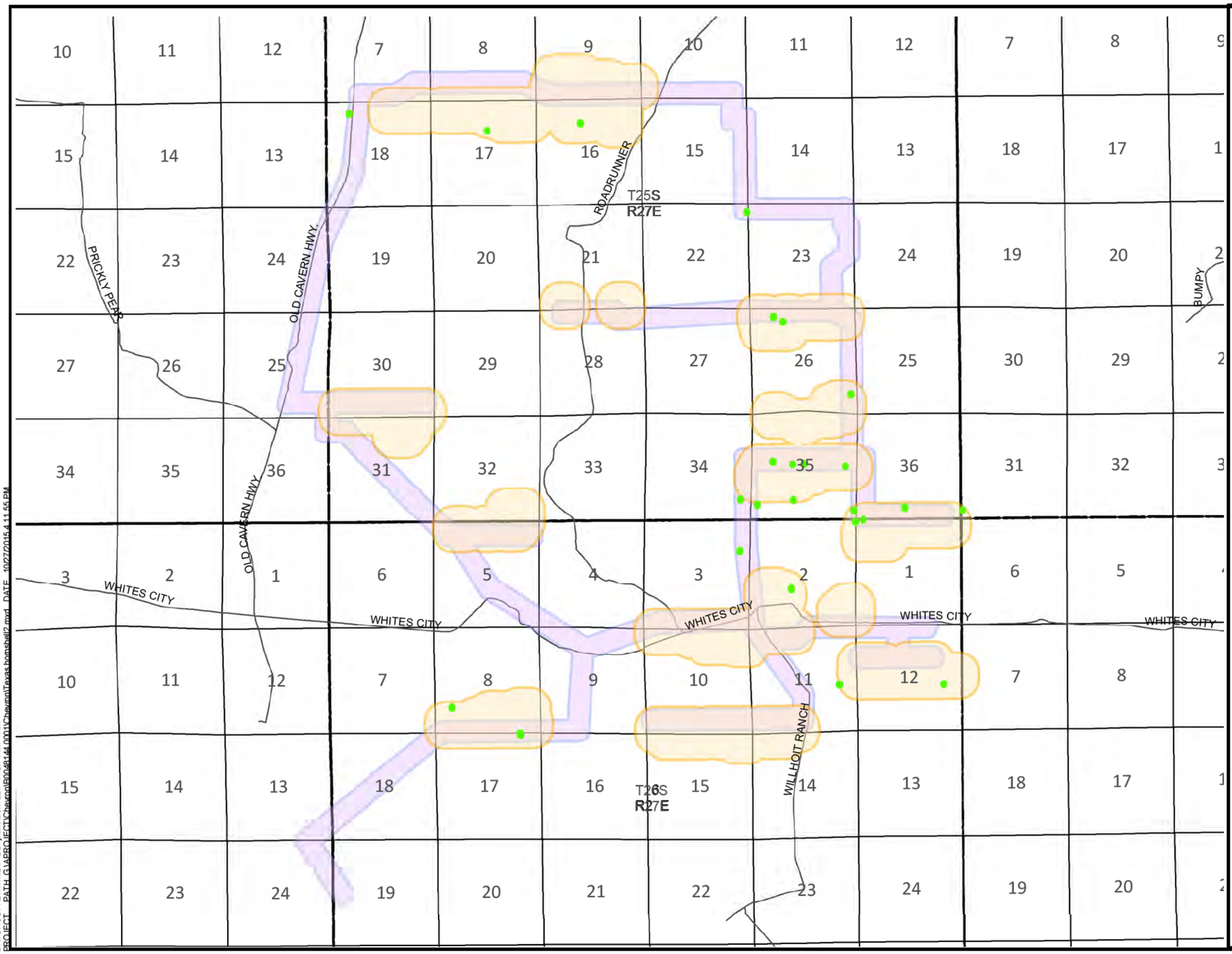
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

COLLAPSED SINKHOLES

ARCADIS

FIGURE 20

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- 50 m Buffer Closed Depressions

0 1 2

Miles

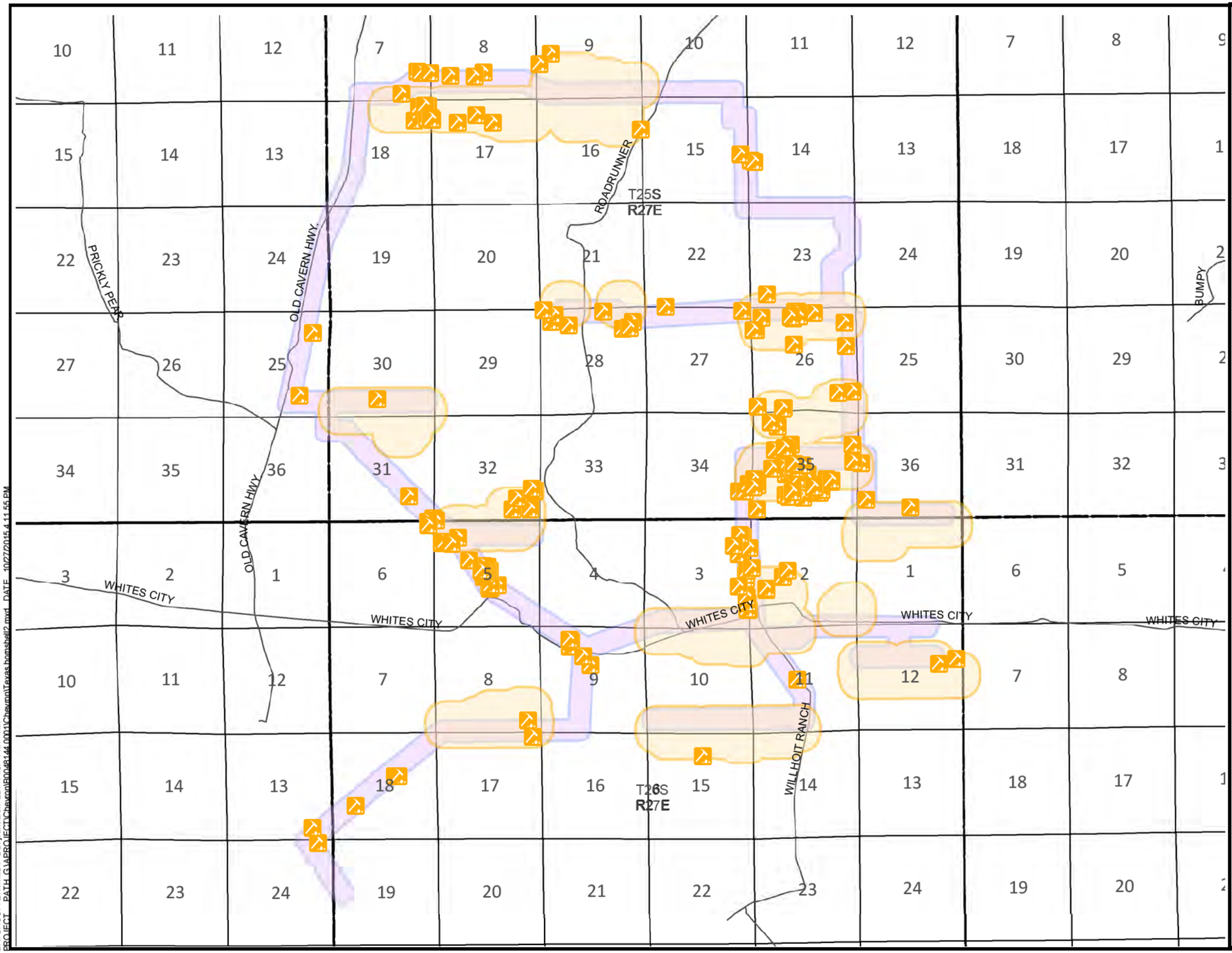
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

DEPRESSIONS / FISSURES

ARCADIS

FIGURE 21

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH: G:\ABR\PROJECT\Chevron\B0008144.0001\Chevron\Texas hornshell2.mxd DATE: 10/27/2015 4:11:55 PM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- Outcropping

0 1 2

Miles

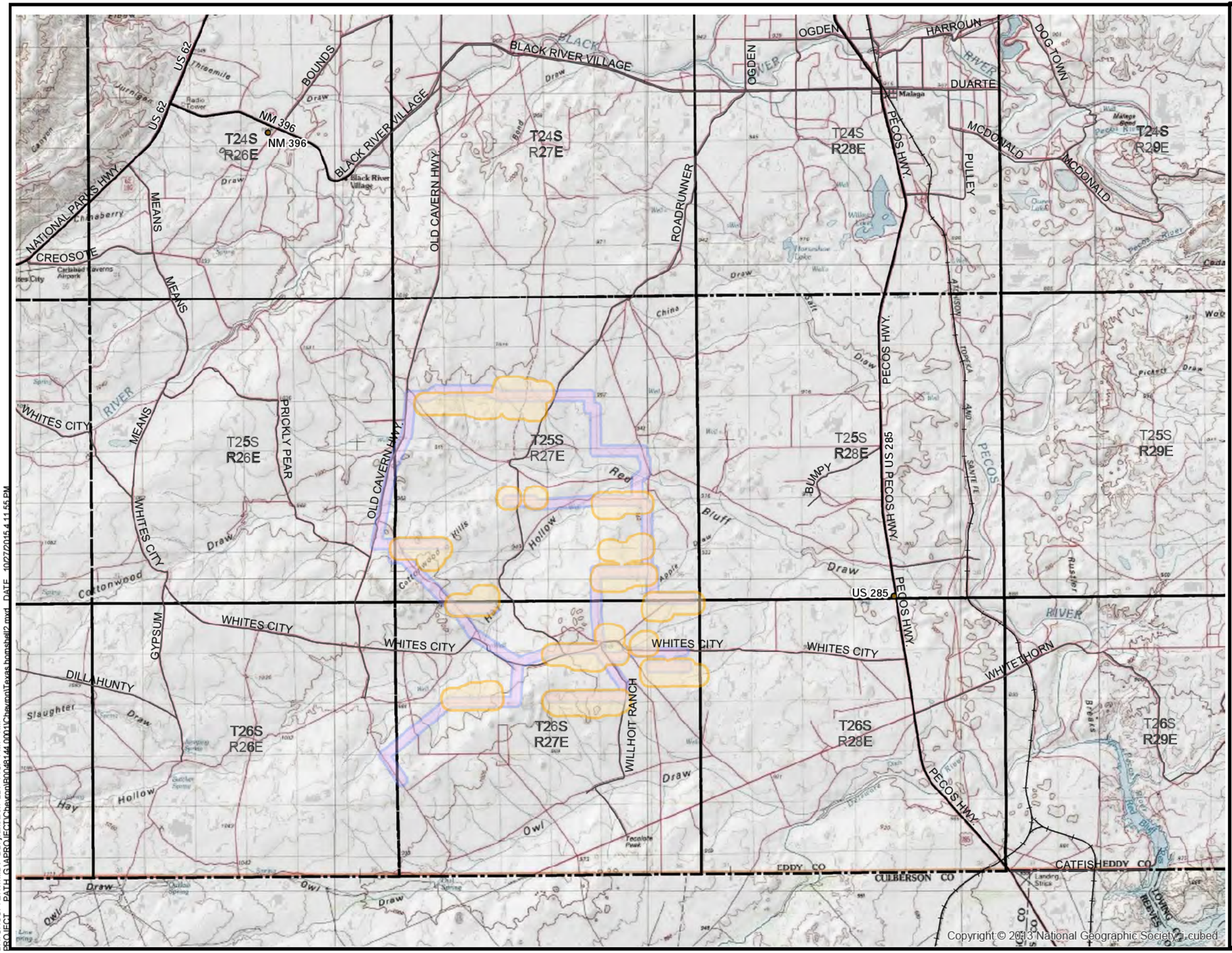
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

ROCK OR GYP OUTCROPPINGS

ARCADIS

FIGURE 22

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH: G:\APROJECT\Chevron\B0048144.0001\ChevronTexas.hornshell2.mxd DATE: 10/27/2015 4:11:55 PM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Townships

0 2 4

Miles

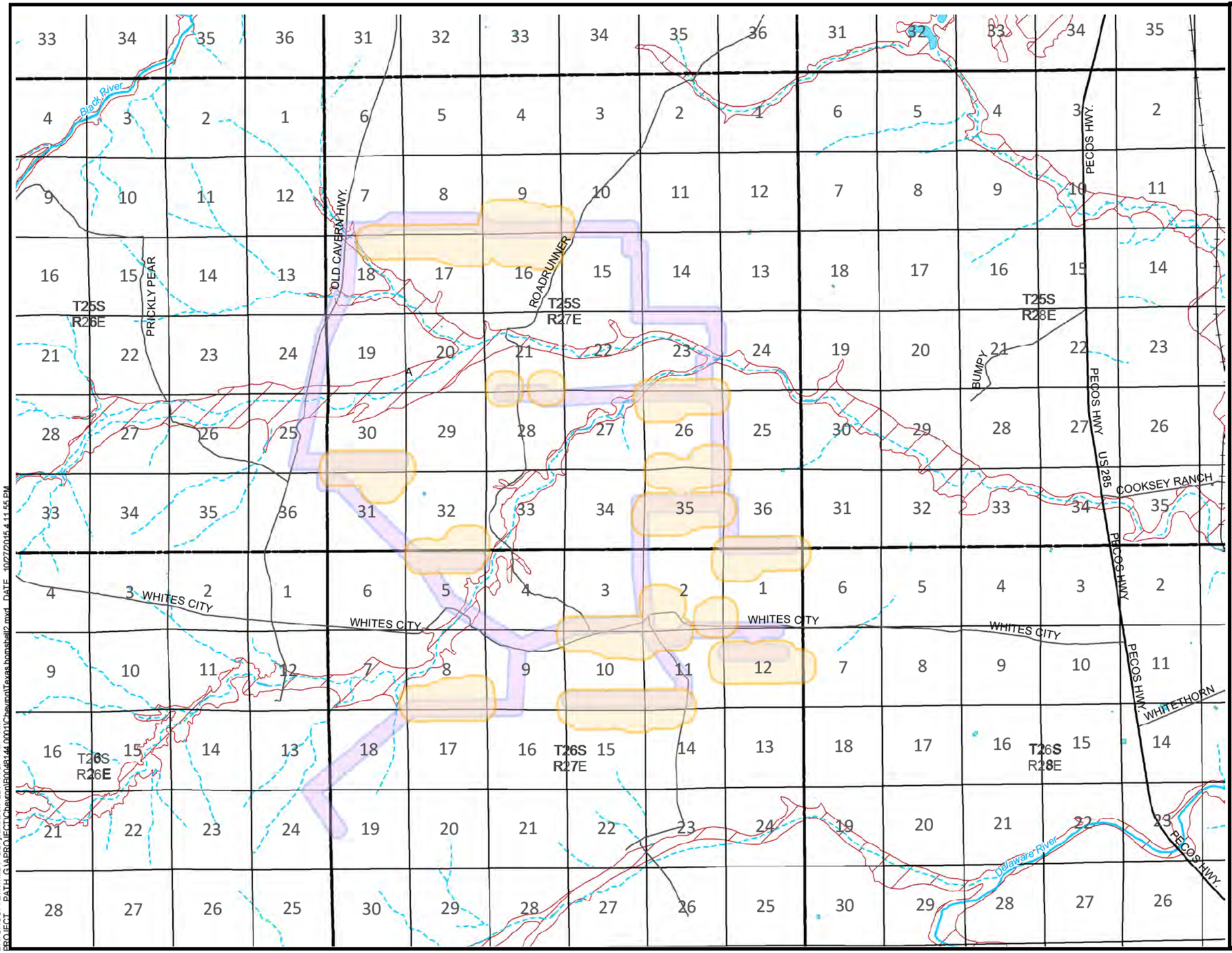
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

SURFACE HYDROLOGY TOPOGRAPHIC MAP

ARCADIS

FIGURE 23

DIV/GROUP: ENV/MDV DB: jvarcuren LD: PIC: PM: TM:
PROJECT PATH: G:\APROJECT\Chevron\P0004144.0001\Chevron\Texas hornshell2.mxd DATE: 10/27/2015 4:11:55 PM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- FEMA Flood Zone
- River
- Stream/River: Hydrographic Category = Intermittent
- Stream/River: Hydrographic Category = Perennial
- LakePond

0 1 2
Miles

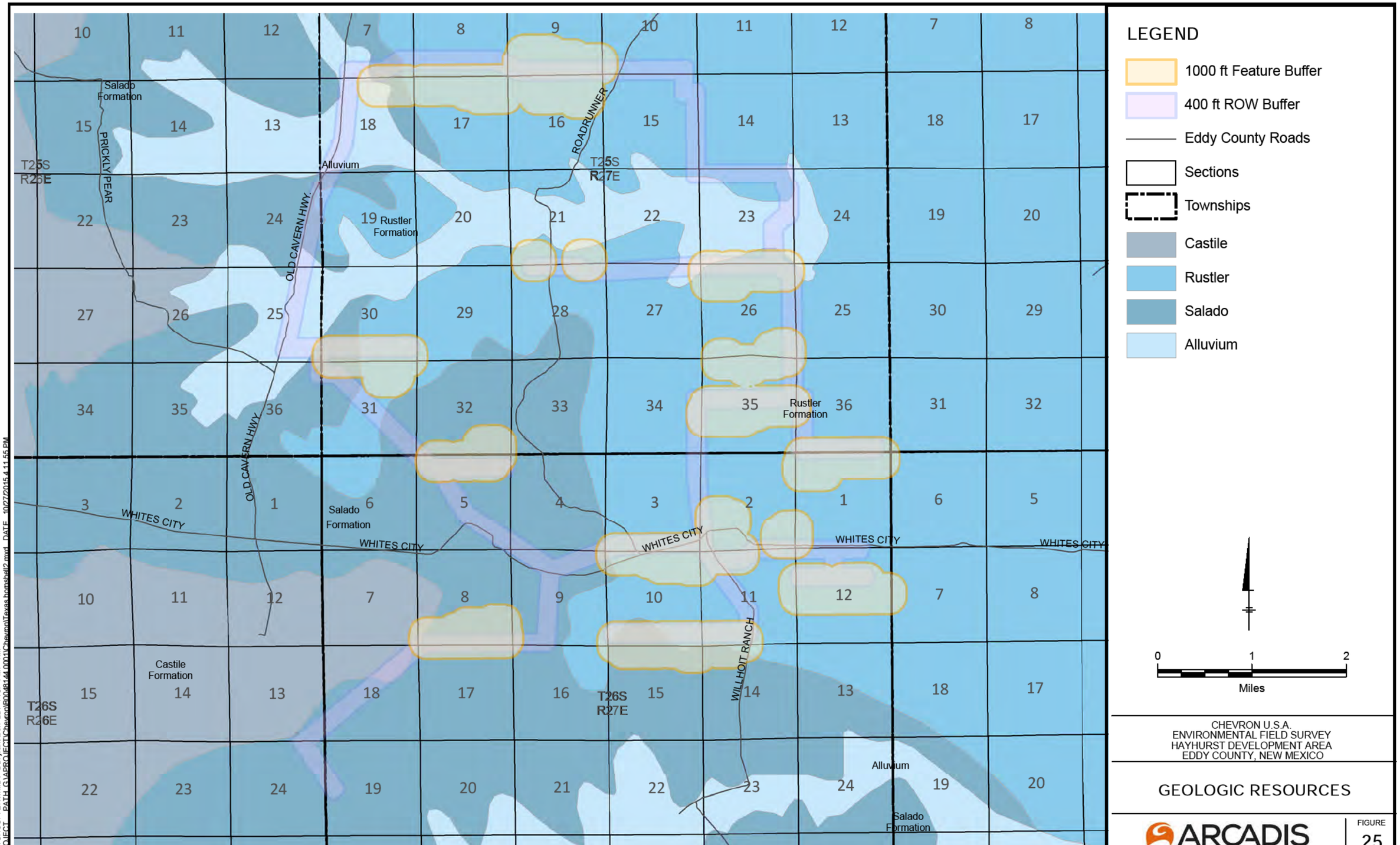
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

SURFACE HYDROLOGY

ARCADIS

FIGURE 24

DIV/GROUP: ENV/IMDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH: G:\APROJECT\Chevron\B0048144.0001\Chevron\Texas.homshell2.mxd DATE 10/27/2015 4:11:55 PM



CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

GEOLOGIC RESOURCES

ARCADIS

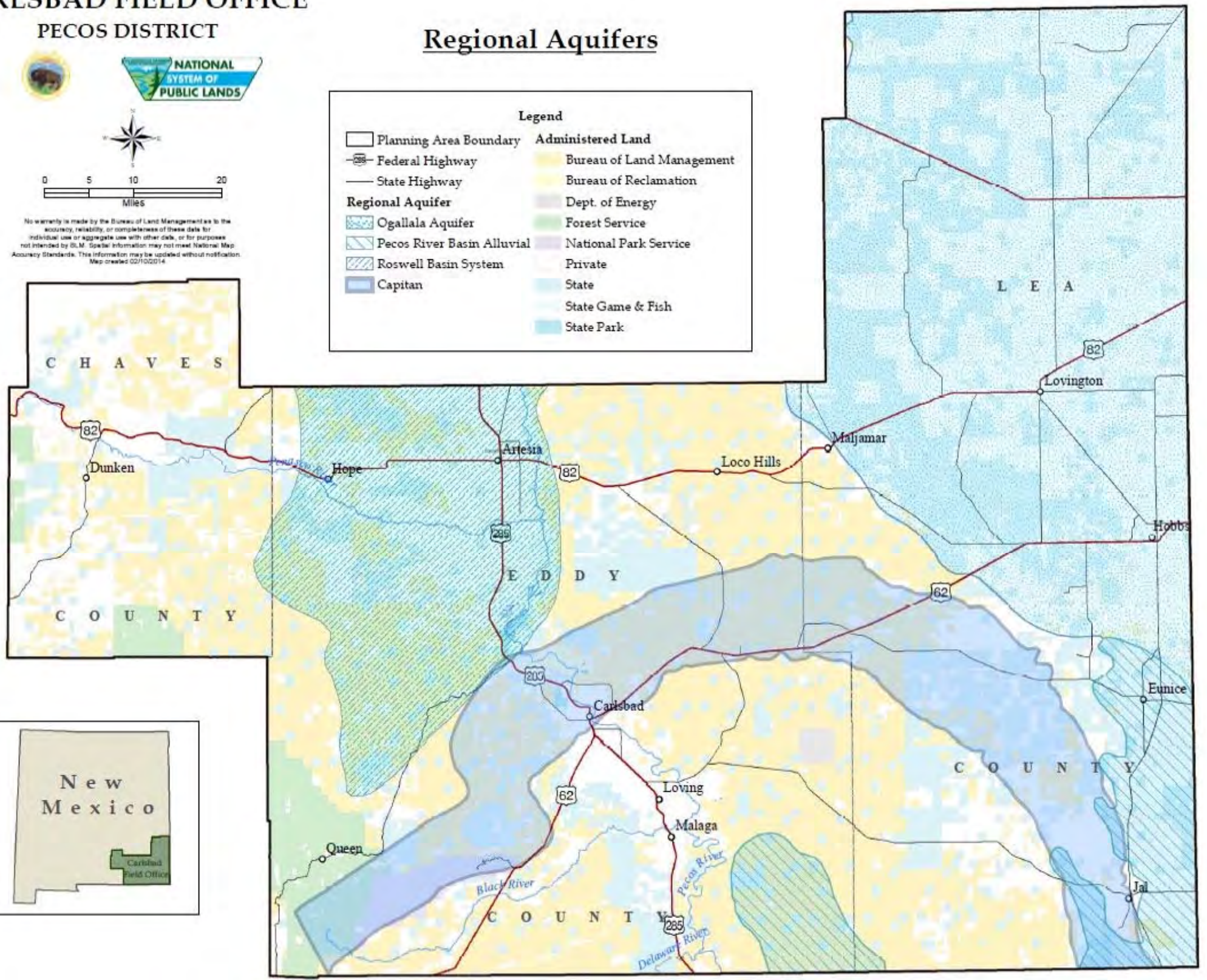
FIGURE 25

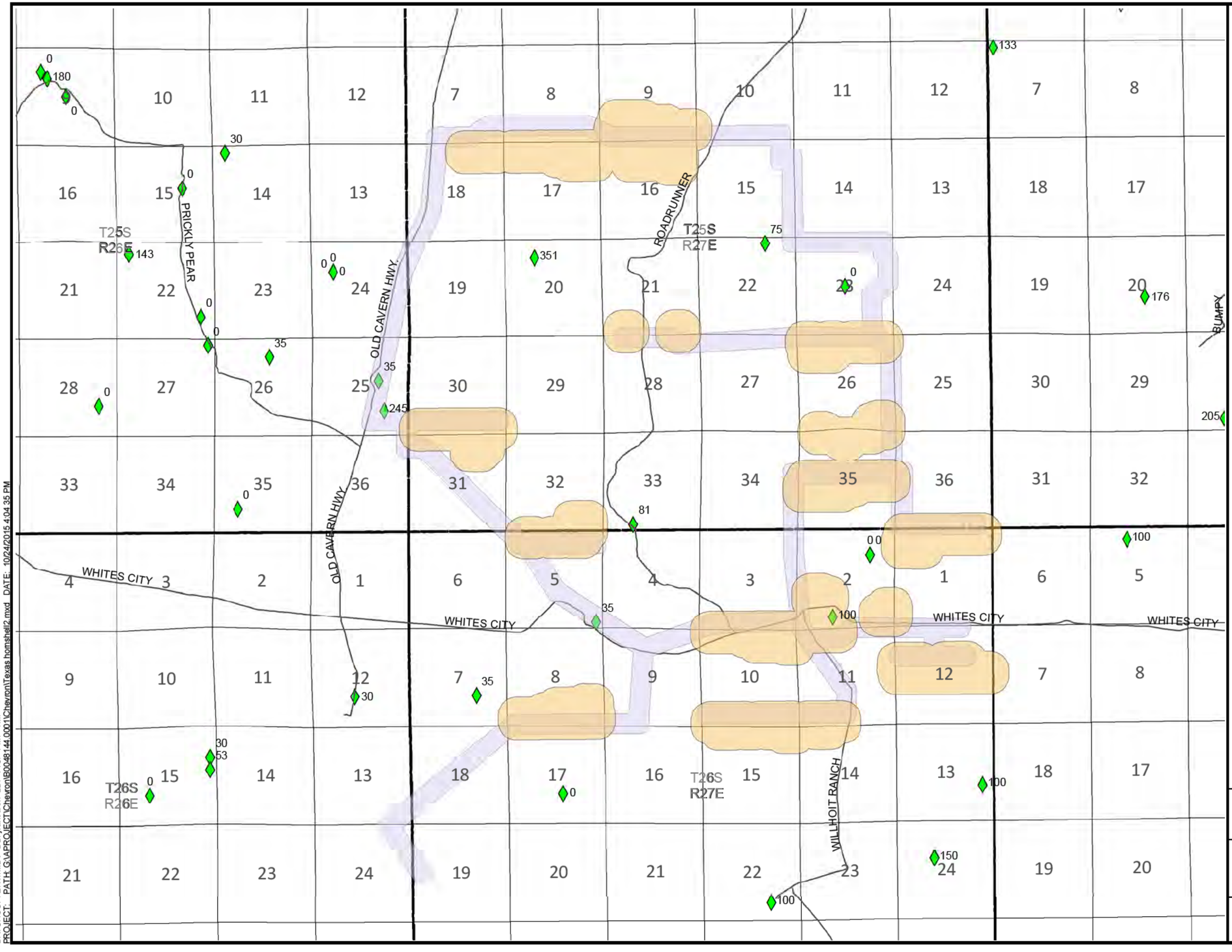
DIV/GROUP: ENV/IMDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH G:\APROJECT\Chevron\B0048144.0001\Chevron\Texas.hornshell2.mxd DATE 10/27/2015 4:11:55 PM

CARLSBAD FIELD OFFICE

PECOS DISTRICT

Regional Aquifers





LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- Groundwater Wells (OSE)

0 1 2

Miles

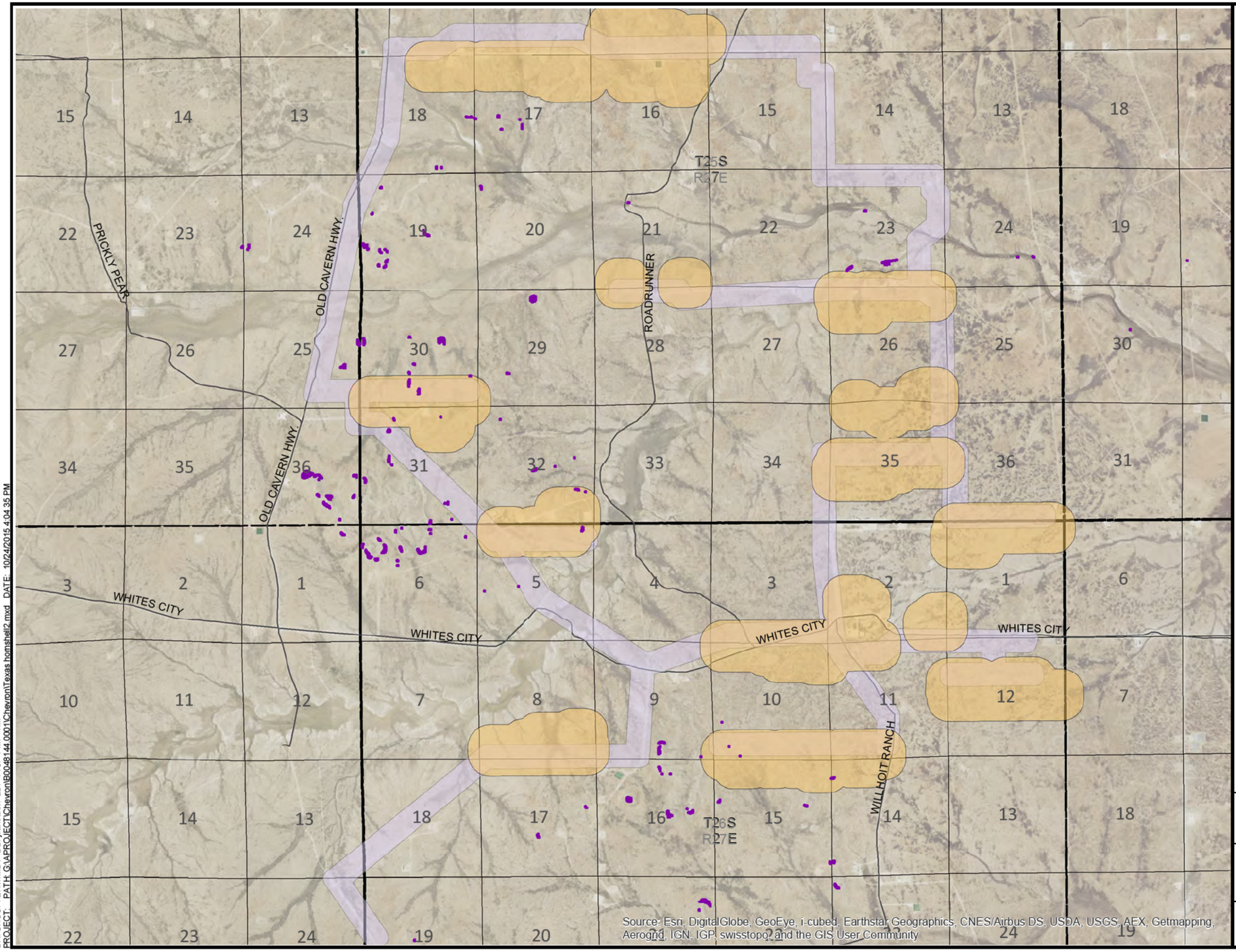
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

GROUNDWATER **WELLS**

ARCADIS

FIGURE 27

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT: PATH: G:\APROJECT\Chevron\B0048144.0001\Chevron\Texas hornshell2.mxd DATE: 10/24/2015 4:04:35 PM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- Slope > 30%

0 1 2

Miles

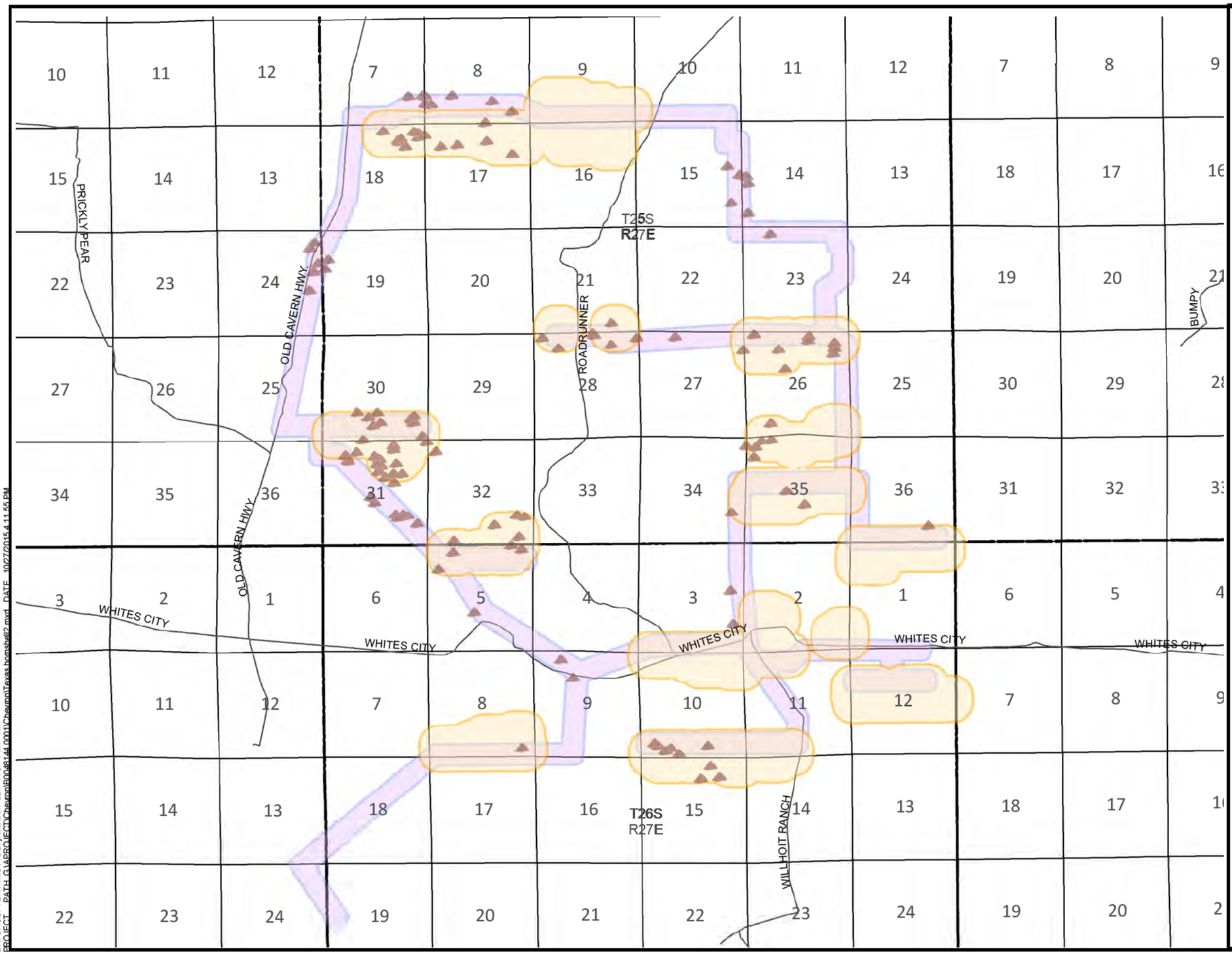
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

SLOPE CONSTRAINTS

ARCADIS

FIGURE
28

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT: PATH: G:\APROJECT\Chevron\B0048144.0001\Chevron1Texas homshell2.mxd DATE: 10/24/2015 4:04:35 PM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- Hill

0 1 2
Miles

CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

HILLTOPS OR STEEP SLOPES

ARCADIS

FIGURE
29

DIV/GROUP: ENV/IMDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH: G:\APROJECT\Chevron\B0048144.0001\Chevron\Texas.hornshell2.mxd DATE 10/27/2015 4:11:55 PM

APPENDIX A

Visual Contrast Rating

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date: 10/02/2015
District: Pecos Valley
Resource Area: Carlsbad Field Office
Activity (program): Oil & Gas Development

SECTION A. PROJECT INFORMATION

1. Project Name: Hayhurst Development Area
2. Key Observation Point: White City
3. VRM Class: Class IV
4. Location: Township T25S,T26S; Range R27E; Section
5. Location Sketch: Exhibit#2 Location Verification Map

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LANDWATER	2. VEGETATION	3. STRUCTURES
FORM	Flat to rolling terrain	Steep / moderate / gentle	Contrasting / compatible
LINE	Horizontal & Diagonal	Undulating / flowing	Cylindrical
COLOR	Dark greens, browns, and tans	Hues- yellow, brown, green	Shale green / tan / black
TEXTURE	Smooth / rough	Smooth / rough / Dense / sparse	Scattered

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LANDWATER	2. VEGETATION	3. STRUCTURES
FORM	Flat (pad) Rolling (roads and ROW)	Bold / definite / transparent	Cylindrical, geometric & angular
LINE	Horizontal (pad) Curved (road)	Regular / irregular	Vertical, horizontal & angular
COLOR	Tan	Light to medium green	Shale green
TEXTURE	Smooth	Patchy	Glossy / matte

SECTION D. CONTRAST RATING ☐ SHORT TERM ☐ LONG TERM

1. DEGREE OF CONSTRAST

ELEMENTS	FEATURES: LANDWATER BODY (1)				VEGETATION (2)				STRUCTURES (3)			
	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None
Form			✓				✓			✓		
Line			✓				✓			✓		
Color			✓				✓				✓	
Texture			✓				✓			✓		

2. Does project design meet visual resource Management objectives? ☒ Yes ☐ No (Explain on reverse side)

3. Additional mitigating measures recommended? ☐ Yes ☒ No (Explain on reverse side)

Evaluator's Names: Jennifer Van Curen
Date: 10/02/2015

SECTION D. (Continued)

Comments from item 2.

The project, as modified by successful implementation of mitigation measures, should result in a moderate level of change to the characteristic landscape. Management activities may attract attention and may dominate the view of the casual observer, but is still mitigated. The project will meet VRM Class IV objectives.

Additional Mitigating Measures (See item 3)

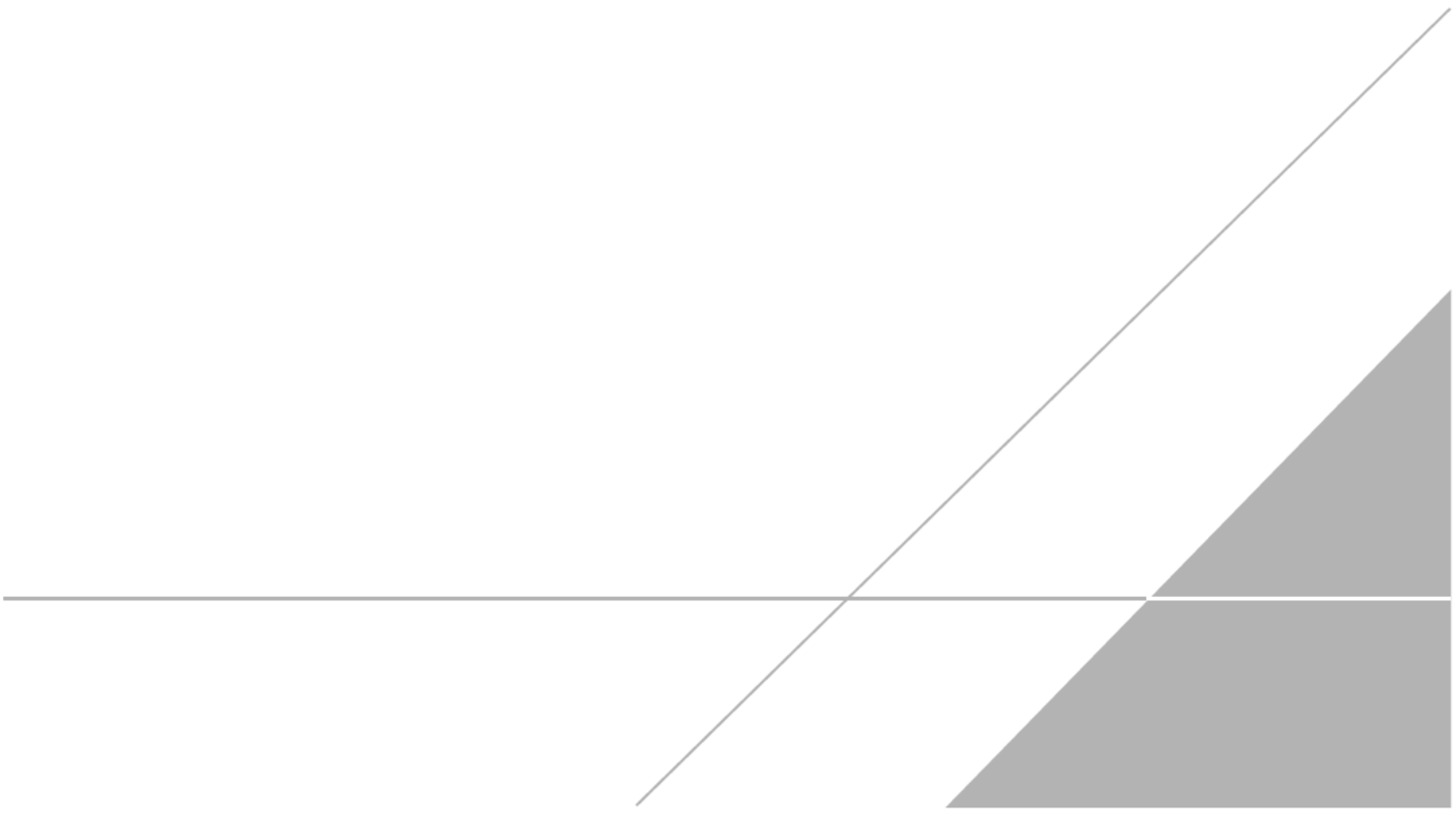
Per EA#:

Lease #: Leases entered here in table- COA stipulations document

U.S. GOVERNMENT PRINTING OFFICE: 1985-461-988/33094

APPENDIX B

Glossary



GLOSSARY

ACQUIRED LANDS. Lands in Federal ownership which were obtained by the government through purchase, condemnation, gift, or exchange.

ACRE-FOOT (AC-FT). Volume of water that will cover one acre of land to a depth of one foot; equals 43,560 cubic feet or 325,851 gallons.

AERIAL PHOTOGRAPHY. Photographs taken of the earth's surface from an aircraft. Both color and infra-red aerial photos can be produced which show surface features. Photographs can indicate vegetation changes and water content associated with fractures where caves may be located.

AGGREGATE. Any of several hard, inert materials, such as sand, gravel, slag, or crushed stone, used for mixing with a cementing or bituminous material to form concrete, mortar, or plaster, or used alone, as in railroad ballast or graded fill.

AIR POLLUTION. The general term alluding to the undesirable addition of substances (gases, liquids, or solid particles) to the atmosphere that are foreign to the natural atmosphere or are present in quantities exceeding natural concentrations.

ALLOTMENT. An area of land designated and managed for grazing of livestock.

ALLOTMENT MANAGEMENT PLAN (AMP). A livestock grazing activity plan for a specific allotment based on multiple-use resource management objectives. The AMP considers livestock grazing in relation to other uses of the rangelands and in relation to renewable resources (i.e., watershed, vegetation and wildlife). An AMP includes the seasons of use, number of livestock permitted on the allotment, grazing system, and the rangeland developments needed. AMPs are prepared in consultation, cooperation and coordination with the permittee(s), lessee(s) or other involved affected parties.

ANIMAL UNIT MONTH (AUM). The amount of forage necessary for the sustenance of one cow with a nursing calf or its equivalent for a period of one month.

ANNUAL WATER YIELD. The total stream flow volume that passes a specified point in a watershed during a year. It generally equals total precipitation and irrigation, less evapotranspiration losses and deep seepage losses.

AREAS OF CRITICAL ENVIRONMENTAL CONCERN (ACEC). Areas within the public land where special management attention is needed to protect and prevent irreparable damage to important historical, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and provide safety from natural hazards.

AVOIDANCE AREA. An environmentally sensitive area where rights-of-way would be granted only in cases where there is a prevailing need and no practical alternative location exists, and then only with appropriate provisions to protect the sensitive environmental components.

BERM. An embankment or mound of earth or other material. Examples of the use of a berm include use around a tank battery in an oil field to contain spilled fluids or as a barrier across a road or trail to prohibit travel by motor vehicles.

BEST MANAGEMENT PRACTICE (BMP). Methods, measures, or practices selected on the basis of site specific conditions to ensure environmental quality will be maintained or restored to its highest practicable level. BMPs include, but are not limited to structural and nonstructural controls, operations, and maintenance procedures. BMPs can be applied before, during, or after activities to reduce or eliminate impacts to soil, air, water, or vegetation resources.

BIODIVERSITY. Refers to the variety of life and its processes and includes the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur.

CALICHE. A brown or white material commonly found as a subsoil deposit in and or semi-arid climates which is composed largely of calcium carbonate.

CAVE. Any naturally occurring void, cavity, recess, or system of interconnected passages which occurs beneath the surface of the earth or within a cliff or ledge (including any cave resource therein, but not including any vug, mine, tunnel, aqueduct, or other manmade excavation) and which is large enough to permit an individual to enter, whether or not the entrance is naturally formed or manmade. The term "cave" includes any natural pit, sinkhole, or other feature which is an extension of the entrance. Refer also to "Significant Cave."

CAVE EXPLORATION. The act of entering a naturally occurring void, cavity, recess or system of interconnected passages which occurs beneath the surface of the earth, ledge, or cliff to investigate, study or analyze contents, hazards and extent; to travel into new territories for adventure or discovery.

CLASSIFICATION OF LANDS. The process of determining whether the lands are more valuable or suitable for transfer or use under particular or various public land laws than for retention in federal ownership for management purposes.

COMMUNITY. A group of plants and animals living together in a common area having close interactions.

COMMUNITY PIT. A site from which nonexclusive disposals of mineral materials can be made.

CONDITION OF APPROVAL (COA). A requirement appended to a use authorization that must be met in order to be in conformance with the authorization. Conditions of approval may be standard practices that are routinely applied or may be special requirements developed through the NEPA process. Conditions of approval usually are applied to mitigate the impacts of an action. Conditions of approval do not modify any rights granted by a lease (e.g., an oil and gas lease).

CONSERVATION (ARCHAEOLOGY). A level of management applied to cultural resources exhibiting uniqueness or relative scarcity of similar cultural properties; research potential that surpasses current state of the art; or singular historic importance or architectural interest.

COORDINATED RESOURCE MANAGEMENT PLAN. A plan for management of one or more grazing allotments that involve all the affected resources, e.g., range, wildlife, watershed, minerals, and recreation.

CORRIDOR. A linear strip of land forming a passageway between two points in which transportation and/or utility systems exist or may be located. A designated corridor is the preferred location for existing and future rights-of-way grants that have been identified by law, by secretarial order, through land use planning, or by other management decision.

CRITICAL HABITAT. Any air, land, or water area, including elements thereof, which have been determined (and published in the *Federal Register*) to be essential to the survival of wild populations of an endangered or threatened species or to be necessary for their recovery to a point at which the measures provided pursuant to the ESA are no longer necessary.

CULTURAL RESOURCE. The fragile and nonrenewable remains of human activity, occupation, or endeavor reflected in districts, sites, structures, buildings, objects, artifacts, ruins, works of art, architecture, and natural features that were of importance in human events. These resources consist of physical remains, areas where significant human events occurred even though evidence of the event no longer remains, and the environment immediately surrounding the actual resource and oral history or ethnographic accounts of life ways and customs.

DESIGNATION. The official identification and naming of a general area or site on public land. Lands may be designated when they are either (1) withdrawn, (2) given special status by act of Congress, or (3) established by an approved land use plan.

DESIGNATED USES. Surface water uses specified by the Water Quality Control Commission for which water quality standards have been established. Designated uses apply whether or not they are being attained.

DESIRED PLANT COMMUNITY (DPC). The plant community which provides the vegetation attributes required for meeting or exceeding RMP vegetation objectives. The DPC must be within an ecological site's capability to produce these attributes through natural succession, management action, or both. A specific description of the vegetation needed to meet the vegetation objectives of a detailed activity plan or implementing action can be described as a desired plant community. Seeding mixtures under DPC would emphasize the use of native species and avoid noxious weeds and exotic species.

DISTRICT. The specific area of public land administered by a District Manager.

DIVERSION. A man-made construction that diverts water from its natural source to be put to beneficial use.

DIVERSITY. The relative degree of abundance of wildlife species, plant species, communities, habitats, or habitat features per unit area.

DRAINAGE. A term used in oil and natural gas extraction meaning the pool of either resource is “drained” or removed either through existing pressure or pumping. These pools may extend beyond the surface ownership boundaries and a well drilled on one surface owner may drain the resource underneath an adjacent surface owner.

ECOSYSTEM. A complex self-sustaining natural system which includes living and nonliving components of the environment and the circulation of matter and energy between organisms and their environment.

ENDANGERED SPECIES (FEDERAL). An animal or plant species whose prospects of survival and reproduction are in immediate jeopardy and in danger of extinction throughout all or a significant portion of its range, as defined by the USFWS under the authority of the Endangered Species Act of 1973, as amended. Whether a species is threatened or endangered is determined by the following factors: (1) present or threatened destruction, modification, or curtailment of its habitat or range; (2) over utilization for commercial, sporting, scientific, or educational purposes; (3) disease or predation; (4) inadequacy of existing regulatory mechanisms; or (5) other natural or human-made factors. Also, see "Threatened Species (Federal)" in the Glossary.

ENDANGERED SPECIES (STATE). Any species or subspecies whose prospects of survival or recruitment in New Mexico are in jeopardy. Also, see "Threatened Species (State)" in the Glossary.

ENVIRONMENTAL ASSESSMENT (EA). The procedure for analyzing the impacts of some proposed action on a given environment and the documentation of that analysis. An EA is similar to an environmental impact statement (EIS) but is generally smaller in scope. An EA may be preliminary to an EIS.

ENVIRONMENTAL IMPACT STATEMENT (EIS). The procedure for analyzing the impacts (both beneficial and adverse) of a proposed action on a given environment, and the documentation of that analysis.

EXCEPTION. Case-by-case exemption from a lease stipulation. The stipulation continues to apply to all other sites within the leasehold to which the restrictive criteria apply.

EXCHANGE. A trading of public land (surface or subsurface estates) that usually does not have high public value, for lands in other ownerships which do have value for public use, management and enjoyment. The exchange may be for the benefit of other Federal agencies as well as the BLM.

EXCLUSION AREAS. Areas where future rights-of-way may be granted only when mandated by law.

EXTENSIVE RECREATION MANAGEMENT AREA (ERMA). Areas where recreation is unstructured and dispersed and where minimal recreation-related investments are required. ERMAs provide recreation visitors the freedom of choice with minimal regulatory constraint. These areas consist of the remainder of land areas not included in Special Recreation Management Areas within a District or Field Office area.

FEDERAL CAVE RESOURCES PROTECTION ACT (FCRPA) OF 1988. The purposes of this act are (1) to secure, protect, and preserve significant caves on Federal lands for the perpetual use, enjoyment, and benefit of all people; and (2) to foster increased cooperation and exchange of information between governmental authorities and those who utilize caves located on Federal lands for scientific, education, or recreational purposes.

FEDERAL LAND. Land owned by the United States and administered by the Federal government. Federal land includes public land (see Public Land in the Glossary).

FEDERAL LAND POLICY AND MANAGEMENT ACT (FLPMA) OF 1976. Public Law 94-579, gives the BLM legal authority to establish public land policy; to establish guidelines for administering such policy; and to provide for the management, protection, development, and enhancement of the public land. Often referred to and pronounced "flipma."

FEDERAL RESERVED WATER RIGHT. A water right which is reserved by the Federal government when land is withdrawn from the public domain for a particular purpose, such as National parks, forests, and monuments. The amount of water reserved is only that necessary to fulfill the intended purpose.

FIELD OFFICE. The smallest administrative subdivision of a BLM district. A Field Office is administered by a Field Manager and is the equivalent of a resource area.

FIRE MANAGEMENT UNIT (FMU). A land management area definable by objectives, management constraints, topographic features, access, values to be protected, political boundaries, fuel types, major fire regime groups, etc.

that set it apart from the characteristics of an adjacent FMU. The FMU may have dominant management objectives and pre-selected strategies assigned to accomplish these objectives.

FLOODPLAIN. See "One Hundred-Year Floodplain" in the Glossary.

FLOWLINE. The surface pipe through which oil, water, or gas travels from a well to processing equipment or to storage.

FRAGILE SOIL. A soil that is easily damaged by use or disturbance. Examples include soils that are susceptible to compaction or other mechanic damage to their structure, or soils that are highly erodible when disturbed.

GEOGRAPHIC INFORMATION SYSTEM (GIS). Through the use of computer technology, GIS allows the input, storage, analysis, and display of a great volume and variety of physically locatable data (i.e., data which is known to exist at some specific place or area on the ground).

GRANT. A gift of public land either in quantity or in place. Also, the document or the action which conveys land or an interest in land.

GRAZING CAPACITY. The maximum livestock stocking rate possible without inducing damage to vegetation or related resources such as watershed. This incorporates factors such as suitability of the rangeland for grazing a well as the proper use which can be made on all of the plants within the area. Normally expressed in terms of acres per animal unit month (AC/AUM) or sometimes referred to as the total AUMs that are available in any given area, such as an allotment. Areas that are unsuitable for livestock use are not computed in the grazing capacity. Grazing capacity may or may not be the same as the stocking rate.

GRAZING DISTRICT. Means the specific area within which the public land are administered under Section 3 of the Taylor Grazing Act. Public land outside grazing district boundaries is administered under Section 15 of the Taylor Grazing Act.

GROUND WATER. Subsurface water contained in interconnected pores between soil or rock particles in a zone of saturation. Groundwater includes underground lakes and streams in karst areas.

HABITAT. The place where an animal or plant normally lives during its life cycle often characterized by dominant food, cover, water, and space (e.g., the stream habitat, the forest habitat).

HABITAT MANAGEMENT PLAN (HMP). A written and officially approved plan for a specific geographical area of public land which identifies wildlife habitat and related objectives, establishes the sequence of actions for achieving objectives, and outlines procedures for evaluating accomplishments.

HAZARDOUS MATERIAL. Any substance posing a threat to the health or safety of persons or the environment. These includes but is not limited to RCRA hazardous wastes, CERCLA and CWA hazardous substances, DOT hazardous materials, OSHA hazardous chemicals, SRA Title III toxics and extremely hazardous substances, and biological and disease-causing agents.

HISTORICAL USE. The average of the highest two use seasons in the preceding five-year period.

INFORMATION (ARCHAEOLOGY). A level of management applied to cultural resources. Most sites fall into this category and would be studied for the information that could be retrieved from them. The process of extracting information often destroys the site. These sites could be lithic scatters, campsites and other types of sites.

INTERMITTENT STREAM. A stream that does not flow year round but has some association with ground water for surface or subsurface flows.

KARST. A landform where the topography has been formed chiefly by the dissolving of rock. In some cases, the dissolving of rock may be extensive enough to form passages through which an individual could pass. Surface expressions include sinking streams, swalletts, springs and resurgences, and the presence of sinkholes and caves. Surface streams are few, with most of the drainage being underground. These features are important for groundwater recharge of karst systems.

LEASABLE MINERALS. See Mineral Materials.

LEASE. An authorization to possess and use public land for a fixed period of time (usually long-term). Also, any contract, profit-share arrangement, joint venture, or other agreement issued or approved by the United States Government under a mineral leasing law that authorizes exploration for, extraction of, or removal of oil and gas resources.

LEASE NOTICE. An attachment to an oil and gas lease that transmits information at the time of lease issuance to assist a lessee in submitting acceptable plans of operation, or to assist in administration of leases. A Lease Notice is used to disclose a situation or condition known to exist that could affect lease operations. Lease Notices are not a basis for denial of lease operations.

LEGAL ACCESS. In the context of access to public land, especially public land tracts that may be adjacent to or surrounded by land of other ownerships, legal access exists when a person can reach a given public land tract without trespassing, such as from a public road or highway, or from another tract of public land. (See "Physical Access.")

LENTIC. Pertaining to static, calm, or slow moving water or aquatic habitats, such as a marsh.

LOCATABLE MINERALS. Minerals subject to disposal and development through the Mining Law of 1872 (as amended). Includes all "valuable mineral deposits" including metallic and nonmetallic minerals such as gold, lead, barite, fluorspar or high calcium limestone. It also includes uncommon varieties of sand, stone, gravel, cinders, pumice, pumicite and clay. Also included are all valuable minerals that are not excluded under the leasable and salable minerals.

MANAGEMENT FRAMEWORK PLAN (MFP). A planning decision document now replaced by RMPs that establishes for a given planning area land use allocations, coordination guidelines for multiple use, and management objectives to be achieved for each class of land use or protection.

MINERAL MATERIALS. Minerals such as common varieties of sand, stone, gravel, pumice, pumicite and clay which are not obtainable under the mining or leasing laws but which can be obtained under the Materials Act of 1947, as amended. Also known as saleable minerals.

MODIFICATION. A fundamental change in the provisions of a lease stipulation, either temporarily or for the term of the lease. A modification may, therefore, include an exemption from or an alteration to a stipulated requirement. Depending on the specific modification, the stipulation may or may not apply to all other sites within the leasehold to which the restrictive stipulation applies.

NATIONAL REGISTER OF HISTORIC PLACES. A list of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, and culture.

NONCOMMERCIAL USE. A recreational activity on public land or related waters where actual expenses are shared equally among all members or participants. Any person, group, or organization seeking to qualify as noncommercial must establish to the satisfaction of BLM that no financial or business gain will be derived from the proposed use. Fund raising, for any purpose, renders an activity a commercial use.

NONPOINT SOURCE POLLUTION (NPS). The alteration of waters by activities not regulated as point sources, which degrade the quality or adversely affect the biological community inhabiting the waters.

NO SURFACE OCCUPANCY (NSO). A condition of surface use attached to a lease or other authorization applied to minerals exploration and development which prohibits occupancy of only the land surface or to protect other identified resource values.

NOXIOUS WEED. A plant that causes disease or has other adverse effects on the human environment and is, therefore, detrimental to the agriculture and commerce of the United States and public health. Generally, noxious weeds possess one or more of the characteristics of being aggressive and difficult to manage, parasitic, a carrier or host of harmful insects or disease, and being either native, new to, or not common in, the United States. In most cases, however noxious weeds are normative species. Noxious weeds are designated and regulated by various state and Federal laws.

OCCUPIED RAPTOR NEST. An occupied raptor nest is defined as a large stick nest with the observation of one or more raptors within the nest or within the immediate vicinity of the nest and/or evidence of raptor occupation (e.g. recent nest material, prey remains) during the breeding season (March – June).

ONE HUNDRED-YEAR FLOOD. The flood that will be equaled or exceeded an average of once every 100 years; i.e. the flood that has a one percent chance of being equaled or exceeded in any given year.

ONE HUNDRED-YEAR FLOODPLAIN. The area adjacent to a stream or body of water that would be inundated at the peak of the one hundred-year flood. The floodplain delineated on Flood Insurance Rate Maps (FIRMS) or Flood Hazard Boundary Maps (FHBMS) published by the Federal Emergency Management Agency will be used for management purposes. When a FIRM or FHBM map is not available for the area of interest, the best available information will be used.

OPERATING PLAN. An applicant's/permittee's plan to conduct their activity or event on public lands or related waters in conjunction with a Special Recreation Permit. An operating plan will describe at a minimum how services will be delivered, how an event will be conducted, and describes measures that will be implemented to protect resources and provide for public health and safety.

PERENNIAL STREAM. Surface water normally flows throughout the year except during infrequent years of drought.

PERMIT (GRAZING). A document authorizing use of the public land within grazing districts under Section 3 of the Taylor Grazing Act for the purpose of grazing livestock.

PERMIT. An authorization, revocable by or at the discretion of BLM, to utilize public lands for a fixed period of time. A permit conveys no possessory interest in the land.

PERMITTEE. An individual, group or organization who has fulfilled all the requirements for and has been awarded a permit.

PETROGLYPH. A form of rock art manufactured by incising, scratching, or pecking designs into rock surfaces.

PHYSICAL ACCESS. In the context of access to public land, especially public land tracts that may be adjacent to or surrounded by land of other ownerships, physical access exists when a person can physically reach a given public land tract. The existence of physical access does not always mean that legal access exists. In some cases, taking advantage of physical access may involve trespass. (See "Legal Access.")

PIPELINE. A system of connected lengths of steel or plastic pipe, laid either in the earth or on the surface that is used for transporting petroleum, petroleum products, chemicals, natural gas, or other fluids.

PLAYA. A shallow, nearly level, often saline, dry lake bed. Playas vary considerably in materials, salinity, and hydrologic regime. In general, playas: (1) collect surface runoff in closed basins; (2) are poorly vegetated; (3) are ephemerally flooded; and (4) have a thin surface of non-gravelly, fine-textured sediment.

PRECIPITATION. Any or all forms of water particles, liquid or solid, which fall from the atmosphere and reach the ground.

PRESCRIBED FIRE. Any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan must exist, and NEPA requirements (where applicable) must be met, prior to ignition.

PUBLIC LAND. Any land and interest in land owned by the United States within the several states and administered by the Secretary of the Interior through the Bureau of the Land Management, without regard to how the United States acquired ownership, except (1) land located on the Outer Continental Shelf; and (2) land held for the benefit of Indians, Aleuts, and Eskimos.

PUBLIC VALUES AND INTERPRETATION (ARCHAEOLOGY). A level of management of cultural sites which contribute to the belief systems and folkways of a cultural group such as locations having religious significance. Public interpretive sites would have qualities that would lend themselves to being utilized as recreation, education, and interpretive areas.

RANGE IMPROVEMENT. An authorized activity or program on or relating to rangelands which is designed to improve production of forage; range vegetative composition; control patterns of use; provide water; stabilize soil and water conditions; and provide habitat for livestock, wild horses or burros, and wildlife. The term includes, but is not limited to structures, treatment projects, and use of mechanical means to accomplish the desired results.

RANGELAND. Land used for grazing by livestock and big game animals on which the vegetation is dominated by grasses, grass-like plants, forbs, or shrubs.

RAPTOR. A bird of prey, such as an eagle, hawk, or owl.

RECLAMATION. The reconstruction of disturbance by returning the land to a condition approximate or equal to that which existed prior to disturbance, or to a stable and productive condition compatible with the land use plan. The immediate goal of reclamation is to stabilize disturbed areas and protect both disturbed and adjacent undisturbed areas from unnecessary degradation.

RECREATION AREA/SITE. An area of recreation may be a site, complex of sites, or a high impact recreation area that, at a minimum, meets all of the conditions in REA Chapter 3(f)(4)(A-D). Further Definition: High-Impact Recreation Area, Geographic area, or Waterway Corridor: A high impact recreation area or geographic area or waterway corridor of concentrated recreation use which includes a variety of developed sites providing a similar recreation opportunity. High-impact recreation areas incur significant expenditures for restoration, public safety, sanitation facilities,

education, maintenance, and other activities necessary to protect the health and safety of visitors, cultural resources and the natural environment. They may contain sub-areas of little development and use which results in environmental impacts such as noticeable litter, vandalism, soil compaction, or erosion. These areas require intensive management to enhance visitor experiences, address environmental impacts, and manage conflicting uses. An area of high recreation impact is not an administrative unit such as a National Forest, BLM Field Office, or Reclamation Project.

In addition, it is contiguous areas directly associated with a clearly identified special, natural, or cultural features, place or activity that is the focal point of recreation use and have clearly defined access points and clearly described area boundaries.

Typically, a high impact recreation area is comprised of a complex of individual sites and displays one or more of the following characteristics:

(1) Has a population of one million or more within two hours of driving time;

(2) Contains rivers, streams, lakes or interpreted scenic byways corridors;

(3) Designed and conducted to maintain or enhance the recreational opportunities through Natural Resource Management Activities;

(4) Has regionally or nationally recognized recreation resources; and

(5) Is regionally or locally marketed for its tourism value.

RELATED WATERS. Waters which lie directly over or adjacent to public lands and require some management control to protect federally administered resources or to provide for enhanced visitor safety.

RESOURCE MANAGEMENT PLAN (RMP). A written land use plan that outlines BLM's decisions and strategies for management of the resources in a particular area. The RMP has been used by the BLM since 1980.

RESTRICTED AREAS. Areas where mitigation such as seasonal restrictions is required to protect resource values.

RURAL (R). Areas with recreation opportunities to experience affiliation with individuals and groups are prevalent as is the convenience of sites and opportunities. These factors are generally more important than the natural setting. Opportunities for wild land challenges, risk taking, and testing of outdoor skills are unimportant, except in activities involving challenge and risk.

RIGHT-OF-WAY (ROW). The legal right for use, occupancy, or access across land or water areas for a specified purpose or purposes. Also, the lands covered by such a right. Examples are roads, power lines, pipelines, water wells, and communication sites. It does not grant an estate of any kind.

RIPARIAN AREAS. Riparian areas are a form of wetland transition between permanently saturated wetlands and upland areas. These areas exhibit vegetation or physical characteristics reflective of permanent surface or subsurface water influence. Lands along, adjacent to, or contiguous with perennially and intermittently flowing rivers, and streams, glacial potholes, and the shores of lakes and reservoirs with stable water levels are typical riparian areas. Excluded are such sites as ephemeral streams or washes that do not exhibit the presence of vegetation dependent upon free water in the soil.

RIPARIAN AREA. A riparian area is an area of land occurring adjacent to streams, rivers, and other water bodies that is directly influenced by water. A riparian community is characterized by certain types of vegetation, soils, hydrology, and fauna and requires free or unbound water or conditions more moist than normally found in the area. Excluded are such sites as ephemeral streams or washes that do no exhibit the presence of vegetation dependent on free water in the soil.

SEDIMENT YIELD. A quantitative measure of the total sediment outflow from a watershed over a given period of time at a specified point in the channel. Sediment yield is the difference between the total erosion from slopes, channels, and mass wasting, and the amount of sediment deposited before reaching the specified point in the channel.

SEEPS. Is where ground water percolates to the surface and forms a saturated area.

SIGNIFICANT CAVE. A cave located on federal lands that possesses one or more of the following features, characteristics, or values (1) Biota; (2) Cultural; (3) Geologic / Mineralogic / Paleontologic; (4) Hydrologic; (5) Recreational; (6) Educational or Scientific.

SIGNIFICANT KARST. An area in which sinkholes or other features, such as lineaments, provide points of recharge to an aquifer that is the source of water for human, livestock, or wildlife use, or which provides a primary recharge zone for cave-related hydrologic systems.

SINKHOLE. A closed depression formed when the ground surface collapses above voids created by the solution of carbonate or evaporate rocks. Water levels typically fluctuate rapidly in sinkholes because of their close connection to groundwater.

SLOPE. The inclination of the land surface to the horizontal. When expressed as a percent, slope equals the change in elevation divided by the horizontal distance, with the result multiplied by 100 percent. Thus, a slope of 20 percent is a change in elevation of 20 feet for every 100 feet horizontally.

SPECIAL AREAS. Designated by statute, Executive, or Secretarial order, State Director special rule making authority, or an area covered by joint agreement between BLM and a State under Title II of the Sikes Act (16 U.S.C. 670a et seq.).

SPECIAL HABITAT FEATURE. A specific component of a habitat site requiring individual consideration, including geological anomalies (cliffs), aquatic situations (seeps), or manmade structures (windmill). A feature may be present in the habitat site because of animal use (booming grounds). Special habitat features may affect wildlife positively or negatively.

SPECIAL MANAGEMENT AREAS. An area containing one or a combination of unique resources or values that receive more intensive management (e.g., ACECS, WSAS, and SRMAS.)

SPECIAL STATUS SPECIES. Wildlife and plant species either Federally-listed or proposed for listing (candidates) as endangered or threatened, State-listed species, or BLM determined priority species (sensitive species).

SPRING. Where water is discharged from a fixed point and the flow usually forms a small channel.

SOLID LEASABLE MINERALS. The chlorides, sulfates, carbonates, borates, silicates or nitrates of potassium or sodium and related products; Sulphur in the States of Louisiana and New Mexico and on all acquired lands; phosphate, including associated and related minerals; asphalt in certain lands in Oklahoma; and gilsonite (including all vein-type solid hydrocarbons).

STATE APPROPRIATIVE WATER RIGHT. A water right licensed by the New Mexico State Engineer once proof of beneficial use is established.

STATE HISTORIC PRESERVATION OFFICER (SHPO). A position within State governments responsible for coordinating State participation in the implementation of the National Historic Preservation Act. This officer serves as an assistant and consultant when identifying cultural properties, assessing effects to them, and considering alternatives to avoid or reduce those effects.

STIPULATION. A requirement, usually dealing with protection of the environment that is made a part of a lease, grant, or other authorizing document. In the case of oil and gas leases, a provision that modifies standard lease rights and is attached to and made a part of the lease. Also, refer to "CONDITION OF APPROVAL" in the Glossary.

The following represent the major stipulations on BLM land:

No Surface Occupancy Stipulation (NSO): A stipulation in which use or occupancy of the land surface for fluid mineral exploration or development is prohibited to protect identified resource values.

Timing Limitation Stipulation: A stipulation which prohibits surface use during specified time periods to protect identified resource values. This stipulation does not apply to the operation and maintenance of production facilities unless the findings of analysis demonstrate the continued need for such mitigation and that less stringent, project specific mitigation measures would be insufficient.

SUITABILITY. The adaptability of an area to grazing by livestock or wildlife.

SUITABLE RANGE. Rangeland that is accessible to livestock, which can be grazed on a sustained yield basis without damaging the resource.

SURFACE DISTURBANCE. Any action that removal of soil or vegetation and expose the mineral soil to erosive processes. Used in the literal context of actual, physical disturbance and movement or removal of the land surface and vegetation.

SURFACE USE PLAN OF OPERATIONS (SUPO). The purpose of a Surface Use Plan of Operations (SUPO) is to manage development so that impacts to special status species habitat are minimized or eliminated. A SUPO would incorporate applicable best management practices and disclose all future well locations; the location and arrangement of well infrastructure (e. g., tank batteries, compressors, power lines and poles); road locations; and rights-of-way. Surface Use Plan of Operations (SUPO) contain proprietary information and therefore are not subject to disclosure under the Freedom of Information Act.

SURFACE WATER. All water located at the surface of the land, such as streams, rivers, and lakes.

THREATENED SPECIES (Federal). Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Whether a species is threatened or endangered is determined by the following factors: (1) present or threatened destruction, modification, or curtailment of its habitat or range; (2) over utilization for commercial, sporting, scientific, or educational purposes; (3) disease or predation; (4) inadequacy of existing regulatory mechanisms; or (5) other natural or human-made factors. Also, see "Endangered Species (Federal)" in the Glossary.

THREATENED SPECIES (State). Any species or subspecies that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range in New Mexico. Also, see "Endangered Species (State)" in the Glossary.

VALUE. As used in the RMP/EIS, a value refers to a natural resource or characteristic of a natural resource that is not usually a commodity or is difficult to quantify in terms of a unit of measurement. Examples of values in this context are listed in FLPMA and include scientific, scenic, air and atmospheric, historical, archeological and ecological resources.

VEGETATION TREATMENTS. Methods used to manage the growth and spread of vegetation. A vegetative management practice can either be a direct management of the vegetation itself, for example prescribed fire or indirect management like a change in the number of livestock utilizing the vegetation, or a change in the time frames when livestock are utilizing the vegetation.

VISUAL RESOURCES MANAGEMENT (VRM). The inventory and planning actions taken to identify visual values and to establish objectives for managing those values; and the management actions taken to achieve the visual management objectives.

VISUAL RESOURCE MANAGEMENT (VRM) CLASSES. VRM classes are based on relative visual ratings of inventoried lands. Each class describes the different degree of modification allowed to the basic elements of the landscape. The following are the minimum management objective for each class:

Class 1: Natural ecological changes and very limited management activity are allowed. Any contrast created within the characteristic landscape must not attract attention. This classification is applied to

Visual Areas of Critical Environmental Concern, wilderness areas, wild and scenic rivers, and other similar situations.

Class II: Changes in any of the basic elements (form, line, color, texture) caused by a management activity should not be evident in the landscape. A contrast may be seen but should not attract attention.

Class III: Contrasts to the basic elements caused by a management activity may be evident and begin to attract attention in the landscape. The changes, however, should remain subordinate in the existing landscape.

Class IV: Contrasts may attract attention and be a dominant feature in the landscape in terms of scale. However, the changes should repeat the basic elements of the landscape.

Rehabilitation Area: Change is needed or change may add acceptable visual variety to an area. This class applies to areas where the naturalistic character has been disturbed to a point where rehabilitation is needed to bring it back into character with the surrounding landscape. This class would apply to areas identified in the scenic evaluation where the quality class has been reduced because of unacceptable cultural modification. The contrast is inharmonious with the characteristic landscape. It may also be applied to areas that have the potential for enhancement; i.e., add acceptable visual variety to an area or site. It should be considered an interim or short term classification until one of the other VRM class objectives can be reached through rehabilitation or enhancement. The desired visual resource management class should be identified.

WATER QUALITY STANDARD. Regulations which specify designated uses for surface waters of the state, and water quality criteria to protect those uses. Standards are specified by the Water Quality Control Commission, in accordance with Section 303 of the Clean Water Act.

WETLANDS. Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support and which, under normal circumstances, do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include marshes, shallows, swamps, lake shores, bogs, muskegs, wet meadows, estuaries, and riparian areas.

WILDFIRE. An unplanned, unwanted wildland fire including unauthorized human caused fires, escaped wildland fire use events, escaped prescribed fire projects, and all other wildland fires where the objective is to put the fire out.

WILDFIRE SUPPRESSION. An appropriate management response to wildfire, escaped wildland fire use or prescribed fire that results in curtailment of fire spread and eliminates all identified threats from the particular fire.

WILDLAND FIRE. Any non-structure fire that occurs in the wildland. Three distinct types of wildland fire have been defined and include wildfire, wildland fire use, and prescribed fire.

WILDLIFE. Includes all species of animals, birds, mammals, mollusks, crustaceans, amphibians, fish, insects, reptiles, or their progeny or eggs which, whether raised in captivity or not, are normally found in a wild state.

WITHDRAWAL. Removal or withholding of public land, by statute or secretarial order, from operation of some or all of the public land laws. A mineral withdrawal is the closing of an area to mineral location and development activities. A mineral withdrawal includes public lands potentially valuable for solid leasable minerals, precluding the disposal of the lands except with a mineral reservation clause unless the lands are found not to contain a valuable deposit of minerals.

APPENDIX C

References

REFERENCES

Adams, J.W., J.W. Hawley, L. Pray, and D.W. Love. 1993. Second-day road log from Carlsbad to Whites City, Guadalupe Mountains National Park, Salt Flat, Washington Ranch and return to Carlsbad. New Mexico Geological Society, Field Conference Guidebook 44:43–67.

Bednarz, J. 1975. A Study of the Pecos Gambusia. Unpublished report for Endangered Species Program, New Mexico Department of Game and Fish, Santa Fe.

Brown, K.L., M. Graham, H.C. Higgins, T.G. McEnany, S. Owens, and M. Quirola. 2010. Permian Basin Project: Ethnographic and Archaeological Inventory with the Mescalero Apache Tribe of Potential Traditional Cultural Properties in the Vicinity of the Permian Basin MOA, BLM Pecos District, Eddy County, New Mexico.

Brown, M.E. (ed.). 2011. The Boot Hill Site (LA 32229): An Oasis in the Desert, Eddy County, New Mexico.

Bureau of Land Management (BLM). 1978. Wilderness Inventory Handbook: Policy, Direction, Procedures, and Guidance for Conducting Wilderness Inventory on Public Lands. Washington D.C: Bureau of Land Management.

BLM. 1986. Visual Resource Inventory Handbook: H-8410-1. Washington D.C: Bureau of Land Management.

BLM. 1988. Carlsbad Resource Management Plan. Roswell, New Mexico: Bureau of Land Management Roswell District.

BLM. 1997. Carlsbad Approved Resource Management Plan Amendment and Record of Decision. Carlsbad, New Mexico: Government Printing Office.

BLM. 2001a. New Mexico Standards for Public Land Health and Guidelines for Livestock Grazing Management, Record of Decision. January 2001, U.S. Department of the Interior, Bureau of Land Management.

BLM. 2001c. H-4180-1 – Rangeland Health Standards. Washington D.C: Bureau of Land Management.

BLM. 2010a. New Mexico's Permian Basin Cumulative Air Quality Impact Analysis--Draft Emissions inventory. Carlsbad, New Mexico: Bureau of Land Management.

BLM. 2010c. Carlsbad Field Office Allotment Master Report. Rangeland Administration System. Bureau of Land Management, June 2010. Available at: http://www.blm.gov/ras/.

BLM. 2012a. BLM Manual 6310—Conducting Wilderness Characteristics Inventory on BLM Lands (Public). Available at: http://www.blm.gov/pgdata/etc/medialib/blm/wo/Information_Resources_Management/policy/blm_manual.Par.38337.File.dat/6310.pdf.

Carmen, S.M. 2007. Texas Hornshell Popenaias popeii Recovery Plan. Santa Fe, New Mexico: New Mexico Department of Game and Fish, Conservation Services Division.

Federal Register/Volume 44 No. 217 Wednesday November 7, 1979, 64741. 50 CFR Part 17. Endangered and Threatened Wildlife and Plants: determination that Coryphantha sneedii is an Endangered Species.

Federal Register. Vol. 46, No.12. January 19, 1981. 50 CFR Part 17. Endangered and Threatened Wildlife and Plants: Determination of Two New Mexico Plants to be Endangered Species and Threatened Species, with Critical Habitat.

Federal Register/Volume 55 No. 60 Wednesday March 28, 1990, 11413. 50 CFR Part 17. Endangered and Threatened Wildlife and Plants: Finding on a Petition to List the Mexican Spotted Owl as Threatened or Endangered.

Federal Register/Volume 58 No. 49 March 16, 1993, 14248-14271. 50 CFR 17. Endangered and Threatened Wildlife and Plants: Final Rule to List the Mexican Spotted Owl as a Threatened Species.

Federal Register/Volume 60 No. 133 Wednesday July 12, 1995, 36000. 50 CFR 17. Endangered and Threatened Wildlife and Plants: Final Rule to Reclassify the Bald Eagle from Endangered to Threatened in All of the Lower 48 States.

Federal Register/Volume 71 No. 143 Wednesday July 26, 2006, 42298. 50 CFR Part 17. Endangered and Threatened Wildlife and Plants: Establishment of a Nonessential Experimental population of Northern Aplomado Falcons in New Mexico and Arizona.

Hill, C.A., 1996, Geology of the Delaware Basin, Guadalupe, Apache and Glass Mountains: New Mexico and West Texas: Permian Basin Section: Midland, Texas, SEPM, 480 p.

King, P.B. 1949. Regional Geologic Map of Parts of Culberson and Hudspeth Counties, Texas. United States Geological Survey Oil and Gas Investigations Preliminary Map 90. 1 sheet. Scale 1:50,000.

Knight, P.J. 1993. A Status Review of Gypsum Wild Buckwheat. Submitted to U.S. Fish and Wildlife Service, Region 2, Albuquerque.

Morgan, J.A., D.G. Milchunas, D.R. LeCain, M. West, and A.R. Mosier. 2007. Carbon dioxide enrichment alters plant community structure and accelerates shrub growth in the shortgrass steppe. Proceedings of the National Academy of Sciences (USA) 104:14724–14729.

New Mexico Bureau of Geology and Mineral Resources (NMBGMR). 2003. Geologic Map of New Mexico. Scale 1:500,000.

New Mexico Department of Agriculture (NMDA). 2009. 2009 New Mexico Noxious Weed List Update. Memorandum to the general public. from I. Gonzales. April 1, 2009. Available at http://www.nmda.nmsu.edu/wp-content/uploads/2012/01/weed_memo_list.pdf. Accessed October 19, 2015.

New Mexico Department of Game and Fish (NMDGF). 2004. 2004. Threatened and Endangered Species of New Mexico. 2004 Biennial Review. Santa Fe, New Mexico: New Mexico Department of Game and Fish Conservation Services Division.

Palmer, A.N., and Palmer, M.V. 2009. Caves and Karst of the USA. Huntsville: National Speleological Society, Inc.

U.S. Fish and Wildlife Service. 1984. Gypsum Wild Buckwheat (Eriogonum gypsophilum) Recovery Plan. Albuquerque: U.S. Fish and Wildlife Service, New Mexico Ecological Services Field Office.

U.S. Fish and Wildlife Service. 2007. Gypsum Wild Buckwheat (Eriogonum gypsophilum) 5-Year Review: Summary and Evaluation. Albuquerque: New Mexico Ecological Services Field Office, Region 2.

Vine, J.D. 1963. Surface Geology of the Nash Draw Quadrangle, Eddy County, New Mexico. United States Geological Survey Bulletin 1141-B. 46 pages.

Walter, J.C. 1953. Paleontology of Rustler Formation, Culberson County, Texas. Journal of Paleontology. Vol. 27, No. 5. Pp. 679-702.

APPENDIX D

Resumes

ARCADIS

Education
MS, University of Minnesota, Water Resources Management, 2000
BS, Colorado State University, Natural Resource Management, 1995

Years of Experience
Total - 19
With ARCADIS –2

Ethan Jahnke

Energy Project Manager

Mr. Jahnke has more than 19 years of experience in oil and gas project management, federal regulatory permitting and compliance, NEPA, hydrologic modeling, water sampling and GIS analysis. His project management experience includes coordinating over 80 Federal Plans of Developments/Master Development Plans for large and small oil and gas firms, managing and permitting water resources projects, running his own company for several years and managing numerous oil and gas projects. As a project manager, his duties have included coordinating activities of over twenty personnel and contractors, maintaining project timelines within multi-million dollar budget constraints, overseeing negotiations with federal, state and local governments, and managing data and documentation submittals.

His technical experience includes writing Environmental Assessments (EAs), Master Surface Use Plans and Water Management Plans for federal energy projects, writing Water Resource and Visual Resource sections for EAs and FERC reports, Phase 1 environmental site assessments, permitting oil and gas wells at the state and federal level, NPDES permitting, GIS database creation and management, surface and ground water quality sampling and modeling, beta-testing surface water hydrology models, reservoir impoundment design and baseline data investigations for Environmental Impact Statements (EIS) and EAs. He has worked with large multi-national corporations, small businesses, municipalities, local and state agencies and federal agencies including the BLM, USFS, EPA, USFWS and the DOE.

Category of Experience

Environmental Assessments for Oil and Gas Development in the Rockies

As a Project Manager, he has written or co-written numerous EAs for oil and gas development in Wyoming, Utah and New Mexico. Ethan has worked on a variety of EAs, ranging from projects with high resources value (historic and wildlife) near Adobe Town in southwest Wyoming to tribal land (Navajo) near the Four Corners in Utah to several EAs in southeast New Mexico with issues relating to wildlife and karst.

Federal Permitting Coordinator for Coal-bed Natural Gas Plans of Development in Northeast Wyoming

As an in-house contractor for over five years, he coordinated the federal permitting of over 80 Plans of Developments (precursor of Master Development Plans) entailing over 3,000 well APDs. His duties included coordinating permitting process with the BLM (POD submittal, on-

sites, final submittals and Conditions of Approvals), coordinated with internal operations managers, petroleum engineers, GIS contractors, internal regulatory staff, contract civil engineers, surveyors, archeologists, wildlife biologists, several different federal agencies and other stakeholders from project conception to approval. He also coordinated multiple process and software changes that allowed for better quality control and for more APDs to be submitted in a shorter timeframe. He was actively involved in the creation of a GIS database that is used in the operator's field offices in the United States. He was actively involved with biological and endangered species issues, such as the Greater sage-grouse, and coordinated Conditions of Approval with regulatory agencies.

Environmental, Health and Safety Support to Oil and Gas Operator in Wyoming

As contract manager for the project, he helped coordinate environmental, health and safety services to a small independent oil and gas company operating a producing field in Carbon County, Wyoming. He and staff were integrated into the company and served as their environmental, health and safety department. The work included creation of Bureau of Land Management (BLM) Plans of Developments for numerous federal oil and gas wells, conducting storm water audits, evaluating compliance of air quality program, creating site-specific reclamation plans, creation of water management plan, overseeing wildlife issues, such as sage grouse and raptor surveys, and GIS mapping and database creation of project areas.

Environmental Coordinator for In-Situ Coals Gasification Project

Coordinated the surveying and engineering designs of coal-bed natural gas wells for pilot testing of an in-situ coal gasification project in Northeast Wyoming. He used resources from several field offices to work on multiple aspects of the project, including: surveying, engineering designs, permitting, EHS audits and wildlife surveys. All of this was done under a tight deadline in order to all drilling to occur between timing stipulation periods.

Federal Permitting Coordinator in Coal-Bed Natural Gas Field for a Small Operator

Coordinated the federal permitting a coal-bed natural gas field in Northeast Wyoming consisting of over 90 wells. For the small operator, he permitted and negotiated with the BLM the design and layout of the project. He wrote the Master Surface Use Plan in conjunction with the proposed operator, coordinated the surveying, civil engineering, wildlife surveys. He also worked on the Watershed Management Plan, which included the designing and permitting of stock reservoirs and NPDES discharge permits.

El Creston Molybdenum Mexican Environmental Impact Statement

Wrote water resource section and created GIS maps for a Mexican Environmental Impact Statement of a proposed molybdenum and copper mine near Opodepe, Sonora, Mexico. As well as being the author of the two sections, he was tasked with coordinating the hydrological, technical and geographical data transfer with local consultants and other members of the team located in both Central America and South America. The EIS was eventually put on

hold due to low commodity prices.

Federal Permitting Coordinator and Hydrologist for Coal-Bed Natural Gas Operator

Worked to negotiate with the BLM on the approval of over 500 coal-bed natural gas wells in Northeast Wyoming for a major independent oil and gas firm. He wrote Water Management Plans for federal Plans of Development and coordinated the mapping, field layout, stock reservoir designs, state and federal permitting of stock reservoirs and discharge points through the BLM, COE, State of Wyoming, WDEQ and WSEO. Helped create an Access database for water quality that allowed the user to more closely monitor areas that were near or of non-compliance. This Access information was then placed into a GIS for all users to view and was also used for placement into the biannual Discharge Monitoring Reports required for all discharge permits. As part of the NPDES permitting process, he created a model that predicts the distance discharged water will travel based infiltration, evaporation, soil type and soil saturation.

Hydrological Evaluation and Impact of Coal-Bed Natural Gas on Ford Ranch

Evaluated the potential impact of natural gas wells to natural springs on a large ranch in Northeast Wyoming. A Coal-Bed Natural Gas development of over 40 wells was proposed on a historical ranch that would have added numerous reservoirs and possibly impacted the existing springs and, therefore, how the ranch operates. He proposed an alternative solution to water storage and treatment that was eventually used and became advantageous for the operator and landowner.

Coal-Bed Natural Gas Project Management and Plan on Developments for Small Operator

Oversaw the development of multiple Plans of Developments located in Northeast Wyoming. He managed the federal permitting, which included attaining approved well permits, coordinating wildlife surveys, well surveys, civil engineers, archeologist, reservoir permits, Water Management Plans and Master Surface Use Plans. He also managed the biannual Discharge Monitoring Reports for all of their discharge points.

Federal Energy Resource Commission (FERC) Report for Pipeline

Worked as the lead investigator on ground water and surface water for a FERC report on a gas pipeline in Southwest Wyoming. He was required to gather all necessary hydrological data for area the pipeline was to impact and to write his findings into the technical document. He was also the lead GIS Specialist on this project.

Visual Resources and GIS Mapping Sections for Mid-America Pipeline Company, LLC (MAPL) Western Expansion Project Environmental Assessment

Evaluated and wrote the visual impacts sections of a major pipeline Environmental Assessment traveling through New Mexico, Colorado, Utah and Wyoming. As the lead GIS Specialist on this project, he used GIS tools to analyze both the hydrologic and visual impacts

this major pipeline would bring to arid and semi-arid ecosystems.

Water Resources Section of a Pipeline Environmental Assessment

Evaluated and wrote the hydrologic sections of a pipeline Environmental Assessment located in Southwest Wyoming. He researched existing information for this area and used GIS tools to analyze the hydrology impacts. He was also the lead GIS Specialist on this project.

Hydrologic Modeling the Impact of Urban Development on a Trout System

Analyzed the potential impacts of urban development on a trout stream in Eastern Minnesota using hydrologic models and GIS. He used a beta model that combined ArcView and Soil and Water Assessment Tool (SWAT) and analyzed multiple urban densities and the associated runoff's impact to the existing trout stream. The township used this model to plan for impacts of certain urban density within the watershed of the stream.

Lawn Runoff Study in the Twin Cities, MN

Worked as part of a study that evaluated the relationship of phosphorus fertilizer within storm runoff and the quality of nearby lakes that are used as storage for storm water runoff. He coordinated with over 30 homeowners to allow the placement of sampling units within their yards and the sample pickup after storm events. He also was responsible for sampling nearby lakes and streams and analyzing the samples in a water quality laboratory. This study is now used as an example across many State and local governments to determine the types of fertilizer allowed within their region.

GIS Mapping and Database Creation for Wind Company

Created GIS maps for a start-up wind company in Denver. By collecting and researching through multiple existing GIS layers, he generated maps showing optimal sites for wind farms throughout the Rocky Mountain Region. These layers were based on wildlife habitat, average wind speed, proximity to transmission lines, surface ownership and access.

Lead GIS Specialist for Seismic Environmental Assessments

Worked on multiple Seismic Environmental Assessments for oil and gas projects in the Rocky Mountains as the lead GIS Specialist. His duties included the gathering of layers and shapefiles from multiple sources, the creation of maps and geodatabases and coordinating with multiple project managers.

GIS Environmental Atlas

Managed the creation of a GIS environmental atlas for a major energy firm in the Rocky Mountains. He coordinated with multiple State and Federal agencies to obtain approval on access to certain GIS layers and then created a geodatabase for the firm. This allowed quick access to information, such as sage grouse habitat or raptor nests, that is important to the viability of a federal project.

JENNIFER E VAN CUREN

ENVIRONMENTAL PROJECT SCIENTIST

Education
BBA, Management, New Mexico State University, 2003

Years of Experience
Total - 13
With ARCADIS –1.5

Professional Qualifications
Upstream, Midstream, and Downstream Oil & Gas Regulations for Federal & State
Auditing for Upstream and Midstream Facilities
Oil & Gas Well Permitting
Oil & Gas Federal Compliance
NEPA / EA
Undesirable Event & First Responder
SPCC Plans
Visual Resource Management
Production Allocation Mgt.

Jennifer Van Curen is an Environmental Project Scientist focused on Oil & Gas drill permitting and compliance at the ARCADIS Midland, Texas office. Miss Van Curen has thirteen years' experience working on various planning, permitting, and compliance projects throughout the oil and gas community. Miss Van Curen specializes in Permitting and Compliance. She is versed in Federal regulations and requirements: BMP's, RMP's, policies, Acts, Onshore Orders, CFR's, NEPA, EPA, FLPMA, and LUP. Most recently, Miss Van Curen has been working on permitting oil and gas drill locations, surface use permits, emergency response and spill control, NEPA evaluations, environmental site assessments, right of ways, due diligence, and compliance in all stages of oil and gas production from planning to plugging.

NEPA / PERMITTING

Complete NEPA reviews and prepared environmental assessments in accordance to federal regulations for permitting and surface plan uses.

Very familiar with BLM expectations with preparing Permits to drill and sundry notices

Implement procedures to protect the biological needs of plant and animal life through mitigating measures during the life of the well.

Prepare Spill Prevention Control and Countermeasure plan (SPCC), Contingency plans, and Undesirable Incident reports.

FEDERAL AND STATE INTERPRETATION

Interpret Federal regulations, laws, policies, Acts, and Best Management Practices.

Perform annual reviews of facilities for safety, compliance, and inspecting for any hazards to environment or wildlife.

Review air quality permits, SPCC plans, and contingency plans for correctness and up to date information.

AUDITING

Research production accountability issues identified through audit and non-compliance incidents and resolve.

Investigate the mishandling of Federal mineral resources.

Review and analyze oil and gas condensate theft, spill reports and monthly reports of Operations to identify any anomalies or trends

Investigate illegal dumping of contaminated materials

INTERIM AND ABANDONMENT RECLAMATION

Perform rangeland monitoring studies for legacy leases on a wide range of environmental concerns ranging from vegetation availability to wildlife sustenance.

Analyze data for allowance of roadways, disturbances, wildlife projects, and grazing capabilities of rangeland.

Construct transects in order to complete studies and track wildlife populations, relative humidity of grass and shrub, and inspecting foliage types for invasive or poisonous varieties.

Professional work experience and knowledge of soils, biology and agriculture, rangeland ecosystems and soil properties for surface reclamation, geology and hydrology, riparian and threatened or endangered species and resources in SENM

MONITORING

Monitor activities during all phases of oil and gas operations: construction, drilling, completion, production, interim reclamation, undesirable events, abandonment and reclamation. Ensuring that all activities are completed as approved with safety the highest priority.

Confidential Client –

- Complete on-sites and NEPA reviews
- Write Environmental Assessments (EA's)
- Assist with compliance of construction
- Oversee reclamation for IR and submit to BLM
- Review Application to Drill permits for completeness

Confidential Client –

- Complete on-sites and NEPA reviews
- Write Environmental Assessments (EA's)
- Revamped permitting process for a bottleneck free process from planning to permit approval
- Improved mapping and SUP for a better understanding and clear picture of actions proposed
- Improved commingling permit approval process via meetings with BLM to ensure necessary information is included with correct format.
- Project Lead and Surface Management Expert (SME) for Plan of Developments (PODs) for better planning and surface management of planned (present and future) oil and gas activities
- Review Application to Drill permits for completeness

Confidential Client –

- Completed phase I ESA projects with report and cost estimate to bring into compliance
    - Reeves and Pecos ESA
    - Nadel and Gussman ESA
    - Geronimo ESA
    - Endeavor ESA
    - Trinity River ESA

Confidential Client –

- Completed phase I ESA for three Galvanizing Plants

Confidential Client –

- Emergency response team member
- First responder to make initial contact
- Meet with residents, collect information, and complete reports
- Collect water samples
- Work with the outreach team

Confidential Client –

- Review and update compressor station air quality requirements for EPA regulations

Confidential Client –

- Complete SPCC reviews for all facilities
- Make recommendations for updating facilities to meet present regulations
- Review Air Permits and NOI's
- Review regulatory records

AARON SIDES

Staff Scientist

CORE SKILLS

1. SWPPP
2. SPCC
3. Wildlife Surveys
4. Radio Telementry
5. Spatial Modeling

QUALIFICATIONS

- B.S. Biology
- Certified Associate Wildlife Biologist

Project Experience

Inventory of terrestrial mammals

2000 - 2006

Catalogued mammals with various techniques: live trapping, calling, road spot-lighting, aerial transects, camera traps, track stations, and acoustical monitoring.

Gene Howe Wildlife Management Area

Diamond Y Spring Preserve

Davis Mountains Preserve

Amistad National Recreation Area

Rio Grande Wild and Scenic River North of Mexico

Chihuahuan Desert Research Institute

Dolan Falls Preserve

Assistant museum curator

2000 - 2005

Prepared and catalogues vertebrate specimens and tissue samples for inclusion in the Texas Tech Museum of Natural History.
Prepared and catalogued vertebrate specimens for inclusion in the James F. Scudday Vertebrate Museum, Sul Ross State University.

Montezuma Quail
2006 - 2007

Assisted in the capture, radio-fitting, and monitoring of Montezuma Quail for activity patterns, habitat use, and survival rates.

Sierra del Carmen, Chihuahua Mexico

Davis Mountains, Texas

Sul Ross Campus, Texas

Elk home range and habitat use
2006 -2007

Assisted in the capture (helicopter net gun), radio-fitting, and monitoring of Elk for activity patterns, habitat use, and survival rates.

Glass Mountains, Texas

Rangeland restoration and erosion control
2006 - 2007

Installed erosion control devices and accessed effectiveness through the conductance of vegetation surveys. Applied herbicides and accessed effectiveness at controlling juniper and mesquite. Performed controlled burns to restore and maintain ranch grasslands.

Brewster County, Texas

Oak Motte Characteristics
2006

Surveyed oak motte characteristics and distribution at Independence Creek.

Independence Creek, Texas

Fish Surveys
2000 - 2006

Catalogued fishes through electro-fishing, seining, and cast netting.

Independence Creek, Texas

Rio Grande River, Big Bend National Park, Texas

Phantom Cave, Texas

Balmoreah Lake, Texas

Pronghorn Demographics
2006-2007

Utilized Landsat Thematic Mapper imagery to develop vegetation change models for Trans-Pecos, Texas using ArcMap, ArcView, and Erdas Imagine software. Utilized NOAA climatic data to generate drought indices for Trans-Pecos, Texas. Developed predictive pronghorn demographic models with historic Texas Parks and Wildlife pronghorn census data, vegetation models, and drought indices.

Trans-Pecos, Texas

Mule Deer Demographics
2006

Assisted with the utilization of Landsat Thematic Mapper imagery to develop vegetation change models for Trans-Pecos, Texas using ArcMap, ArcView, and Erdas Imagine software.

Trans-Pecos, Texas

Gray Fox
2006

Assisted with the capture and radio fitting of gray fox. Specific duty was the release of incidental skunk captures.

Brewster County, Texas

Mule Deer Demographics
2006

Assisted with the utilization of Landsat Thematic Mapper imagery to develop vegetation change models for Trans-Pecos, Texas using ArcMap, ArcView, and Erdas Imagine software.

Trans-Pecos, Texas

Horned Lizard
2006

Density estimation (Distance sampling), radio fitting, and monitoring of daily activity patterns in Texas Horned Lizards

Big Bend National Park, Texas

Diamond Y Spring Preserve, Texas

Remedial Construction Site
2007 - 2011

Performed site Phase II. Installed wildlife exclusionary devices. Managed the site SWPPP. Reclaimed manmade wetlands impacted by heavy metals. Recovered chemicals from plant process equipment for recycling. Remediated soils and performed sampling seeking closure under TRRP. Designed and implemented final reclaimed site surface.

North East, Texas

Groundwater Remediation System Installation
2007-2011

Field supervision of the installation of BioSparge, Air-sparge, Multi-phase extraction, injection, and ET-DSP® systems

Enid, Oklahoma

Hawthorne, California

Grants, New Mexico

Remediation System Operation and Maintenance
2011 - Present

Operation and maintenance of groundwater remediation systems including EDR, oil-water separation, evaporation ponds.

Mitchell County, Texas

Ector County, Texas

Monitored Natural Attenuation
2011 - Present

Groundwater sampling, data analysis, and reporting under monitored natural attenuation remedies.

Eddy County, New Mexico

Gaines County, Texas

Hockley County, Texas

Phase I ESAs
2011 - Present

Performed Phase I ESAs:

Over 300 oil and gas production facilities, lay down yards, field offices, and maintenance yards. Potential gas plant construction sites. Pipeline ROWs, including bird nest surveys.

West Texas

Southern Oklahoma

Eddy and Lea Counties, New Mexico

Field Investigations for SPCC determinations and planning
2011 - Present

Field investigation of oil and gas production facilities and construction sites for determination and development of SPCC plans.

West Texas

ARCADIS

Education
MS, Geological Sciences, University of Colorado, 2008
BS, Earth Sciences, Montana State University, 2003

Years of Experience
Total - 8
With ARCADIS - 6

Professional Registrations
Professional Geologist WY-#3826

Professional Associations
Geological Society of Nevada
Society of Vertebrate Paleontology

Jason S. Adams, PG

Staff Geologist

Mr. Adams is the ARCADIS soils, geology, and paleontology technical lead for environmental impact analyses in western North America. He has a wide range of experience in the field of geological and hydrological sciences in western North America, Central America, and Eastern Europe. His work has commonly involved a variety of disciplines including: soil science; hydrology; exploration geology; sedimentology; stratigraphy; paleontology; and geochemistry.

Relevant Project Experience

Application for Permit-to-Drill EAs
Lea and Eddy Counties, New Mexico
Assessed paleontological resources and potential impacts to resources for multiple oil and gas APDs in eastern New Mexico. Reviewed Potential Fossil Yield Classification, surficial and bedrock geologic mapping, and known paleontological resources within general geographic area and specific geologic formations.

Eagle Prospect EIS
Plains Exploration and Production Company, Wyoming
Assessed groundwater, surface water, soil, geological and paleontological resources and potential impacts to resources for exploration and development phases of proposed oil and gas activity. Authored Erosion and Sediment Transport Modeling technical support document which incorporated SWAT and KINEROS2 soil erosion models. Coordinated development of multi-stakeholder Surface Water and Groundwater Monitoring and Mitigation Plan and was lead author of Water Monitoring Framework.

Shadura Natural Gas Development Project EIS
USFWS and NordAq, Alaska
Assessed potential impacts to surface water, groundwater, soil, geological, and paleontological resources for oil and gas development on the Kenai National Wildlife Refuge northeast of Kenai, Alaska. Included assessment of potential wetland drainage and impacts to shallow groundwater flow through subsurface peat pipes.

Lesser Prairie-Chicken Stakeholder Conservation Plan EIS
American Habitat Center, Colorado, Kansas, Nebraska, New Mexico, Oklahoma, Texas
Assistant project manager for preparation of the Draft EIS for a Habitat Conservation Plan as part of an Incidental Take Permit for the lesser prairie-chicken. Worked with USFWS to define study

area, impact thresholds, and develop alternatives based on major issues identified during scoping. Coordinated EIS technical team and provided technical oversight, served as primary ARCADIS point of contact for project applicant and USFWS, and managed project budget.

Jonah 3D Seismic EA

Global Geophysical Services, Wyoming

Coordinated document preparation for an Environmental Assessment of a proposed surface geophysical survey in Wyoming in accordance with NEPA requirements, including coordination with client and BLM resource specialists. Assessed visual, soil, hydrological, geological, paleontological, air, range management, and recreation resources and impacts to resources. Project-specific mitigation strategies for each impacted resource were also developed.

BLM Consultations and Permitting Review

Lea and Eddy Counties, New Mexico

Reviewed environmental constraints and permitting pathways for proposed 80-mile water pipelines, electrical substations, and high-yield water wells to support oil and gas drilling in eastern New Mexico. Conducted pre-application review with BLM Carlsbad Field Office staff to identify staff concerns and inform project design alternatives.

Blackfoot Bridge EIS

Monsanto, Idaho

Assessed the soil, geological and paleontological resources and potential impacts to resources for a proposed phosphate mine to satisfy NEPA requirements in this EIS in cooperation with client and BLM resource specialists. Investigated methods and limitations of various cover system designs and materials based on review of technical and industry literature, with a focus on geosynthetic clay laminated liners and potential impacts to hydrology and water chemistry.

South Dakota Resource Management Plan (RMP) and EIS

BLM, South Dakota

Developed a comprehensive, written analysis of impacts to soils and surface and ground water from management actions proposed for the revised South Dakota Field Office RMP. Analysis included evaluation of impacts from oil and gas development, livestock management, renewable energy development, transportation management, and other resource uses and management.

Mine Plan of Operation Amendments and Updates

Multiple Clients, Nevada and New Mexico

Authored site characterization (mineralogy, geology, hydrogeology) sections for multiple potash mine plan updates to include recent regional and site-specific research. Incorporated client, BLM and state comments on proposed mine plan updates for final approval by BLM.

ARCADIS

Education

Graduate Studies, Contaminant Hydrogeology and Geochemistry, Syracuse University, Syracuse, NY, 1994

Graduate Studies, Advanced Hydrogeology, Syracuse University, Syracuse, NY, 1993

BS, Geology, State University of New York, College at Cortland, 1986

Years of Experience

Total - 26

With ARCADIS - 17

Professional Registrations

Professional Geologist, PA

Professional Geologist, IL

Certified Professional Geologist: American Institute of Professional Geologists

Professional Qualifications

American Institute of Professional Geologists

Association of Environmental and Engineering Geologists

Central New York Association of Professional Geologists

National Ground Water Association

National Speleological Society

Keith A. White, CPG, PG

Principal Geologist

Mr. White has over 26 years of progressive experience as an environmental scientist, hydrogeologist, and technical expert. He has designed and managed various hazardous waste (RCRA and CERCLA), solid waste (6NYCRR), and water-resource investigations for industrial, state, and federal clients; served as lead hydrogeologist for multiple Remedial Design/Remedial Action (RD/RA) projects at the state and federal level; provided expert field oversight and critically reviewed remedial investigation/feasibility study (RI/FS) reports as a contractor to the U.S. Environmental Protection Agency (USEPA); co-authored and delivered presentations at multiple conferences and symposia; designed, conducted, and interpreted results of numerous geophysical surveys; prepared groundwater flow models (areal and vertical) using various numerical and analytical codes; and served as the technical lead for multiple sites involving contaminant transport in karst aquifers.

Mr. White currently leads the Company's *Karst Hydrogeology Center of Practice*. Mr. White is a member of the Geological Society of America's (GSA's) new Karst Division, and has served as co-chair for a Topical Session entitled *Contaminant Hydrogeology of Karst—Characterization, Modeling, and Remediation* at the GSA's 2010 Annual Meeting in Denver, CO. Mr. White and a colleague periodically co-instruct one-day and two-day short courses on Karst Contaminant Hydrogeology for the National Ground Water Association and have also taught the 8-hour course, by request, to staff of the Alabama Department of Environmental Management. Mr. White has also presented on the topic of karst remediation at the USEPA Region III Petroleum UST Workshop held in Rehoboth Beach, Delaware (September 2011) and at the 12th Annual Alabama Groundwater Conference in Montgomery, Alabama (June 2012). In addition, Mr. White recently co-chaired a session on Karst Remediation at Battelle's *Ninth International Conference on Remediation of Chlorinated and Recalcitrant Compounds* (May 19-22, Monterey, CA).

Experience

Operational Range Assessments – Fort McClellan, Anniston Army Depot, Redstone Arsenal, and Camp Crowder
Army National Guard and the United States Army – Anniston and Huntsville, Alabama; and Neosho, Missouri
2011
Projects involve evaluating whether the ongoing or historical use of operational firing ranges has affected the quality of groundwater and surface water leaving the ranges. Responsibilities include developing: 1) an updated site conceptual model for karstification and groundwater flow, and 2) a strategic approach for assessing groundwater, spring-water, and surface-water quality of the surrounding karst aquifers.

Hydrogeologic Investigation – Oak Grove Village Well CERCLA Site
Confidential Client, Sullivan, MO

Served as senior karst expert for a deep drilling and sampling program in Operable Unit 2 to further characterize geology and groundwater conditions. At this site, a municipal supply well has been impacted by chlorinated solvents; however, the source of the solvents is still being investigated in this complicated karst terrane. Reviewed and revised scopes of work, designated and oversaw work performed by an ARCADIS karst specialist, and performed high-level review of investigation results and site strategy.

CERCLA Remedial Investigation – Fort Detrick Area B
USACE, Baltimore District, Frederick, Maryland
Ongoing, Project Value: $2,500,000
Senior hydrogeologist and technical expert for this CERCLA project. Project involves completing a groundwater remedial investigation at Fort Detrick's Area B. The area is underlain by karstic carbonate bedrock of Triassic and Cambrian age. Responsible for implementing a work plan that includes well drilling, down-hole geophysical testing, dye tracing, and sampling of groundwater, surface water and spring water. Mr. White is also responsible for analyzing the collected data and updating the site's conceptual model for karstic groundwater movement and contaminant transport.

Risk Assessment and Closure Strategy – Former Manufacturing Facility
Confidential Client, Huntsville, Alabama
Ongoing
Project involves developing a risk assessment and closure strategy for a facility where chlorinated solvents were released to a karstic aquifer. Responsible for CSM development,

evaluating contaminant transport, and developing a karst-specific closure strategy. Developed a unique, karst-specific approach for predicting groundwater contaminant concentrations at hypothetical, offsite domestic supply wells. Project requires working closely with representatives of the Alabama Department of Environmental Management (ADEM). ADEM approved ARCADIS' closure approach and have indicated that the site is on track to become the first such karst site in the state to attain "No Further Action" status.

RCRA Facility Investigation/Interim Measures
Beazer East, Inc., Guthrie, Kentucky
2005, Project Value: $1,800,000
Lead hydrogeologist for a site occupied by an active wood-treating facility that uses coal-tar creosote as the treating fluid. Duties included revising the conceptual model for groundwater flow and DNAPL transport in the karstic bedrock aquifer, optimizing bedrock DNAPL-collection systems (which have collectively removed more than 48,000 gallons of DNAPL), and assisting development and conduct of a dye trace study. That study, which focused on an area where DNAPL had migrated offsite, identified the spring that discharges groundwater from the area, and demonstrated that the site is located in a different drainage basin than the spring that formerly supplied the City of Guthrie with drinking water. The site's DNAPL-collection program includes a passive DNAPL barrier designed to prevent coal-tar creosote from discharging to a nearby stream without pumping or treating groundwater. Mr. White served on the design team for that system component.

CERCLA Remedial Investigation – Former Ramey Air Force Base
USACE, Huntsville District, Aguadilla, Puerto Rico
Ongoing
Senior hydrogeologist and technical expert for this CERCLA project. Project involves characterizing the nature and extent of impacts to a coastal karst aquifer relative to two former landfills. Scope of investigation includes sampling of pore water in residuum beneath the landfills, conducting a study of VOC vapors in the underlying epikarst, designing and implementing a tracer study to evaluate the effectiveness of the existing groundwater-monitoring network, and developing a karst-specific conceptual site model for groundwater (and contaminant) occurrence and movement.

Remediation Program
Confidential Client, Russellville, Kentucky
Ongoing
Lead hydrogeologist for a project that involves the release of PCB DNAPL to a karstic aquifer. Responsible for all aspects of site hydrogeology including developing a groundwater-flow and DNAPL transport conceptual model, developing a long-term groundwater monitoring and

DNAPL-recovery program as part of a Corrective Action Plan for the site, evaluating the effectiveness of a bedrock groundwater-interceptor trench, supervising a dye-trace study, and developing a final groundwater remedy. Was also an integral member of a team tasked with fast-tracking a design for an innovative remedial measure to keep DNAPL and PCB-contaminated groundwater from discharging from the bedrock into a local urban stream.

Tracer Study – Highway Extension
Tennessee Department of Transportation, Knoxville, Tennessee
2009, Project Value: $100,000
This project was performed to support an Environmental Impact Statement being prepared for a new highway extension planned in karst terrane near Knoxville, TN. The terrane contains a cave system that is home to a threatened species of salamander. The objectives of the work were to 1. Develop a karst-specific conceptual site model, and 2. Determine which sinkholes in the proposed highway corridors drained to the salamander's cave system. Mr. White served as the principal hydrogeologist for this project. The work conclusively determined which sinkholes drained to the cave system and which did not. The study also identified a sinkhole that, despite being located outside the local surface-water drainage basin, actually drained to that basin.

Karst Conceptual Model and Sinkhole Vulnerability Assessment
Confidential Client, Narrows, Virginia
2011
Developed a site-specific conceptual model for karstification and assessed the vulnerability of closed process sludge and flyash landfills, as well as a new active sanitary landfill to sinkhole formation. Work entailed performing a comprehensive literature review, analyzing results of geophysical and drilling investigations conducted at the site, reviewing historical maps and aerial photographs, and performing a topographic slope analysis.

Voluntary Site Investigation – Former Wood-Treating Site
Confidential Client, Indiana
Ongoing, Project Cost to Date: >$300,000
Lead hydrogeologist for an investigation that involves characterizing the nature and extent of impacts related to a former creosoting facility. Creosote DNAPL has migrated offsite within the karstic bedrock and into a nearby stream. Currently responsible for all hydrogeologic aspects of the project, including refining the site conceptual model for groundwater and DNAPL movement, overseeing and interpreting results of two dye-trace studies, and developing a scope-of-work to complete the ongoing site characterization , and helping develop a preliminary, karst-specific remedial approach and closure strategy for the site.

Chlorinated-Solvent-in-Groundwater Investigation
Confidential Client, Tennessee
2003, Project Cost: $70,000
Project manager and technical lead for an investigation conducted in a mature karst aquifer. The site houses a large industrial manufacturing facility. Work performed included revising the conceptual site model from a "fractured-rock" to a karst-based model, assisting design and conduct of a spring survey, and a dye-trace study. The study identified several springs that discharge groundwater from the site, some more than 3.5 miles away. Groundwater velocities were calculated to be in excess of 2,500 feet per day.

Karst Conceptual Model and Sinkhole Vulnerability Assessment
Confidential Client, Ohio
2011
Developed a site-specific conceptual model for karstification and evaluated the potential for sinkhole formation related to the design of a 700-million gallon primary drinking water reservoir. Work entailed performing a comprehensive literature review, analyzing results of geophysical and drilling investigations conducted at the site, reviewing historical maps and aerial photographs, and interviewing a member of the Ohio Geological Survey's karst mapping project team.

Karst Aquifer LNAPL Remediation
Confidential Client, Indiana
Ongoing
Karst technical lead for a project involving the delineation and remediation of PCB-containing LNAPL in a mature karst aquifer. Work entails conducting a karst reconnaissance/spring survey, LNAPL bail-down testing, borehole televiewing, and preparing a conceptual model for LNAPL storage and transport in the karst aquifer. Ongoing work will be used to develop and deliver a remedial solution to address the LNAPL.

RCRA Facility Investigation
Beazer East, Inc., Roanoke, Virginia
2004
Lead hydrogeologist for an RCRA Facility Investigation conducted at an active wood-treating facility. The investigation includes characterizing groundwater and contaminant transport (including DNAPL) in a karstic aquifer. Duties included supervising a dye-trace study at the site that included two new backup drinking-water supply wells for the City of Salem, Virginia. The State-approved Corrective Measures Study for the site includes a combination of sentinel-well monitoring and periodic tracer studies to evaluate the effectiveness of the groundwater remedy, which is Monitored Natural Attenuation (MNA).

Selected Publications

Ewers, R.O., K. A. White, and J. F. Fuller. 2012. Contaminant plumes and psuedoplumes in karst aquifers. Carbonates and Evaporites, vol. 27, no. 2, p. 153-159.

Ewers, R.O., K.A. White, K. Paschl, and M.B. Hanish. 2005. "Problems with Applying Traditional Characterization and Monitoring Approaches to Karst Aquifers: A Case History." In *Sinkholes and the Engineering and Environmental Impacts of Karst: Proceedings of the 10th Multidisciplinary Conference*, ed. B. F. Beck. American Society of Civil Engineers: Reston, VA., p. 365-379.

Costa, H.C., K.A. White, and J. Ruspantini. 2004. Distinguishing PAH background and MGP residues in sediments of a freshwater creek. Environmental Forensics 5(3), p. 171-182.

Presentations

White, K. A. 2012. "Remediating and Managing Karst Sites". Presented at the 12th Annual Alabama Groundwater Conference, Montgomery, AL. June 6, 2012.

White, K.A. and D.S. Lipson. 2012. "Remediating groundwater in karst terranes: state of the industry". Presented at the Eight International Conference on Remediation of Chlorinated and Recalcitrant Compounds, 21-24 May, Monterey, California.

White, K. A. 2011. "Remediation and Management of Karst Sites". Presented at the USEPA Region 3 States LUST Technical Workshop, Rehoboth Beach, DE. September 28-30, 2011.

Cobb, M.K., K A. White, P. N. Milionis, and B. Hartley. 2010. "The role of saturated epikarst in solute transport: an example from the Lehigh valley, Pennsylvania". Presented at the Geologic Society of America Annual Meeting, October 31 to November 3, 2010, Denver, CO.

White, K.A., and P. J. Kurzanski. 2010. "Special considerations for remediating a former wood-treating facility in karst terrane." Presented at the Railroad Environmental Conference, University of Illinois at Urbana-Champaign, October 26-27, 2010.

White, K. A., M. Gefell, and M. Thurman, 2010. "Remedy for PCB DNAPL seeps in a fractured bedrock creek bed." Presented at the Seventh International Conference on Remediation of Chlorinated and Recalcitrant Compounds, 24-27 May, Monterey, California.

White, K. A. and R. O. Ewers. 2007. "Problems with Applying Traditional Characterization and Monitoring Approaches to Karst Aquifers: A Case History." In Proceedings of the 2007 U.S. EPA/ NGWA Fractured Rock Conference: State of the Science and Measuring Success in Remediation, USEPA/NGWA. 24-26 September, Portland, Maine.

White, K.A., B.H. Kueper, and M.J. Gefell 2007. “Passive DNAPL Barriers - Concepts, General Design Requirements, and Performance.” Presented at the EPRI MGP 2007 Symposium - Advances in MGP Site Remediation, 8-11 January, Atlanta, Georgia.

White, K.A., B.H. Kueper, M.J. Gefell, and T.L. Blazicek 2006. “Passive DNAPL Barriers - Concepts and Case Histories.” Presented at: Natural Gas Technologies 2006 -Energy and the Environment, 22-25 October, Orlando, Florida.

White, K.A., M.O. Gravelding, M.J. Gefell, D.G. Bessingpas, and M. Slenska. 2006. "Design, Installation, and Operation of a Passive DNAPL Barrier at a Former Wood-Treating Site." Presented at the Fifth International Conference on Remediation of Chlorinated and Recalcitrant Compounds, 22-25 May, Monterey, California.

Ewers, R.O., K.A. White, and K. Paschl. 2005. "Shallow Groundwater and DNAPL Movement within Slightly Dipping Limestone, Southwestern Kentucky." Presented at the 10th Multidisciplinary Conference on Sinkholes and the Engineering and Environmental Impacts of Karst, 24-28 September, San Antonio, Texas.

White, K.A., K. Paschl, and D.S. Lipson. 2004. "Characterization of a DNAPL Site in Karst Terrane: Implications for Remediation." Presented at the 2004 EPA/NGWA Fractured Rock Conference: State of the Science and Measuring Success in Remediation, 13-15 September, Portland, Maine.

White, K.A., M.J. Gefell, P. Alessio, and A. Ferro. 2004. "Stream Re-Routing, DNAPL Containment, and Phytoremediation to Address DNAPL at a Major Wood-Treating Site." Presented at the Fourth Conference on Remediation of Chlorinated and Recalcitrant Compounds, 24-27 May, Monterey, California.

White, K.A., S.T. Saroff, and M.J. Gefell. 1999. “Groundwater Flow Modeling at the Port Washington L-4 Landfill Superfund Site.” Presented at the Sixth Annual Conference on Geology of Long Island and Metropolitan New York, SUNY Stony Brook, April, Stony Brook, New York.

Erica Serna

Geologist 1

Ms. Serna recently joined ARCADIS in December 2014. Prior joining ARCADIS, she attended East Carolina University and Indiana University. During the spring of 2012, Ms. Serna volunteered with the USGS- Hawaiian Volcano Observatory (HVO) where she was in charge of measuring sulfur dioxide emission rates from the Kilauea volcano. Since joining ARCADIS, Ms. Serna has gained experience with installation of soil borings and groundwater monitoring wells. Soil characterization and sampling, groundwater sampling (bailer and low flow techniques), sampling and monitoring of sub-slab vapor ports, indoor air surveying, and vapor intrusion sampling. Ms. Serna has also gained experience with geophysical surveying using a ground penetrating radar.

Category of Experience

Groundwater Sampling
Various Confidential Clients, Indiana
Ongoing
Performed groundwater sampling activities at several active and inactive retail gas stations, automotive facilities and railroad facilities. Work included: health and safety management, monitoring well installation (direct push), drilling subcontractor coordination and oversight, vertical aquifer profile testing, communication with analytical laboratories, and soil and groundwater sample collection. Shipped and transported samples.

DNAPL Recovery
Various clients, Indiana
Ongoing
Recovered DNAPL using advanced techniques developed by ARCADIS. Performed subsequent inspections at a PCB impacted site.

Vapor Intrusion and Soil Gas Sampling
Various clients, Indiana
Ongoing
Conducted indoor air, sub-slab vapor, and soil and gas sampling in residential neighborhoods to determine the proper placement of sub-slab sampling ports, indoor air, crawl spaces, and ambient sample media. Performed subsequent inspections to verify proper system operation.

Education

MS, Geology, East Carolina University, North Carolina, 2014

BS, Geology, Indiana University, Bloomington, Indiana, 2011

Professional Registrations

40-Hour OSHA Hazardous Waste Operations (HAZWOPER) Safety Training, 2014

DOT HazMat, 2014

MARBOP, 2015

CSX FRA Roadway Worker Training, 2015

E-RAILSAFE System Training, 2014

RCRA Training, 2015

CPR/First Aid/AED, 2015

Professional Associations

Geological Society of America

Kristen Audette

Principal Environmental Scientist

Kristen Audette joined the ARCADIS team in July 2015. Prior to joining ARCADIS, she attended Roger Williams University. During her undergraduate career, Ms. Audette presented research on the bioremediation of heavy metals in the Narragansett Bay at the 2015 American Chemical Society National Conference. Ms. Audette also served as an intern for the Blackstone Water Treatment Plant in Massachusetts, focusing on water treatment system design and water sampling/testing. Past project work also includes GIS map creation for the DPW for the City of Pawtucket, RI and the construction of an Osprey Platform for wildlife conservation. Since joining ARCADIS, Ms. Audette has gained experience with Phase 1 report writing, soil characterization/ treatment/sampling and tracking, air emission calculations, groundwater and well sampling and report writing.

Education

BS, Environmental Science, Minor, Environmental Engineering, Roger Williams University, Rhode Island, 2015

Professional Registrations

40-Hour OSHA Hazardous Waste Operations (HAZWOPER) Safety Training, 2015

Chevron 101, 2015

Professional Associations

America Water Works Association

American Chemical Society

Society of Women Engineers

Experience

Well Sampling
Midland, Texas
Ongoing
Performed in home and well sampling activities at residential sites. Work included: health and safety management, shower filtration installation, communication with residents. Shipped and transported samples.

Emission Calculations
RI
Ongoing
Collected generator data from various clients to generate monthly air calculation reports in accordance with EPA standards. Collected chemical concentration levels in treated and contaminated soils to calculate air emissions. Verification air emissions complied with RIDEM permitting thresholds.

Soil Treatment and Tracking
Chevron, RI
Ongoing
Completed treated soil sampling for East Providence Rhode Island gas terminal. Collected samples and sample volume and weight. Created monthly tracking tables and reports for RIDEM.

Phase 1 Report Writing
Rhode Island
July 2015

Completed Phase 1 Site Assessment Report for residential property.
Reviewed environmental databases, conducted questionnaire and initial site assessment. Completed written report.

Odor Map Creation
Chevron, RI
August 2015
Researched surrounding polluters for East Providence Rhode Island Chevron (EPRI) Terminal to create odor map with polluter terminal locations and schedule times of shipping/loading information of sea vessels.

East Providence Bike Path Closure
Chevron, RI
Ongoing
Researched proper contact information/permits/notifications needed to conduct construction work on Providence public bike path. Organized meeting for RIDEM and responsible subcontractors/related parties. Report writing.

Kaylyn Marsano

Environmental Compliance Specialist

Education

Marine and Atmospheric Science, Stony Brook University, M.S., 2013

Marine Sciences, University of Maine, B.S., 2010

1 Year of Experience

Ms. Kaylyn Marsano is an Environmental Compliance Specialist in ARCADIS Environmental Business Consulting group in Houston, Texas. She has experience in the oil and gas upstream and midstream industry in environmental compliance including, preparing applications for U.S. Army Corps of Engineers (USACE) Nationwide Permit's (NWP), stormwater permitting, preparing resource reports for Federal Energy Regulatory Commission (FERC) applications for natural gas projects, preparing state applications for crude oil projects, and conducting environmental constraints analyses for proposed oil and natural gas projects.

Category of Experience

U.S. Army Corps of Engineers (USACE) Nationwide Permit's (NWP)

Supported multiple oil and gas clients in preparing their applications for USACE NWP's for their proposed pipeline projects. Support includes, but is not limited to the following:

- *Desktop analysis of the environmental features within the Project area.*
- *Environmental field surveys using methodology approved by the 1987 USACE Wetlands Delineation Manual and Regional Supplements*
- *Preparation of environmental site assessments that highlight environmental permitting requirements.*
- *Preparation permit matrices that clearly define the permitting process for the client.*
- *Preparation of a pre-construction notification (PCN) for authorization under USACE Section 404 Nationwide Permits.*

Stormwater Permitting

Supported multiple oil and gas clients with their stormwater permits. Support includes, but is not limited to the following:

- *Preparation Stormwater Pollution Protection Plans (SWPPP) in accordance to with the U.S. Environmental Protection Agency (EPA) General Construction Permit for Stormwater Discharges During construction for crude oil pipelines.*
- *Preparation Stormwater Pollution Protection Plans (SWPPP) in accordance to with state stormwater permitting agencies general permits for product pipelines.*
- *Preparation of a Notice of Intent (NOI) if required for the project.*

FERC 7(C) Applications

Supported multiple oil and gas clients in preparing their FERC 7(C) Applications for a Certificate of Public Convenience and Necessity for their proposed natural gas transmission or facility based projects. Support provided includes, but is not limited to, the following:

- *Desktop analysis of the environmental features within the Project area.*
- *Consultation with state and local agencies to verify and define environmental permitting requirements and/or authorizations required.*
- *Preparation and revision of the resource reports included the application.*
- *Interpretation of field and other resource data to include within the resource reports.*
- *Completion of formatting and quality checks of the application materials prior to filing with FERC.*
- *Preparation of monthly reports of the project's progress to be filed to the FERC docket on the client's behalf.*
- *Responding to FERC data requests on the client's behalf throughout the FERC application process.*

Environmental Constraints Analyses

Identified the potential environmental constraints that could result in excessive schedule delays, and/or costs such that the oil or natural gas project would not be profitable. Identified authorizations, documentation, and notifications required by governing agencies with estimated cost and schedule for preparation, process and approval. Prepared a final document that provided an assessment of the risk for environmental constraints of the following areas: Water Use and Quality; Geological and Soil Resources; Wildlife, Vegetation, and Threatened and Endangered Species; Public Lands; Cultural Resources; and Air Quality and Noise.

Journal Publications

Becker (*Marsano*), K. N. Warren, J.D. 2015. *Material Properties of Pacific Hake, Humboldt squid, and two species of myctophids in the California Current*. Journal of the Acoustical Society of America.

Becker (*Marsano*), K.N. Warren, J.D. 2014. *Material Properties of Northeast Pacific Zooplankton.* ICES Journal of Marine Science.

Arcadis U.S., Inc.

2929 Briarpark Drive

Suite 300

Houston, Texas 77042

Tel 713 953 4800

Fax 713 977 4620

www.arcadis.com

ATS-16-723

BLM Carlsbad Field Office

Form 3160-3
(June 2015)

FORM APPROVED
OMB No. 1004-0137
Expires: January 31, 2018

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

APPLICATION FOR PERMIT TO DRILL OR REENTER

5. Lease Serial No.
NMNM118108

6. If Indian, Allotee or Tribe Name

1a. Type of work: ☑ DRILL ☐ REENTER

1b. Type of Well: ☑ Oil Well ☐ Gas Well ☐ Other

1c. Type of Completion: ☐ Hydraulic Fracturing ☑ Single Zone ☐ Multiple Zone

7. If Unit or CA Agreement, Name and No.

8. Lease Name and Well No.
HH SO 8 P2 _13H

2. Name of Operator
CHEVRON USA INC

9. API Well No.
~~13N~~

3a. Address
1616 W. BENDER BLVD HOBBS, NM 88240

3b. Phone No. *(include area code)*
575-263-0431

10. Field and Pool, or Exploratory
WILDCAT; WOLFCAMP

4. Location of Well *(Report location clearly and in accordance with any State requirements.*)*
At surface 305' FNL & 960' FWL
At proposed prod. zone 180' FNL & 330' FWL

UNORTHODOX LOCATION

11. Sec., T. R. M. or Blk. and Survey or Area
SEC17, T26S, R27E, UL D (SHL)

14. Distance in miles and direction from nearest town or post office*
12.8 MILES FROM MALAGA, NEW MEXICO

12. County or Parish
EDDY

13. State
NM

15. Distance from proposed* location to nearest property or lease line, ft. (Also to nearest drig. unit line, if any)
305' FNL

16. No of acres in lease
1920 ACRES

17. Spacing Unit dedicated to this well
320 ACRES

18. Distance from proposed location* to nearest well, drilling, completed, applied for, on this lease, ft.
4300 FT SKEEN 2 SW

19. Proposed Depth
TD 9904' MD 20,551'

20. BLM/BIA Bond No. in file
CA 0329

21. Elevations (Show whether DF, KDB, RT, GL, etc.)
3246' GL

22. Approximate date work will start*
OCTOBER 2016

23. Estimated duration
30 DAYS

24. Attachments

The following, completed in accordance with the requirements of Onshore Oil and Gas Order No. 1, and the Hydraulic Fracturing rule per 43 CFR 3162.3-3 (as applicable)

1. Well plat certified by a registered surveyor.
2. A Drilling Plan.
3. A Surface Use Plan (if the location is on National Forest System Lands, the SUPO must be filed with the appropriate Forest Service Office).
4. Bond to cover the operations unless covered by an existing bond on file (see Item 20 above).
5. Operator certification.
6. Such other site specific information and/or plans as may be requested by the BLM.

25. Signature Cindy Herrera-Murillo
Name *(Printed/Typed)* CINDY HERRERA-MURILLO
Date 02/11/2016

Title
PERMITTING SPECIALIST

Approved by *(Signature)* /s/ George MacDonell
Name *(Printed/Typed)* /s/George MacDonell
Date 10/11/16

Title FIELD MANAGER
Office CARLSBAD FIELD OFFICE

Application approval does not warrant or certify that the applicant holds legal or equitable title to those rights in the subject lease which would entitle the applicant to conduct operations thereon.
Conditions of approval, if any, are attached.

APPROVAL FOR TWO YEARS

Title 18 U.S.C. Section 1001 and Title 43 U.S.C. Section 1212, make it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious or fraudulent statements or representations as to any matter within its jurisdiction.

Carlsbad Controlled Water Basin

Witness Surface & Intermediate Casing

SEE ATTACHED FOR CONDITIONS OF APPROVAL

Approval Subject to General Requirements & Special Stipulations Attached

(Continued on page 2)

*(Instructions on page 2)

District I
1625 N French Dr, Hobbs, NM 88240
Phone: (575) 393-6161 Fax: (575) 393-0720
District II
811 S First St, Artesia, NM 88210
Phone: (575) 748-1283 Fax: (575) 748-9720
District III
1000 Rio Brazos Road, Aztec, NM 87410
Phone: (505) 334-6178 Fax: (505) 334-6170
District IV
1220 S St Francis Dr, Santa Fe, NM 87505
Phone: (505) 476-3460 Fax: (505) 476-3462

State of New Mexico
Energy, Minerals & Natural Resources Department
OIL CONSERVATION DIVISION
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-102
Revised August 1, 2011
Submit one copy to appropriate District Office

☐ AMENDED REPORT

WELL LOCATION AND ACREAGE DEDICATION PLAT

[1] API Number	[2] Pool Code	[3] Pool Name
		Wildcat;Wolfcamp

[4] Property Code	[5] Property Name	[6] Well Number
	HH SO 8 P2	13H

[7] OGRID No.	[8] Operator Name	[9] Elevation
4323	CHEVRON U.S.A. INC.	3246'

[10] Surface Location

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
D	17	26 SOUTH	27 EAST, N.M.P.M.		305'	NORTH	960'	WEST	EDDY

[11] Bottom Hole Location If Different From Surface

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
D	5	26 SOUTH	27 EAST, N.M.P.M.		180'	NORTH	330'	WEST	EDDY

[12] Dedicated Acres	[13] Joint or Infill	[14] Consolidation Code	[15] Order No.
320			

No allowable will be assigned to this completion until all interests have been consolidated or a non-standard unit has been approved by the division.

[16]

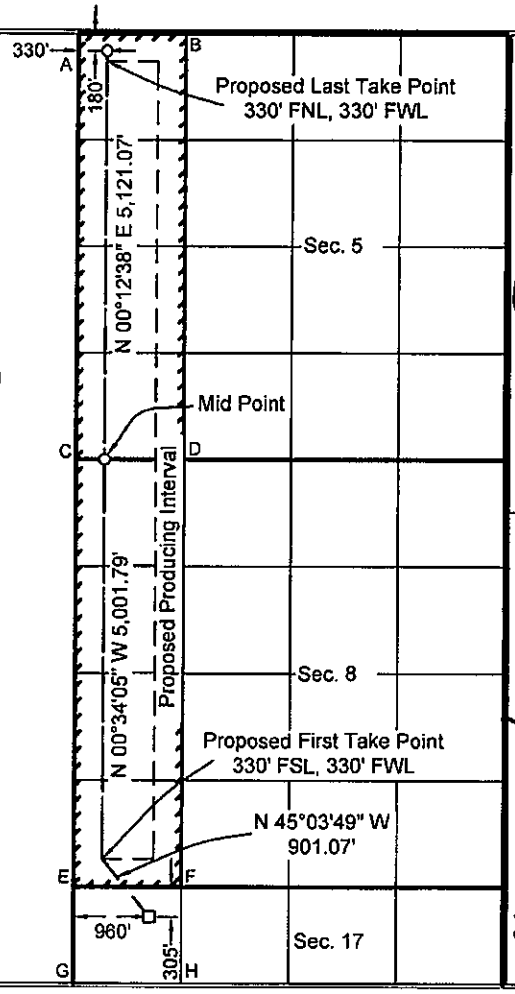
PROPOSED BOTTOM HOLE LOCATION		
X=	535,284	NAD 27
Y=	392,263	
LAT.	32.078395	
LONG.	104.219414	
X=	576,468	NAD83
Y=	392,320	
LAT.	32.078516	
LONG.	104.219909	

CORNER COORDINATES TABLE (NAD 27)

A - Y=392442.33, X=534954.83
B - Y=392444.24, X=536280.85
C - Y=387143.09, X=534935.36
D - Y=387137.83, X=536254.75
E - Y=381810.94, X=534988.20
F - Y=381808.02, X=536317.14
G - Y=380478.27, X=535007.69
H - Y=380475.74, X=536334.89

Mid Point
Y=387141.77, X=535265.35

HH SO 8 P2 13H WELL		
X=	535,953	NAD 27
Y=	381,504	
LAT.	32.048816	
LONG.	104.217293	
X=	577,136	NAD83
Y=	381,561	
LAT.	32.048937	
LONG.	104.217787	
ELEVATION +3246' NAVD 88		



[17] OPERATOR CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief, and that this organization either owns a working interest or unleased mineral interest in the land including the proposed bottom hole location or has a right to drill this well at this location pursuant to a contract with an owner of such a mineral or working interest, or to a voluntary pooling agreement or a compulsory pooling order heretofore entered by the division.

Cindy Herrera-Murillo 2-4-16
Signature Date

Cindy Herrera-Murillo
Printed Name

Ciherreramurillo@chevron.com
E-mail Address

[18] SURVEYOR CERTIFICATION

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my belief.

JAN 5, 2016
Date of Survey

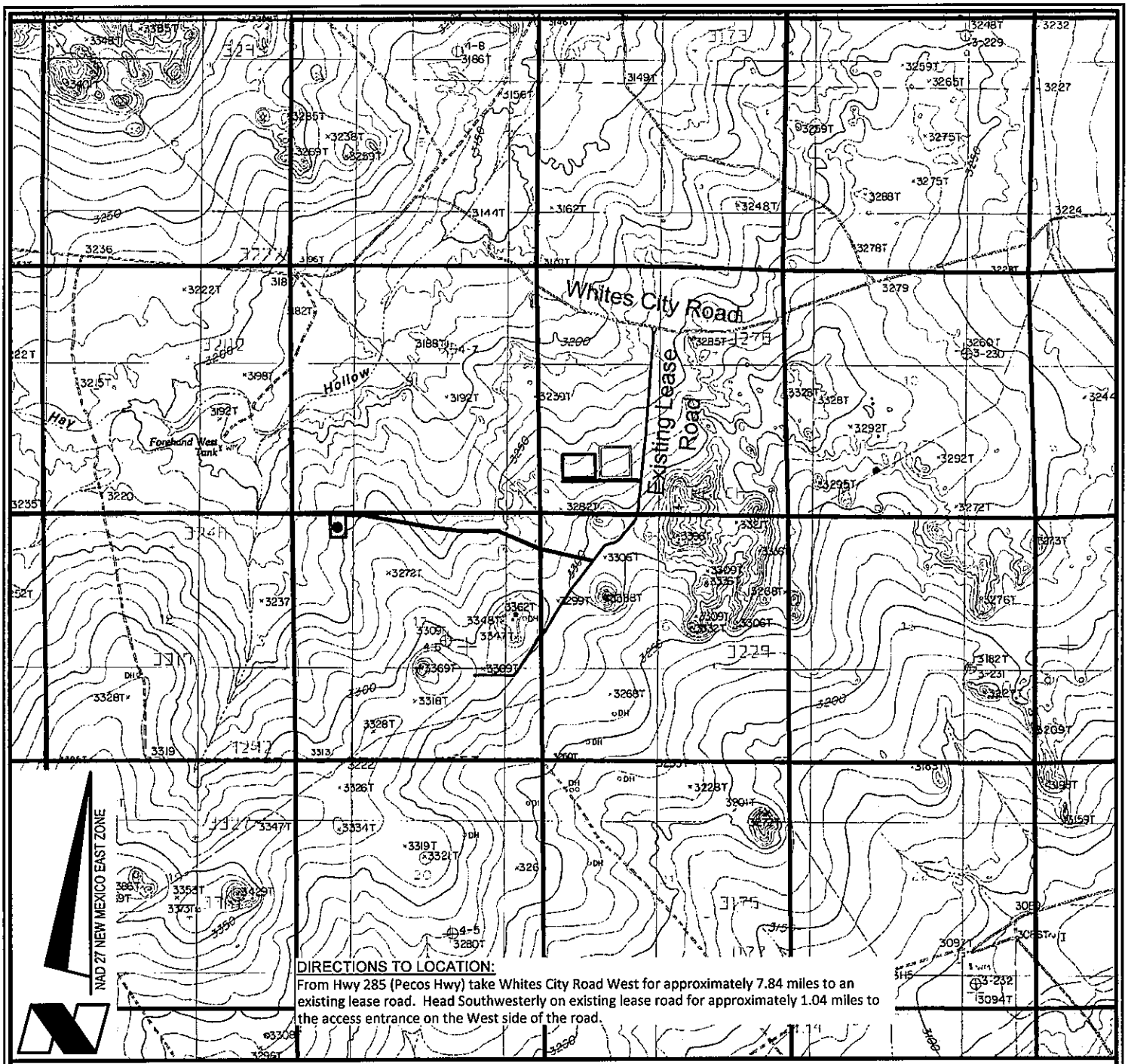
Signature and Seal of Professional Surveyor

ROBERT L. LASTRAPES
NEW MEXICO
23006
PROFESSIONAL SURVEYOR

2-3-2016

23006
Certificate Number

EXHIBIT 1



DIRECTIONS TO LOCATION:
From Hwy 285 (Pecos Hwy) take Whites City Road West for approximately 7.84 miles to an existing lease road. Head Southwesterly on existing lease road for approximately 1.04 miles to the access entrance on the West side of the road.

VICINITY MAP

SCALE: 1" = 3000'
3000' 0 1500' 3000'

LEGEND

- Proposed Well
- Proposed Access Road
- Proposed Drillsite
- Existing Road
- Section Line
- Proposed Frac Pond
- Proposed Facility

CHEVRON U.S.A. INC.

HH SO 8 P2 NO. 13H WELL
LOCATED 305' FNL AND 960' FWL
SECTION 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

FENSTERMAKER
C.H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

DRAWN BY: VHV	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 12/23/2015	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\HH SO 8 P2 13H_APD.dwg			

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

ROBERT L. LASTRAPES
NEW MEXICO
23006
PROFESSIONAL SURVEYOR

1-19-2016

Robert L. Lastrapes
Registration No.23006

R 27 E

T 26 S

Sec. 8

Bureau of Land Management

NW PAD CORNER	NE PAD CORNER	HH SO 8 P2 NO. 13H WELL
X= 535,799 NAD 27	X= 536,129 NAD 27	X= 535,953 NAD 27
Y= 381,809	Y= 381,808	Y= 381,504
ELEVATION +3241' NAVD 88	ELEVATION +3247' NAVD 88	LAT. 32.048816
		LONG. 104.217293
SW PAD CORNER	SE PAD CORNER	X= 577,136 NAD83
X= 535,805 NAD 27	X= 536,135 NAD 27	Y= 381,561
Y= 381,284	Y= 381,284	LAT. 32.048937
ELEVATION +3244' NAVD 88	ELEVATION +3256' NAVD 88	LONG. 104.217787
		ELEVATION +3246' NAVD 88

S 89°52'10" E 810.78'

Fnd. 2" Iron Pipe w/ Cap at the NW Corner of Section 17

305'
52'
525'
150'
180'
25'
220'
330'

HH SO 8 P2
No. 13H Well
305' FNL, 960' FWL

PROPOSED PAD
±3.98 Acres

CENTERLINE PROPOSED ACCESS ROAD (1)
24' X ±5,444.40'
±3.00 Acres
±329.96 Rods
(SEE PAGE 2)

Sec. 17

Bureau of Land Management

(Access Road 1) ± 4289.90', ±2.36 Acres, ±259.99 Rods

NAD 27 NEW MEXICO EAST ZONE

Scale: 1" = 300'

300' 0 150' 300'

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED PADS, FRAC POND & ACCESS ROADS
HH SO 8 P2 NO. 13H WELL
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

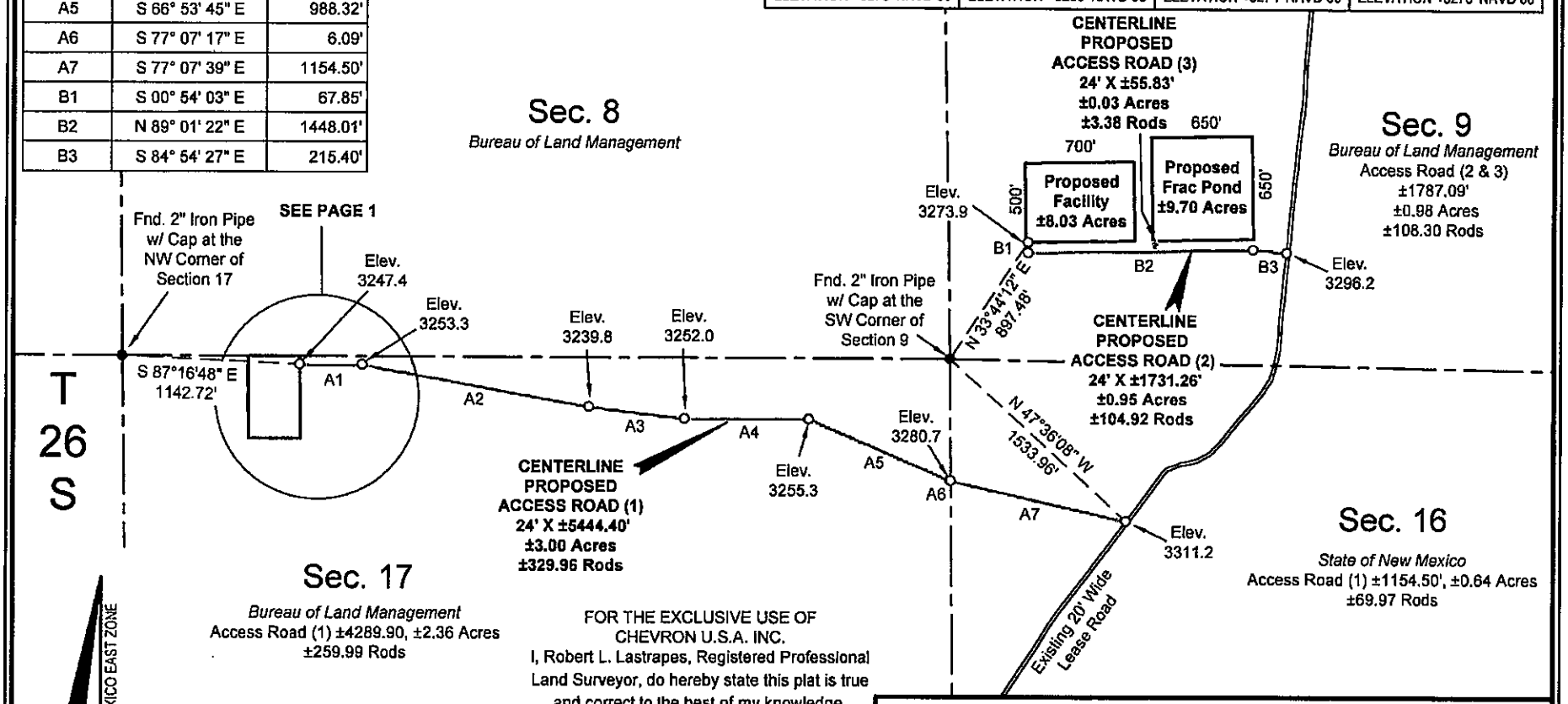
DRAWN BY: LJG	REVISIONS		
PROJ. MGR.: GDG	No. 1	DATE: 1/6/2016	REVISED BY: GDG
DATE: 12/22/2015	No. 2	DATE: 1/19/2016	REVISED BY: GDG
FILENAME: T:\2015\2153440\DWG\HH SO 8 P2 13H_SUP.dwg			

EXHIBITS 2&5

Centerline Proposed Access Roads		
COURSE	BEARING	DISTANCE
A1	S 89° 49' 39" E	398.61'
A2	S 79° 37' 12" E	1478.11'
A3	S 82° 59' 20" E	620.58'
A4	S 89° 50' 47" E	798.19'
A5	S 66° 53' 45" E	988.32'
A6	S 77° 07' 17" E	6.09'
A7	S 77° 07' 39" E	1154.50'
B1	S 00° 54' 03" E	67.85'
B2	N 89° 01' 22" E	1448.01'
B3	S 84° 54' 27" E	215.40'

R 27 E

NW FRAC POND CORNER	NE FRAC POND CORNER	NW FACILITY CORNER	NE FACILITY CORNER
X= 541,594 NAD 27 Y= 383,209	X= 542,244 NAD 27 Y= 383,220	X= 540,762 NAD 27 Y= 383,045	X= 541,482 NAD 27 Y= 383,057
ELEVATION +3264' NAVD 88	ELEVATION +3270' NAVD 88	ELEVATION +3263' NAVD 88	ELEVATION +3265' NAVD 88
SW FRAC POND CORNER	SE FRAC POND CORNER	SW FACILITY CORNER	SE FACILITY CORNER
X= 541,605 NAD 27 Y= 382,559	X= 542,255 NAD 27 Y= 382,570	X= 540,790 NAD 27 Y= 382,545	X= 541,490 NAD 27 Y= 382,557
ELEVATION +3278' NAVD 88	ELEVATION +3289' NAVD 88	ELEVATION +3274' NAVD 88	ELEVATION +3276' NAVD 88



FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

ROBERT L. LASTRAPES NEW MEXICO 23006 1-19-2016 PROFESSIONAL SURVEYOR

Robert L. Lastrapes
Registration No. 23006

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED PADS, FRAC POND & ACCESS ROADS
HH SO 8 P2 NO. 13H WELL
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: LJG	REVISIONS		
PROJ. MGR.: GDG	No. 1	DATE: 1/6/2016	REVISED BY: GDG
DATE: 12/22/2015	No. 2	DATE: 1/19/2016	REVISED BY: GDG
FILENAME: T:\2015\2153440\DWG\HH SO 8 P2 13H_SUP.dwg			

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:
Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

NOTE:
Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call.
www.nmonecall.org

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

ROBERT L. LASTRAPES
NEW MEXICO
23006
1-19-2016
PROFESSIONAL SURVEYOR

Robert L. Lastrapes
Registration No. 23006

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

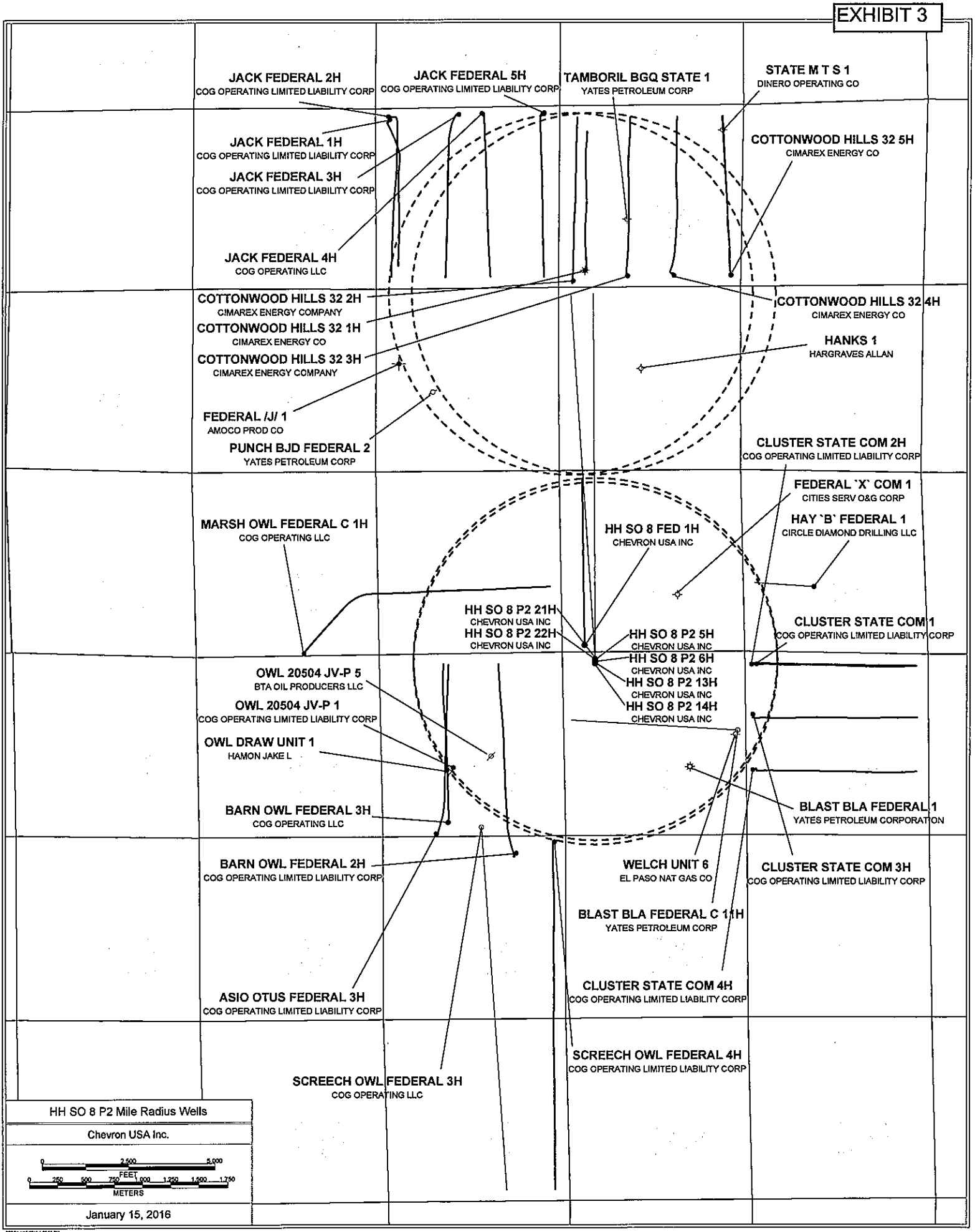
SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED PADS, FRAC POND & ACCESS ROADS
HH SO 8 P2 NO. 13H WELL
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: LJG	REVISIONS		
PROJ. MGR.: GDG	No. 1	DATE: 1/6/2016	REVISED BY: GDG
DATE: 12/22/2015	No. 2	DATE: 1/19/2016	REVISED BY: GDG
FILENAME: T:\2015\2153440\DWG\HH SO 8 P2 13H_SUP.dwg			

EXHIBIT 3


JACK FEDERAL 2H
COG OPERATING LIMITED LIABILITY CORP
JACK FEDERAL 5H
COG OPERATING LIMITED LIABILITY CORP
TAMBORIL BGQ STATE 1
YATES PETROLEUM CORP
STATE M T S 1
DINERO OPERATING CO
JACK FEDERAL 1H
COG OPERATING LIMITED LIABILITY CORP
JACK FEDERAL 3H
COG OPERATING LIMITED LIABILITY CORP
COTTONWOOD HILLS 32 5H
CIMAREX ENERGY CO
JACK FEDERAL 4H
COG OPERATING LLC
COTTONWOOD HILLS 32 2H
CIMAREX ENERGY COMPANY
COTTONWOOD HILLS 32 4H
CIMAREX ENERGY CO
COTTONWOOD HILLS 32 1H
CIMAREX ENERGY CO
HANKS 1
HARGRAVES ALLAN
COTTONWOOD HILLS 32 3H
CIMAREX ENERGY COMPANY
FEDERAL /J/ 1
AMOCO PROD CO
PUNCH BJD FEDERAL 2
YATES PETROLEUM CORP
CLUSTER STATE COM 2H
COG OPERATING LIMITED LIABILITY CORP
FEDERAL `X` COM 1
CITIES SERV O&G CORP
MARSH OWL FEDERAL C 1H
COG OPERATING LLC
HH SO 8 FED 1H
CHEVRON USA INC
HAY `B` FEDERAL 1
CIRCLE DIAMOND DRILLING LLC
HH SO 8 P2 21H
CHEVRON USA INC
HH SO 8 P2 22H
CHEVRON USA INC
HH SO 8 P2 5H
CHEVRON USA INC
CLUSTER STATE COM 1
COG OPERATING LIMITED LIABILITY CORP
HH SO 8 P2 6H
CHEVRON USA INC
HH SO 8 P2 13H
CHEVRON USA INC
HH SO 8 P2 14H
CHEVRON USA INC
OWL 20504 JV-P 5
BTA OIL PRODUCERS LLC
OWL 20504 JV-P 1
COG OPERATING LIMITED LIABILITY CORP
OWL DRAW UNIT 1
HAMON JAKE L
BARN OWL FEDERAL 3H
COG OPERATING LLC
BLAST BLA FEDERAL 1
YATES PETROLEUM CORPORATION
BARN OWL FEDERAL 2H
COG OPERATING LIMITED LIABILITY CORP
WELCH UNIT 6
EL PASO NAT GAS CO
CLUSTER STATE COM 3H
COG OPERATING LIMITED LIABILITY CORP
BLAST BLA FEDERAL C 1H
YATES PETROLEUM CORP
CLUSTER STATE COM 4H
COG OPERATING LIMITED LIABILITY CORP
ASIO OTUS FEDERAL 3H
COG OPERATING LIMITED LIABILITY CORP
SCREECH OWL FEDERAL 4H
COG OPERATING LIMITED LIABILITY CORP
SCREECH OWL FEDERAL 3H
COG OPERATING LLC
HH SO 8 P2 Mile Radius Wells
Chevron USA Inc.
0 2,500 5,000
FEET
0 250 500 750 1,000 1,250 1,500 1,750
METERS
January 15, 2016

1. **FORMATION TOPS**

The estimated tops of important geologic markers are as follows:

FORMATION	SUB-SEA TVD	KBTVD	MD
Castille		505	
Lamar		2395	
Bell		2310	
Cherry		3208	
Brushy		4450	
Bone Spring/Avalon		6299	
First Bone Spring Sand		6888	
First Bone Spring Shale		6914	
Second Bone Spring Sand		7621	
Harkey Sand		8123	
Third Bone Spring Sand		8617	
Wolfcamp A		9342	
Wolfcamp D		9904	
Lateral TVD Wolfcamp D		9904	20551.37'

2. **ESTIMATED DEPTH OF WATER, OIL, GAS & OTHER MINERAL BEARING FORMATIONS**

The estimated depths at which the top and bottom of the anticipated water, oil, gas, or other mineral bearing formations are expected to be encountered are as follows:

Substance	Formation	Depth
Deepest Expected Base of Fresh Water		450
Water	Castille	505
Water	Cherry Canyon	3208
Oil/Gas	Brushy Canyon	4450
Oil/Gas	Bone Spring Limestone	6888
Oil/Gas	First Bone Spring Shale	6914
Oil/Gas	Second Bone Spring Sand	7621
Oil/Gas	Harkey Sand	8123
Oil/Gas	Wolfcamp A	9342
Oil/Gas	Wolfcamp D	9904

All shows of fresh water and minerals will be reported and protected.

3. **BOP EQUIPMENT**

PLEASE REFERENCE MDP

10 M BOP after surface casing

Batch Drilling

4. **CASING PROGRAM**

Purpose	From	To	Hole Size	Csg Size	Weight	Grade	Thread	Condition
Surface	0'	450'	17-1/2"	13-3/8"	54.5 #	K-55	STC	New
Intermediate	0'	9,015'	12-1/4"	9-5/8"	40.0 #	L-80	TXP	New
Production	0'	20,551'	8-1/2"	~~5~~ 5 1/2"	20.0 #	P-110	TXP	New

SF Calculations based on the following "Worst Case" casing design:

Surface Casing: 450'
Intermediate Casing: 9015'
Production Casing: 20551.37' MD/9,904' TVD (10,000' VS @ 89.7 deg inc)

Casing String	Min SF Burst	Min SF Collapse	Min SF Tension	Min SF Tri-Axial
Surface	1.82	5.11	3.97	2.31
Intermediate	1.45	1.32	1.78	1.84
Production	1.26	1.5	2.43	1.35

Min SF is the smallest of a group of safety factors that include the following considerations:

	Surf	Int	Prod
Burst Design			
Pressure Test- Surface, Int, Prod Csg P external: Water P internal: Test psi + next section heaviest mud in csg	X	X	X
Displace to Gas- Surf Csg P external: Water P internal: Dry Gas from Next Csg Point	X		
Frac at Shoe, Gas to Surf- Int Csg P external: Water P internal: Dry Gas, 15 ppg Frac Gradient		X	
Stimulation (Frac) Pressures- Prod Csg P external: Water P internal: Max inj pressure w/ heaviest injected fluid			X
Tubing leak- Prod Csg (packer at KOP) P external: Water P internal: Leak just below surf, 8.7 ppg packer fluid			X
Collapse Design			
Full Evacuation P external: Water gradient in cement, mud above TOC P internal: none	X	X	X
Cementing- Surf, Int, Prod Csg P external: Wet cement P internal: water	X	X	X
Tension Design			
100k lb overpull	X	X	X

5. **CEMENTING PROGRAM**

Slurry	Type	Cement Top	Cement Bottom	Weight	Yield	%Excess	Sacks	Water
Surface				(ppg)	(sx/cu ft)	Open Hole		gal/sk
Tail	Class C	0'	450'	14.8	1.33	50	356	6.37
Intermediate								
Stage 2 Lead	50:50 Poz: Class C + Antifoam, Extender, Salt, Retarder	0'	1,100'	11.9	2.43	50	213	14.21
Stage 2 Tail	Class C + Antifoam, Retarder, Viscosifier	1,100'	2,100'	14.8	1.33	0	235	6.37
DV TOOL		2,100'						
Stage 1 Lead	50:50 Poz: Class H + Extender, Antifoam, Retarder, Salt, Viscosifier	2,100'	8,015'	11.9	2.43	100	1524	13.76
Stage 1 Tail	Class H + Retarder, Extender, Dispersant	8,015'	9,015'	15.6	1.21	50	389	5.54
Production								
Lead	50:50 Poz: Class H + Extender, Antifoam, Dispersant, , Retarder	7,015'	8,015'	14.5	1.21	100	430	5.54
Tail	Class H + Viscosifier, Antifoam, Dispersant, Fluid Loss, Retarder, Expanding Agent	8,015'	20,551'	15.6	1.2	50	3587	5.30

6. **MUD PROGRAM**

From	To	Type	8.3-8.7 Weight	32-34 F. Vis	NC-NC Filtrate
0'	450'	Spud Mud	~~0~~	~~0~~	~~0~~
450'	9015'	OBM	9.0 - 9.5	50 -70	5.0 - 10
9015'	20,551'	OBM	10.0 - 13.5	50 -70	5.0 - 10

7. **TESTING, LOGGING, AND CORING**

TYPE	Logs	Interval	Timing	Vendor
Mudlogs	2 man mudlog	Int Csg to TD	Drillout of Int Csg	TBD
LWD	MWD Gamma	Int. and Prod. Hole	While Drilling	TBD

8. **ABNORMAL PRESSURES AND HYDROGEN SULFIDE**

PLEASE REFERENCE MDP

Schlumberger

#13H - Rev0

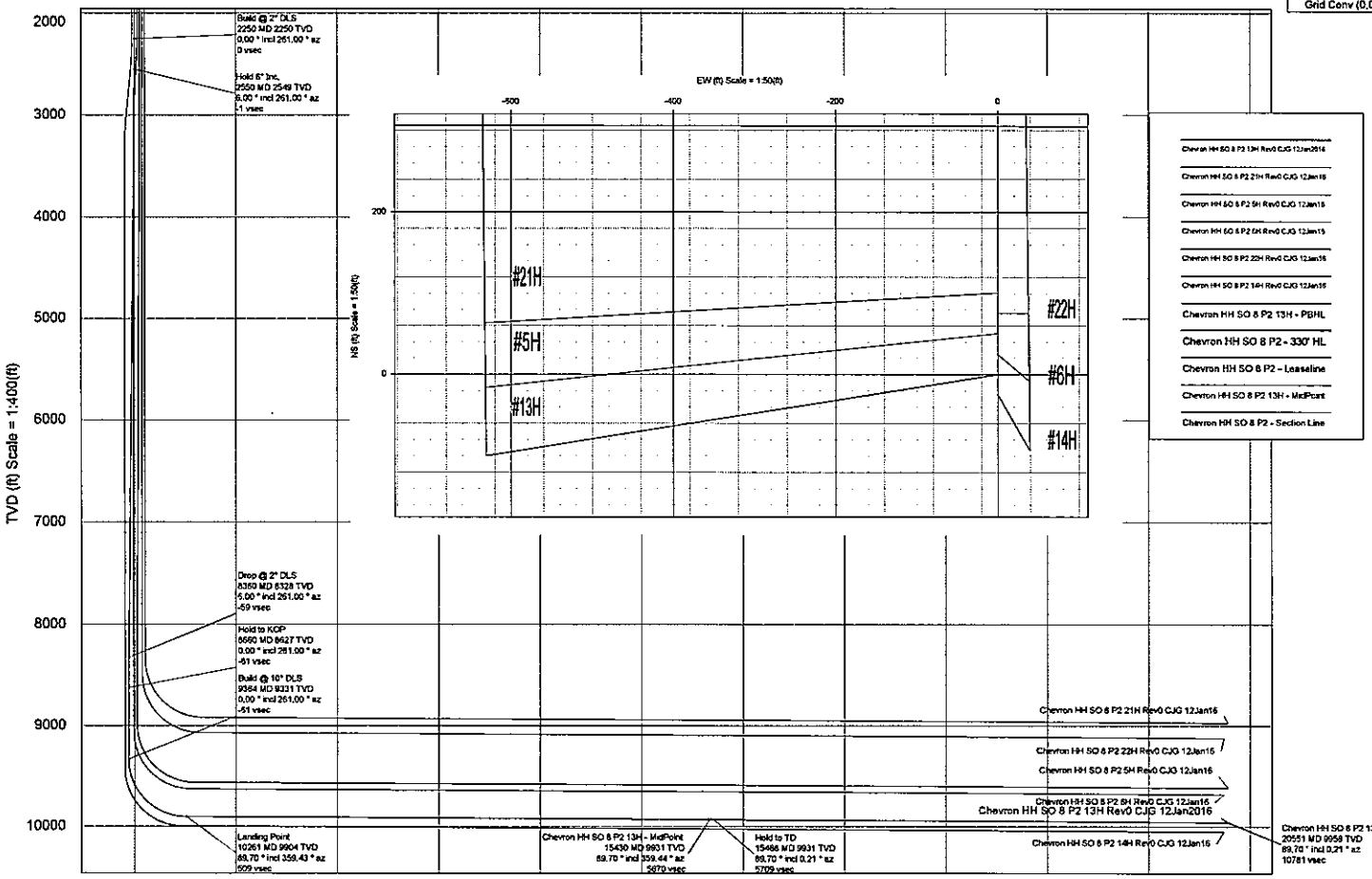
Chevron

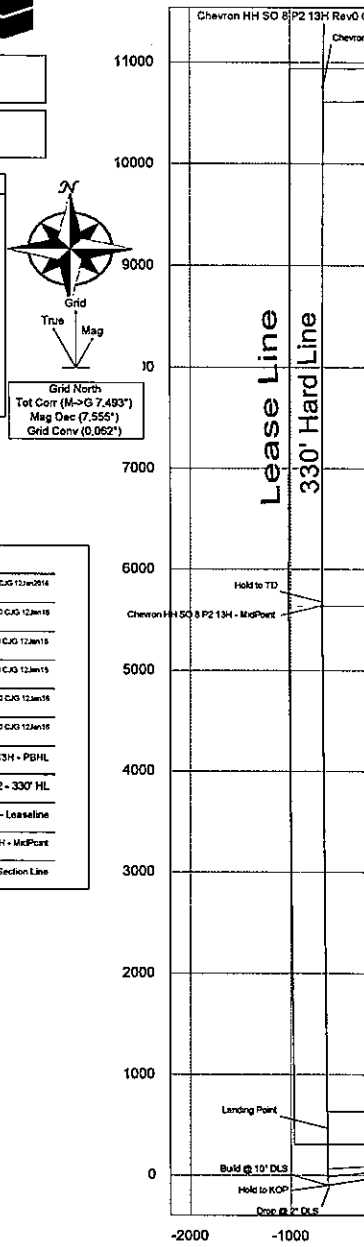
Borehole:	Well:	Field:	Structure:
Original Borehole	HH SO 8 P2 13H	NM Eddy County (NAD 27)	TBD

Gravity & Magnetic Parameters					Surface Location	NAD27 New Mexico State Plane, Eastern Zone, US Feet				Miscellaneous				
Model:	HDGM 2015	Dip:	59.774°	Date:	06-Jan-2016	Lat:	N 32 2 55.74	Northing:	381504ftUS	Grid Conv:	0.0616°	Slot:	HH SO 8 P2 13H	TVD Ref:	RKB(3278ft above MSL)
MagDec:	7.555°	FS:	48139.025nT	Gravity FS:	998.431mgn (9.80665 Based)	Lon:	W 104 13 2.25	Easting:	635953ftUS	Scale Fact:	0.99991057	Plan:	Rev0 CJG 12Jan16		

Critical Points

Critical Point	MD	INCL	AZIM	TVD	VSEC	N(+)/S(-)	E(+)/W(-)	DLS
SHL	0.00	0.00	261.00	0.00	0.00	0.00	0.00	
Build @ 2° DLS	2250.00	0.00	261.00	2250.00	0.00	0.00	0.00	0.00
Hold 6° Inc.	2550.00	6.00	261.00	2549.45	-1.49	-2.46	-15.50	2.00
Drop @ 2° DLS	8380.00	6.00	261.00	8327.62	-59.08	-97.46	-615.33	0.00
Hold to KOP	8660.00	0.00	261.00	8627.08	-60.57	-99.91	-630.83	2.00
Build @ 10° DLS	9363.97	0.00	261.00	9331.05	-60.57	-99.91	-630.83	0.00
Landing Point	10260.98	89.70	359.43	9904.00	508.61	470.02	-636.50	10.00
Chevron HH SO 8 P2 13H - MidPoint	15429.57	89.70	359.43	9931.03	5670.10	5638.29	-687.71	0.00
Hold to TD	15468.34	89.70	0.21	9931.23	5708.80	5677.05	-687.83	2.00
Chevron HH SO 8 P2 13H - PBHL	20551.37	89.70	0.21	9957.79	10780.76	10759.98	-669.05	0.00





Grid North
Tot Corr (M->G 7.493°)
Mag Dec (7.555°)
Grid Conv (0.062°)

CONTROLLED

Plan ref		Chevron HH SO 8 P2 13H Rev0 CJG 12Jan16
Drawing ref		
Copy number		of 3
Date		12-Jan-2016
1	Originator	Colby Gannon
2	DEC Sign Off	
3	CC Sign Off	
4	Client	Chevron
Copy number		By

Schlumberger

Chevron

Chevron HH SO 8 P2 13H Rev0 CJG 12Jan16 Proposal Geodetic Report

(Non-Def Plan)

Report Date:	January 12, 2016 - 02:23 PM	**Survey / DLS Computation:**	Minimum Curvature / Lubinski
Client:	Chevron	**Vertical Section Azimuth:**	356.442 ° (Grid North)
Field:	NM Eddy County (NAD 27)	**Vertical Section Origin:**	0.000 ft, 0.000 ft
Structure / Slot:	Chevron HH SO 8 P2 Pad / Chevron HH SO 8 P2 13H	**TVD Reference Datum:**	RKB
Well:	HH SO 8 P2 13H	**TVD Reference Elevation:**	3279.000 ft above MSL
Borehole:	Original Borehole	**Seabed / Ground Elevation:**	3246.000 ft above MSL
UWI / API#:	Unknown / Unknown	**Magnetic Declination:**	7.555 °
Survey Name:	Chevron HH SO 8 P2 13H Rev0 CJG 12Jan16	**Total Gravity Field Strength:**	998.4305mgn (9.80665 Based)
Survey Date:	January 08, 2016	**Gravity Model:**	GARM
Tort / AHD / DDI / ERD Ratio:	102.464 ° / 11498.913 ft / 6.386 / 1.155	**Total Magnetic Field Strength:**	48139.026 nT
Coordinate Reference System:	NAD27 New Mexico State Plane, Eastern Zone, US Feet	**Magnetic Dip Angle:**	59.774 °
Location Lat / Long:	N 32° 2' 55.73673", W 104° 13' 2.25276"	**Declination Date:**	January 08, 2016
Location Grid N/E Y/X:	N 381504.000 ftUS, E 535953.000 ftUS	**Magnetic Declination Model:**	HDGM 2015
CRS Grid Convergence Angle:	0.0616 °	**North Reference:**	Grid North
Grid Scale Factor:	0.99991057	**Grid Convergence Used:**	0.0616 °
Version / Patch:	2.8.572.0	**Total Corr Mag North->Grid North:**	7.4939 °
		Local Coord Referenced To:	Well Head

Comments	MD (ft)	Incl (°)	Azim Grid (°)	TVD (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLS (°/100ft)	Northing (ftUS)	Easting (ftUS)	Latitude (N/S ° ' ")	Longitude (E/W ° ' ")
SHL	0.00	0.00	261.00	0.00	0.00	0.00	0.00	N/A	381504.00	535953.00	N 32 2 55.74	W 104 13 2.25
	100.00	0.00	261.00	100.00	0.00	0.00	0.00	0.00	381504.00	535953.00	N 32 2 55.74	W 104 13 2.25
	200.00	0.00	261.00	200.00	0.00	0.00	0.00	0.00	381504.00	535953.00	N 32 2 55.74	W 104 13 2.25
	300.00	0.00	261.00	300.00	0.00	0.00	0.00	0.00	381504.00	535953.00	N 32 2 55.74	W 104 13 2.25
	400.00	0.00	261.00	400.00	0.00	0.00	0.00	0.00	381504.00	535953.00	N 32 2 55.74	W 104 13 2.25
	500.00	0.00	261.00	500.00	0.00	0.00	0.00	0.00	381504.00	535953.00	N 32 2 55.74	W 104 13 2.25
	600.00	0.00	261.00	600.00	0.00	0.00	0.00	0.00	381504.00	535953.00	N 32 2 55.74	W 104 13 2.25
	700.00	0.00	261.00	700.00	0.00	0.00	0.00	0.00	381504.00	535953.00	N 32 2 55.74	W 104 13 2.25
	800.00	0.00	261.00	800.00	0.00	0.00	0.00	0.00	381504.00	535953.00	N 32 2 55.74	W 104 13 2.25
	900.00	0.00	261.00	900.00	0.00	0.00	0.00	0.00	381504.00	535953.00	N 32 2 55.74	W 104 13 2.25
	1000.00	0.00	261.00	1000.00	0.00	0.00	0.00	0.00	381504.00	535953.00	N 32 2 55.74	W 104 13 2.25
	1100.00	0.00	261.00	1100.00	0.00	0.00	0.00	0.00	381504.00	535953.00	N 32 2 55.74	W 104 13 2.25
	1200.00	0.00	261.00	1200.00	0.00	0.00	0.00	0.00	381504.00	535953.00	N 32 2 55.74	W 104 13 2.25
	1300.00	0.00	261.00	1300.00	0.00	0.00	0.00	0.00	381504.00	535953.00	N 32 2 55.74	W 104 13 2.25
	1400.00	0.00	261.00	1400.00	0.00	0.00	0.00	0.00	381504.00	535953.00	N 32 2 55.74	W 104 13 2.25
	1500.00	0.00	261.00	1500.00	0.00	0.00	0.00	0.00	381504.00	535953.00	N 32 2 55.74	W 104 13 2.25
	1600.00	0.00	261.00	1600.00	0.00	0.00	0.00	0.00	381504.00	535953.00	N 32 2 55.74	W 104 13 2.25
	1700.00	0.00	261.00	1700.00	0.00	0.00	0.00	0.00	381504.00	535953.00	N 32 2 55.74	W 104 13 2.25
	1800.00	0.00	261.00	1800.00	0.00	0.00	0.00	0.00	381504.00	535953.00	N 32 2 55.74	W 104 13 2.25
	1900.00	0.00	261.00	1900.00	0.00	0.00	0.00	0.00	381504.00	535953.00	N 32 2 55.74	W 104 13 2.25
	2000.00	0.00	261.00	2000.00	0.00	0.00	0.00	0.00	381504.00	535953.00	N 32 2 55.74	W 104 13 2.25
	2100.00	0.00	261.00	2100.00	0.00	0.00	0.00	0.00	381504.00	535953.00	N 32 2 55.74	W 104 13 2.25
	2200.00	0.00	261.00	2200.00	0.00	0.00	0.00	0.00	381504.00	535953.00	N 32 2 55.74	W 104 13 2.25
Build @ 2° DLS	2250.00	0.00	261.00	2250.00	0.00	0.00	0.00	0.00	381504.00	535953.00	N 32 2 55.74	W 104 13 2.25
	2300.00	1.00	261.00	2300.00	-0.04	-0.07	-0.43	2.00	381503.93	535952.57	N 32 2 55.74	W 104 13 2.26
	2400.00	3.00	261.00	2399.93	-0.37	-0.61	-3.88	2.00	381503.39	535949.12	N 32 2 55.73	W 104 13 2.30
	2500.00	5.00	261.00	2499.68	-1.03	-1.71	-10.77	2.00	381502.29	535942.23	N 32 2 55.72	W 104 13 2.38
Hold 6° Inc.	2550.00	6.00	261.00	2549.45	-1.49	-2.46	-15.50	2.00	381501.55	535937.50	N 32 2 55.71	W 104 13 2.43
	2600.00	6.00	261.00	2599.18	-1.98	-3.27	-20.66	0.00	381500.73	535932.34	N 32 2 55.71	W 104 13 2.49
	2700.00	6.00	261.00	2698.63	-2.98	-4.91	-30.99	0.00	381499.09	535922.02	N 32 2 55.69	W 104 13 2.61
	2800.00	6.00	261.00	2798.08	-3.97	-6.54	-41.31	0.00	381497.46	535911.69	N 32 2 55.67	W 104 13 2.73
	2900.00	6.00	261.00	2897.53	-4.96	-8.18	-51.63	0.00	381495.82	535901.37	N 32 2 55.66	W 104 13 2.85
	3000.00	6.00	261.00	2996.99	-5.95	-9.81	-61.96	0.00	381494.19	535891.05	N 32 2 55.64	W 104 13 2.97
	3100.00	6.00	261.00	3096.44	-6.94	-11.45	-72.28	0.00	381492.55	535880.72	N 32 2 55.63	W 104 13 3.09
	3200.00	6.00	261.00	3195.89	-7.93	-13.08	-82.61	0.00	381490.92	535870.40	N 32 2 55.61	W 104 13 3.21
	3300.00	6.00	261.00	3295.34	-8.92	-14.72	-92.93	0.00	381489.28	535860.08	N 32 2 55.59	W 104 13 3.33
	3400.00	6.00	261.00	3394.80	-9.91	-16.35	-103.26	0.00	381487.65	535849.75	N 32 2 55.58	W 104 13 3.45
	3500.00	6.00	261.00	3494.25	-10.91	-17.99	-113.58	0.00	381486.01	535839.43	N 32 2 55.56	W 104 13 3.57
	3600.00	6.00	261.00	3593.70	-11.90	-19.62	-123.90	0.00	381484.38	535829.11	N 32 2 55.55	W 104 13 3.69
	3700.00	6.00	261.00	3693.15	-12.89	-21.26	-134.23	0.00	381482.74	535818.78	N 32 2 55.53	W 104 13 3.81
	3800.00	6.00	261.00	3792.60	-13.88	-22.89	-144.55	0.00	381481.11	535808.46	N 32 2 55.51	W 104 13 3.93
	3900.00	6.00	261.00	3892.06	-14.87	-24.53	-154.88	0.00	381479.47	535798.14	N 32 2 55.50	W 104 13 4.05
	4000.00	6.00	261.00	3991.51	-15.86	-26.17	-165.20	0.00	381477.84	535787.81	N 32 2 55.48	W 104 13 4.17
	4100.00	6.00	261.00	4090.96	-16.85	-27.80	-175.52	0.00	381476.20	535777.49	N 32 2 55.47	W 104 13 4.29
	4200.00	6.00	261.00	4190.41	-17.84	-29.44	-185.85	0.00	381474.57	535767.17	N 32 2 55.45	W 104 13 4.41
	4300.00	6.00	261.00	4289.87	-18.84	-31.07	-196.17	0.00	381472.93	535756.84	N 32 2 55.43	W 104 13 4.53
	4400.00	6.00	261.00	4389.32	-19.83	-32.71	-206.50	0.00	381471.30	535746.52	N 32 2 55.42	W 104 13 4.65
	4500.00	6.00	261.00	4488.77	-20.82	-34.34	-216.82	0.00	381469.66	535736.20	N 32 2 55.40	W 104 13 4.77
	4600.00	6.00	261.00	4588.22	-21.81	-35.98	-227.15	0.00	381468.03	535725.88	N 32 2 55.39	W 104 13 4.89
	4700.00	6.00	261.00	4687.67	-22.80	-37.61	-237.47	0.00	381466.39	535715.55	N 32 2 55.37	W 104 13 5.01
	4800.00	6.00	261.00	4787.13	-23.79	-39.25	-247.79	0.00	381464.76	535705.23	N 32 2 55.35	W 104 13 5.13
	4900.00	6.00	261.00	4886.58	-24.78	-40.88	-258.12	0.00	381463.12	535694.91	N 32 2 55.34	W 104 13 5.25
	5000.00	6.00	261.00	4986.03	-25.78	-42.52	-268.44	0.00	381461.49	535684.58	N 32 2 55.32	W 104 13 5.37
	5100.00	6.00	261.00	5085.48	-26.77	-44.15	-278.77	0.00	381459.85	535674.26	N 32 2 55.30	W 104 13 5.49
	5200.00	6.00	261.00	5184.94	-27.76	-45.79	-289.09	0.00	381458.22	535663.94	N 32 2 55.29	W 104 13 5.61
	5300.00	6.00	261.00	5284.39	-28.75	-47.42	-299.41	0.00	381456.58	535653.61	N 32 2 55.27	W 104 13 5.73
	5400.00	6.00	261.00	5383.84	-29.74	-49.06	-309.74	0.00	381454.95	535643.29	N 32 2 55.26	W 104 13 5.85
	5500.00	6.00	261.00	5483.29	-30.73	-50.69	-320.06	0.00	381453.31	535632.97	N 32 2 55.24	W 104 13 5.97
	5600.00	6.00	261.00	5582.74	-31.72	-52.33	-330.39	0.00	381451.68	535622.64	N 32 2 55.22	W 104 13 6.09
	5700.00	6.00	261.00	5682.20	-32.71	-53.96	-340.71	0.00	381450.04	535612.32	N 32 2 55.21	W 104 13 6.21
	5800.00	6.00	261.00	5781.65	-33.71	-55.60	-351.04	0.00	381448.41	535602.00	N 32 2 55.19	W 104 13 6.33
	5900.00	6.00	261.00	5881.10	-34.70	-57.23	-361.36	0.00	381446.77	535591.67	N 32 2 55.18	W 104 13 6.45
	6000.00	6.00	261.00	5980.55	-35.69	-58.87	-371.68	0.00	381445.14	535581.35	N 32 2 55.16	W 104 13 6.57
	6100.00	6.00	261.00	6080.00	-36.68	-60.50	-382.01	0.00	381443.50	535571.03	N 32 2 55.14	W 104 13 6.69
	6200.00	6.00	261.00	6179.46	-37.67	-62.14	-392.33	0.00	381441.87	535560.70	N 32 2 55.13	W 104 13 6.81

Comments	MD (ft)	Incl (°)	Azim Grid (°)	TVD (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLS (°/100ft)	Northing (ftUS)	Easting (ftUS)	Latitude (N/S ° ' ")	Longitude (E/W ° ' ")
	6300.00	6.00	261.00	6278.91	-38.66	-63.77	-402.66	0.00	381440.23	535550.38	N 32 2 55.11	W 104 13 6.93
	6400.00	6.00	261.00	6378.36	-39.65	-65.41	-412.98	0.00	381438.60	535540.06	N 32 2 55.10	W 104 13 7.05
	6500.00	6.00	261.00	6477.81	-40.65	-67.04	-423.30	0.00	381436.96	535529.73	N 32 2 55.08	W 104 13 7.17
	6600.00	6.00	261.00	6577.27	-41.64	-68.68	-433.63	0.00	381435.33	535519.41	N 32 2 55.06	W 104 13 7.29
	6700.00	6.00	261.00	6676.72	-42.63	-70.32	-443.95	0.00	381433.69	535509.09	N 32 2 55.05	W 104 13 7.41
	6800.00	6.00	261.00	6776.17	-43.62	-71.95	-454.28	0.00	381432.06	535498.76	N 32 2 55.03	W 104 13 7.53
	6900.00	6.00	261.00	6875.62	-44.61	-73.59	-464.60	0.00	381430.42	535488.44	N 32 2 55.02	W 104 13 7.65
	7000.00	6.00	261.00	6975.07	-45.60	-75.22	-474.93	0.00	381428.79	535478.12	N 32 2 55.00	W 104 13 7.77
	7100.00	6.00	261.00	7074.53	-46.59	-76.86	-485.25	0.00	381427.15	535467.79	N 32 2 54.98	W 104 13 7.89
	7200.00	6.00	261.00	7173.98	-47.58	-78.49	-495.57	0.00	381425.52	535457.47	N 32 2 54.97	W 104 13 8.01
	7300.00	6.00	261.00	7273.43	-48.58	-80.13	-505.90	0.00	381423.88	535447.15	N 32 2 54.95	W 104 13 8.13
	7400.00	6.00	261.00	7372.88	-49.57	-81.76	-516.22	0.00	381422.25	535436.83	N 32 2 54.94	W 104 13 8.25
	7500.00	6.00	261.00	7472.34	-50.56	-83.40	-526.55	0.00	381420.61	535426.50	N 32 2 54.92	W 104 13 8.37
	7600.00	6.00	261.00	7571.79	-51.55	-85.03	-536.87	0.00	381418.98	535416.18	N 32 2 54.90	W 104 13 8.49
	7700.00	6.00	261.00	7671.24	-52.54	-86.67	-547.19	0.00	381417.34	535405.86	N 32 2 54.89	W 104 13 8.61
	7800.00	6.00	261.00	7770.69	-53.53	-88.30	-557.52	0.00	381415.71	535395.53	N 32 2 54.87	W 104 13 8.73
	7900.00	6.00	261.00	7870.14	-54.52	-89.94	-567.84	0.00	381414.07	535385.21	N 32 2 54.85	W 104 13 8.85
	8000.00	6.00	261.00	7969.60	-55.51	-91.57	-578.17	0.00	381412.44	535374.89	N 32 2 54.84	W 104 13 8.97
	8100.00	6.00	261.00	8069.05	-56.51	-93.21	-588.49	0.00	381410.80	535364.56	N 32 2 54.82	W 104 13 9.09
	8200.00	6.00	261.00	8168.50	-57.50	-94.84	-598.82	0.00	381409.17	535354.24	N 32 2 54.81	W 104 13 9.21
	8300.00	6.00	261.00	8267.95	-58.49	-96.48	-609.14	0.00	381407.53	535343.92	N 32 2 54.79	W 104 13 9.33
Drop @ 2° DLS	8360.00	6.00	261.00	8327.62	-59.08	-97.46	-615.33	0.00	381406.55	535337.72	N 32 2 54.78	W 104 13 9.40
	8400.00	5.20	261.00	8367.43	-59.45	-98.07	-619.19	2.00	381405.94	535333.87	N 32 2 54.77	W 104 13 9.45
	8500.00	3.20	261.00	8467.16	-60.15	-99.22	-626.42	2.00	381404.79	535326.63	N 32 2 54.76	W 104 13 9.53
	8600.00	1.20	261.00	8567.08	-60.51	-99.82	-630.21	2.00	381404.19	535322.84	N 32 2 54.76	W 104 13 9.58
Hold to KOP	8660.00	0.00	261.00	8627.08	-60.57	-99.91	-630.83	2.00	381404.09	535322.22	N 32 2 54.76	W 104 13 9.58
	8700.00	0.00	261.00	8667.08	-60.57	-99.91	-630.83	0.00	381404.09	535322.22	N 32 2 54.76	W 104 13 9.58
	8800.00	0.00	261.00	8767.08	-60.57	-99.91	-630.83	0.00	381404.09	535322.22	N 32 2 54.76	W 104 13 9.58
	8900.00	0.00	261.00	8867.08	-60.57	-99.91	-630.83	0.00	381404.09	535322.22	N 32 2 54.76	W 104 13 9.58
	9000.00	0.00	261.00	8967.08	-60.57	-99.91	-630.83	0.00	381404.09	535322.22	N 32 2 54.76	W 104 13 9.58
	9100.00	0.00	261.00	9067.08	-60.57	-99.91	-630.83	0.00	381404.09	535322.22	N 32 2 54.76	W 104 13 9.58
	9200.00	0.00	261.00	9167.08	-60.57	-99.91	-630.83	0.00	381404.09	535322.22	N 32 2 54.76	W 104 13 9.58
	9300.00	0.00	261.00	9267.08	-60.57	-99.91	-630.83	0.00	381404.09	535322.22	N 32 2 54.76	W 104 13 9.58
Build @ 10° DLS	9363.97	0.00	261.00	9331.05	-60.57	-99.91	-630.83	0.00	381404.09	535322.22	N 32 2 54.76	W 104 13 9.58
	9400.00	3.60	359.43	9367.05	-59.44	-98.78	-630.85	10.00	381405.23	535322.21	N 32 2 54.77	W 104 13 9.58
	9500.00	13.60	359.43	9465.80	-44.52	-83.84	-630.99	10.00	381420.16	535322.06	N 32 2 54.92	W 104 13 9.58
	9600.00	23.60	359.43	9560.46	-12.71	-51.99	-631.31	10.00	381452.02	535321.75	N 32 2 55.23	W 104 13 9.59
	9700.00	33.60	359.43	9648.14	35.04	-4.18	-631.79	10.00	381499.82	535321.27	N 32 2 55.70	W 104 13 9.59
	9800.00	43.60	359.43	9726.19	97.27	58.13	-632.41	10.00	381562.13	535320.65	N 32 2 56.32	W 104 13 9.60
	9900.00	53.60	359.43	9792.24	172.09	133.05	-633.15	10.00	381637.04	535319.91	N 32 2 57.06	W 104 13 9.61
	10000.00	63.60	359.43	9844.27	257.22	218.29	-634.00	10.00	381722.27	535319.06	N 32 2 57.91	W 104 13 9.62
	10100.00	73.60	359.43	9880.70	350.08	311.28	-634.93	10.00	381815.25	535318.13	N 32 2 58.83	W 104 13 9.63
	10200.00	83.60	359.43	9900.44	447.85	409.18	-635.90	10.00	381913.14	535317.16	N 32 2 59.79	W 104 13 9.64
Landing Point	10260.98	89.70	359.43	9904.00	508.61	470.02	-636.50	10.00	381973.98	535316.55	N 32 3 0.40	W 104 13 9.64
	10300.00	89.70	359.43	9904.20	547.58	509.04	-636.89	0.00	382012.99	535316.17	N 32 3 0.78	W 104 13 9.65
	10400.00	89.70	359.43	9904.73	647.45	609.03	-637.89	0.00	382112.98	535315.17	N 32 3 1.77	W 104 13 9.66
	10500.00	89.70	359.43	9905.25	747.31	709.03	-638.88	0.00	382212.96	535314.18	N 32 3 2.76	W 104 13 9.67
	10600.00	89.70	359.43	9905.77	847.17	809.02	-639.88	0.00	382312.95	535313.18	N 32 3 3.75	W 104 13 9.68
	10700.00	89.70	359.43	9906.30	947.03	909.01	-640.87	0.00	382412.93	535312.19	N 32 3 4.74	W 104 13 9.69
	10800.00	89.70	359.43	9906.82	1046.90	1009.01	-641.86	0.00	382512.92	535311.19	N 32 3 5.73	W 104 13 9.70
	10900.00	89.70	359.43	9907.34	1146.76	1109.00	-642.86	0.00	382612.90	535310.20	N 32 3 6.72	W 104 13 9.71
	11000.00	89.70	359.43	9907.86	1246.62	1208.99	-643.85	0.00	382712.88	535309.21	N 32 3 7.71	W 104 13 9.72
	11100.00	89.70	359.43	9908.39	1346.48	1308.99	-644.85	0.00	382812.87	535308.21	N 32 3 8.70	W 104 13 9.73
	11200.00	89.70	359.43	9908.91	1446.35	1408.98	-645.84	0.00	382912.85	535307.22	N 32 3 9.69	W 104 13 9.74
	11300.00	89.70	359.43	9909.43	1546.21	1508.98	-646.83	0.00	383012.84	535306.23	N 32 3 10.68	W 104 13 9.75
	11400.00	89.70	359.43	9909.96	1646.07	1608.97	-647.83	0.00	383112.82	535305.23	N 32 3 11.67	W 104 13 9.76
	11500.00	89.70	359.43	9910.48	1745.94	1708.96	-648.82	0.00	383212.81	535304.24	N 32 3 12.66	W 104 13 9.77
	11600.00	89.70	359.43	9911.00	1845.80	1808.96	-649.81	0.00	383312.79	535303.25	N 32 3 13.65	W 104 13 9.78
	11700.00	89.70	359.43	9911.53	1945.66	1908.95	-650.80	0.00	383412.78	535302.26	N 32 3 14.64	W 104 13 9.79
	11800.00	89.70	359.43	9912.05	2045.52	2008.94	-651.80	0.00	383512.76	535301.26	N 32 3 15.63	W 104 13 9.80
	11900.00	89.70	359.43	9912.57	2145.39	2108.94	-652.79	0.00	383612.75	535300.27	N 32 3 16.62	W 104 13 9.81
	12000.00	89.70	359.43	9913.09	2245.25	2208.93	-653.78	0.00	383712.73	535299.28	N 32 3 17.60	W 104 13 9.82
	12100.00	89.70	359.43	9913.62	2345.11	2308.93	-654.77	0.00	383812.71	535298.28	N 32 3 18.59	W 104 13 9.83
	12200.00	89.70	359.43	9914.14	2444.97	2408.92	-655.76	0.00	383912.70	535297.30	N 32 3 19.58	W 104 13 9.84
	12300.00	89.70	359.43	9914.66	2544.84	2508.91	-656.76	0.00	384012.68	535296.30	N 32 3 20.57	W 104 13 9.85
	12400.00	89.70	359.43	9915.19	2644.70	2608.91	-657.75	0.00	384112.67	535295.31	N 32 3 21.56	W 104 13 9.86
	12500.00	89.70	359.43	9915.71	2744.56	2708.90	-658.74	0.00	384212.65	535294.32	N 32 3 22.55	W 104 13 9.87
	12600.00	89.70	359.43	9916.23	2844.42	2808.89	-659.73	0.00	384312.64	535293.33	N 32 3 23.54	W 104 13 9.88
	12700.00	89.70	359.43	9916.76	2944.29	2908.89	-660.72	0.00	384412.62	535292.34	N 32 3 24.53	W 104 13 9.89
	12800.00	89.70	359.43	9917.28	3044.15	3008.88	-661.71	0.00	384512.61	535291.35	N 32 3 25.52	W 104 13 9.90
	12900.00	89.70	359.43	9917.80	3144.01	3108.88	-662.70	0.00	384612.59	535290.36	N 32 3 26.51	W 104 13 9.91
	13000.00	89.70	359.43	9918.32	3243.87	3208.87	-663.69	0.00	384712.58	535289.37	N 32 3 27.50	W 104 13 9.92
	13100.00	89.70	359.43	9918.85	3343.74	3308.86	-664.68	0.00	384812.56	535288.38	N 32 3 28.49	W 104 13 9.93
	13200.00	89.70	359.43	9919.37	3443.60	3408.86	-665.67	0.00	384912.54	535287.39	N 32 3 29.48	W 104 13 9.94
	13300.00	89.70	359.43	9919.89	3543.46	3508.85	-666.66	0.00	385012.53	535286.40	N 32 3 30.47	W 104 13 9.96
	13400.00	89.70	359.43	9920.42	3643.32	3608.84	-667.65	0.00	385112.51	535285.41	N 32 3 31.46	W 104 13 9.97
	13500.00	89.70	359.43	9920.94	3743.18	3708.84	-668.64	0.00	385212.50	535284.42	N 32 3 32.45	W 104 13 9.98
	13600.00	89.70	359.43	9921.46	3843.05	3808.83	-669.63	0.00	385312.48	535283.43	N 32 3 33.44	W 104 13 9.99
	13700.00	89.70	359.43	9921.98	3942.91	3908.83	-670.62	0.00	385412.47	535282.44	N 32 3 34.43	W 104 13 10.00
	13800.00	89.70	359.43	9922.51	4042.77	4008.82	-671.61	0.00	385512.45	535281.45	N 32 3 35.42	W 104 13 10.01
	13900.00	89.70	359.43	9923.03	4142.63	4108.81	-672.60	0.00	385612.44	535280.46	N 32 3 36.41	W 104 13 10.02
	14000.00	89.70	359.43	9923.55	4242.50	4208.81	-673.59	0.00	385712.42	535279.47	N 32 3 37.40	W 104 13 10.03
	14100.00	89.70	359.43	9924.08	4342.36	4308.80	-674.58	0.00	385812.41	535278.48	N 32 3 38.38	W 104 13 10.04
	14200.00	89.70	359.43	9924.60	4442.22	4408.79	-675.57	0.00	385912.39	535277.49	N 32 3 39.37	W 104 13 10.05
	14300.00	89.70	359.43	9925.12	4542.08	4508.79	-676.56	0.00	386012.38	535276.50	N 32 3 40.36	W 104 13 10.06
	14400.00	89.70	359.43	9925.65	4641.95	4608.78	-677.55	0.00	386112.36	535275.52	N 32 3 41.35	W 104 13 10.07
	14500.00	89.70	359.43	9926.17	4741.81	4708.78	-678.53	0.00	386212.34	535274.53	N 32 3 42.34	W 104 13 10.08
	14600.00	89.70	359.43	9926.69	4841.67	4808.77	-679.52	0.00	386312.33	535273.54	N 32 3 43.33	W 104 13 10.09

Comments	MD (ft)	Incl (°)	Azim Grid (°)	TVD (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLS (°/100ft)	Northing (ftUS)	Easting (ftUS)	Latitude (N/S ° ' ")	Longitude (E/W ° ' ")
	14700.00	89.70	359.43	9927.21	4941.53	4908.76	-680.51	0.00	386412.31	535272.55	N 32 3 44.32	W 104 13 10.10
	14800.00	89.70	359.43	9927.74	5041.40	5008.76	-681.50	0.00	386512.30	535271.56	N 32 3 45.31	W 104 13 10.11
	14900.00	89.70	359.43	9928.26	5141.26	5108.75	-682.49	0.00	386612.28	535270.58	N 32 3 46.30	W 104 13 10.12
	15000.00	89.70	359.43	9928.78	5241.12	5208.74	-683.47	0.00	386712.27	535269.59	N 32 3 47.29	W 104 13 10.13
	15100.00	89.70	359.43	9929.31	5340.98	5308.74	-684.46	0.00	386812.25	535268.60	N 32 3 48.28	W 104 13 10.14
	15200.00	89.70	359.43	9929.83	5440.84	5408.73	-685.45	0.00	386912.24	535267.62	N 32 3 49.27	W 104 13 10.15
	15300.00	89.70	359.43	9930.35	5540.71	5508.73	-686.43	0.00	387012.22	535266.63	N 32 3 50.26	W 104 13 10.16
	15400.00	89.70	359.43	9930.88	5640.57	5608.72	-687.42	0.00	387112.21	535265.64	N 32 3 51.25	W 104 13 10.17
Chevron HH SO 8 P2 13H - MidPoint	15429.57	89.70	359.43	9931.03	5670.10	5638.29	-687.71	0.00	387141.77	535265.35	N 32 3 51.54	W 104 13 10.17
Hold to TD	15468.34	89.70	0.21	9931.23	5708.80	5677.05	-687.83	2.00	387180.53	535265.23	N 32 3 51.92	W 104 13 10.17
	15500.00	89.70	0.21	9931.40	5740.39	5708.72	-687.72	0.00	387212.19	535265.35	N 32 3 52.24	W 104 13 10.17
	15600.00	89.70	0.21	9931.92	5840.17	5808.71	-687.35	0.00	387312.18	535265.71	N 32 3 53.23	W 104 13 10.17
	15700.00	89.70	0.21	9932.45	5939.96	5908.71	-686.98	0.00	387412.17	535266.08	N 32 3 54.22	W 104 13 10.16
	15800.00	89.70	0.21	9932.97	6039.74	6008.71	-686.62	0.00	387512.16	535266.45	N 32 3 55.21	W 104 13 10.16
	15900.00	89.70	0.21	9933.49	6139.52	6108.71	-686.25	0.00	387612.15	535266.81	N 32 3 56.20	W 104 13 10.15
	16000.00	89.70	0.21	9934.02	6239.30	6208.71	-685.88	0.00	387712.14	535267.18	N 32 3 57.19	W 104 13 10.15
	16100.00	89.70	0.21	9934.54	6339.09	6308.70	-685.52	0.00	387812.13	535267.55	N 32 3 58.18	W 104 13 10.14
	16200.00	89.70	0.21	9935.06	6438.87	6408.70	-685.15	0.00	387912.12	535267.91	N 32 3 59.16	W 104 13 10.13
	16300.00	89.70	0.21	9935.59	6538.65	6508.70	-684.78	0.00	388012.10	535268.28	N 32 4 0.15	W 104 13 10.13
	16400.00	89.70	0.21	9936.11	6638.43	6608.70	-684.41	0.00	388112.09	535268.65	N 32 4 1.14	W 104 13 10.12
	16500.00	89.70	0.21	9936.63	6738.22	6708.70	-684.05	0.00	388212.08	535269.02	N 32 4 2.13	W 104 13 10.12
	16600.00	89.70	0.21	9937.16	6838.00	6808.69	-683.68	0.00	388312.07	535269.38	N 32 4 3.12	W 104 13 10.11
	16700.00	89.70	0.21	9937.68	6937.78	6908.69	-683.31	0.00	388412.06	535269.75	N 32 4 4.11	W 104 13 10.11
	16800.00	89.70	0.21	9938.20	7037.56	7008.69	-682.94	0.00	388512.05	535270.12	N 32 4 5.10	W 104 13 10.10
	16900.00	89.70	0.21	9938.72	7137.35	7108.69	-682.57	0.00	388612.04	535270.49	N 32 4 6.09	W 104 13 10.10
	17000.00	89.70	0.21	9939.25	7237.13	7208.68	-682.21	0.00	388712.03	535270.86	N 32 4 7.08	W 104 13 10.09
	17100.00	89.70	0.21	9939.77	7336.91	7308.68	-681.84	0.00	388812.01	535271.22	N 32 4 8.07	W 104 13 10.08
	17200.00	89.70	0.21	9940.29	7436.69	7408.68	-681.47	0.00	388912.00	535271.59	N 32 4 9.06	W 104 13 10.08
	17300.00	89.70	0.21	9940.82	7536.47	7508.68	-681.10	0.00	389011.99	535271.96	N 32 4 10.05	W 104 13 10.07
	17400.00	89.70	0.21	9941.34	7636.26	7608.68	-680.73	0.00	389111.98	535272.33	N 32 4 11.04	W 104 13 10.07
	17500.00	89.70	0.21	9941.86	7736.04	7708.67	-680.36	0.00	389211.97	535272.70	N 32 4 12.03	W 104 13 10.06
	17600.00	89.70	0.21	9942.38	7835.82	7808.67	-680.00	0.00	389311.96	535273.07	N 32 4 13.02	W 104 13 10.06
	17700.00	89.70	0.21	9942.91	7935.60	7908.67	-679.63	0.00	389411.95	535273.44	N 32 4 14.01	W 104 13 10.05
	17800.00	89.70	0.21	9943.43	8035.39	8008.67	-679.26	0.00	389511.94	535273.80	N 32 4 15.00	W 104 13 10.05
	17900.00	89.70	0.21	9943.95	8135.17	8108.67	-678.89	0.00	389611.93	535274.17	N 32 4 15.99	W 104 13 10.04
	18000.00	89.70	0.21	9944.47	8234.95	8208.66	-678.52	0.00	389711.91	535274.54	N 32 4 16.98	W 104 13 10.04
	18100.00	89.70	0.21	9945.00	8334.73	8308.66	-678.15	0.00	389811.90	535274.91	N 32 4 17.97	W 104 13 10.03
	18200.00	89.70	0.21	9945.52	8434.52	8408.66	-677.78	0.00	389911.89	535275.28	N 32 4 18.96	W 104 13 10.02
	18300.00	89.70	0.21	9946.04	8534.30	8508.66	-677.41	0.00	390011.88	535275.65	N 32 4 19.95	W 104 13 10.02
	18400.00	89.70	0.21	9946.56	8634.08	8608.66	-677.04	0.00	390111.87	535276.02	N 32 4 20.93	W 104 13 10.01
	18500.00	89.70	0.21	9947.09	8733.86	8708.65	-676.67	0.00	390211.86	535276.39	N 32 4 21.92	W 104 13 10.01
	18600.00	89.70	0.21	9947.61	8833.64	8808.65	-676.30	0.00	390311.85	535276.76	N 32 4 22.91	W 104 13 10.00
	18700.00	89.70	0.21	9948.13	8933.43	8908.65	-675.93	0.00	390411.84	535277.13	N 32 4 23.90	W 104 13 10.00
	18800.00	89.70	0.21	9948.65	9033.21	9008.65	-675.56	0.00	390511.82	535277.50	N 32 4 24.89	W 104 13 9.99
	18900.00	89.70	0.21	9949.17	9132.99	9108.65	-675.19	0.00	390611.81	535277.87	N 32 4 25.88	W 104 13 9.99
	19000.00	89.70	0.21	9949.70	9232.77	9208.64	-674.82	0.00	390711.80	535278.24	N 32 4 26.87	W 104 13 9.98
	19100.00	89.70	0.21	9950.22	9332.56	9308.64	-674.45	0.00	390811.79	535278.61	N 32 4 27.86	W 104 13 9.97
	19200.00	89.70	0.21	9950.74	9432.34	9408.64	-674.08	0.00	390911.78	535278.98	N 32 4 28.85	W 104 13 9.97
	19300.00	89.70	0.21	9951.26	9532.12	9508.64	-673.71	0.00	391011.77	535279.35	N 32 4 29.84	W 104 13 9.96
	19400.00	89.70	0.21	9951.78	9631.90	9608.64	-673.34	0.00	391111.76	535279.72	N 32 4 30.83	W 104 13 9.96
	19500.00	89.70	0.21	9952.31	9731.68	9708.63	-672.97	0.00	391211.75	535280.09	N 32 4 31.82	W 104 13 9.95
	19600.00	89.70	0.21	9952.83	9831.47	9808.63	-672.60	0.00	391311.73	535280.47	N 32 4 32.81	W 104 13 9.95
	19700.00	89.70	0.21	9953.35	9931.25	9908.63	-672.23	0.00	391411.72	535280.84	N 32 4 33.80	W 104 13 9.94
	19800.00	89.70	0.21	9953.87	10031.03	10008.63	-671.85	0.00	391511.71	535281.21	N 32 4 34.79	W 104 13 9.94
	19900.00	89.70	0.21	9954.39	10130.81	10108.63	-671.48	0.00	391611.70	535281.58	N 32 4 35.78	W 104 13 9.93
	20000.00	89.70	0.21	9954.91	10230.59	10208.62	-671.11	0.00	391711.69	535281.95	N 32 4 36.77	W 104 13 9.92
	20100.00	89.70	0.21	9955.44	10330.38	10308.62	-670.74	0.00	391811.68	535282.32	N 32 4 37.76	W 104 13 9.92
	20200.00	89.70	0.21	9955.96	10430.16	10408.62	-670.37	0.00	391911.67	535282.69	N 32 4 38.75	W 104 13 9.91
	20300.00	89.70	0.21	9956.48	10529.94	10508.62	-670.00	0.00	392011.66	535283.07	N 32 4 39.74	W 104 13 9.91
	20400.00	89.70	0.21	9957.00	10629.72	10608.62	-669.62	0.00	392111.65	535283.44	N 32 4 40.73	W 104 13 9.90
	20500.00	89.70	0.21	9957.52	10729.51	10708.61	-669.25	0.00	392211.63	535283.81	N 32 4 41.72	W 104 13 9.90
Chevron HH SO 8 P2 13H - PBHL	20551.37	89.70	0.21	9957.79	10780.76	10759.98	-669.06	0.00	392263.00	535284.00	N 32 4 42.22	W 104 13 9.89

Survey Type: Non-Def Plan

Survey Error Model: ISCWSA Rev 0 *** 3-D 95.000% Confidence 2.7955 sigma

Survey Program:

Description	Part	MD From (ft)	MD To (ft)	EOU Freq (ft)	Hole Size (in)	Casing Diameter (in)	Survey Tool Type	Borehole / Survey
	1	0.000	33.000	1/100.000	30.000	30.000	SLB_MWD-STD-Depth Only	Original Borehole / Chevron HH SO 8 P2 13H Rev0 CJG 12Jan16
	1	33.000	20551.372	1/100.000	30.000	30.000	SLB_MWD-STD	Original Borehole / Chevron HH SO 8 P2 13H Rev0 CJG 12Jan16

Generic Hayhurst Development Pad Layout - Phase 1

H2S Monitor Locations
- Bop/Cellar
- Rig Floor
- Shaker Skid
- Bell Nipple

Flag Locations
- Sign-in Shack
- Rig Floor
- Dog House

10 Minute Escape Packs
- 1 at Pits
- 1 at Trip Tank
- 1 at Accumulator
- 4 at Rig Floor

45 Minute Escape Packs
- 2 at Briefing Area
- 2 at Alternate Briefing Area

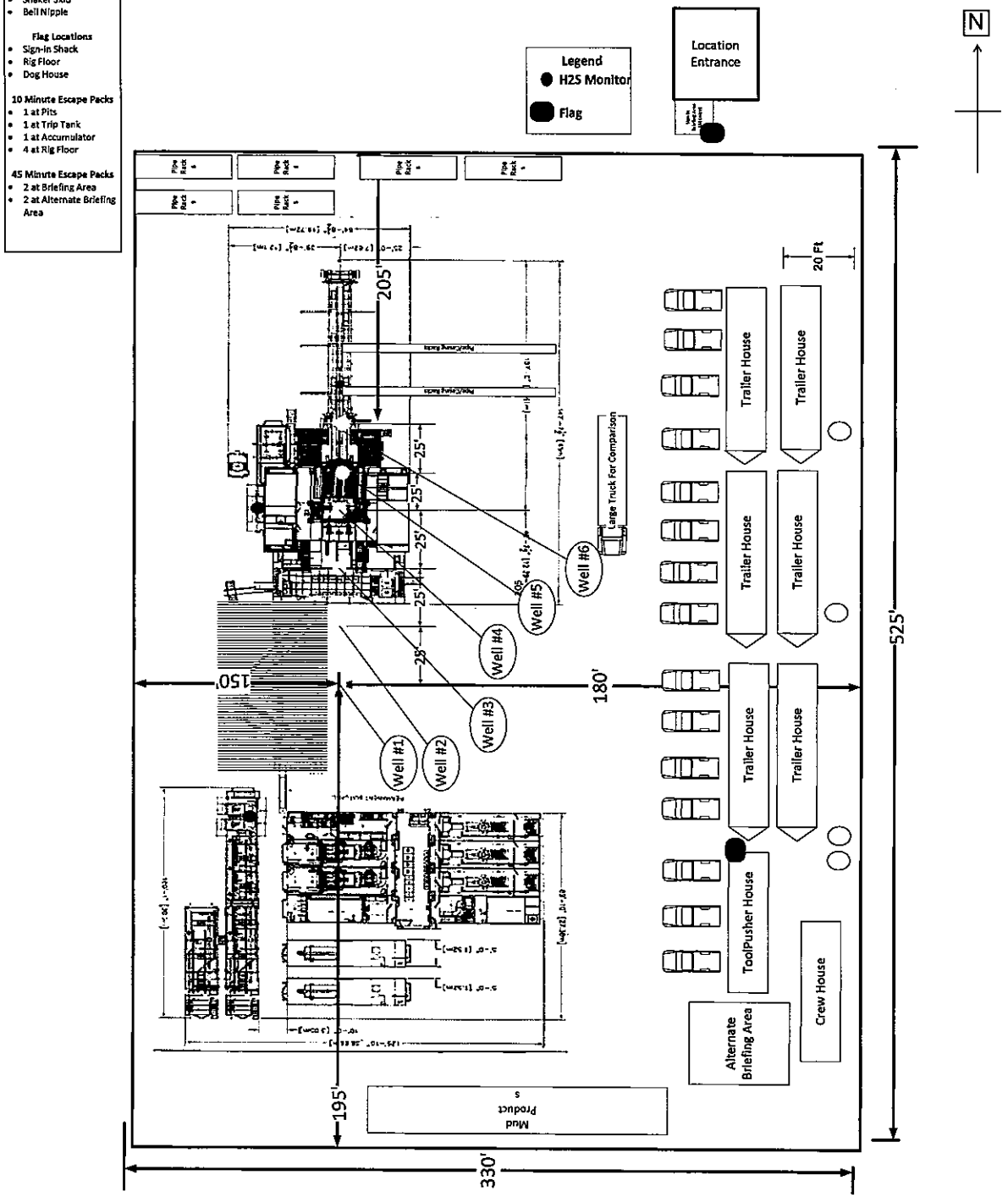
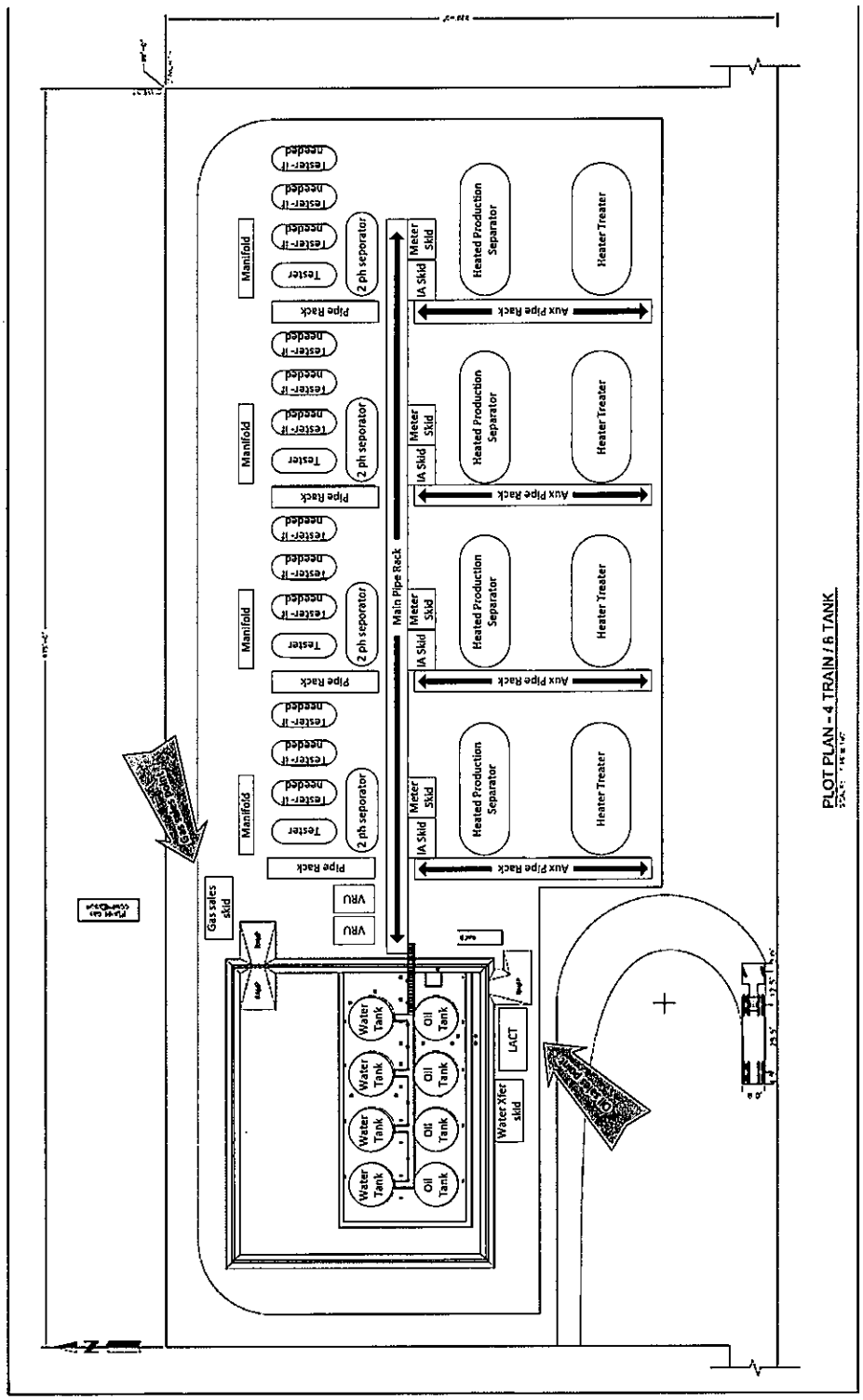


EXHIBIT 4



PLOT PLAN - 4 TRAIN / 6 TANK

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge

ROBERT L. LASTRAPES
NEW MEXICO
23006
1-8-2016
PROFESSIONAL SURVEYOR

Robert L. Lastrapes
Registration No. 23006

R 27 E

T 26 S

NW PAD CORNER		NE PAD CORNER		HH SO 8 P2 NO. 5H WELL	
X=	535,799 NAD 27	X=	536,129 NAD 27	X=	535,952 NAD 27
Y=	381,809	Y=	381,808	Y=	381,554
ELEVATION +3241' NAVD 88		ELEVATION +3247' NAVD 88		LAT.	32.048953
SW PAD CORNER		SE PAD CORNER		LONG.	104.217295
X=	535,805 NAD 27	X=	536,135 NAD 27	X=	577,136 NAD83
Y=	381,284	Y=	381,284	Y=	381,611
ELEVATION +3244' NAVD 88		ELEVATION +3256' NAVD 88		LAT.	32.049075
				LONG.	104.217789
				ELEVATION +3245' NAVD 88	

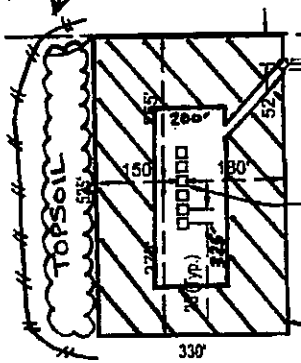
Sec. 8

Bureau of Land Management

EROSION CONTROL (STRAW WATTLES)

S 89°52'10" E 810.78'

Fnd. 2" Iron Pipe w/ Cap at the NW Corner of Section 17



HH SO 8 P2
No. 5H Well
255' FNL, 960' FWL

PROPOSED PAD
±3.98 Acres

CENTERLINE PROPOSED ACCESS ROAD (1)
24' X ±5,444.40'
±3.00 Acres
±329.96 Rods
(SEE PAGE 2)

Sec. 17

Bureau of Land Management

(Access Road 1) ± 4289.90': ±2.36 Acres ±259.99 Rods

NAD 27 NEW MEXICO EAST ZONE

Scale: 1" = 300'

300' 0 150' 300'

INTERIM RECLAMATION

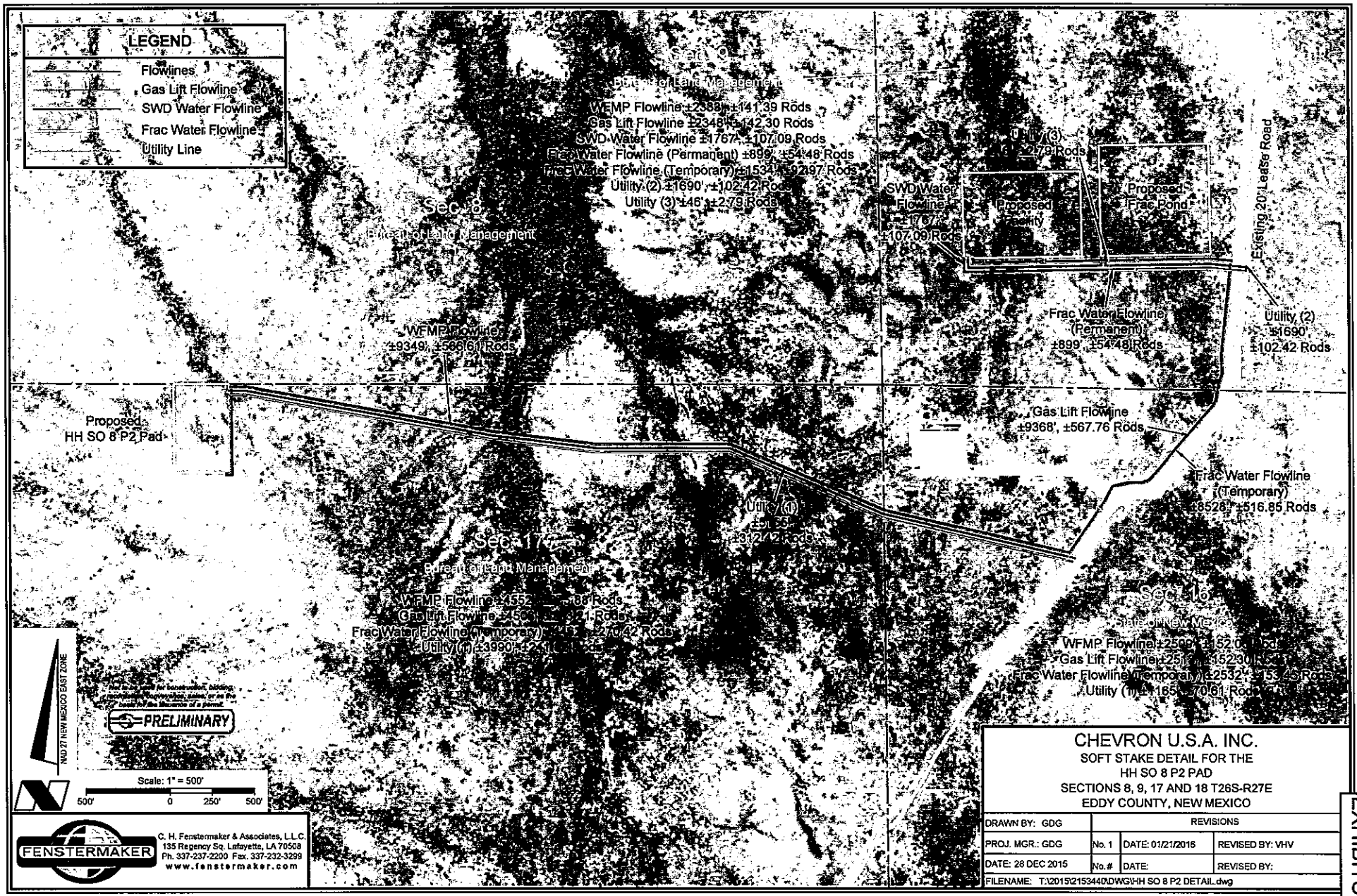
SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED PADS, FRAC POND & ACCESS ROADS
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: LJG	REVISIONS		
PROJ. MGR.: GDG	No. 1	DATE: 1/7/2016	REVISED BY: MBD
DATE: 12/22/2015	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153438\DWG\HH SO 8 P2 5H_SUP.dwg			

FENSTERMAKER
C H Fenstermaker & Associates L.L.C
135 Regency Sq. Lafayette, LA 70508
Ph 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com



FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

CHEVRON U.S.A. INC.

SOFT STAKE DETAIL FOR THE
HH SO 8 P2 PAD
SECTIONS 8, 9, 17 AND 18 T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: GDG	REVISIONS		
PROJ. MGR.: GDG	No. 1	DATE: 01/21/2016	REVISED BY: VHV
DATE: 28 DEC 2015	No. #	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\HH SO 8 P2 DETAIL.dwg			

EXHIBITS 4&5

CHEVRON U.S.A. Inc
HH SO 8 P2 13H
NMNM 118108
SECTION 17, T26S-R27E (Off Lease SHL) SECTION 5, T26S, R27E
SHL 305' FNL & 960' FWL BHL 180' FNL & 330' FWL

APD Surface Use Plan of Operations

This Surface Use Plan of Operations has been designed to be reviewed in conjunction with Hayhurst Development Area (HDA) Master Development Plan

HDA Master Development Plan Reference Table

The contents referenced below apply to all HDA APD's

Existing Roads	Exhibit 1, MDP SUPO Page 1
Construction Materials	MDP SUPO Page 6
Methods for Handling Waste	MDP SUPO Page 6
Reclamation Objectives	MDP SUPO Page 6-8
Final Surface Reclamation	MDP SUPO Page 6-8

Driving Directions

- Driving Directions – From Malaga, New Mexico. The location is approximately 11.5 miles from the nearest town, which is Malaga, New Mexico. From Malaga, proceed South on Highway 285 approximately 11.5 miles and turn right (West) onto White City Rd and go approximately 7.5 miles on White City Road until the road reaches an intersection with a permanent sign reading "Chevron Access". Turn left onto this and travel 1 mile, then right and travel for another .5 miles to the well location.

New or Reconstructed Access Roads – (Exhibit 2, MDP SUPO Pg. 1)

- There will be 7172' of new road construction for this proposal.
- Ditches: See Exhibit 2 (To be submitted at later date)
- Culverts: See Exhibit 2 (To be submitted at later date)
- Road Cuts: See Exhibit 2 (To be submitted at later date)

Location of Existing Wells (Exhibit 3)

- 1-Mile radius map is attached

CHEVRON U.S.A. Inc
HH SO 8 P2 13H
NMNM 118108
SECTION 17, T26S-R27E (Off Lease SHL) SECTION 5, T26S, R27E
SHL 305' FNL & 960' FWL BHL 180' FNL & 330' FWL

Location of Existing and/or Proposed Production Facilities (Exhibit 4, MDP SUP Pg. 2)

- Facilities: Proposed production facilities located in the SW corner of Sec. 9, T26S-R27E where oil and gas sales will take place.
    - The proposed facility and frac pond is in Sec. 9, T26S-R27E
    - Gas purchaser pipeline is in place at the tank battery.
    - Open top tanks or open containments will be netted.
    - Open vent exhaust stacks will be modified to prevent birds or bats from entering, discourage perching, roosting, and nesting.
    - Facilities will have a secondary containment 1.5 times the holding capacity of largest storage tank.
    - All above ground structures will be painted non-reflective shale green for blending with surrounding environment.
    - The permanent water disposal system will be determined prior to construction of any water transfer pipeline. Until permanent water takeaway is available, produced water will be hauled off location in trucks. **Notification will be provided to BLM upon site selection and survey – plats (including SWD well information) will be provided.**
- Pipelines: See Detail – Exhibit 5
    - Pipelines Include:
        - 9,349' of Flowlines carrying production (buried)
        - 9,368' Gas Lift Line carrying pressurized gas (buried)
        - 1,767' SWD Line carrying produced water (buried)
        - 899' Permanent Frac water line carrying fresh water (buried)
        - 8528' Temporary Water line carrying fresh water (surface)
    - A ROW will be applied for through the State and BLM.
    - All construction activity will be confined to the approved ROW.
    - Pipeline will run parallel to the road and will stay within approved ROW.
- Power lines\Utility lines: 6,891' of new power lines

Location and Types of Water Supply (Exhibit 5, MDP SUPO Pg. 5)

- Proposed pond in Section 9, T26S-R27E will be utilized for fresh water.
- Fresh water will be obtained from a private water source.

Construction Materials (MDP SUPO Pg. 6)

- Location-specific caliche sources will be provided in post-application supplement

CHEVRON U.S.A. Inc
HH SO 8 P2 13H
NMNM 118108
SECTION 17, T26S-R27E (Off Lease SHL) SECTION 5, T26S, R27E
SHL 305' FNL & 960' FWL BHL 180' FNL & 330' FWL

Well Site Layout (Exhibit 6)

- Surveyor Plat (Exhibit 6a)
  - Exterior well pad dimensions are 525' x 330'
  - Interior well pad dimensions from point of entry (well head) of the well are N-220', S-305', E-180', W-150'. Total disturbance area needed for construction of well pad will be approximately 4 acres
  - Topsoil placement is on the west where interim reclamation is planned to be completed upon completion of well and evaluation of best management practices.
  - Cut and fill: will be minimal.
- Rig Layout (Exhibit 6b)

Plans for Surface Reclamation (Exhibit 6, MDP SUPA Pg. 8)

Interim Reclamation Procedures

- Reclaimed pad size: 200' x 325'
- See Exhibit for reclaimed pad layout, topsoil location & erosion control features

Surface Ownership

- BLM Surface
  - Surface Tenant – Phillip Stell
- **Nearest Post Office:** Malaga Post Office; 11.4 Miles north

Other Information

- On-site performed by BLM NRS: Paul Murphy 11/4/2015
- Cultural report attached: **Yes** Participating Agreement attached: N/A

CHEVRON U.S.A. Inc
HH SO 8 P2 13H
NMNM 118108
SECTION 17, T26S-R27E (Off Lease SHL) SECTION 5, T26S, R27E
SHL 305' FNL & 960' FWL BHL 180' FNL & 330' FWL

Chevron Representatives

Primary point of contact:
Jennifer Van Curen
Jennifer.VanCuren@arcadis-us.com
M- 432-270-8753

Chevron Functional Contacts

Project Manager Name: Sean Cheben Address: 1400 Smith Street Houston, TX 77002 Phone: (432) 664-6809 Email: Sean.Cheben@chevron.com	**Drilling Engineer** Name: Roderick Milligan Address: 1400 Smith Street Houston, TX 77002 Phone: (281) 413-9794 Email: RoderickMilligan@chevron.com
Surface Land Representative Name: Kevin Dickerson Address: 15 Smith Road Midland Texas 79705 Phone: (432) 687-7104 Email: Kevin.Dickerson@chevron.com	**Facility Lead** Name: Tyler Weaver Address: 1400 Smith Street Houston, TX 77002 Phone: (281) 384-8934 Email: tyler.weaver@chevron.com
Geologist Name: Jeff Fabre Address: 1400 Smith Street Houston, TX 77002 Phone: (713) 372-0523 Email: JeffreyFabre@chevron.com	**Regulatory Specialist** Cindy Herrera-Murillo Address: 1616 W. Bender Blvd, Hobbs, NM 88240 Office: (575) 263-0431 Email: CHerreraMurillo@chevron.com

CHEVRON U.S.A. Inc
HH SO 8 P2 13H
NMNM 118108
SECTION 17, T26S-R27E (Off Lease SHL) SECTION 5, T26S, R27E
SHL 305' FNL & 960' FWL BHL 180' FNL & 330' FWL

EXHIBITS:

Exhibit 1 -- Existing Roads

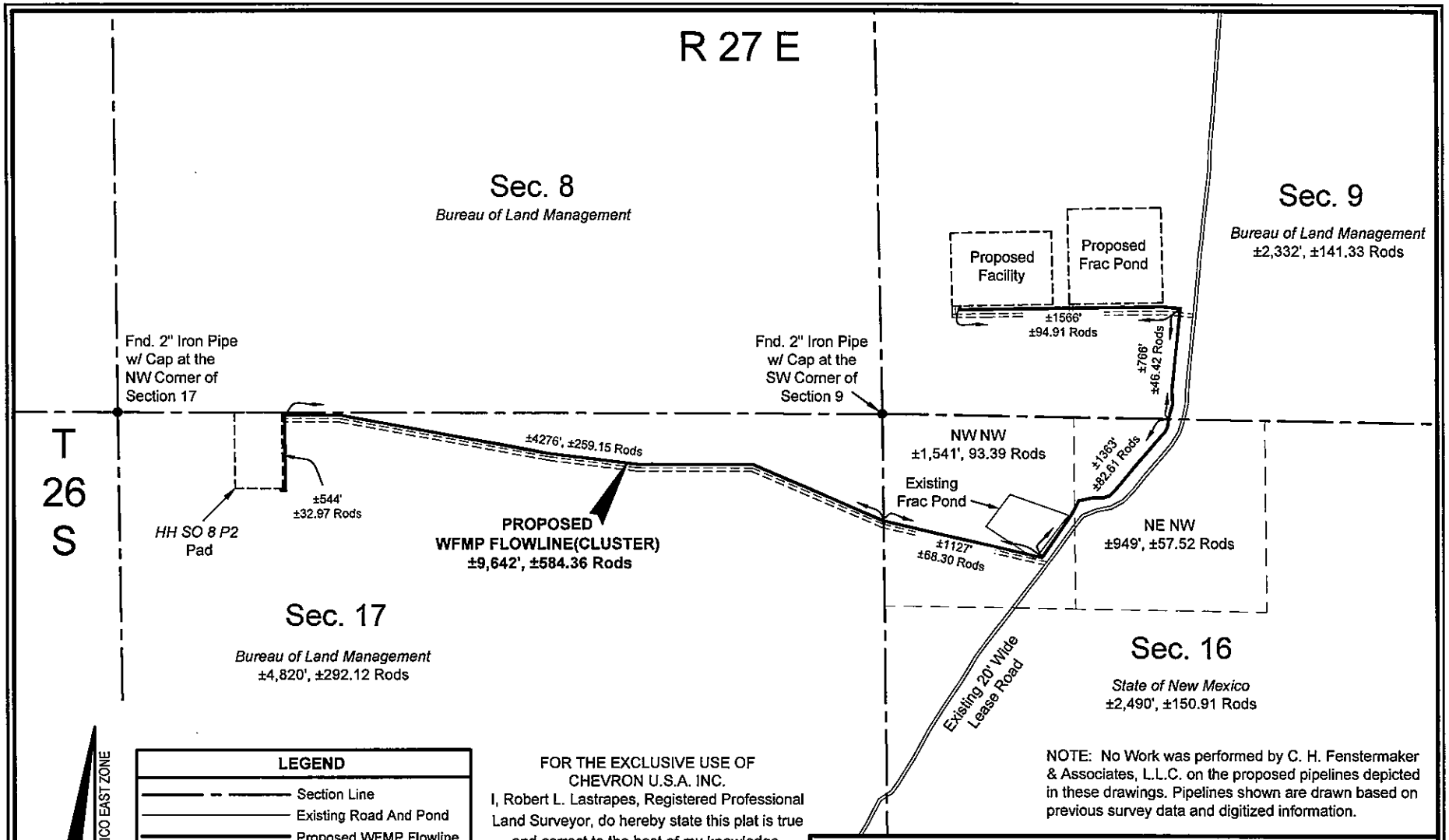
Exhibit 2 -- Survey Plat: New or Reconstructed Roads Map: if road is outside 600' x 600'.

Exhibit 3 -- 1-mile Radius Map

Exhibit 4 -- Location of Existing and/or Proposed Production Facilities (Tank Battery)

Exhibit 5 -- Survey Plat: Infrastructure: roads, pipelines, power lines, frac pond

Exhibit 6 -- Rig Layout: Well Site Layout Map / Diagram



FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

NOTE: No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED WFMP FLOWLINE(CLUSTER)
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\WFMP FL_SUP.dwg			

EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No.23006

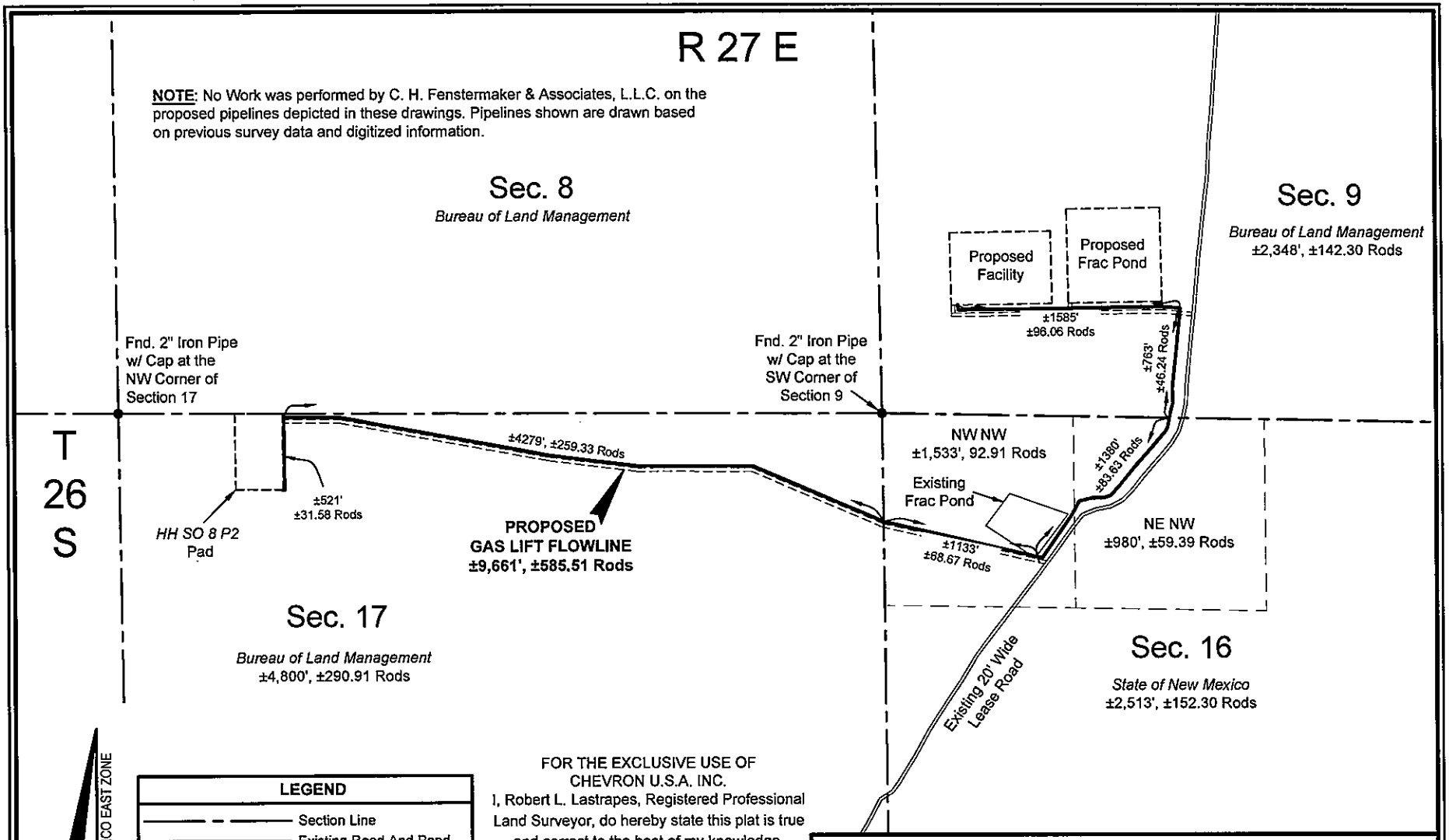
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED WFMP FLOWLINE(CLUSTER)
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\WFMP FL_SUP.dwg			


R 27 E
NOTE: No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.
Sec. 8
Bureau of Land Management
Sec. 9
Bureau of Land Management
±2,348', ±142.30 Rods
Proposed Facility
Proposed Frac Pond
±1585'
±96.06 Rods
±763'
±46.24 Rods
Fnd. 2" Iron Pipe w/ Cap at the NW Corner of Section 17
Fnd. 2" Iron Pipe w/ Cap at the SW Corner of Section 9
T 26 S
±4279', ±259.33 Rods
NW NW
±1,533', 92.91 Rods
±1380'
±83.63 Rods
Existing Frac Pond
±521'
±31.58 Rods
HH SO 8 P2 Pad
PROPOSED GAS LIFT FLOWLINE
±9,661', ±585.51 Rods
±1133'
±68.67 Rods
NE NW
±980', ±59.39 Rods
Sec. 17
Bureau of Land Management
±4,800', ±290.91 Rods
Sec. 16
State of New Mexico
±2,513', ±152.30 Rods
Existing 20' Wide Lease Road
NAD 27 NEW MEXICO EAST ZONE
LEGEND
Section Line
Existing Road And Pond
Proposed Gas Lift Flowline
Proposed Access Road, Frac Pump, Tank Battery, Compressor Station & Pad
Found Occupation
Scale: 1" = 1000'
1000' 0 500' 1000'
FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.
Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.
PRELIMINARY
Robert L. Lastrapes
Registration No. 23006
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com
SURFACE USE PLAT
CHEVRON U.S.A. INC.
PROPOSED GAS LIFT FLOWLINE
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO
PAGE 1 OF 2
DRAWN BY: BOR
PROJ. MGR.: GDG
DATE: 02/11/2016
REVISIONS
No. DATE: REVISED BY:
No. DATE: REVISED BY:
FILENAME: T:\2015\2153440\DWG\Gas Lift FL_SUP.dwg
EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

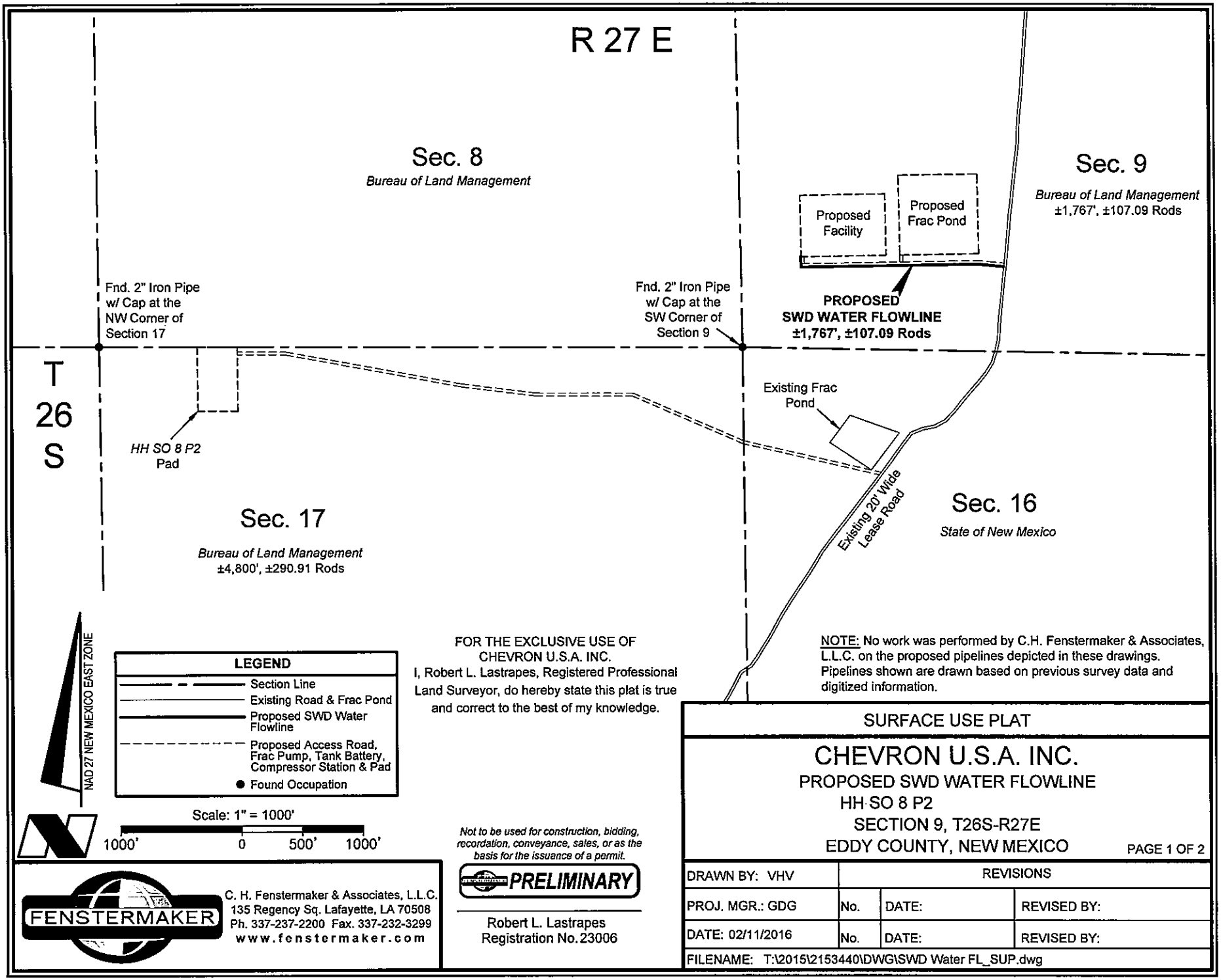
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED GAS LIFT FLOWLINE
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Gas Lift FL_SUP.dwg			



FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

NOTE: No work was performed by C.H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED SWD WATER FLOWLINE
HH SO 8 P2
SECTION 9, T26S-R27E
EDDY COUNTY, NEW MEXICO

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

DRAWN BY: VHV	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\SWD Water FL_SUP.dwg			

EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

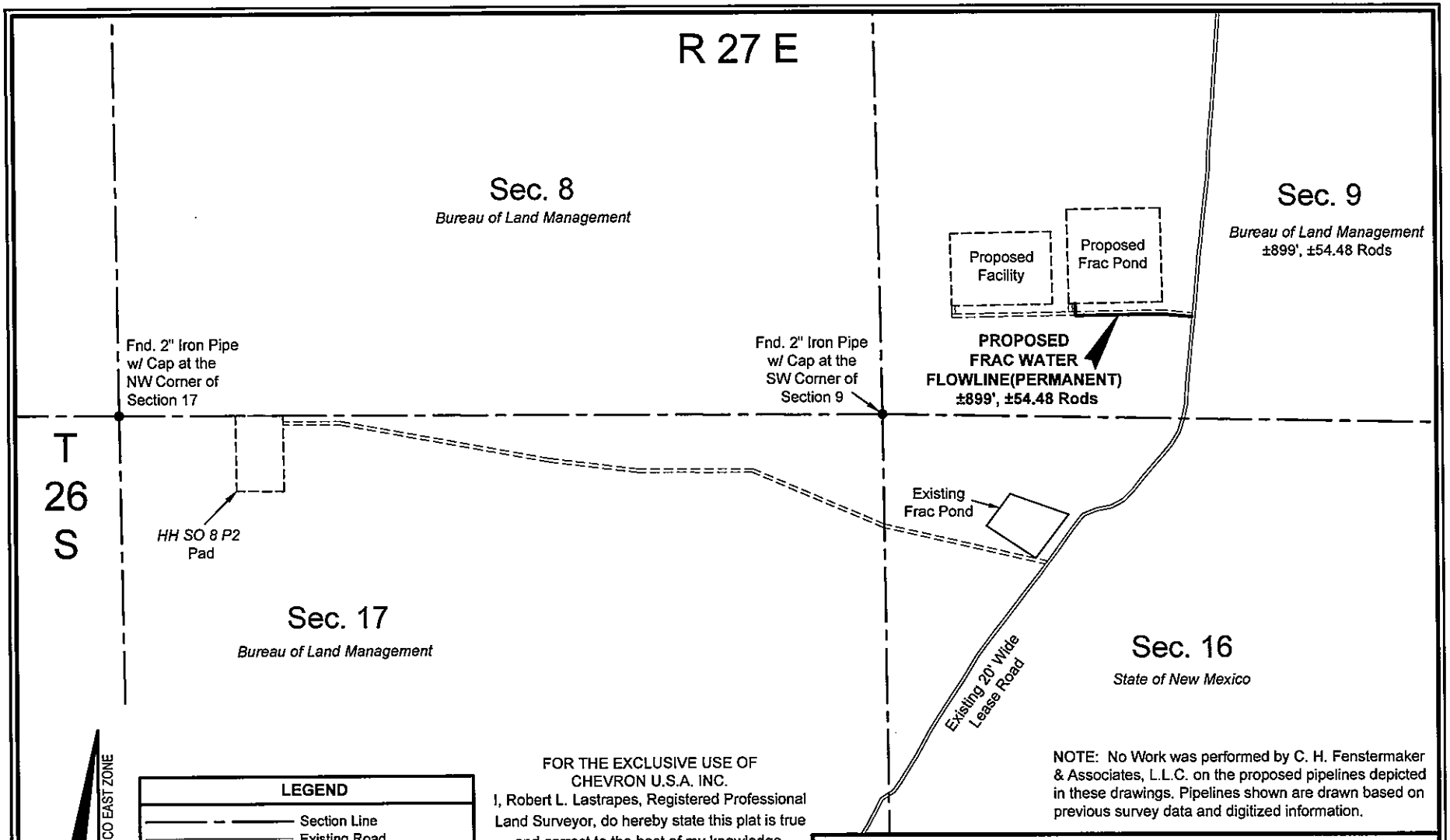
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED SWD WATER FLOWLINE
HH SO 8 P2
SECTION 9, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: VHV	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\SWD Water FL_SUP.dwg			



FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

NOTE: No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED FRAC WATER FLOWLINE(PERMANENT)
HH SO 8 P2
SECTION 9, T26S-R27E
EDDY COUNTY, NEW MEXICO

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Frac Water FL_Perm_SUP.dwg			

EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

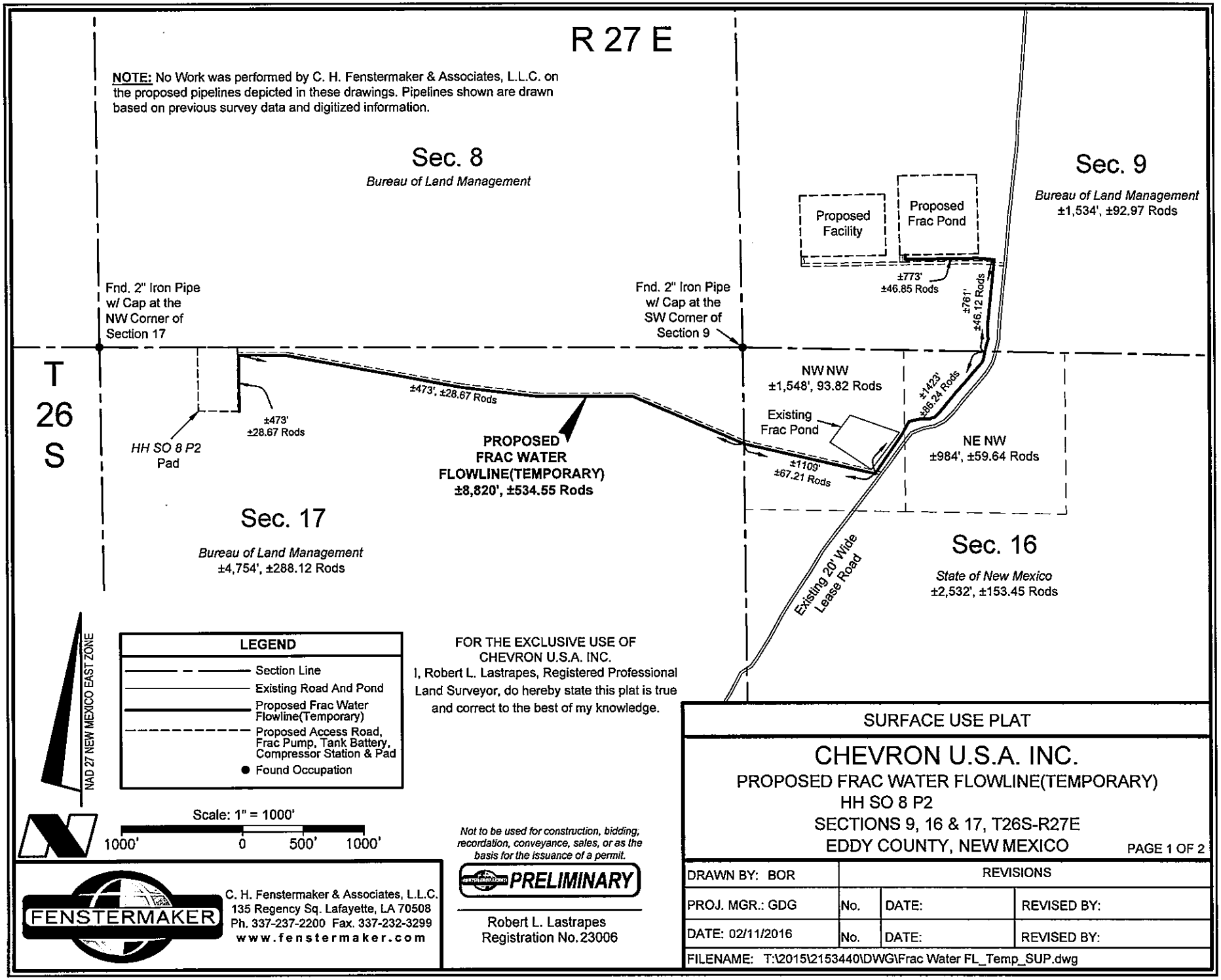
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED FRAC WATER FLOWLINE(PERMANENT)
HH SO 8 P2
SECTION 9, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Frac Water FL_Perm_SUP.dwg			


R 27 E
NOTE: No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.
Sec. 8
Bureau of Land Management
Sec. 9
Bureau of Land Management
±1,534', ±92.97 Rods
Proposed Facility
Proposed Frac Pond
±773'
±46.85 Rods
±761'
±46.12 Rods
Fnd. 2" Iron Pipe w/ Cap at the NW Corner of Section 17
Fnd. 2" Iron Pipe w/ Cap at the SW Corner of Section 9
T 26 S
±473', ±28.67 Rods
±473'
±28.67 Rods
HH SO 8 P2 Pad
PROPOSED FRAC WATER FLOWLINE(TEMPORARY) ±8,820', ±534.55 Rods
NW NW
±1,548', 93.82 Rods
±1423'
±86.24 Rods
Existing Frac Pond
NE NW
±984', ±59.64 Rods
±1109'
±67.21 Rods
Sec. 17
Bureau of Land Management
±4,754', ±288.12 Rods
Sec. 16
State of New Mexico
±2,532', ±153.45 Rods
Existing 20' Wide Lease Road
NAD 27 NEW MEXICO EAST ZONE
LEGEND
Section Line
Existing Road And Pond
Proposed Frac Water Flowline(Temporary)
Proposed Access Road, Frac Pump, Tank Battery, Compressor Station & Pad
Found Occupation
Scale: 1" = 1000'
1000' 0 500' 1000'
FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.
Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.
PRELIMINARY
Robert L. Lastrapes
Registration No. 23006
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com
SURFACE USE PLAT
CHEVRON U.S.A. INC.
PROPOSED FRAC WATER FLOWLINE(TEMPORARY)
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO
PAGE 1 OF 2
DRAWN BY: BOR
PROJ. MGR.: GDG
DATE: 02/11/2016
REVISIONS
No. DATE: REVISED BY:
No. DATE: REVISED BY:
FILENAME: T:\2015\2153440\DWG\Frac Water FL_Temp_SUP.dwg
EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

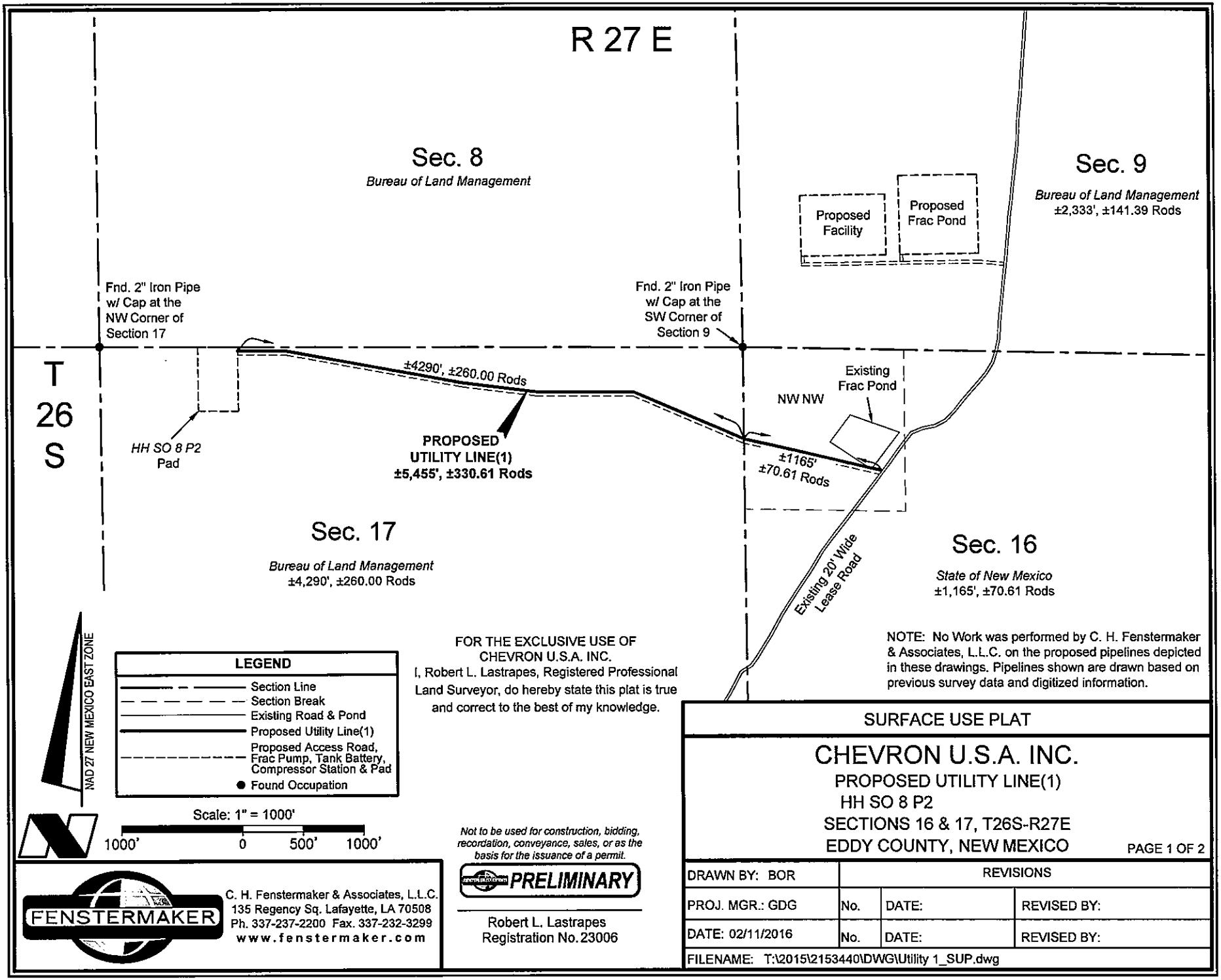
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED FRAC WATER FLOWLINE(TEMPORARY)
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Frac Water FL_Temp_SUP.dwg			



FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

NOTE: No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED UTILITY LINE(1)
HH SO 8 P2
SECTIONS 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Utility 1_SUP.dwg			

EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

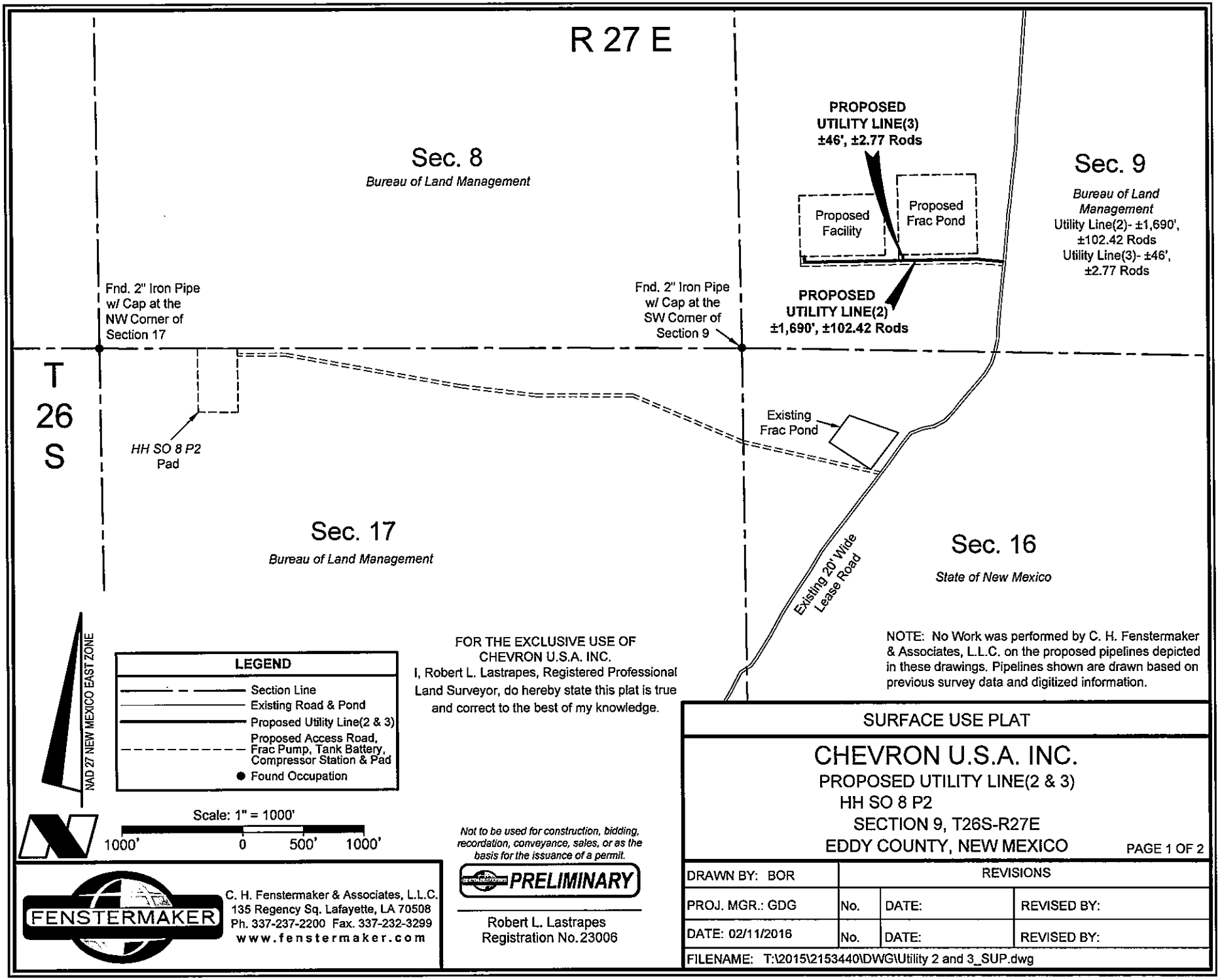
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED UTILITY LINE(1)
HH SO 8 P2
SECTIONS 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Utility 1_SUP.dwg			



FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

NOTE: No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED UTILITY LINE(2 & 3)
HH SO 8 P2
SECTION 9, T26S-R27E
EDDY COUNTY, NEW MEXICO

PAGE 1 OF 2

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Utility 2 and 3_SUP.dwg			

EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED UTILITY LINE(2 & 3)
HH SO 8 P2
SECTION 9, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Utility 2 and 3_SUP.dwg			

CERTIFICATION

I hereby certify that I, or someone under my direct supervision, have inspected the drill site and access route proposed herein; that I am familiar with the conditions which currently exist; that I have full knowledge of state and federal laws applicable to this operation; that the statements made in this APD package are, to the best of my knowledge, true and correct; and, that the work associated with the operations proposed will be performed in conformity with this APD package and the terms and conditions under which it is approved. I also certify that I, or the company I represent, am responsible for the operations conducted under this application. These statements are subject to the provisions of 18 U.S.C. 1001 for the filing of a false statement.

Executed this 19th day of JANUARY, 2016

Name: _____

Sean Cheben-Project Manager

Address: 1400 Smith Street

Houston, TX 77002

Room 40125

Office: 713-372-9382

Email: Sean.Cheben@CHEVRON.COM

PECOS DISTRICT
CONDITIONS OF APPROVAL

OPERATOR'S NAME:	**Chevron USA Inc.**
LEASE NO.:	**NMNM-118108**
WELL NAME & NO.:	**HH SO 8 P2 13H**
SURFACE HOLE FOOTAGE:	**0305' FNL & 0960' FWL**
BOTTOM HOLE FOOTAGE	**0180' FNL & 0330' FWL Sec. 05, T. 26 S., R 27 E.**
LOCATION:	**Section 17, T. 26 S., R 27 E., NMPM**
COUNTY:	**Eddy County, New Mexico**

TABLE OF CONTENTS

Standard Conditions of Approval (COA) apply to this APD. If any deviations to these standards exist or special COAs are required, the section with the deviation or requirement will be checked below.

- ☐ **General Provisions**
- ☐ **Permit Expiration**
- ☐ **Archaeology, Paleontology, and Historical Sites**
- ☐ **Noxious Weeds**
- ☒ **Special Requirements**
  - Raptor Nest
  - Avian Protection
  - Cave/Karst
  - VRM
  - Cultural
- ☐ **Construction**
  - Notification
  - Topsoil
  - Closed Loop System
  - Federal Mineral Material Pits
  - Well Pads
  - Roads
- ☐ **Road Section Diagram**
- ☒ **Drilling**
  - Cement Requirements
  - High Cave/Karst
  - Logging Requirements
  - Waste Material and Fluids
- ☒ **Production (Post Drilling)**
  - Well Structures & Facilities
  - Pipelines
  - Electric Lines
- ☐ **Interim Reclamation**
- ☐ **Final Abandonment & Reclamation**

I. GENERAL PROVISIONS

The approval of the Application For Permit To Drill (APD) is in compliance with all applicable laws and regulations: 43 Code of Federal Regulations 3160, the lease terms, Onshore Oil and Gas Orders, Notices To Lessees, New Mexico Oil Conservation Division (NMOCD) Rules, National Historical Preservation Act As Amended, and instructions and orders of the Authorized Officer. Any request for a variance shall be submitted to the Authorized Officer on Form 3160-5, Sundry Notices and Report on Wells.

II. PERMIT EXPIRATION

If the permit terminates prior to drilling and drilling cannot be commenced within 60 days after expiration, an operator is required to submit Form 3160-5, Sundry Notices and Reports on Wells, requesting surface reclamation requirements for any surface disturbance. However, if the operator will be able to initiate drilling within 60 days after the expiration of the permit, the operator must have set the conductor pipe in order to allow for an extension of 60 days beyond the expiration date of the APD. (Filing of a Sundry Notice is required for this 60 day extension.)

III. ARCHAEOLOGICAL, PALEONTOLOGY & HISTORICAL SITES

Any cultural and/or paleontological resource discovered by the operator or by any person working on the operator's behalf shall immediately report such findings to the Authorized Officer. The operator is fully accountable for the actions of their contractors and subcontractors. The operator shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery shall be made by the Authorized Officer to determine the appropriate actions that shall be required to prevent the loss of significant cultural or scientific values of the discovery. The operator shall be held responsible for the cost of the proper mitigation measures that the Authorized Officer assesses after consultation with the operator on the evaluation and decisions of the discovery. Any unauthorized collection or disturbance of cultural or paleontological resources may result in a shutdown order by the Authorized Officer.

IV. NOXIOUS WEEDS

The operator shall be held responsible if noxious weeds become established within the areas of operations. Weed control shall be required on the disturbed land where noxious weeds exist, which includes the roads, pads, associated pipeline corridor, and adjacent land affected by the establishment of weeds due to this action. The operator shall consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies.

V. SPECIAL REQUIREMENT(S)

Avian Protection

Power lines shall be constructed and designed in accordance to standards outlined in "Suggested Practices for Avian Protection on Power lines: The State of the Art in 2006" Edison Electric Institute, APLIC, and the California Energy Commission 2006. The holder shall assume the burden and expense of proving that pole designs not shown in the above publication deter raptor perching, roosting, and nesting. Such proof shall be provided by a raptor expert approved by the Authorized Officer. The BLM reserves the right to require modification or additions to all power line structures placed on this right-of-way, should they be necessary to ensure the safety of large perching birds. The holder without liability or expense shall make such modifications and/or additions to the United States.

Raptor Nest

Raptor Nest Mitigation

- A BLM Wildlife Biologist must be contacted by the operator prior to construction activities to determine if the raptor nest is active.
- Raptor nests on special, natural habitat features, such as trees, large brush, cliff faces and escarpments, will be protected by not allowing surface disturbance within up to 200 meters of nests or by delaying activity for up to 90 days, or a combination of both. Exceptions to this requirement for raptor nests will be considered if the nests expected to be disturbed are inactive, the proposed activity is of short duration (e.g. habitat enhancement projects, fences, pipelines), and will not result in continuing activity in proximity to the nest.
- Exhaust noise from pump jack engines must be muffled or otherwise controlled so as not to exceed 75 db measured at 30 ft. from the source of the noise.

Visual Resource Management (VRM)

- Above-ground structures including meter housing that are not subject to safety requirements are painted a flat non-reflective paint color, Shale Green from the BLM Standard Environmental Color Chart (CC-001: June 2008)
- Chevron would use minimal light necessary for site safety, security, and operations.
- Light should be directed downward or only where needed.
- Low-pressure sodium lamps, such as yellow LED lighting (3,000 Kelvin or less) or equivalent, would be used to reduce sky glow and wildlife impacts.
- Properly shielded and mounted light fixtures would be used to reduce sky glow from upward pointing light, as well as trespass from light falling outside of desired area of illumination. Full cutoff shielding would be used during production.

Cave and Karst

** Depending on location, additional Drilling, Casing, and Cementing procedures may be required by engineering to protect critical karst groundwater recharge areas.

Cave/Karst Surface Mitigation

The following stipulations will be applied to minimize impacts during construction, drilling and production.

Construction:
In the advent that any underground voids are opened up during construction activities, construction activities will be halted and the BLM will be notified immediately.

No Blasting:
No blasting will be utilized for pad construction. The pad will be constructed and leveled by adding the necessary fill and caliche.

Pad Berming:
The entire perimeter of the well pad will be bermed to prevent oil, salt, and other chemical contaminants from leaving the well pad.

- The compacted berm shall be constructed at a minimum of 12 inches high with impermeable mineral material (e.g. caliche).
- No water flow from the uphill side(s) of the pad shall be allowed to enter the well pad.
- The topsoil stockpile shall be located outside the bermed well pad.
- Topsoil, either from the well pad or surrounding area, shall not be used to construct the berm.
- No storm drains, tubing or openings shall be placed in the berm.
- If fluid collects within the bermed area, the fluid must be vacuumed into a safe container and disposed of properly at a state approved facility.
- The integrity of the berm shall be maintained around the surfaced pad throughout the life of the well and around the downsized pad after interim reclamation has been completed.
- Any access road entering the well pad shall be constructed so that the integrity of the berm height surrounding the well pad is not compromised. (Any access road crossing the berm cannot be lower than the berm height.)

Tank Battery Liners and Berms:
Tank battery locations and all facilities will be lined and bermed. A 20 mil permanent liner will be installed with a 4 oz. felt backing to prevent tears or punctures. Tank battery berms must be large enough to contain 1 ½ times the content of the largest tank.

Leak Detection System:
A method of detecting leaks is required. The method could incorporate gauges to measure loss, situating values and lines so they can be visually inspected, or installing

electronic sensors to alarm when a leak is present. Leak detection plan will be submitted to BLM for approval.

Automatic Shut-off Systems:
Automatic shut off, check values, or similar systems will be installed for pipelines and tanks to minimize the effects of catastrophic line failures used in production or drilling.

Cave/Karst Subsurface Mitigation

The following stipulations will be applied to protect cave/karst and ground water concerns:

Rotary Drilling with Fresh Water:
Fresh water will be used as a circulating medium in zones where caves or karst features are expected. SEE ALSO: Drilling COAs for this well.

Directional Drilling:
Kick off for directional drilling will occur at least 100 feet below the bottom of the cave occurrence zone. SEE ALSO: Drilling COAs for this well.

Lost Circulation:
ALL lost circulation zones from the surface to the base of the cave occurrence zone will be logged and reported in the drilling report.

Regardless of the type of drilling machinery used, if a void of four feet or more and circulation losses greater than 70 percent occur simultaneously while drilling in any cave-bearing zone, the BLM will be notified immediately by the operator. The BLM will assess the situation and work with the operator on corrective actions to resolve the problem.

Abandonment Cementing:
Upon well abandonment in high cave karst areas additional plugging conditions of approval may be required. The BLM will assess the situation and work with the operator to ensure proper plugging of the wellbore.

Pressure Testing:
Annual pressure monitoring will be performed by the operator on all casing annuli and reported in a sundry notice. If the test results indicated a casing failure has occurred, remedial action will be undertaken to correct the problem to the BLM's approval.

VI. CONSTRUCTION

A. NOTIFICATION

The BLM shall administer compliance and monitor construction of the access road and well pad. Notify the Carlsbad Field Office at (575) 234-5909 at least 3 working days prior to commencing construction of the access road and/or well pad.

When construction operations are being conducted on this well, the operator shall have the approved APD and Conditions of Approval (COA) on the well site and they shall be made available upon request by the Authorized Officer.

B. TOPSOIL

The operator shall strip the top portion of the soil (root zone) from the entire well pad area and stockpile the topsoil along the edge of the well pad as depicted in the APD. The root zone is typically six (6) inches in depth. All the stockpiled topsoil will be redistributed over the interim reclamation areas. Topsoil shall not be used for berming the pad or facilities. For final reclamation, the topsoil shall be spread over the entire pad area for seeding preparation.

Other subsoil (below six inches) stockpiles must be completely segregated from the topsoil stockpile. Large rocks or subsoil clods (not evident in the surrounding terrain) must be buried within the approved area for interim and final reclamation.

C. CLOSED LOOP SYSTEM

Tanks are required for drilling operations: No Pits.

The operator shall properly dispose of drilling contents at an authorized disposal site.

D. FEDERAL MINERAL MATERIALS PIT

Payment shall be made to the BLM prior to removal of any federal mineral materials. Call the Carlsbad Field Office at (575) 234-5972.

E. WELL PAD SURFACING

Surfacing of the well pad is not required.

If the operator elects to surface the well pad, the surfacing material may be required to be removed at the time of reclamation.The well pad shall be constructed in a manner which creates the smallest possible surface disturbance, consistent with safety and operational needs.

F. EXCLOSURE FENCING (CELLARS & PITS)

Exclosure Fencing
The operator will install and maintain exclosure fencing for all open well cellars to prevent access to public, livestock, and large forms of wildlife before and after drilling operations until the pit is free of fluids and the operator initiates backfilling. (For examples of exclosure fencing design, refer to BLM's Oil and Gas Gold Book, Exclosure Fence Illustrations, Figure 1, Page 18.)

G. ON LEASE ACCESS ROADS

Road Width
The access road shall have a driving surface that creates the smallest possible surface disturbance and does not exceed fourteen (14) feet in width. The maximum width of surface disturbance, when constructing the access road, shall not exceed twenty-five (25) feet.

Surfacing
Surfacing material is not required on the new access road driving surface. If the operator elects to surface the new access road or pad, the surfacing material may be required to be removed at the time of reclamation.

Where possible, no improvements should be made on the unsurfaced access road other than to remove vegetation as necessary, road irregularities, safety issues, or to fill low areas that may sustain standing water.

The Authorized Officer reserves the right to require surfacing of any portion of the access road at any time deemed necessary. Surfacing may be required in the event the road deteriorates, erodes, road traffic increases, or it is determined to be beneficial for future field development. The surfacing depth and type of material will be determined at the time of notification.

Crowning
Crowning shall be done on the access road driving surface. The road crown shall have a grade of approximately 2% (i.e., a 1" crown on a 14' wide road). The road shall conform to Figure 1; cross section and plans for typical road construction.

Ditching
Ditching shall be required on both sides of the road.

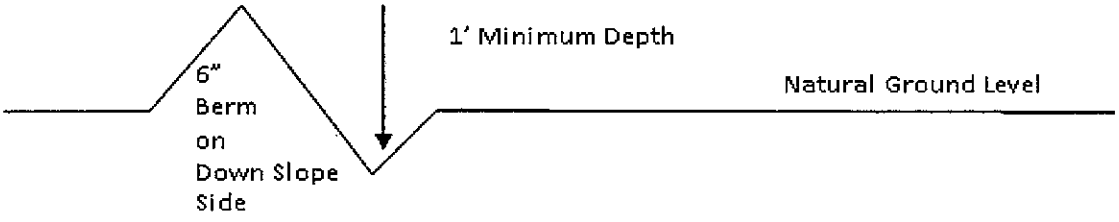
Turnouts
Vehicle turnouts shall be constructed on the road. Turnouts shall be intervisible with interval spacing distance less than 1000 feet. Turnouts shall conform to Figure 1; cross section and plans for typical road construction.

Drainage

Drainage control systems shall be constructed on the entire length of road (e.g. ditches, sidehill outsloping and insloping, lead-off ditches, culvert installation, and low water crossings).

A typical lead-off ditch has a minimum depth of 1 foot below and a berm of 6 inches above natural ground level. The berm shall be on the down-slope side of the lead-off ditch.

Cross Section of a Typical Lead-off Ditch



All lead-off ditches shall be graded to drain water with a 1 percent minimum to 3 percent maximum ditch slope. The spacing interval are variable for lead-off ditches and shall be determined according to the formula for spacing intervals of lead-off ditches, but may be amended depending upon existing soil types and centerline road slope (in %);

Formula for Spacing Interval of Lead-off Ditches

Example - On a 4% road slope that is 400 feet long, the water flow shall drain water into a lead-off ditch. Spacing interval shall be determined by the following formula:

400 foot road with 4% road slope: $\frac{400'}{4\%} + 100' = 200'$ lead-off ditch interval

Cattleguards

An appropriately sized cattleguard sufficient to carry out the project shall be installed and maintained at fence/road crossings. Any existing cattleguards on the access road route shall be repaired or replaced if they are damaged or have deteriorated beyond practical use. The operator shall be responsible for the condition of the existing cattleguards that are in place and are utilized during lease operations.

Fence Requirement

Where entry is granted across a fence line, the fence shall be braced and tied off on both sides of the passageway prior to cutting. The operator shall notify the private surface landowner or the grazing allotment holder prior to crossing any fences.

Public Access

Public access on this road shall not be restricted by the operator without specific written approval granted by the Authorized Officer.

Construction Steps

1. Salvage topsoil
2. Construct road
3. Redistribute topsoil
4. Revegetate slopes

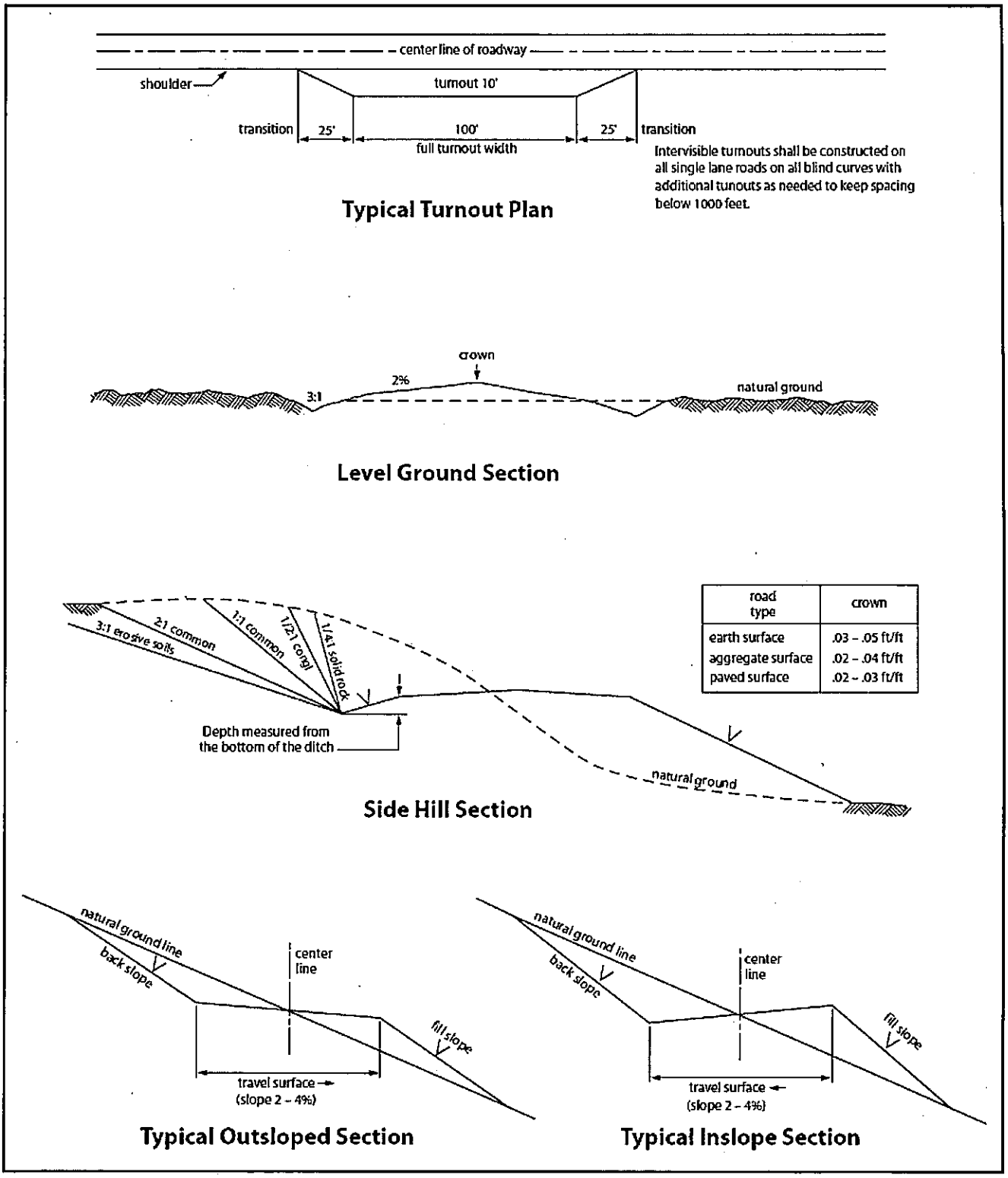


Figure 1. Cross-sections and plans for typical road sections representative of BLM resource or FS local and higher-class roads.

VII. DRILLING

A. DRILLING OPERATIONS REQUIREMENTS

The BLM is to be notified in advance for a representative to witness:

a. Spudding well (minimum of 24 hours)
b. Setting and/or Cementing of all casing strings (minimum of 4 hours)
c. BOPE tests (minimum of 4 hours)

☒ **Eddy County**

Call the Carlsbad Field Office, 620 East Greene St., Carlsbad, NM 88220, (575) 361-2822

1. **Hydrogen Sulfide (H2S) monitors shall be installed prior to drilling out the surface shoe. If H2S is detected in concentrations greater than 100 ppm, the Hydrogen Sulfide area shall meet Onshore Order 6 requirements, which includes equipment and personnel/public protection items. If Hydrogen Sulfide is encountered, provide measured values and formations to the BLM.**

2. Unless the production casing has been run and cemented or the well has been properly plugged, the drilling rig shall not be removed from over the hole without prior approval. **If the drilling rig is removed without approval – an Incident of Non-Compliance will be written and will be a "Major" violation.**

3. **The operator has proposed to drill multiple wells utilizing a skid/walking rig. Operator shall secure the wellbore on the current well, after installing and testing the wellhead, by installing a blind flange of like pressure rating to the wellhead and a pressure gauge that can be monitored while drilling is performed on the other wells.**

4. Floor controls are required for 3M or Greater systems. These controls will be on the rig floor, unobstructed, readily accessible to the driller and will be operational at all times during drilling and/or completion activities. Rig floor is defined as the area immediately around the rotary table; the area immediately above the substructure on which the draw works is located, this does not include the dog house or stairway area.

5. **The record of the drilling rate along with the GR/N well log run from TD to surface (horizontal well – vertical portion of hole) shall be submitted to the BLM office as well as all other logs run on the borehole 30 days from completion. If available, a digital copy of the logs is to be submitted in addition to the paper copies. The Rustler top and top and bottom of Salt are to be recorded on the Completion Report.**

B. CASING

Changes to the approved APD casing program need prior approval if the items substituted are of lesser grade or different casing size or are Non-API. The Operator can exchange the components of the proposal with that of superior strength (i.e. changing from J-55 to N-80, or from 36# to 40#). Changes to the approved cement program need prior approval if the altered cement plan has less

volume or strength or if the changes are substantial (i.e. Multistage tool, ECP, etc.). The initial wellhead installed on the well will remain on the well with spools used as needed.

Centralizers required on surface casing per Onshore Order 2.III.B.1.f.

Wait on cement (WOC) for Water Basin:
After cementing but before commencing any tests, the casing string shall stand cemented under pressure until both of the following conditions have been met: 1) cement reaches a minimum compressive strength of 500 psi at the shoe, 2) until cement has been in place at least 8 hours. WOC time will be recorded in the driller's log. See individual casing strings for details regarding lead cement slurry requirements.

Provide compressive strengths including hours to reach required 500 pounds compressive strength prior to cementing each casing string. Have well specific cement details onsite prior to pumping the cement for each casing string.

No pea gravel permitted for remedial or fall back remedial without prior authorization from the BLM engineer.

High Cave/Karst
Possibility of water flows in the Castillo and Salado.
Possibility of lost circulation in the Delaware.
Abnormal Pressures may be encountered when penetrating the 3rd Bone Spring Sandstone and all subsequent formations.

A MINIMUM OF TWO CASING STRINGS CEMENTED TO SURFACE IS REQUIRED IN HIGH CAVE/KARST AREAS. THE CEMENT MUST BE IN A SOLID SHEATH. THEREFORE, ONE INCH OPERATIONS ARE NOT SUFFICIENT TO PROTECT CAVE KARST RESOURCES. A CASING DESIGN THAT HAS A ONE INCH JOB PERFORMED DOES NOT COUNT AS A SOLID SHEATH. IF THE PRIMARY CEMENT JOB ON THE SURFACE CASING DOES NOT CIRCULATE, THEN THE NEXT TWO CASING STRINGS MUST BE CEMENTED TO SURFACE.

1. The **13-3/8** inch surface casing shall be set at approximately **450** feet (a minimum of 25 feet into the Rustler Anhydrite and above the salt) and cemented to the surface. **If salt is encountered, set casing at least 25 feet above the salt.**
    a. If cement does not circulate to the surface, the appropriate BLM office shall be notified and a temperature survey utilizing an electronic type temperature survey with surface log readout will be used or a cement bond log shall be run to verify the top of the cement. Temperature survey will be run a minimum of six hours after pumping cement and ideally between 8-10 hours after completing the cement job.

b. **Wait on cement (WOC) time for a primary cement job is to include the lead cement slurry.**
c. Wait on cement (WOC) time for a remedial job will be a minimum of 4 hours after bringing cement to surface or 500 pounds compressive strength, whichever is greater.
d. If cement falls back, remedial cementing will be done prior to drilling out that string.

Formation below the 13-3/8" shoe to be tested according to Onshore Order 2.III.B.1.i. Test to be done as a mud equivalency test using the mud weight necessary for the pore pressure of the formation below the shoe and the mud weight for the bottom of the hole. Report results to BLM office.

Intermediate casing shall be kept fluid filled while running into hole to meet BLM minimum collapse requirements.

2. The minimum required fill of cement behind the **9-5/8** inch intermediate casing is:

Operator has proposed DV tool at depth of 2100', but will adjust cement proportionately if moved. DV tool shall be set a minimum of 50' below previous shoe and a minimum of 200' above current shoe. Operator shall submit sundry if DV tool depth cannot be set in this range. If an ECP is used, it is to be set a minimum of 50' below the shoe to provide cement across the shoe. If it cannot be set below the shoe, a CBL shall be run to verify cement coverage.

a. First stage to DV tool:
☒ Cement to circulate. If cement does not circulate, contact the appropriate BLM office before proceeding with second stage cement job. Operator should have plans as to how they will achieve circulation on the next stage.
b. Second stage above DV tool:
☒ Cement to surface. If cement does not circulate see B.1.a, c-d above. **Wait on cement (WOC) time for a primary cement job is to include the lead cement slurry due to cave/karst. Excess calculates to 22% - Additional cement may be required.**

Formation below the 9-5/8" shoe to be tested according to Onshore Order 2.III.B.1.i. Test to be done as a mud equivalency test using the mud weight necessary for the pore pressure of the formation below the shoe (not the mud weight required to prevent dissolving the salt formation) and the mud weight for the bottom of the hole. Report results to BLM office.

Centralizers required on horizontal leg, must be type for horizontal service and a minimum of one every other joint.

3. The minimum required fill of cement behind the **5-1/2** inch production casing is:

☒ Cement as proposed by operator. Operator shall provide method of verification.

4. If hardband drill pipe is rotated inside casing, returns will be monitored for metal. If metal is found in samples, drill pipe will be pulled and rubber protectors which have a larger diameter than the tool joints of the drill pipe will be installed prior to continuing drilling operations.

C. PRESSURE CONTROL

1. All blowout preventer (BOP) and related equipment (BOPE) shall comply with well control requirements as described in Onshore Oil and Gas Order No. 2 and API 53.

2. Minimum working pressure of the blowout preventer (BOP) and related equipment (BOPE) required for drilling below the surface casing shoe shall be **10,000 (10M)** psi. **10M system requires an HCR valve, remote kill line and annular to match. The remote kill line is to be installed prior to testing the system and tested to stack pressure.** BOP/BOPE shall be tested after nipple up according to Onshore Order #2.

3. The appropriate BLM office shall be notified a minimum of 4 hours in advance for a representative to witness the tests.
   a. In a water basin, for all casing strings utilizing slips, these are to be set as soon as the crew and rig are ready and any fallback cement remediation has been done. The casing cut-off and BOP installation can be initiated four hours after installing the slips, which will be approximately six hours after bumping the plug. For those casing strings not using slips, the minimum wait time before cut-off is eight hours after bumping the plug. BOP/BOPE testing can begin after cut-off or once cement reaches 500 psi compressive strength (including lead when specified), whichever is greater. However, if the float does not hold, cut-off cannot be initiated until cement reaches 500 psi compressive strength (including lead when specified).
   b. The tests shall be done by an independent service company utilizing a test plug **not a cup or J-packer**.
   c. The test shall be run on a 5000 psi chart for a 2-3M BOP/BOP, on a 10000 psi chart for a 5M BOP/BOPE and on a 15000 psi chart for a 10M BOP/BOPE. If a linear chart is used, it shall be a one hour chart. A circular chart shall have a maximum 2 hour clock. If a twelve hour or twenty-four hour chart is used, tester shall make a notation that it is run with a two hour clock.
   d. The results of the test shall be reported to the appropriate BLM office.
   e. All tests are required to be recorded on a calibrated test chart. **A copy of the BOP/BOPE test chart and a copy of independent service company test will be submitted to the appropriate BLM office.**
   f. The BOP/BOPE test shall include a low pressure test from 250 to 300 psi. The test will be held for a minimum of 10 minutes if test is done with a test plug and 30 minutes without a test plug. This test shall be performed prior to the test at full stack pressure.

g. BOP/BOPE must be tested by an independent service company within 500 feet of the top of the **Wolfcamp** formation if the time between the setting of the intermediate casing and reaching this depth exceeds 20 days. This test does not exclude the test prior to drilling out the casing shoe as per Onshore Order No. 2.

D. DRILLING MUD

Mud system monitoring equipment, with derrick floor indicators and visual and audio alarms, shall be operating before drilling into the **Wolfcamp** formation, and shall be used until production casing is run and cemented.

E. DRILL STEM TEST

If drill stem tests are performed, Onshore Order 2.III.D shall be followed.

F. WASTE MATERIAL AND FLUIDS

All waste (i.e. drilling fluids, trash, salts, chemicals, sewage, gray water, etc.) created as a result of drilling operations and completion operations shall be safely contained and disposed of properly at a waste disposal facility. No waste material or fluid shall be disposed of on the well location or surrounding area.

Porto-johns and trash containers will be on-location during fracturing operations or any other crew-intensive operations.

JAM 072516

VIII. PRODUCTION (POST DRILLING)

A. WELL STRUCTURES & FACILITIES

Placement of Production Facilities

Production facilities should be placed on the well pad to allow for maximum interim recontouring and revegetation of the well location.

Exclosure Netting (Open-top Tanks)

Immediately following active drilling or completion operations, the operator will take actions necessary to prevent wildlife and livestock access, including avian wildlife, to all open-topped tanks that contain or have the potential to contain salinity sufficient to cause harm to wildlife or livestock, hydrocarbons, or Resource Conservation and Recovery Act of 1976-exempt hazardous substances. At a minimum, the operator will net, screen, or cover open-topped tanks to exclude wildlife and livestock and prevent mortality. If the operator uses netting, the operator will cover and secure the open portion of the tank to prevent wildlife entry. The operator will net, screen, or cover the tanks until the operator removes the tanks from the location or the tanks no longer contain substances that could be harmful to wildlife or livestock. Use a maximum netting mesh size of 1 ½ inches. The netting must not be in contact with fluids and must not have holes or gaps.

Chemical and Fuel Secondary Containment and Exclosure Screening

The operator will prevent all hazardous, poisonous, flammable, and toxic substances from coming into contact with soil and water. At a minimum, the operator will install and maintain an impervious secondary containment system for any tank or barrel containing hazardous, poisonous, flammable, or toxic substances sufficient to contain the contents of the tank or barrel and any drips, leaks, and anticipated precipitation. The operator will dispose of fluids within the containment system that do not meet applicable state or U. S. Environmental Protection Agency livestock water standards in accordance with state law; the operator must not drain the fluids to the soil or ground. The operator will design, construct, and maintain all secondary containment systems to prevent wildlife and livestock exposure to harmful substances. At a minimum, the operator will install effective wildlife and livestock exclosure systems such as fencing, netting, expanded metal mesh, lids, and grate covers. Use a maximum netting mesh size of 1 ½ inches.

Open-Vent Exhaust Stack Exclosures
The operator will construct, modify, equip, and maintain all open-vent exhaust stacks on production equipment to prevent birds and bats from entering, and to discourage perching, roosting, and nesting. (*Recommended exclosure structures on open-vent exhaust stacks are in the shape of a cone.*) Production equipment includes, but may not be limited to, tanks, heater-treaters, separators, dehydrators, flare stacks, in-line units, and compressor mufflers.

Containment Structures
Proposed production facilities such as storage tanks and other vessels will have a secondary containment structure that is constructed to hold the capacity of 1.5 times the largest tank, plus freeboard to account for precipitation, unless more stringent protective requirements are deemed necessary.

Painting Requirement
All above-ground structures including meter housing that are not subject to safety requirements shall be painted a flat non-reflective paint color, **Shale Green** from the BLM Standard Environmental Color Chart (CC-001: June 2008).

B. PIPELINES

BURIED PIPELINE STIPULATIONS

A copy of the application (Grant, APD, or Sundry Notice) and attachments, including conditions of approval, survey plat and/or map, will be on location during construction. BLM personnel may request to you a copy of your permit during construction to ensure compliance with all stipulations.

Holder agrees to comply with the following stipulations to the satisfaction of the Authorized Officer:

1. The Holder shall indemnify the United States against any liability for damage to life or property arising from the occupancy or use of public lands under this grant.

2. The Holder shall comply with all applicable Federal laws and regulations existing or hereafter enacted or promulgated. In any event, the holder shall comply with the Toxic Substances Control Act of 1976 as amended, 15 USC 2601 et seq. (1982) with regards to any toxic substances that are used, generated by or stored on the right-of-way or on facilities authorized under this right-of-way grant. (See 40 CFR Part 702-799 and especially, provisions on polychlorinated biphenyls, 40 CFR 761.1-761.193.) Additionally, any release of toxic substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act, section 102b. A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to the authorized officer concurrent with the filing of the reports to the involved Federal agency or State government.

3. The holder agrees to indemnify the United States against any liability arising from the release of any hazardous substance or hazardous waste (as these terms are defined in the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. 9601, et seq. or the Resource Conservation and Recovery Act, 42 U.S.C.6901, et seq.) on the Right-of-Way (unless the release or threatened release is wholly unrelated to the Right-of-Way holder's activity on the Right-of-Way), or resulting from the activity of the Right-of-Way holder on the Right-of-Way. This agreement applies without regard to whether a release is caused by the holder, its agent, or unrelated third parties.

4. If, during any phase of the construction, operation, maintenance, or termination of the pipeline, any oil or other pollutant should be discharged from the pipeline system, impacting Federal lands, the control and total removal, disposal, and cleaning up of such oil or other pollutant, wherever found, shall be the responsibility of holder, regardless of fault. Upon failure of holder to control, dispose of, or clean up such discharge on or affecting Federal lands, or to repair all damages resulting therefrom, on the Federal lands, the Authorized Officer may take such measures as he deems necessary to control and clean up the discharge and restore the area, including where appropriate, the aquatic environment and fish and wildlife habitats, at the full expense of the holder. Such action by the Authorized Officer shall not relieve holder of any responsibility as provided herein.

5. All construction and maintenance activity will be confined to the authorized right-of-way.

6. The pipeline will be buried with a minimum cover of **36** inches between the top of the pipe and ground level.

7. The maximum allowable disturbance for construction in this right-of-way will be **30** feet:

- Blading of vegetation within the right-of-way will be allowed: maximum width of blading operations will not exceed **20** feet. The trench is included in this area. (*Blading is defined as the complete removal of brush and ground vegetation.*)

- Clearing of brush species within the right-of-way will be allowed: maximum width of clearing operations will not exceed **30** feet. The trench and bladed area are included in this area. (*Clearing is defined as the removal of brush while leaving ground vegetation (grasses, weeds, etc.) intact. Clearing is best accomplished by holding the blade 4 to 6 inches above the ground surface.*)
- The remaining area of the right-of-way (if any) shall only be disturbed by compressing the vegetation. (*Compressing can be caused by vehicle tires, placement of equipment, etc.*)

8. The holder shall stockpile an adequate amount of topsoil where blading is allowed. The topsoil to be stripped is approximately ___6___ inches in depth. The topsoil will be segregated from other spoil piles from trench construction. The topsoil will be evenly distributed over the bladed area for the preparation of seeding.

9. The holder shall minimize disturbance to existing fences and other improvements on public lands. The holder is required to promptly repair improvements to at least their former state. Functional use of these improvements will be maintained at all times. The holder will contact the owner of any improvements prior to disturbing them. When necessary to pass through a fence line, the fence shall be braced on both sides of the passageway prior to cutting of the fence. No permanent gates will be allowed unless approved by the Authorized Officer.

10. Vegetation, soil, and rocks left as a result of construction or maintenance activity will be randomly scattered on this right-of-way and will not be left in rows, piles, or berms, unless otherwise approved by the Authorized Officer. The entire right-of-way shall be recontoured to match the surrounding landscape. The backfilled soil shall be compacted and a 6 inch berm will be left over the ditch line to allow for settling back to grade.

11. In those areas where erosion control structures are required to stabilize soil conditions, the holder will install such structures as are suitable for the specific soil conditions being encountered and which are in accordance with sound resource management practices.

12. The holder will reseed all disturbed areas. Seeding will be done according to the attached seeding requirements, using the following seed mix.

( ) seed mixture 1	( ) seed mixture 3
() seed mixture 2	(X) seed mixture 4
( ) seed mixture 2/LPC	( ) Aplomado Falcon Mixture

13. All above-ground structures not subject to safety requirements shall be painted by the holder to blend with the natural color of the landscape. The paint used shall be color which simulates "Standard Environmental Colors" – **Shale Green**, Munsell Soil Color No. 5Y 4/2.

14. The pipeline will be identified by signs at the point of origin and completion of the right-of-way and at all road crossings. At a minimum, signs will state the holder's name, BLM serial number, and the product being transported. All signs and information thereon will be posted in a permanent, conspicuous manner, and will be maintained in a legible condition for the life of the pipeline.

15. The holder shall not use the pipeline route as a road for purposes other than routine maintenance as determined necessary by the Authorized Officer in consultation with the holder before maintenance begins. The holder will take whatever steps are necessary to ensure that the pipeline route is not used as a roadway. As determined necessary during the life of the pipeline, the Authorized Officer may ask the holder to construct temporary deterrence structures.

16. Any cultural and/or paleontological resources (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the Authorized Officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery will be made by the Authorized Officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the Authorized Officer after consulting with the holder.

17. The operator shall be held responsible if noxious weeds become established within the areas of operations. Weed control shall be required on the disturbed land where noxious weeds exist, which includes associated roads, pipeline corridor and adjacent land affected by the establishment of weeds due to this action. The operator shall consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies.

18. Escape Ramps - The operator will construct and maintain pipeline/utility trenches [that are not otherwise fenced, screened, or netted] to prevent livestock, wildlife, and humans from becoming entrapped. At a minimum, the operator will construct and maintain escape ramps, ladders, or other methods of avian and terrestrial wildlife escape in the trenches according to the following criteria:

a. Any trench left open for eight (8) hours or less is not required to have escape ramps; however, before the trench is backfilled, the contractor/operator shall

inspect the trench for wildlife, remove all trapped wildlife, and release them at least 100 yards from the trench.

b. For trenches left open for eight (8) hours or more, earthen escape ramps (built at no more than a 30 degree slope and spaced no more than 500 feet apart) shall be placed in the trench.

C. ELECTRIC LINES

STANDARD STIPULATIONS FOR OVERHEAD ELECTRIC DISTRIBUTION LINES

A copy of the grant and attachments, including stipulations, survey plat and/or map, will be on location during construction. BLM personnel may request to you a copy of your permit during construction to ensure compliance with all stipulations.

Holder agrees to comply with the following stipulations to the satisfaction of the Authorized Officer:

1. The holder shall indemnify the United States against any liability for damage to life or property arising from the occupancy or use of public lands under this grant.

2. The holder shall comply with all applicable Federal laws and regulations existing or hereafter enacted or promulgated. In any event, the holder shall comply with the Toxic Substances Control Act of 1976 as amended, 15 USC 2601 et seq. (1982) with regards to any toxic substances that are used, generated by or stored on the right-of-way or on facilities authorized under this right-of-way grant. (See 40 CFR, Part 702-799 and especially, provisions on polychlorinated biphenyls, 40 CFR 761.1-761.193.) Additionally, any release of toxic substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR, Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act, section 102b. A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to the authorized officer concurrent with the filing of the reports to the involved Federal agency or State government.

3. The holder agrees to indemnify the United States against any liability arising from the release of any hazardous substance or hazardous waste (as these terms are defined in the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. 9601, et seq. or the Resource Conservation and Recovery Act, 42 U.S.C. 6901, et seq.) on the Right-of-Way (unless the release or threatened release is wholly unrelated to the Right-of-Way holder's activity on the Right-of-Way), or resulting from the activity of the Right-of-Way holder on the Right-of-Way. This agreement applies without regard to whether a release is caused by the holder, its agent, or unrelated third parties.

4. There will be no clearing or blading of the right-of-way unless otherwise agreed to in writing by the Authorized Officer.

5. Power lines shall be constructed and designed in accordance to standards outlined in

"Suggested Practices for Avian Protection on Power lines: The State of the Art in 2006" Edison Electric Institute, APLIC, and the California Energy Commission 2006 . The holder shall assume the burden and expense of proving that pole designs not shown in the above publication deter raptor perching, roosting, and nesting. Such proof shall be provided by a raptor expert approved by the Authorized Officer. The BLM reserves the right to require modification or additions to all powerline structures placed on this right-of-way, should they be necessary to ensure the safety of large perching birds. Such modifications and/or additions shall be made by the holder without liability or expense to the United States.

Raptor deterrence will consist of but not limited to the following: triangle perch discouragers shall be placed on each side of the cross arms and a nonconductive perching deterrence shall be placed on all vertical poles that extend past the cross arms.

6. The holder shall minimize disturbance to existing fences and other improvements on public lands. The holder is required to promptly repair improvements to at least their former state. Functional use of these improvements will be maintained at all times. The holder will contact the owner of any improvements prior to disturbing them. When necessary to pass through a fence line, the fence shall be braced on both sides of the passageway prior to cutting the fence. No permanent gates will be allowed unless approved by the Authorized Officer.

7. The BLM serial number assigned to this authorization shall be posted in a permanent, conspicuous manner where the power line crosses roads and at all serviced facilities. Numbers will be at least two inches high and will be affixed to the pole nearest the road crossing and at the facilities served.

8. Upon cancellation, relinquishment, or expiration of this grant, the holder shall comply with those abandonment procedures as prescribed by the Authorized Officer.

9. All surface structures (poles, lines, transformers, etc.) shall be removed within 180 days of abandonment, relinquishment, or termination of use of the serviced facility or facilities or within 180 days of abandonment, relinquishment, cancellation, or expiration of this grant, whichever comes first. This will not apply where the power line extends service to an active, adjoining facility or facilities.

10. Any cultural and/or paleontological resource (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the Authorized Officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery will be made by the Authorized Officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the Authorized Officer after consulting with the holder.

11. Special Stipulations:
    - For reclamation remove poles, lines, transformer, etc. and dispose of properly.
    - Fill in any holes from the poles removed.

IX. INTERIM RECLAMATION

During the life of the development, all disturbed areas not needed for active support of production operations should undergo interim reclamation in order to minimize the environmental impacts of development on other resources and uses.

Within six (6) months of well completion, operators should work with BLM surface management specialists (Jim Amos: 575-234-5909) to devise the best strategies to reduce the size of the location. Interim reclamation should allow for remedial well operations, as well as safe and efficient removal of oil and gas.

During reclamation, the removal of caliche is important to increasing the success of revegetating the site. Removed caliche that is free of contaminants may be used for road repairs, fire walls or for building other roads and locations. In order to operate the well or complete workover operations, it may be necessary to drive, park and operate on restored interim vegetation within the previously disturbed area. Disturbing revegetated areas for production or workover operations will be allowed. If there is significant disturbance and loss of vegetation, the area will need to be revegetated. Communicate with the appropriate BLM office for any exceptions/exemptions if needed.

All disturbed areas after they have been satisfactorily prepared need to be reseeded with the seed mixture provided below.

Upon completion of interim reclamation, the operator shall submit a Sundry Notices and Reports on Wells, Subsequent Report of Reclamation (Form 3160-5).

X. FINAL ABANDONMENT & RECLAMATION

At final abandonment, well locations, production facilities, and access roads must undergo "final" reclamation so that the character and productivity of the land are restored.

Earthwork for final reclamation must be completed within six (6) months of well plugging. All pads, pits, facility locations and roads must be reclaimed to a satisfactory revegetated, safe, and stable condition, unless an agreement is made with the landowner or BLM to keep the road and/or pad intact.

After all disturbed areas have been satisfactorily prepared, these areas need to be revegetated with the seed mixture provided below. Seeding should be accomplished by drilling on the contour whenever practical or by other approved methods. Seeding may need to be repeated until revegetation is successful, as determined by the BLM.

Operators shall contact a BLM surface protection specialist prior to surface abandonment operations for site specific objectives (Jim Amos: 575-234-5909).

Mixture 4, for Gypsum Sites

The holder shall seed all the disturbed areas with the seed mixture listed below. The seed mixture shall be planted in the amounts specified in pounds of pure live seed (PLS)* per acre. There shall be no primary or secondary noxious weeds in the seed mixture. Seed will be tested and the viability testing of seed will be done in accordance with State law(s) and within nine (9) months prior to purchase. Commercial seed will be either certified or registered seed. The seed container will be tagged in accordance with State law(s) and available for inspection by the authorized officer.

Seed will be planted using a drill equipped with a depth regulator to ensure proper depth of planting where drilling is possible. The seed mixture will be evenly and uniformly planted over the disturbed area (smaller/heavier seeds have a tendency to drop the bottom of the drill and are planted first). The holder shall take appropriate measures to ensure this does not occur. Where drilling is not possible, seed will be broadcast and the area shall be raked or chained to cover the seed. When broadcasting the seed, the pounds per acre are to be doubled. The seeding will be repeated until a satisfactory stand is established as determined by the authorized officer. Evaluation of growth will not be made before completion of at least one full growing season after seeding.

Species to be planted in pounds of pure live seed* per acre:

Species	lb/acre
Alkli Sacaton (*Sporobolus airoides*)	1.5
DWS~ Four-wing saltbush (*Atriplex canescens*)	8.0

~DWS: DeWinged Seed

*Pounds of pure live seed:

Pounds of seed **x** percent purity **x** percent germination = pounds pure live seed

United States Department of the Interior
Bureau of Land Management
Carlsbad Field Office

Refer to: 3160-3

ORIGINAL

To: AFM, Lands & Minerals, CFO
From: Geologist, CFO
Subject: Geologic Review of Application for Permit to Drill

Operator: Chevron USA Inc
Well Name and Number: HH SO 8 P2-13H
Potash: No
Location: SHL:305'/N.& 960'/W. SEC017 T026S, R027E.(NWNW)
County Eddy **Lease Number:** NMNM118108 **APD Received:** 2-18-2016
Ground Level Elevation: 3246 **Surface Geology:** Psl-Salado Formation
TVD: 9904 **MD:** 20551 **BH Mud Weight:** 13.5
BHP: 6953 **MASP:** 4774

1. Geologic Marker Tops (from reports on surrounding wells):

Geologic Marker	WELCH #004 3001501153 T26S R27E Sec 20 990FNL 330FEL Elevation Depth	WELCH ABV FEDERAL #001 3001501159 T26S R27E Sec 21 660FNL 760FWL Elevation Depth	BLAST BLA FEDERAL #001 3001536136 T26S R27E Sec 17 1980FSL 1650FEL Elevation Depth	Cluster State Com 1H 3001537547 T26S R27E Sec 16 380FNL 330FWL Elevation Depth	**Proposed Well** **HH SO 8 P2-13H** T026S, R027E.(NWNWSEC017 305'/N.& 960'/W Unit Elevation Estimated Depth
Top of Salt	-	-	0	0	0
Castile	432	-	-	480	525
Lamar	2040	2028	2137	2140	2015
Bell Canyon	2100	2062	2178	2200	2065
Bone Spring Lime	-	5690	5720	5740	5615
1st BS Sand	-	6570	6682	6684	6565
2nd BS Sand	-	7330	7350	7382	7245
3rd BS Sand	-	8410	8510	8537	8385
Wolfcamp	-	8763	8857	8894	8745
Strawn	-	11210	11248	-	11125

2. Fresh Water Information

a. Fresh Water: 350

b. Fresh Water Remarks:

NEPA Log No: IT4RM-P020-2016-1711-EA
Project Type:

Reference Number: NMNM118108
Project Title: HH SO 8 P2 13H

Project Lead: Paul Murphy
Applicant: Chevron USA Inc

Recd Date: 09-30-2016
Routing Started: 10-04-2016

NEPA Checklist

Resource/Activity	Not Present	Not Impacted	**May be Impacted	Reviewer	COAs/Stips Req	Sign Off Date
Wastes, Hazardous or Solid	○	◉	○	Paul Murphy	☐	10-04-2016
Public Health and Safety	○	◉	○			
Enivronmental Justice	○	◉	○			
General Topography/Surface Geology	○	◉	○	Paul Murphy	☐	10-04-2016
Socio Economics	○	◉	○			
Lands/Realty, ROW	○	◉	○	Robert Gomez	☑	10-06-2016
Access/Transportation	○	◉	○			
Vegetation/Forestry	○	○	◉			
Livestock Grazing	○	○	◉	Stephen Daly	☐	10-06-2016
Invasive, Non-Native Species	○	○	◉			
Soils	○	○	◉	Stephen Daly	☐	10-06-2016
Air Quality	○	○	◉			
Floodplains	○	◉	○			
Water Quality Surface/Ground	○	○	◉	Stephen Daly	☐	10-06-2016
Watershed	○	○	◉			
Mineral Materials	○	○	◉	Paul Murphy	☐	10-04-2016
Potash	◉	○	○	Paul Murphy	☐	10-04-2016
Endangered Species	◉	○	○			
Wetlands/Riparian Zones	◉	○	○	Cassandra Brooks	☐	10-06-2016
Special Status Species	◉	○	○			
Wildlife Habitat	○	○	◉			
Karst Resources	○	○	◉	Stan Allison	☑	10-07-2016
ACECs	○	◉	○	Cassandra Brooks	☐	10-06-2016
Wild/Scenic Rivers	◉	○	○			
Wilderness	◉	○	○	Stan Allison	☐	10-07-2016
Outdoor Recreation	○	○	◉			
Visual Resources	○	○	◉			
Native American Religious Concerns	◉ Unknown					
Cultural Resources	○	◉	○	Stephanie Bergman	☐	10-07-2016
Paleontology	◉ Unknown					

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Pecos District
Carlsbad Field Office
620 East Greene Street
Carlsbad, NM 88220

Hayhurst Master Development Plan Environmental Assessment

NEPA No. DOI-BLM-NM-P020-2016-1434-EA

Conditions of Approval

In order to ensure that the proponent's impacts are consistent with the operating parameters considered in the air quality analysis, Conditions of Approval (COA) will be applied to Applications for Permit to Drill requested under the Hayhurst Master Development Plan. These COAs are:

- All project activities including equipment emissions shall meet or exceed all state and federal standards for air quality as regulated by the New Mexico Environment Department Air Quality Bureau and the U.S. Environmental Protection Agency.

- The operator will implement a drill and completion rig schedule where Tier 4 (or equivalent) drill and completion rigs are phased in. The operator will not exceed four drill rigs at one time and will be 100% compliant with Tier 4 (or equivalent) standards in 2020.

- During the drilling phase, the operator will emit NOx emissions of 262.95 tons per year (tpy) or less from nonroad (mobile sources) between Year 1 and Year 3 and 220.7 tpy or less from nonroad (mobile sources) for the remainder of the drilling phase.

- The operator will emit 213.6 tpy or less of NOx emissions during production operations, as defined in the emission inventory analyzed in the Environmental Assessment. The operator will submit emissions and/or parameters with an Application for Permit to Drill or annual emissions inventory that show the NOx emissions are within the limits of the air quality analysis within the Environmental Assessment.

PECOS DISTRICT
CONDITIONS OF APPROVAL

OPERATOR'S NAME:	**Chevron USA Inc.**
LEASE NO.:	**NMNM-118108**
WELL NAME & NO.:	**HH SO 8 P2 13H**
SURFACE HOLE FOOTAGE:	**0305' FNL & 0960' FWL**
BOTTOM HOLE FOOTAGE	**0180' FNL & 0330' FWL Sec. 05, T. 26 S., R 27 E.**
LOCATION:	**Section 17, T. 26 S., R 27 E., NMPM**
COUNTY:	**Eddy County, New Mexico**

TABLE OF CONTENTS

Standard Conditions of Approval (COA) apply to this APD. If any deviations to these standards exist or special COAs are required, the section with the deviation or requirement will be checked below.

- ☐ **General Provisions**
- ☐ **Permit Expiration**
- ☐ **Archaeology, Paleontology, and Historical Sites**
- ☐ **Noxious Weeds**
- ☒ **Special Requirements**
  - Raptor Nest
  - Avian Protection
  - Cave/Karst
  - VRM
  - Cultural
- ☐ **Construction**
  - Notification
  - Topsoil
  - Closed Loop System
  - Federal Mineral Material Pits
  - Well Pads
  - Roads
- ☐ **Road Section Diagram**
- ☒ **Drilling**
  - Cement Requirements
  - High Cave/Karst
  - Logging Requirements
  - Waste Material and Fluids
- ☒ **Production (Post Drilling)**
  - Well Structures & Facilities
  - Pipelines
  - Electric Lines
- ☐ **Interim Reclamation**
- ☐ **Final Abandonment & Reclamation**

I. GENERAL PROVISIONS

The approval of the Application For Permit To Drill (APD) is in compliance with all applicable laws and regulations: 43 Code of Federal Regulations 3160, the lease terms, Onshore Oil and Gas Orders, Notices To Lessees, New Mexico Oil Conservation Division (NMOCD) Rules, National Historical Preservation Act As Amended, and instructions and orders of the Authorized Officer. Any request for a variance shall be submitted to the Authorized Officer on Form 3160-5, Sundry Notices and Report on Wells.

II. PERMIT EXPIRATION

If the permit terminates prior to drilling and drilling cannot be commenced within 60 days after expiration, an operator is required to submit Form 3160-5, Sundry Notices and Reports on Wells, requesting surface reclamation requirements for any surface disturbance. However, if the operator will be able to initiate drilling within 60 days after the expiration of the permit, the operator must have set the conductor pipe in order to allow for an extension of 60 days beyond the expiration date of the APD. (Filing of a Sundry Notice is required for this 60 day extension.)

III. ARCHAEOLOGICAL, PALEONTOLOGY & HISTORICAL SITES

Any cultural and/or paleontological resource discovered by the operator or by any person working on the operator's behalf shall immediately report such findings to the Authorized Officer. The operator is fully accountable for the actions of their contractors and subcontractors. The operator shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery shall be made by the Authorized Officer to determine the appropriate actions that shall be required to prevent the loss of significant cultural or scientific values of the discovery. The operator shall be held responsible for the cost of the proper mitigation measures that the Authorized Officer assesses after consultation with the operator on the evaluation and decisions of the discovery. Any unauthorized collection or disturbance of cultural or paleontological resources may result in a shutdown order by the Authorized Officer.

IV. NOXIOUS WEEDS

The operator shall be held responsible if noxious weeds become established within the areas of operations. Weed control shall be required on the disturbed land where noxious weeds exist, which includes the roads, pads, associated pipeline corridor, and adjacent land affected by the establishment of weeds due to this action. The operator shall consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies.

V. SPECIAL REQUIREMENT(S)

Avian Protection

Power lines shall be constructed and designed in accordance to standards outlined in "Suggested Practices for Avian Protection on Power lines: The State of the Art in 2006" Edison Electric Institute, APLIC, and the California Energy Commission 2006. The holder shall assume the burden and expense of proving that pole designs not shown in the above publication deter raptor perching, roosting, and nesting. Such proof shall be provided by a raptor expert approved by the Authorized Officer. The BLM reserves the right to require modification or additions to all power line structures placed on this right-of-way, should they be necessary to ensure the safety of large perching birds. The holder without liability or expense shall make such modifications and/or additions to the United States.

Raptor Nest

Raptor Nest Mitigation

- A BLM Wildlife Biologist must be contacted by the operator prior to construction activities to determine if the raptor nest is active.
- Raptor nests on special, natural habitat features, such as trees, large brush, cliff faces and escarpments, will be protected by not allowing surface disturbance within up to 200 meters of nests or by delaying activity for up to 90 days, or a combination of both. Exceptions to this requirement for raptor nests will be considered if the nests expected to be disturbed are inactive, the proposed activity is of short duration (e.g. habitat enhancement projects, fences, pipelines), and will not result in continuing activity in proximity to the nest.
- Exhaust noise from pump jack engines must be muffled or otherwise controlled so as not to exceed 75 db measured at 30 ft. from the source of the noise.

Visual Resource Management (VRM)

- Above-ground structures including meter housing that are not subject to safety requirements are painted a flat non-reflective paint color, Shale Green from the BLM Standard Environmental Color Chart (CC-001: June 2008)
- Chevron would use minimal light necessary for site safety, security, and operations.
- Light should be directed downward or only where needed.
- Low-pressure sodium lamps, such as yellow LED lighting (3,000 Kelvin or less) or equivalent, would be used to reduce sky glow and wildlife impacts.
- Properly shielded and mounted light fixtures would be used to reduce sky glow from upward pointing light, as well as trespass from light falling outside of desired area of illumination. Full cutoff shielding would be used during production.

Cave and Karst

** Depending on location, additional Drilling, Casing, and Cementing procedures may be required by engineering to protect critical karst groundwater recharge areas.

Cave/Karst Surface Mitigation

The following stipulations will be applied to minimize impacts during construction, drilling and production.

Construction:
In the advent that any underground voids are opened up during construction activities, construction activities will be halted and the BLM will be notified immediately.

No Blasting:
No blasting will be utilized for pad construction. The pad will be constructed and leveled by adding the necessary fill and caliche.

Pad Berming:
The entire perimeter of the well pad will be bermed to prevent oil, salt, and other chemical contaminants from leaving the well pad.

- The compacted berm shall be constructed at a minimum of 12 inches high with impermeable mineral material (e.g. caliche).
- No water flow from the uphill side(s) of the pad shall be allowed to enter the well pad.
- The topsoil stockpile shall be located outside the bermed well pad.
- Topsoil, either from the well pad or surrounding area, shall not be used to construct the berm.
- No storm drains, tubing or openings shall be placed in the berm.
- If fluid collects within the bermed area, the fluid must be vacuumed into a safe container and disposed of properly at a state approved facility.
- The integrity of the berm shall be maintained around the surfaced pad throughout the life of the well and around the downsized pad after interim reclamation has been completed.
- Any access road entering the well pad shall be constructed so that the integrity of the berm height surrounding the well pad is not compromised. (Any access road crossing the berm cannot be lower than the berm height.)

Tank Battery Liners and Berms:
Tank battery locations and all facilities will be lined and bermed. A 20 mil permanent liner will be installed with a 4 oz. felt backing to prevent tears or punctures. Tank battery berms must be large enough to contain 1 ½ times the content of the largest tank.

Leak Detection System:
A method of detecting leaks is required. The method could incorporate gauges to measure loss, situating values and lines so they can be visually inspected, or installing

electronic sensors to alarm when a leak is present. Leak detection plan will be submitted to BLM for approval.

Automatic Shut-off Systems:
Automatic shut off, check values, or similar systems will be installed for pipelines and tanks to minimize the effects of catastrophic line failures used in production or drilling.

Cave/Karst Subsurface Mitigation

The following stipulations will be applied to protect cave/karst and ground water concerns:

Rotary Drilling with Fresh Water:
Fresh water will be used as a circulating medium in zones where caves or karst features are expected. SEE ALSO: Drilling COAs for this well.

Directional Drilling:
Kick off for directional drilling will occur at least 100 feet below the bottom of the cave occurrence zone. SEE ALSO: Drilling COAs for this well.

Lost Circulation:
ALL lost circulation zones from the surface to the base of the cave occurrence zone will be logged and reported in the drilling report.

Regardless of the type of drilling machinery used, if a void of four feet or more and circulation losses greater than 70 percent occur simultaneously while drilling in any cave-bearing zone, the BLM will be notified immediately by the operator. The BLM will assess the situation and work with the operator on corrective actions to resolve the problem.

Abandonment Cementing:
Upon well abandonment in high cave karst areas additional plugging conditions of approval may be required. The BLM will assess the situation and work with the operator to ensure proper plugging of the wellbore.

Pressure Testing:
Annual pressure monitoring will be performed by the operator on all casing annuli and reported in a sundry notice. If the test results indicated a casing failure has occurred, remedial action will be undertaken to correct the problem to the BLM's approval.

VI. CONSTRUCTION

A. NOTIFICATION

The BLM shall administer compliance and monitor construction of the access road and well pad. Notify the Carlsbad Field Office at (575) 234-5909 at least 3 working days prior to commencing construction of the access road and/or well pad.

When construction operations are being conducted on this well, the operator shall have the approved APD and Conditions of Approval (COA) on the well site and they shall be made available upon request by the Authorized Officer.

B. TOPSOIL

The operator shall strip the top portion of the soil (root zone) from the entire well pad area and stockpile the topsoil along the edge of the well pad as depicted in the APD. The root zone is typically six (6) inches in depth. All the stockpiled topsoil will be redistributed over the interim reclamation areas. Topsoil shall not be used for berming the pad or facilities. For final reclamation, the topsoil shall be spread over the entire pad area for seeding preparation.

Other subsoil (below six inches) stockpiles must be completely segregated from the topsoil stockpile. Large rocks or subsoil clods (not evident in the surrounding terrain) must be buried within the approved area for interim and final reclamation.

C. CLOSED LOOP SYSTEM

Tanks are required for drilling operations: No Pits.

The operator shall properly dispose of drilling contents at an authorized disposal site.

D. FEDERAL MINERAL MATERIALS PIT

Payment shall be made to the BLM prior to removal of any federal mineral materials. Call the Carlsbad Field Office at (575) 234-5972.

E. WELL PAD SURFACING

Surfacing of the well pad is not required.

If the operator elects to surface the well pad, the surfacing material may be required to be removed at the time of reclamation.The well pad shall be constructed in a manner which creates the smallest possible surface disturbance, consistent with safety and operational needs.

F. EXCLOSURE FENCING (CELLARS & PITS)

Exclosure Fencing
The operator will install and maintain exclosure fencing for all open well cellars to prevent access to public, livestock, and large forms of wildlife before and after drilling operations until the pit is free of fluids and the operator initiates backfilling. (For examples of exclosure fencing design, refer to BLM's Oil and Gas Gold Book, Exclosure Fence Illustrations, Figure 1, Page 18.)

G. ON LEASE ACCESS ROADS

Road Width
The access road shall have a driving surface that creates the smallest possible surface disturbance and does not exceed fourteen (14) feet in width. The maximum width of surface disturbance, when constructing the access road, shall not exceed twenty-five (25) feet.

Surfacing
Surfacing material is not required on the new access road driving surface. If the operator elects to surface the new access road or pad, the surfacing material may be required to be removed at the time of reclamation.

Where possible, no improvements should be made on the unsurfaced access road other than to remove vegetation as necessary, road irregularities, safety issues, or to fill low areas that may sustain standing water.

The Authorized Officer reserves the right to require surfacing of any portion of the access road at any time deemed necessary. Surfacing may be required in the event the road deteriorates, erodes, road traffic increases, or it is determined to be beneficial for future field development. The surfacing depth and type of material will be determined at the time of notification.

Crowning
Crowning shall be done on the access road driving surface. The road crown shall have a grade of approximately 2% (i.e., a 1" crown on a 14' wide road). The road shall conform to Figure 1; cross section and plans for typical road construction.

Ditching
Ditching shall be required on both sides of the road.

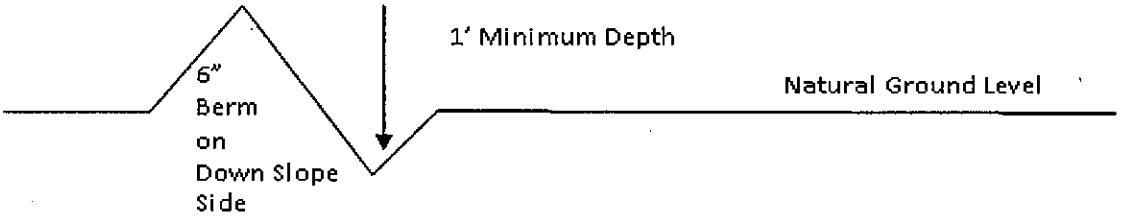
Turnouts
Vehicle turnouts shall be constructed on the road. Turnouts shall be intervisible with interval spacing distance less than 1000 feet. Turnouts shall conform to Figure 1; cross section and plans for typical road construction.

Drainage

Drainage control systems shall be constructed on the entire length of road (e.g. ditches, sidehill outsloping and insloping, lead-off ditches, culvert installation, and low water crossings).

A typical lead-off ditch has a minimum depth of 1 foot below and a berm of 6 inches above natural ground level. The berm shall be on the down-slope side of the lead-off ditch.

Cross Section of a Typical Lead-off Ditch



All lead-off ditches shall be graded to drain water with a 1 percent minimum to 3 percent maximum ditch slope. The spacing interval are variable for lead-off ditches and shall be determined according to the formula for spacing intervals of lead-off ditches, but may be amended depending upon existing soil types and centerline road slope (in %);

Formula for Spacing Interval of Lead-off Ditches

Example - On a 4% road slope that is 400 feet long, the water flow shall drain water into a lead-off ditch. Spacing interval shall be determined by the following formula:

400 foot road with 4% road slope: $\frac{400'}{4\%} + 100' = 200'$ lead-off ditch interval

Cattleguards

An appropriately sized cattleguard sufficient to carry out the project shall be installed and maintained at fence/road crossings. Any existing cattleguards on the access road route shall be repaired or replaced if they are damaged or have deteriorated beyond practical use. The operator shall be responsible for the condition of the existing cattleguards that are in place and are utilized during lease operations.

Fence Requirement

Where entry is granted across a fence line, the fence shall be braced and tied off on both sides of the passageway prior to cutting. The operator shall notify the private surface landowner or the grazing allotment holder prior to crossing any fences.

Public Access

Public access on this road shall not be restricted by the operator without specific written approval granted by the Authorized Officer.

Construction Steps

1. Salvage topsoil
2. Construct road
3. Redistribute topsoil
4. Revegetate slopes

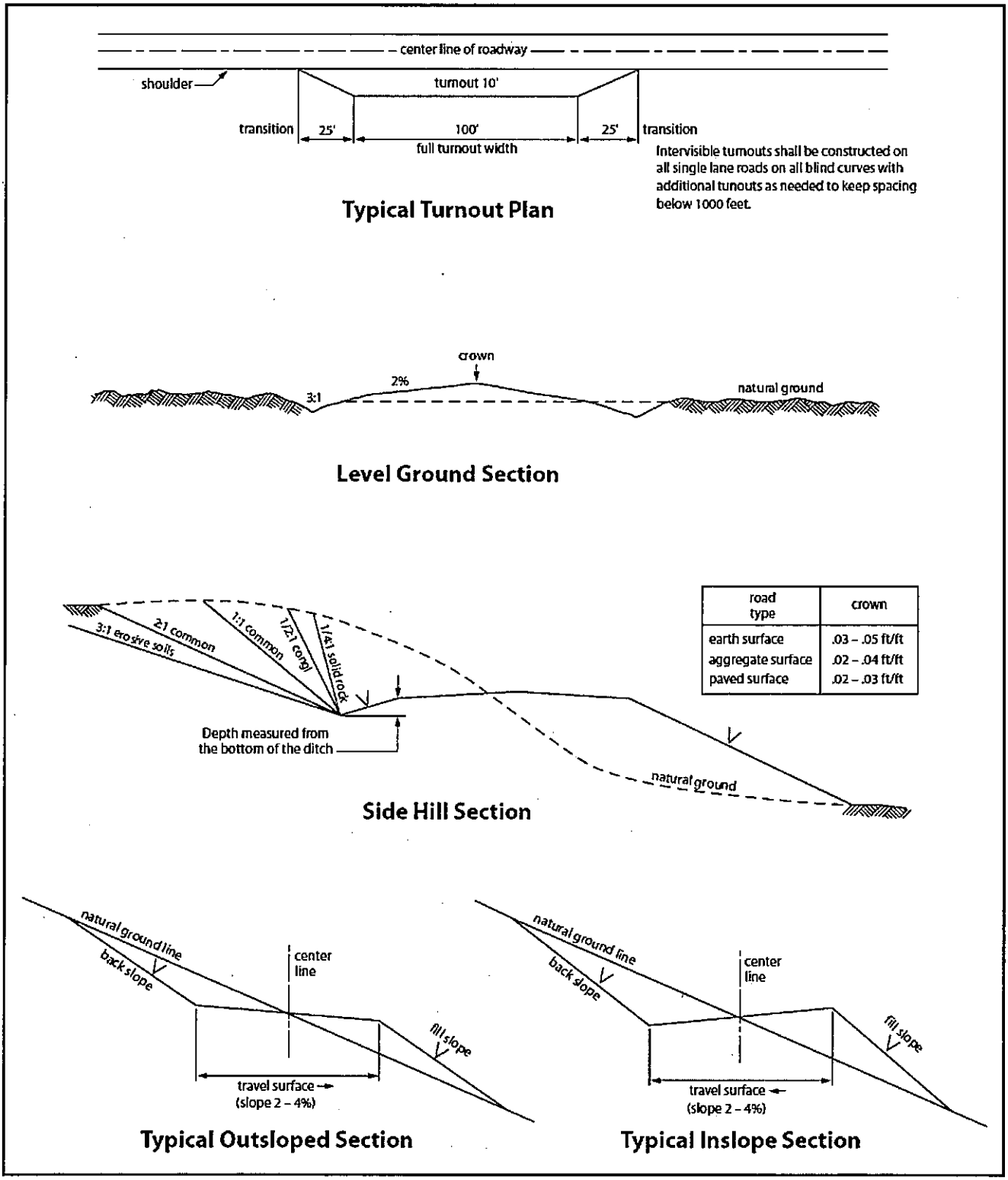


Figure 1. Cross-sections and plans for typical road sections representative of BLM resource or FS local and higher-class roads.

VII. DRILLING

A. DRILLING OPERATIONS REQUIREMENTS

The BLM is to be notified in advance for a representative to witness:

a. Spudding well (minimum of 24 hours)
b. Setting and/or Cementing of all casing strings (minimum of 4 hours)
c. BOPE tests (minimum of 4 hours)

☒ **Eddy County**
Call the Carlsbad Field Office, 620 East Greene St., Carlsbad, NM 88220, (575) 361-2822

1. **Hydrogen Sulfide (H2S) monitors shall be installed prior to drilling out the surface shoe. If H2S is detected in concentrations greater than 100 ppm, the Hydrogen Sulfide area shall meet Onshore Order 6 requirements, which includes equipment and personnel/public protection items. If Hydrogen Sulfide is encountered, provide measured values and formations to the BLM.**

2. Unless the production casing has been run and cemented or the well has been properly plugged, the drilling rig shall not be removed from over the hole without prior approval. **If the drilling rig is removed without approval – an Incident of Non-Compliance will be written and will be a "Major" violation.**

3. **The operator has proposed to drill multiple wells utilizing a skid/walking rig. Operator shall secure the wellbore on the current well, after installing and testing the wellhead, by installing a blind flange of like pressure rating to the wellhead and a pressure gauge that can be monitored while drilling is performed on the other wells.**

4. Floor controls are required for 3M or Greater systems. These controls will be on the rig floor, unobstructed, readily accessible to the driller and will be operational at all times during drilling and/or completion activities. Rig floor is defined as the area immediately around the rotary table; the area immediately above the substructure on which the draw works is located, this does not include the dog house or stairway area.

5. **The record of the drilling rate along with the GR/N well log run from TD to surface (horizontal well – vertical portion of hole) shall be submitted to the BLM office as well as all other logs run on the borehole 30 days from completion. If available, a digital copy of the logs is to be submitted in addition to the paper copies. The Rustler top and top and bottom of Salt are to be recorded on the Completion Report.**

B. CASING

Changes to the approved APD casing program need prior approval if the items substituted are of lesser grade or different casing size or are Non-API. The Operator can exchange the components of the proposal with that of superior strength (i.e. changing from J-55 to N-80, or from 36# to 40#). Changes to the approved cement program need prior approval if the altered cement plan has less volume or strength or if the changes are substantial (i.e. Multistage tool, ECP, etc.). The initial wellhead installed on the well will remain on the well with spools used as needed.

Centralizers required on surface casing per Onshore Order 2.III.B.1.f.

Wait on cement (WOC) for Water Basin:
After cementing but before commencing any tests, the casing string shall stand cemented under pressure until both of the following conditions have been met: 1) cement reaches a minimum compressive strength of 500 psi at the shoe, 2) until cement has been in place at least 8 hours. WOC time will be recorded in the driller's log. See individual casing strings for details regarding lead cement slurry requirements.

Provide compressive strengths including hours to reach required 500 pounds compressive strength prior to cementing each casing string. Have well specific cement details onsite prior to pumping the cement for each casing string.

No pea gravel permitted for remedial or fall back remedial without prior authorization from the BLM engineer.

High Cave/Karst
Possibility of water flows in the Castillo and Salado.
Possibility of lost circulation in the Delaware.
Abnormal Pressures may be encountered when penetrating the 3rd Bone Spring Sandstone and all subsequent formations.

A MINIMUM OF TWO CASING STRINGS CEMENTED TO SURFACE IS REQUIRED IN HIGH CAVE/KARST AREAS. THE CEMENT MUST BE IN A SOLID SHEATH. THEREFORE, ONE INCH OPERATIONS ARE NOT SUFFICIENT TO PROTECT CAVE KARST RESOURCES. A CASING DESIGN THAT HAS A ONE INCH JOB PERFORMED DOES NOT COUNT AS A SOLID SHEATH. IF THE PRIMARY CEMENT JOB ON THE SURFACE CASING DOES NOT CIRCULATE, THEN THE NEXT TWO CASING STRINGS MUST BE CEMENTED TO SURFACE.

1. The **13-3/8** inch surface casing shall be set at approximately **450** feet (a minimum of 25 feet into the Rustler Anhydrite and above the salt) and cemented to the surface. **If salt is encountered, set casing at least 25 feet above the salt.**

    a. If cement does not circulate to the surface, the appropriate BLM office shall be notified and a temperature survey utilizing an electronic type temperature survey with surface log readout will be used or a cement bond log shall be run to verify the top of the cement. Temperature survey will be run a minimum of six hours after pumping cement and ideally between 8-10 hours after completing the cement job.

    b. Wait on cement (WOC) time for a primary cement job is to include the lead cement slurry.

    c. Wait on cement (WOC) time for a remedial job will be a minimum of 4 hours after bringing cement to surface or 500 pounds compressive strength, whichever is greater.

    d. If cement falls back, remedial cementing will be done prior to drilling out that string.

Formation below the 13-3/8" shoe to be tested according to Onshore Order 2.III.B.1.i. Test to be done as a mud equivalency test using the mud weight necessary for the pore pressure of the formation below the shoe and the mud weight for the bottom of the hole. Report results to BLM office.

Intermediate casing shall be kept fluid filled while running into hole to meet BLM minimum collapse requirements.

2. The minimum required fill of cement behind the **9-5/8** inch intermediate casing is:

Operator has proposed DV tool at depth of 2100', but will adjust cement proportionately if moved. DV tool shall be set a minimum of 50' below previous shoe and a minimum of 200' above current shoe. Operator shall submit sundry if DV tool depth cannot be set in this range. If an ECP is used, it is to be set a minimum of 50' below the shoe to provide cement across the shoe. If it cannot be set below the shoe, a CBL shall be run to verify cement coverage.

a. First stage to DV tool:

☒ Cement to circulate. If cement does not circulate, contact the appropriate BLM office before proceeding with second stage cement job. Operator should have plans as to how they will achieve circulation on the next stage.

b. Second stage above DV tool:

☒ Cement to surface. If cement does not circulate see B.1.a, c-d above. **Wait on cement (WOC) time for a primary cement job is to include the lead cement slurry due to cave/karst. Excess calculates to 22% - Additional cement may be required.**

Formation below the 9-5/8" shoe to be tested according to Onshore Order 2.III.B.1.i. Test to be done as a mud equivalency test using the mud weight necessary for the pore pressure of the formation below the shoe (not the mud weight required to prevent dissolving the salt formation) and the mud weight for the bottom of the hole. Report results to BLM office.

Centralizers required on horizontal leg, must be type for horizontal service and a minimum of one every other joint.

3. The minimum required fill of cement behind the **5-1/2** inch production casing is:

   ☒ Cement as proposed by operator. Operator shall provide method of verification.

4. If hardband drill pipe is rotated inside casing, returns will be monitored for metal. If metal is found in samples, drill pipe will be pulled and rubber protectors which have a larger diameter than the tool joints of the drill pipe will be installed prior to continuing drilling operations.

C. PRESSURE CONTROL

1. All blowout preventer (BOP) and related equipment (BOPE) shall comply with well control requirements as described in Onshore Oil and Gas Order No. 2 and API 53.

2. Minimum working pressure of the blowout preventer (BOP) and related equipment (BOPE) required for drilling below the surface casing shoe shall be **10,000 (10M)** psi. **10M system requires an HCR valve, remote kill line and annular to match. The remote kill line is to be installed prior to testing the system and tested to stack pressure.** BOP/BOPE shall be tested after nipple up according to Onshore Order #2.

3. The appropriate BLM office shall be notified a minimum of 4 hours in advance for a representative to witness the tests.

    a. In a water basin, for all casing strings utilizing slips, these are to be set as soon as the crew and rig are ready and any fallback cement remediation has been done. The casing cut-off and BOP installation can be initiated four hours after installing the slips, which will be approximately six hours after bumping the plug. For those casing strings not using slips, the minimum wait time before cut-off is eight hours after bumping the plug. BOP/BOPE testing can begin after cut-off or once cement reaches 500 psi compressive strength (including lead when specified), whichever is greater. However, if the float does not hold, cut-off cannot be initiated until cement reaches 500 psi compressive strength (including lead when specified).

    b. The tests shall be done by an independent service company utilizing a test plug **not a cup or J-packer.**

    c. The test shall be run on a 5000 psi chart for a 2-3M BOP/BOP, on a 10000 psi chart for a 5M BOP/BOPE and on a 15000 psi chart for a 10M BOP/BOPE. If a linear chart is used, it shall be a one hour chart. A circular chart shall have a maximum 2 hour clock. If a twelve hour or twenty-four hour chart is used, tester shall make a notation that it is run with a two hour clock.

    d. The results of the test shall be reported to the appropriate BLM office.

    e. All tests are required to be recorded on a calibrated test chart. **A copy of the BOP/BOPE test chart and a copy of independent service company test will be submitted to the appropriate BLM office.**

    f. The BOP/BOPE test shall include a low pressure test from 250 to 300 psi. The test will be held for a minimum of 10 minutes if test is done with a test plug and 30 minutes without a test plug. This test shall be performed prior to the test at full stack pressure.

    g. BOP/BOPE must be tested by an independent service company within 500 feet of the top of the **Wolfcamp** formation if the time between the setting of the intermediate casing and reaching this depth exceeds 20 days. This test does not exclude the test prior to drilling out the casing shoe as per Onshore Order No. 2.

D. DRILLING MUD

Mud system monitoring equipment, with derrick floor indicators and visual and audio alarms, shall be operating before drilling into the **Wolfcamp** formation, and shall be used until production casing is run and cemented.

E. DRILL STEM TEST

If drill stem tests are performed, Onshore Order 2.III.D shall be followed.

F. WASTE MATERIAL AND FLUIDS

All waste (i.e. drilling fluids, trash, salts, chemicals, sewage, gray water, etc.) created as a result of drilling operations and completion operations shall be safely contained and disposed of properly at a waste disposal facility. No waste material or fluid shall be disposed of on the well location or surrounding area.

Porto-johns and trash containers will be on-location during fracturing operations or any other crew-intensive operations.

JAM 072516

VIII. PRODUCTION (POST DRILLING)

A. WELL STRUCTURES & FACILITIES

Placement of Production Facilities
Production facilities should be placed on the well pad to allow for maximum interim recontouring and revegetation of the well location.

Exclosure Netting (Open-top Tanks)
Immediately following active drilling or completion operations, the operator will take actions necessary to prevent wildlife and livestock access, including avian wildlife, to all open-topped tanks that contain or have the potential to contain salinity sufficient to cause harm to wildlife or livestock, hydrocarbons, or Resource Conservation and Recovery Act of 1976-exempt hazardous substances. At a minimum, the operator will net, screen, or cover open-topped tanks to exclude wildlife and livestock and prevent mortality. If the operator uses netting, the operator will cover and secure the open portion of the tank to prevent wildlife entry. The operator will net, screen, or cover the tanks until the operator removes the tanks from the location or the tanks no longer contain substances that could be harmful to wildlife or livestock. Use a maximum netting mesh size of 1 ½ inches. The netting must not be in contact with fluids and must not have holes or gaps.

Chemical and Fuel Secondary Containment and Exclosure Screening
The operator will prevent all hazardous, poisonous, flammable, and toxic substances from coming into contact with soil and water. At a minimum, the operator will install and maintain an impervious secondary containment system for any tank or barrel containing hazardous, poisonous, flammable, or toxic substances sufficient to contain the contents of the tank or barrel and any drips, leaks, and anticipated precipitation. The operator will dispose of fluids within the containment system that do not meet applicable state or U. S. Environmental Protection Agency livestock water standards in accordance with state law; the operator must not drain the fluids to the soil or ground. The operator will design, construct, and maintain all secondary containment systems to prevent wildlife and livestock exposure to harmful substances. At a minimum, the operator will install effective wildlife and livestock exclosure systems such as fencing, netting, expanded metal mesh, lids, and grate covers. Use a maximum netting mesh size of 1 ½ inches.

Open-Vent Exhaust Stack Exclosures
The operator will construct, modify, equip, and maintain all open-vent exhaust stacks on production equipment to prevent birds and bats from entering, and to discourage perching, roosting, and nesting. (*Recommended exclosure structures on open-vent exhaust stacks are in the shape of a cone.*) Production equipment includes, but may not be limited to, tanks, heater-treaters, separators, dehydrators, flare stacks, in-line units, and compressor mufflers.

Containment Structures
Proposed production facilities such as storage tanks and other vessels will have a secondary containment structure that is constructed to hold the capacity of 1.5 times the

largest tank, plus freeboard to account for precipitation, unless more stringent protective requirements are deemed necessary.

Painting Requirement
All above-ground structures including meter housing that are not subject to safety requirements shall be painted a flat non-reflective paint color, **Shale Green** from the BLM Standard Environmental Color Chart (CC-001: June 2008).

B. PIPELINES

BURIED PIPELINE STIPULATIONS

A copy of the application (Grant, APD, or Sundry Notice) and attachments, including conditions of approval, survey plat and/or map, will be on location during construction. BLM personnel may request to you a copy of your permit during construction to ensure compliance with all stipulations.

Holder agrees to comply with the following stipulations to the satisfaction of the Authorized Officer:

1. The Holder shall indemnify the United States against any liability for damage to life or property arising from the occupancy or use of public lands under this grant.

2. The Holder shall comply with all applicable Federal laws and regulations existing or hereafter enacted or promulgated. In any event, the holder shall comply with the Toxic Substances Control Act of 1976 as amended, 15 USC 2601 et seq. (1982) with regards to any toxic substances that are used, generated by or stored on the right-of-way or on facilities authorized under this right-of-way grant. (See 40 CFR Part 702-799 and especially, provisions on polychlorinated biphenyls, 40 CFR 761.1-761.193.) Additionally, any release of toxic substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act, section 102b. A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to the authorized officer concurrent with the filing of the reports to the involved Federal agency or State government.

3. The holder agrees to indemnify the United States against any liability arising from the release of any hazardous substance or hazardous waste (as these terms are defined in the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. 9601, et seq. or the Resource Conservation and Recovery Act, 42 U.S.C.6901, et seq.) on the Right-of-Way (unless the release or threatened release is wholly unrelated to the Right-of-Way holder's activity on the Right-of-Way), or resulting from the activity of the Right-of-Way holder on the Right-of-Way. This agreement applies without regard to whether a release is caused by the holder, its agent, or unrelated third parties.

4. If, during any phase of the construction, operation, maintenance, or termination of the pipeline, any oil or other pollutant should be discharged from the pipeline system, impacting Federal lands, the control and total removal, disposal, and cleaning up of such oil or other pollutant, wherever found, shall be the responsibility of holder, regardless of fault. Upon failure of holder to control, dispose of, or clean up such discharge on or affecting Federal lands, or to repair all damages resulting therefrom, on the Federal lands, the Authorized Officer may take such measures as he deems necessary to control and clean up the discharge and restore the area, including where appropriate, the aquatic environment and fish and wildlife habitats, at the full expense of the holder. Such action by the Authorized Officer shall not relieve holder of any responsibility as provided herein.

5. All construction and maintenance activity will be confined to the authorized right-of-way.

6. The pipeline will be buried with a minimum cover of **36** inches between the top of the pipe and ground level.

7. The maximum allowable disturbance for construction in this right-of-way will be **30** feet:

- Blading of vegetation within the right-of-way will be allowed: maximum width of blading operations will not exceed **20** feet. The trench is included in this area. (*Blading is defined as the complete removal of brush and ground vegetation.*)

- Clearing of brush species within the right-of-way will be allowed: maximum width of clearing operations will not exceed **30** feet. The trench and bladed area are included in this area. (*Clearing is defined as the removal of brush while leaving ground vegetation (grasses, weeds, etc.) intact. Clearing is best accomplished by holding the blade 4 to 6 inches above the ground surface.*)

- The remaining area of the right-of-way (if any) shall only be disturbed by compressing the vegetation. (*Compressing can be caused by vehicle tires, placement of equipment, etc.*)

8. The holder shall stockpile an adequate amount of topsoil where blading is allowed. The topsoil to be stripped is approximately 6 inches in depth. The topsoil will be segregated from other spoil piles from trench construction. The topsoil will be evenly distributed over the bladed area for the preparation of seeding.

9. The holder shall minimize disturbance to existing fences and other improvements on public lands. The holder is required to promptly repair improvements to at least their former state. Functional use of these improvements will be maintained at all times. The holder will contact the owner of any improvements prior to disturbing them. When necessary to pass through a fence line, the fence shall be braced on both sides of the passageway prior to cutting of the fence. No permanent gates will be allowed unless approved by the Authorized Officer.

10. Vegetation, soil, and rocks left as a result of construction or maintenance activity will be randomly scattered on this right-of-way and will not be left in rows, piles, or berms, unless otherwise approved by the Authorized Officer. The entire right-of-way shall be recontoured to match the surrounding landscape. The backfilled soil shall be compacted and a 6 inch berm will be left over the ditch line to allow for settling back to grade.

11. In those areas where erosion control structures are required to stabilize soil conditions, the holder will install such structures as are suitable for the specific soil conditions being encountered and which are in accordance with sound resource management practices.

12. The holder will reseed all disturbed areas. Seeding will be done according to the attached seeding requirements, using the following seed mix.

( ) seed mixture 1 ( ) seed mixture 3

() seed mixture 2 (X) seed mixture 4

( ) seed mixture 2/LPC ( ) Aplomado Falcon Mixture

13. All above-ground structures not subject to safety requirements shall be painted by the holder to blend with the natural color of the landscape. The paint used shall be color which simulates "Standard Environmental Colors" – **Shale Green**, Munsell Soil Color No. 5Y 4/2.

14. The pipeline will be identified by signs at the point of origin and completion of the right-of-way and at all road crossings. At a minimum, signs will state the holder's name, BLM serial number, and the product being transported. All signs and information thereon will be posted in a permanent, conspicuous manner, and will be maintained in a legible condition for the life of the pipeline.

15. The holder shall not use the pipeline route as a road for purposes other than routine maintenance as determined necessary by the Authorized Officer in consultation with the holder before maintenance begins. The holder will take whatever steps are necessary to

ensure that the pipeline route is not used as a roadway. As determined necessary during the life of the pipeline, the Authorized Officer may ask the holder to construct temporary deterrence structures.

16. Any cultural and/or paleontological resources (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the Authorized Officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery will be made by the Authorized Officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the Authorized Officer after consulting with the holder.

17. The operator shall be held responsible if noxious weeds become established within the areas of operations. Weed control shall be required on the disturbed land where noxious weeds exist, which includes associated roads, pipeline corridor and adjacent land affected by the establishment of weeds due to this action. The operator shall consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies.

18. Escape Ramps - The operator will construct and maintain pipeline/utility trenches [that are not otherwise fenced, screened, or netted] to prevent livestock, wildlife, and humans from becoming entrapped. At a minimum, the operator will construct and maintain escape ramps, ladders, or other methods of avian and terrestrial wildlife escape in the trenches according to the following criteria:

a. Any trench left open for eight (8) hours or less is not required to have escape ramps; however, before the trench is backfilled, the contractor/operator shall inspect the trench for wildlife, remove all trapped wildlife, and release them at least 100 yards from the trench.
b. For trenches left open for eight (8) hours or more, earthen escape ramps (built at no more than a 30 degree slope and spaced no more than 500 feet apart) shall be placed in the trench.

C. ELECTRIC LINES

STANDARD STIPULATIONS FOR OVERHEAD ELECTRIC DISTRIBUTION LINES

A copy of the grant and attachments, including stipulations, survey plat and/or map, will be on location during construction. BLM personnel may request to you a copy of your permit during construction to ensure compliance with all stipulations.

Holder agrees to comply with the following stipulations to the satisfaction of the Authorized Officer:

1. The holder shall indemnify the United States against any liability for damage to life or property arising from the occupancy or use of public lands under this grant.

2. The holder shall comply with all applicable Federal laws and regulations existing or hereafter enacted or promulgated. In any event, the holder shall comply with the Toxic Substances Control Act of 1976 as amended, 15 USC 2601 et seq. (1982) with regards to any toxic substances that are used, generated by or stored on the right-of-way or on facilities authorized under this right-of-way grant. (See 40 CFR, Part 702-799 and especially, provisions on polychlorinated biphenyls, 40 CFR 761.1-761.193.) Additionally, any release of toxic substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR, Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act, section 102b. A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to the authorized officer concurrent with the filing of the reports to the involved Federal agency or State government.

3. The holder agrees to indemnify the United States against any liability arising from the release of any hazardous substance or hazardous waste (as these terms are defined in the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. 9601, et seq. or the Resource Conservation and Recovery Act, 42 U.S.C. 6901, et seq.) on the Right-of-Way (unless the release or threatened release is wholly unrelated to the Right-of-Way holder's activity on the Right-of-Way), or resulting from the activity of the Right-of-Way holder on the Right-of-Way. This agreement applies without regard to whether a release is caused by the holder, its agent, or unrelated third parties.

4. There will be no clearing or blading of the right-of-way unless otherwise agreed to in writing by the Authorized Officer.

5. Power lines shall be constructed and designed in accordance to standards outlined in "Suggested Practices for Avian Protection on Power lines: The State of the Art in 2006" Edison Electric Institute, APLIC, and the California Energy Commission 2006 . The holder shall assume the burden and expense of proving that pole designs not shown in the above publication deter raptor perching, roosting, and nesting. Such proof shall be provided by a raptor expert approved by the Authorized Officer. The BLM reserves the right to require modification or additions to all powerline structures placed on this right-of-way, should they be necessary to ensure the safety of large perching birds. Such modifications and/or additions shall be made by the holder without liability or expense to the United States.

Raptor deterrence will consist of but not limited to the following: triangle perch discouragers shall be placed on each side of the cross arms and a nonconductive perching deterrence shall be placed on all vertical poles that extend past the cross arms.

6. The holder shall minimize disturbance to existing fences and other improvements on

public lands. The holder is required to promptly repair improvements to at least their former state. Functional use of these improvements will be maintained at all times. The holder will contact the owner of any improvements prior to disturbing them. When necessary to pass through a fence line, the fence shall be braced on both sides of the passageway prior to cutting the fence. No permanent gates will be allowed unless approved by the Authorized Officer.

7. The BLM serial number assigned to this authorization shall be posted in a permanent, conspicuous manner where the power line crosses roads and at all serviced facilities. Numbers will be at least two inches high and will be affixed to the pole nearest the road crossing and at the facilities served.

8. Upon cancellation, relinquishment, or expiration of this grant, the holder shall comply with those abandonment procedures as prescribed by the Authorized Officer.

9. All surface structures (poles, lines, transformers, etc.) shall be removed within 180 days of abandonment, relinquishment, or termination of use of the serviced facility or facilities or within 180 days of abandonment, relinquishment, cancellation, or expiration of this grant, whichever comes first. This will not apply where the power line extends service to an active, adjoining facility or facilities.

10. Any cultural and/or paleontological resource (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the Authorized Officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery will be made by the Authorized Officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the Authorized Officer after consulting with the holder.

11. Special Stipulations:
- For reclamation remove poles, lines, transformer, etc. and dispose of properly.
- Fill in any holes from the poles removed.

IX. INTERIM RECLAMATION

During the life of the development, all disturbed areas not needed for active support of production operations should undergo interim reclamation in order to minimize the environmental impacts of development on other resources and uses.

Within six (6) months of well completion, operators should work with BLM surface management specialists (Jim Amos: 575-234-5909) to devise the best strategies to reduce the size of the location. Interim reclamation should allow for remedial well operations, as well as safe and efficient removal of oil and gas.

During reclamation, the removal of caliche is important to increasing the success of revegetating the site. Removed caliche that is free of contaminants may be used for road repairs, fire walls or for building other roads and locations. In order to operate the well or complete workover operations, it may be necessary to drive, park and operate on restored interim vegetation within the previously disturbed area. Disturbing revegetated areas for production or workover operations will be allowed. If there is significant disturbance and loss of vegetation, the area will need to be revegetated. Communicate with the appropriate BLM office for any exceptions/exemptions if needed.

All disturbed areas after they have been satisfactorily prepared need to be reseeded with the seed mixture provided below.

Upon completion of interim reclamation, the operator shall submit a Sundry Notices and Reports on Wells, Subsequent Report of Reclamation (Form 3160-5).

X. FINAL ABANDONMENT & RECLAMATION

At final abandonment, well locations, production facilities, and access roads must undergo "final" reclamation so that the character and productivity of the land are restored.

Earthwork for final reclamation must be completed within six (6) months of well plugging. All pads, pits, facility locations and roads must be reclaimed to a satisfactory revegetated, safe, and stable condition, unless an agreement is made with the landowner or BLM to keep the road and/or pad intact.

After all disturbed areas have been satisfactorily prepared, these areas need to be revegetated with the seed mixture provided below. Seeding should be accomplished by drilling on the contour whenever practical or by other approved methods. Seeding may need to be repeated until revegetation is successful, as determined by the BLM.

Operators shall contact a BLM surface protection specialist prior to surface abandonment operations for site specific objectives (Jim Amos: 575-234-5909).

Mixture 4, for Gypsum Sites

The holder shall seed all the disturbed areas with the seed mixture listed below. The seed mixture shall be planted in the amounts specified in pounds of pure live seed (PLS)* per acre. There shall be no primary or secondary noxious weeds in the seed mixture. Seed will be tested and the viability testing of seed will be done in accordance with State law(s) and within nine (9) months prior to purchase. Commercial seed will be either certified or registered seed. The seed container will be tagged in accordance with State law(s) and available for inspection by the authorized officer.

Seed will be planted using a drill equipped with a depth regulator to ensure proper depth of planting where drilling is possible. The seed mixture will be evenly and uniformly planted over the disturbed area (smaller/heavier seeds have a tendency to drop the bottom of the drill and are planted first). The holder shall take appropriate measures to ensure this does not occur. Where drilling is not possible, seed will be broadcast and the area shall be raked or chained to cover the seed. When broadcasting the seed, the pounds per acre are to be doubled. The seeding will be repeated until a satisfactory stand is established as determined by the authorized officer. Evaluation of growth will not be made before completion of at least one full growing season after seeding.

Species to be planted in pounds of pure live seed* per acre:

Species	lb/acre
Alkli Sacaton (*Sporobolus airoides*)	1.5
DWS~ Four-wing saltbush (*Atriplex canescens*)	8.0

~DWS: DeWinged Seed

*Pounds of pure live seed:

Pounds of seed **x** percent purity **x** percent germination = pounds pure live seed

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Pecos District
Carlsbad Field Office
620 East Greene Street
Carlsbad, NM 88220

DECISION RECORD

for the

Hayhurst Master Development Plan Environmental Assessment

NEPA No. DOI-BLM-NM-P020-2016-1434-EA

I. Decision

I have decided to select the proposed action for implementation as described in the September 2016, Hayhurst Master Development Plan Environmental Assessment (EA). Based on my review of the EA and project record, I have concluded that the proposed action was analyzed in sufficient detail to allow me to make an informed decision. I have selected this alternative because the proposed treatments will allow reasonable access to oil and gas development.

II. Finding of No Significant Impact

I have reviewed the direct, indirect and cumulative effects of the proposed activities documented in the EA for the DOI-BLM-NM-P020-2016-1434-EA. I have also reviewed the project record for this analysis. The effects of the proposed action are disclosed in the Environmental Consequences sections of the EA. I have determined that the proposed action as described in the EA will not significantly affect the quality of the human environment. Accordingly, I have determined that the preparation of an Environmental Impact Statement is not necessary.

III. Other Alternatives Considered

No reasonable action alternative was substantially different in design or effects from the proposed action for this project. Therefore no other alternative was considered or analyzed.

IV. Public Involvement

The Carlsbad Field Office (CFO) publishes a NEPA log for public inspection. This log contains a list of proposed and approved actions in the field office. The log is located in the lobby of the CFO as well as on the BLM New Mexico website (http://www.blm.gov/nm/st/en/prog/planning/nepa_logs.html). The BLM also has an ePlanning website (https://eplanning.blm.gov/epl-front-office/eplanning/lup/lup_register.do) that allows the public to review and comment online on BLM NEPA and planning projects. Hard copies of the draft EA were also available at the BLM CFO as well as the BLM Santa Fe and Albuquerque Offices. The draft EA was be made available for a 30-day public review and comment period.

BLM CFO received a total of nine comment letters on the EA. Comments were categorized into issue statements that primarily focused on air resources, vegetation, wildlife, karst, night skies, visual resources, Areas of Critical Environmental Concern, Lands with Wilderness Characteristics, impacts to Carlsbad Caverns National Park, NEPA (e.g. level of documentation, alternatives), mitigation, and the

Resource Management Plan revision. Responses to comment issue statements are provided in Appendix F of the EA.

V. Appeals

This decision may be appealed to the Interior Board of Land Appeals (IBLA), Office of the Secretary, in accordance with the regulations contained in 43 CFR Part 4. Any appeal must be filed within 30 days of this decision. Any notice of appeal must be filed with George MacDonell, Carlsbad Field Manager, at 620 East Greene Street, Carlsbad, NM 88220. The appellant shall serve a copy of the notice of appeal and any statement of reasons, written arguments, or briefs on each adverse party named in the decision, not later than 15 days after filing such document (see 43 CFR 4.413(a)). Failure to serve within the time required will subject the appeal to summary dismissal (see 43 CFR 4.413(b)). If a statement of reasons for the appeal is not included with the notice, it must be filed with the IBLA, Office of Hearings and Appeals, U. S. Department of the Interior, 801 North Quincy St., Suite 300, Arlington, VA 22203 within 30 days after the notice of appeal is filed with the IBLA, Office of Hearings and Appeals, U.S. Department of the Interior, 801 North Quincy St., Suite 300 Arlington, VA 22203 within 30 days after the notice of appeal is filed with George MacDonell, Carlsbad Field Manger.

Notwithstanding the provisions of 43 CFR 4.21(a)(1), filing a notice of appeal under 43 CFR Part 4 does not automatically suspend the effect of the decision. If you wish to file a petition for a stay of the effectiveness of this decision during the time that your appeal is being reviewed by the Board, the petition for a stay must accompany your notice of appeal.

A petition for a stay is required to show sufficient justification based on the following standards:

(1) The relative harm to the parties if the stay is granted or denied;

(2) The likelihood of the appellant's success on the merits;

(3) The likelihood of immediate and irreparable harm if the stay is not granted; and

(4) Whether the public interest favors granting the stay.

In the event a request for stay or an appeal is filed, the person/party requesting the stay or filing the appeal must serve a copy of the appeal on the Office of the Field Solicitor, 1100 Old Santa Fe Trail, Santa Fe, NM 87505.

George MacDonell
Field Manager

10/7/16
Date

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Pecos District
Carlsbad Field Office
620 East Greene Street
Carlsbad, NM 88220

Finding of No Significant Impact
Hayhurst Master Development Plan

NEPA No. DOI-BLM-NM-P020-2016-1434-EA

FINDING OF NO SIGNIFICANT IMPACT:

I have determined that the proposed action, as described in the EA will not have any significant impact, individually or cumulatively, on the quality of the human environment. Because there would not be any significant impact, an environmental impact statement is not required.

In making this determination, I considered the following factors:

1. The activities described in the proposed action do not include any significant beneficial or adverse impacts (40 CFR 1508.27(b)(1)). The EA includes a description of the expected environmental consequences of implementation of the Master Development Plan, including construction and operation of well pads; production, storage, and compression facilities; water disposal and recycling facilities; gathering pipelines for oil, gas, and produced water; pipelines for fresh, brackish, or recycled water to support hydraulic fracturing operations; and upgraded and new access roads.

   In order to ensure that the proponent's impacts are consistent with the operating parameters considered in the air quality analysis, Conditions of Approval (COA) will be applied to Applications for Permit to Drill requested under the Hayhurst Master Development Plan. These COAs are:

   - All project activities including equipment emissions shall meet or exceed all state and federal standards for air quality as regulated by the New Mexico Environment Department Air Quality Bureau and the U.S. Environmental Protection Agency.

   - The operator will implement a drill and completion rig schedule where Tier 4 (or equivalent) drill and completion rigs are phased in. The operator will not exceed four drill rigs at one time and will be 100% compliant with Tier 4 (or equivalent) standards in 2020.

   - During the drilling phase, the operator will emit NOx emissions of 262.95 tons per year (tpy) or less from nonroad (mobile sources) between Year 1 and Year 3 and 220.7 tpy or less from nonroad (mobile sources) for the remainder of the drilling phase.

   - The operator will emit 213.6 tpy or less of NOx emissions during production operations, as defined in the emission inventory analyzed in the Environmental Assessment. The operator will submit emissions and/or parameters with an Application for Permit to Drill or annual emissions inventory that show the NOx emissions are within the limits of the air quality analysis within the Environmental Assessment.

2. The activities included in the proposed action would not significantly affect public health or safety (40 CFR 1508.27(b)(2)).

3. The proposed activities would not significantly affect any unique characteristics (40 CFR 1508.27(b)(3)) of the geographic area such as prime and unique farmlands, caves, wild and scenic rivers, designated wilderness areas, wilderness study areas, or areas of critical concern.

4. The activities described in the proposed action do not involve effects on the human environment that are likely to be highly controversial (40 CFR 1508.27(b)(4)).

5. The activities described in the proposed action do not involve effects that are highly uncertain or involve unique or unknown risks (40 CFR 1508.27(b)(5)).

6. My decision to implement these activities does not establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration (40 CFR 1508.27(b)(6)).

7. The effects of the Master Development Plan including construction and operation of well pads; production, storage, and compression facilities; water disposal and recycling facilities; gathering pipelines for oil, gas, and produced water; pipelines for fresh, brackish, or recycled water to support hydraulic fracturing operations; and upgraded and new access roads would not be significant, individually or cumulatively, when considered with the effects of other actions (40 CFR 1508.27(b)(7)). The EA discloses that there are no other connected or cumulative actions that would cause significant cumulative impacts.

8. I have determined that the activities described in the proposed action will not adversely affect or cause loss or destruction of scientific, cultural, or historical resources, including those listed in or eligible for listing in the National Register of Historic Places (40 CFR 1508.27(b)(8)).

9. The proposed activities are not likely to adversely affect any endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act (40 CFR 1508.27(b)(9)).

10. The proposed activities will not knowingly threaten any violation of Federal, State, or local law or requirements imposed for the protection of the environment (40 CFR 1508.27(b)(10)).

APPROVED:

George MacDonell
Field Manager
Carlsbad Field Office

10/7/16
Date

HOLLAND&HART LLP

Jordan L. Kessler
Associate
Phone (505) 988-4421
Fax (505) 983-6043
jlkessler@hollandhart.com

June 10, 2016

VIA CERTIFIED MAIL
RETURN RECEIPT REQUESTED

TO AFFECTED PARTIES

Re: Application of Chevron U.S.A. Inc. for administrative approval of an unorthodox location, Sections 5 and 8, Township 26 South, Range 27 East, N.M.P.M., Eddy County, New Mexico.
HH SO 8 P2 No. 13H Well

Ladies and Gentlemen:

Enclosed is a copy of the above-referenced application which was filed with the New Mexico Oil Conservation Division on this date. Any objection to this application must be filed in writing within twenty days from this date with the applicant and the New Mexico Oil Conservation Division, 1220 South St. Francis Drive, Santa Fe, New Mexico, 87505. If no objection is received within this twenty-day period, this application may be approved administratively by the Division.

If you have any questions about this application, please contact the following:

Amber Tarr Delach
Chevron U.S.A. Inc.
(713) 372-9877
ATarr@chevron.com

Sincerely,

Jordan L. Kessler
ATTORNEY FOR CHEVRON U.S.A. INC.

HOLLAND&HART LLP

Jordan L. Kessler
Associate
Phone (505) 954-7286
Fax (505) 983-6043
JLKessler@hollandhart.com

June 10, 2016

VIA HAND DELIVERY

David Catanach
Oil Conservation Division
New Mexico Department of Energy,
Minerals and Natural Resources
1220 South Saint Francis Dr.
Santa Fe, New Mexico 87505

Re: Application of Chevron U.S.A. Inc. for administrative approval of an unorthodox location, Sections 5 and 8, Township 26 South, Range 27 East, N.M.P.M., Eddy County, New Mexico.
HH SO 8 P2 No. 13H Well

Dear Mr. Catanach:

Chevron U.S.A. Inc. ("Chevron") (OGRID 4323) seeks administrative approval of an unorthodox well location for its **HH SO 8 P2 No. 13H Well** to be completed within the Wolfcamp formation (WC-015 S262734P; Wolfcamp (98140)) underlying Sections 5 and 8.[1] This well will be drilled from a surface location 305 feet from the North line and 960 feet from the West line of Section 17. The upper most perforation will be located 330 feet from the South line and 330 feet from the West line of Section 8 and the lower most perforation will be located 330 feet from the North line and 330 feet from the West line of Section 5. Since this acreage is governed by the Division Rule 19.15.15.10.B which provides for wells in gas pools in Eddy County to be spaced on 320 acres and located no closer than 660 feet to the outer boundary of the spacing unit, the completed interval for this well will be unorthodox. Approval of the unorthodox completed interval will allow for efficient well spacing and prevent waste of a productive reservoir.

Exhibit A is the Well Location and Acreage Dedication Plat (Form C-102), which shows that the completed interval of the proposed **HH SO 8 P2 No. 13H Well** encroaches on the spacing and proration units to the North, Northwest, West, Southwest, and South.

Exhibit B is a land plat showing the proposed **HH SO 8 P2 No. 13H Well** in relation to adjoining spacing units.

[1] Chevron's development plan calls for six two-mile wells within Sections 5 and 8, to be drilled in the Wolfcamp formation from the same pad. Applications for administrative approval of unorthodox locations for all six wells have been simultaneously submitted to the Division.

ATS-16-692

Form 3160-3
(June 2015)

BLM Carlsbad Field Office

FORM APPROVED
OMB No. 1004-0137
Expires: January 31, 2018

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

APPLICATION FOR PERMIT TO DRILL OR REENTER

5. Lease Serial No.
NMNM118108

6. If Indian, Allotee or Tribe Name

1a. Type of work: ☑ DRILL ☐ REENTER UNORTHODOX LOCATION

1b. Type of Well: ☑ Oil Well ☐ Gas Well ☐ Other

1c. Type of Completion: ☐ Hydraulic Fracturing ☑ Single Zone ☐ Multiple Zone

7. If Unit or CA Agreement, Name and No.

8. Lease Name and Well No.
HH SO 8 P2 14H

2. Name of Operator
CHEVRON USA INC

9. API Well No.
~~30-~~

3a. Address	3b. Phone No. *(include area code)*	10. Field and Pool, or Exploratory
1616 W. BENDER BLVD HOBBS, NM 88240	575-263-0431	WILDCAT; WOLFCAMP

4. Location of Well *(Report location clearly and in accordance with any State requirements.*)*
At surface 330' FNL & 960' FWL
At proposed prod. zone 180' FNL & 996' FWL

11. Sec., T. R. M. or Blk. and Survey or Area
SEC17, T26S, R27E, UL D (SHL)

14. Distance in miles and direction from nearest town or post office*	12. County or Parish	13. State
12.8 MILES FROM MALAGA, NEW MEXICO	EDDY	NM

15. Distance from proposed* location to nearest property or lease line, ft. (Also to nearest drig. unit line, if any)	16. No of acres in lease	17. Spacing Unit dedicated to this well
330' FNL	1920 ACRES	320 ACRES

18. Distance from proposed location* to nearest well, drilling, completed, applied for, on this lease, ft.	19. Proposed Depth	20. BLM/BIA Bond No. in file
4300 FT SKEEN 2 SW	TD 9904' MD 20,551'	CA 0329

21. Elevations (Show whether DF, KDB, RT, GL, etc.)	22. Approximate date work will start*	23. Estimated duration
3247' GL	OCTOBER 2016	30 DAYS

24. Attachments

The following, completed in accordance with the requirements of Onshore Oil and Gas Order No. 1, and the Hydraulic Fracturing rule per 43 CFR 3162.3-3 (as applicable)

1. Well plat certified by a registered surveyor.
2. A Drilling Plan.
3. A Surface Use Plan (if the location is on National Forest System Lands, the SUPO must be filed with the appropriate Forest Service Office).
4. Bond to cover the operations unless covered by an existing bond on file (see Item 20 above).
5. Operator certification.
6. Such other site specific information and/or plans as may be requested by the BLM.

25. Signature	Name *(Printed/Typed)*	Date
Cindy Herrera-Murillo	CINDY HERRERA-MURILLO	02/11/2016

Title
PERMITTING SPECIALIST

Approved by *(Signature)*	Name *(Printed/Typed)*	Date
/s/ George MacDonell	/s/George MacDonell	10/11/16

Title	Office
FIELD MANAGER	CARLSBAD FIELD OFFICE

Application approval does not warrant or certify that the applicant holds legal or equitable title to those rights in the subject lease which would entitle the applicant to conduct operations thereon.
Conditions of approval, if any, are attached.

APPROVAL FOR TWO YEARS

Title 18 U.S.C. Section 1001 and Title 43 U.S.C. Section 1212, make it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious or fraudulent statements or representations as to any matter within its jurisdiction.

Carlsbad Controlled Water Basin

Witness Surface & Intermediate Casing

SEE ATTACHED FOR CONDITIONS OF APPROVAL

Approval Subject to General Requirements & Special Stipulations Attached

(Continued on page 2)

*(Instructions on page 2)

District I
1625 N French Dr , Hobbs, NM 88240
Phone: (575) 393-6161 Fax: (575) 393-0720
District II
811 S First St , Artesia, NM 88210
Phone: (575) 748-1283 Fax: (575) 748-9720
District III
1000 Rio Brazos Road, Aztec, NM 87410
Phone: (505) 334-6178 Fax: (505) 334-6170
District IV
1220 S St Francis Dr , Santa Fe, NM 87505
Phone: (505) 476-3460 Fax: (505) 476-3462

State of New Mexico
Energy, Minerals & Natural Resources Department
OIL CONSERVATION DIVISION
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-102
Revised August 1, 2011
Submit one copy to appropriate District Office

☐ AMENDED REPORT

WELL LOCATION AND ACREAGE DEDICATION PLAT

[1] API Number	[2] Pool Code	[3] Pool Name
		Wildcat: Wolfcamp

[4] Property Code	[5] Property Name	[6] Well Number
	HH SO 8 P2	14H

[7] OGRID No.	[8] Operator Name	[9] Elevation
4323	CHEVRON U.S.A. INC.	3247'

[10] Surface Location

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
D	17	26 SOUTH	27 EAST, N.M.P.M.		330'	NORTH	960'	WEST	EDDY

[11] Bottom Hole Location If Different From Surface

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
D	5	26 SOUTH	27 EAST, N.M.P.M.		180'	NORTH	996'	WEST	EDDY

[12] Dedicated Acres	[13] Joint or Infill	[14] Consolidation Code	[15] Order No.
320			

No allowable will be assigned to this completion until all interests have been consolidated or a non-standard unit has been approved by the division.

[16]

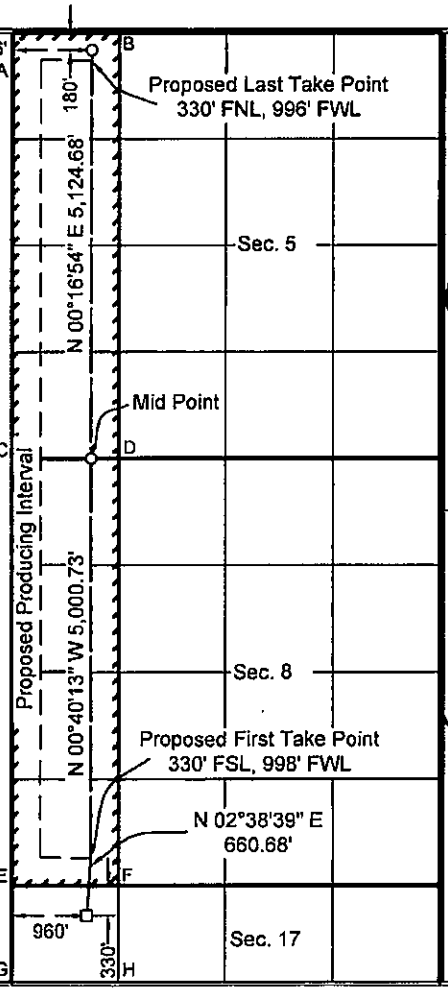
PROPOSED BOTTOM HOLE LOCATION		
X=	535,950	NAD 27
Y=	392,264	
LAT.	32.078396	
LONG.	104.217265	
X=	577,133	NAD83
Y=	392,321	
LAT.	32.078517	
LONG.	104.217760	

CORNER COORDINATES TABLE (NAD 27)

A - Y=392442.33, X=534954.83
B - Y=392444.24, X=536280.85
C - Y=387143.09, X=534935.36
D - Y=387137.83, X=536254.75
E - Y=381810.94, X=534988.20
F - Y=381808.02, X=536317.14
G - Y=380478.27, X=535007.69
H - Y=380475.74, X=536334.89

Mid Point
Y=387139.14, X=535924.76

HH SO 8 P2 14H WELL		
X=	535,953	NAD 27
Y=	381,479	
LAT.	32.048747	
LONG.	104.217293	
X=	577,136	NAD83
Y=	381,536	
LAT	32.048869	
LONG.	104.217787	
ELEVATION +3247' NAVD 88		



[17] OPERATOR CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief, and that this organization either owns a working interest or unleased mineral interest in the land including the proposed bottom hole location or has a right to drill this well at this location pursuant to a contract with an owner of such a mineral or working interest, or to a voluntary pooling agreement or a compulsory pooling order heretofore entered by the division

Cindy Herrera-Murillo 2-4-16
Signature Date

Cindy Herrera-Murillo
Printed Name

Cherreramurillo @chevron.com
E-mail Address

[18] SURVEYOR CERTIFICATION

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my belief.

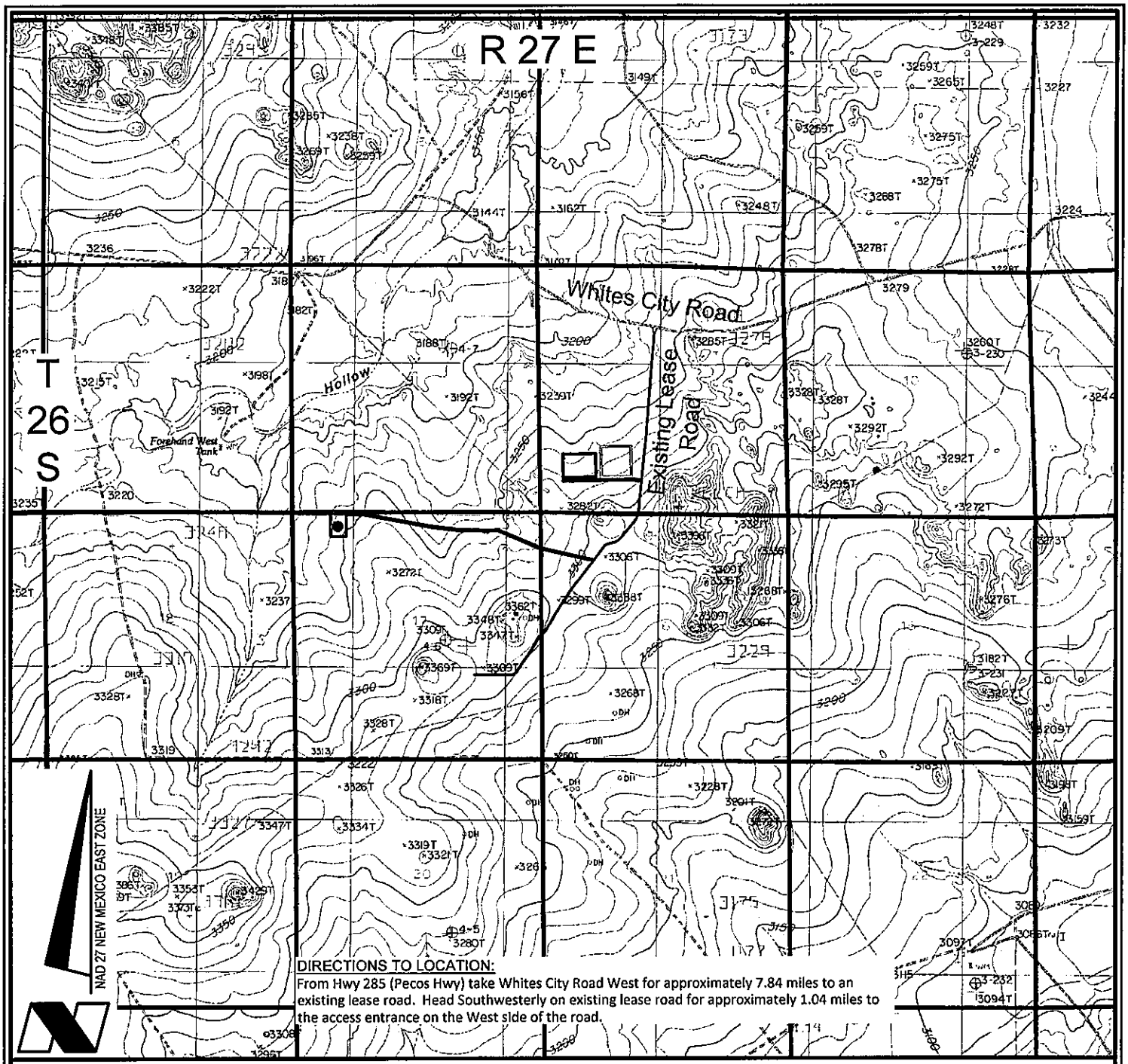
JAN 5, 2016
Date of Survey

ROBERT L. ASHRAPES
NEW MEXICO
2-8-2016
23006
PROFESSIONAL SURVEYOR

Signature and Seal of Professional Surveyor

23006
Certificate Number

EXHIBIT 1



VICINITY MAP

SCALE: 1" = 3000'

3000' 0 1500' 3000'

LEGEND

- Proposed Well
- Proposed Access Road
- Proposed Drillsite
- Existing Road
- Section Line
- Proposed Frac Pond
- Proposed Facility

CHEVRON U.S.A. INC.

HH SO 8 P2 NO. 14H WELL
LOCATED 330' FNL AND 960' FWL
SECTION 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

FENSTERMAKER

C.H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

DRAWN BY: MBD	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 01/07/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153441\DWG\HH SO 8 P2 14H_APD.dwg			

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

ROBERT L. LASTRAPES
NEW MEXICO
23006
PROFESSIONAL SURVEYOR
1-19-2016

Robert L. Lastrapes
Registration No. 23006

R 27 E

NW PAD CORNER		NE PAD CORNER		HH SO 8 P2 NO. 14H WELL	
X= 535,799	NAD 27	X= 536,129	NAD 27	X= 535,953	NAD 27
Y= 381,809		Y= 381,808		Y= 381,479	
ELEVATION +3241' NAVD 88		ELEVATION +3247' NAVD 88		LAT. 32.048747	
SW PAD CORNER		SE PAD CORNER		LONG. 104.217293	
X= 535,805	NAD 27	X= 536,135	NAD 27	X= 577,136	NAD83
Y= 381,284		Y= 381,284		Y= 381,536	
ELEVATION +3244' NAVD 88		ELEVATION +3256' NAVD 88		LAT. 32.048869	
				LONG. 104.217787	
				ELEVATION +3247' NAVD 88	

T 26 S

Sec. 8

Bureau of Land Management

S 89°52'10" E 810.78'

Fnd. 2" Iron Pipe w/ Cap at the NW Corner of Section 17

330'
25' (Typ.)
52'
525'
150'
180'
195'
330'

HH SO 8 P2
No. 14H Well
330' FNL, 960' FWL

PROPOSED PAD
±3.98 Acres

CENTERLINE PROPOSED ACCESS ROAD (1)
24' X ±5,444.40'
±3.00 Acres
±329.96 Rods
(SEE PAGE 2)

Sec. 17

Bureau of Land Management

(Access Road 1) ± 4289.90', ±2.36 Acres, ±259.99 Rods

NAD 27 NEW MEXICO EAST ZONE

Scale: 1" = 300'

300' 0 150' 300'

FENSTERMAKER

C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED PADS, FRAC POND & ACCESS ROADS
HH SO 8 P2 NO. 14H WELL
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

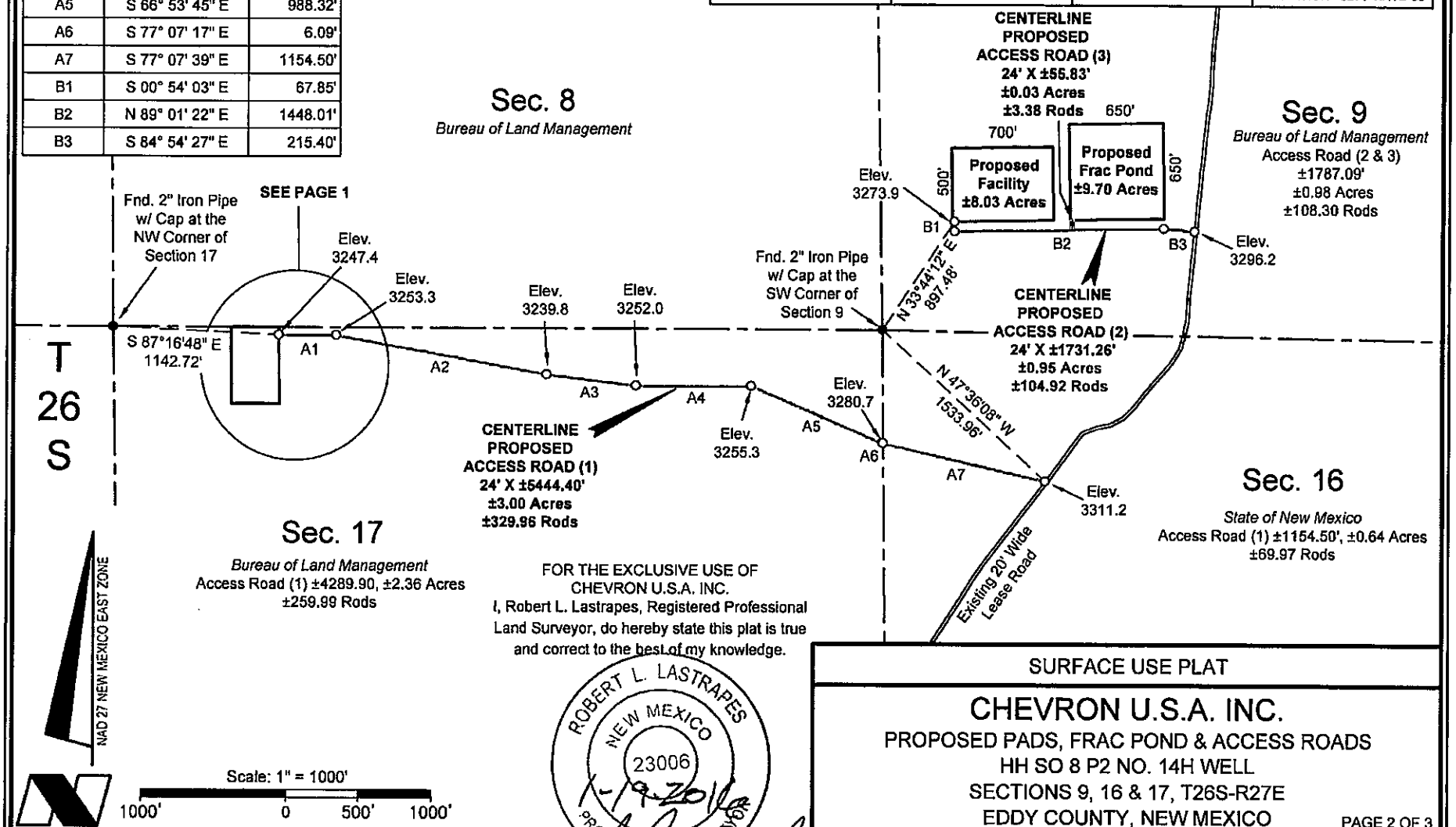
DRAWN BY: LJG	REVISIONS		
PROJ. MGR.: GDG	No. 1	DATE: 1/7/2016	REVISED BY: MBD
DATE: 12/22/2015	No. 2	DATE: 1/19/2016	REVISED BY: GDG
FILENAME: T:\2015\2153441\DWG\HH SO 8 P2 14H_SUP.dwg			

EXHIBITS 2&5

Centerline Proposed Access Roads		
COURSE	BEARING	DISTANCE
A1	S 89° 49' 39" E	398.61'
A2	S 79° 37' 12" E	1478.11'
A3	S 82° 59' 20" E	620.58'
A4	S 89° 50' 47" E	798.19'
A5	S 66° 53' 45" E	988.32'
A6	S 77° 07' 17" E	6.09'
A7	S 77° 07' 39" E	1154.50'
B1	S 00° 54' 03" E	67.85'
B2	N 89° 01' 22" E	1448.01'
B3	S 84° 54' 27" E	215.40'

R 27 E

NW FRAC POND CORNER	NE FRAC POND CORNER	NW FACILITY CORNER	NE FACILITY CORNER
X= 541,594 NAD 27 Y= 383,209	X= 542,244 NAD 27 Y= 383,220	X= 540,782 NAD 27 Y= 383,045	X= 541,482 NAD 27 Y= 383,057
ELEVATION +3264' NAVD 88	ELEVATION +3270' NAVD 88	ELEVATION +3263' NAVD 88	ELEVATION +3265' NAVD 88
SW FRAC POND CORNER	SE FRAC POND CORNER	SW FACILITY CORNER	SE FACILITY CORNER
X= 541,605 NAD 27 Y= 382,559	X= 542,255 NAD 27 Y= 382,570	X= 540,790 NAD 27 Y= 382,545	X= 541,490 NAD 27 Y= 382,557
ELEVATION +3278' NAVD 88	ELEVATION +3289' NAVD 88	ELEVATION +3274' NAVD 88	ELEVATION +3276' NAVD 88



FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

ROBERT L. LASTRAPES NEW MEXICO 23006 PROFESSIONAL SURVEYOR

Robert L. Lastrapes
Registration No. 23006

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED PADS, FRAC POND & ACCESS ROADS
HH SO 8 P2 NO. 14H WELL
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: LJG	REVISIONS		
PROJ. MGR.: GDG	No. 1	DATE: 1/7/2016	REVISED BY: MBD
DATE: 12/22/2015	No. 2	DATE: 1/19/2016	REVISED BY: GDG
FILENAME: T:\2015\2153441\DWG\HH SO 8 P2 14H_SUP.dwg			

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:
Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

NOTE:
Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

ROBERT L. LASTRAPES
NEW MEXICO
23006
PROFESSIONAL SURVEYOR
1-19-2016

Robert L. Lastrapes
Registration No. 23006

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax 337-232-3299
www.fenstermaker.com

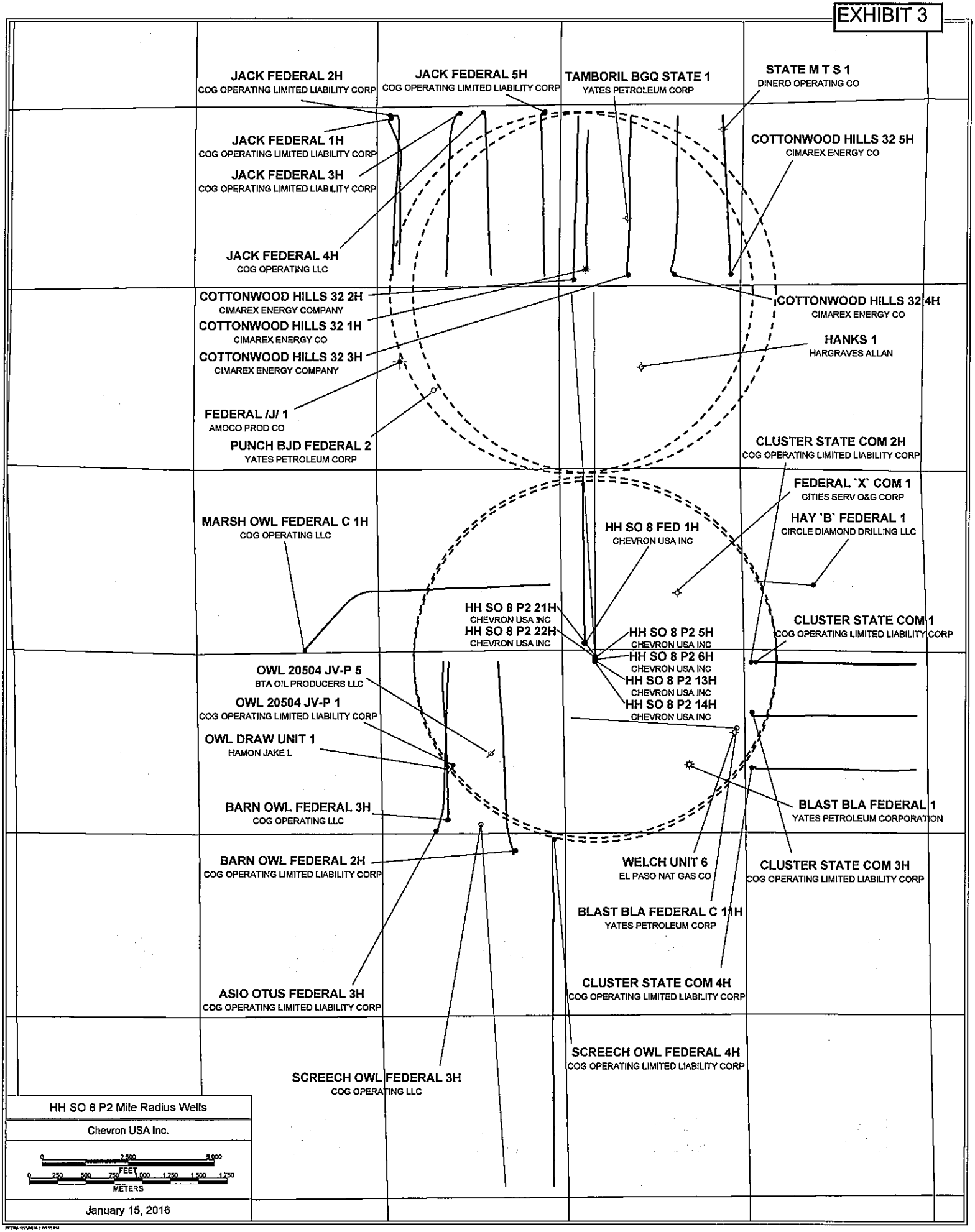
SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED PADS, FRAC POND & ACCESS ROADS
HH SO 8 P2 NO. 14H WELL
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: LJG	REVISIONS		
PROJ. MGR.: GDG	No. 1	DATE: 1/7/2016	REVISED BY: MBD
DATE: 12/22/2015	No. 2	DATE: 1/19/2016	REVISED BY: GDG
FILENAME: T:\2015\2153441\DWG\HH SO 8 P2 14H_SUP.dwg			

EXHIBIT 3



HH SO 8 P2 Mile Radius Wells

Chevron USA Inc.

0 2,500 5,000
FEET
0 250 500 750 1,000 1,250 1,500 1,750
METERS

January 15, 2016

1. **FORMATION TOPS**

The estimated tops of important geologic markers are as follows:

FORMATION	SUB-SEA TVD	KBTVD	MD
Castille		505	
Lamar		2395	
Bell		2310	
Cherry		3208	
Brushy		4450	
Bone Spring/Avalon		6299	
First Bone Spring Sand		6888	
First Bone Spring Shale		6914	
Second Bone Spring Sand		7621	
Harkey Sand		8123	
Third Bone Spring Sand		8617	
Wolfcamp A		9342	
Wolfcamp D		10000	
Lateral TVD Wolfcamp D		10000	20613.13'

2. **ESTIMATED DEPTH OF WATER, OIL, GAS & OTHER MINERAL BEARING FORMATIONS**

The estimated depths at which the top and bottom of the anticipated water, oil, gas, or other mineral bearing formations are expected to be encountered are as follows:

Substance	Formation	Depth
Deepest Expected Base of Fresh Water		450
Water	Castille	505
Water	Cherry Canyon	3208
Oil/Gas	Brushy Canyon	4450
Oil/Gas	Bone Spring Limestone	6888
Oil/Gas	First Bone Spring Shale	6914
Oil/Gas	Second Bone Spring Sand	7621
Oil/Gas	Harkey Sand	8123
Oil/Gas	Wolfcamp A	9342
Oil/Gas	Wolfcamp D	10000

All shows of fresh water and minerals will be reported and protected.

3. **BOP EQUIPMENT**

PLEASE REFERENCE MDP

10 M BOP after surface casing

Batch Drilling

4. **CASING PROGRAM**

Purpose	From	To	Hole Size	Csg Size	Weight	Grade	Thread	Condition
Surface	0'	450'	17-1/2"	13-3/8"	54.5 #	K-55	STC	New
Intermediate	0'	9,015'	12-1/4"	9-5/8"	40.0 #	L-80	TXP	New
Production	0'	20,613'	8-1/2"	0"	20.0 #	P-110	TXP	New

SF Calculations based on the following "Worst Case" casing design:

Surface Casing: 450'
Intermediate Casing: 9015'
Production Casing: 20613.13' MD/10,000' TVD (10,000' VS @ 89.7 deg inc)

Casing String	Min SF Burst	Min SF Collapse	Min SF Tension	Min SF Tri-Axial
Surface	1.82	5.11	3.97	2.31
Intermediate	1.45	1.32	1.78	1.84
Production	1.26	1.5	2.43	1.35

Min SF is the smallest of a group of safety factors that include the following considerations:

	Surf	Int	Prod
Burst Design			
Pressure Test- Surface, Int, Prod Csg P external: Water P internal: Test psi + next section heaviest mud in csg	X	X	X
Displace to Gas- Surf Csg P external: Water P internal: Dry Gas from Next Csg Point	X		
Frac at Shoe, Gas to Surf- Int Csg P external: Water P internal: Dry Gas, 15 ppg Frac Gradient		X	
Stimulation (Frac) Pressures- Prod Csg P external: Water P internal: Max inj pressure w/ heaviest injected fluid			X
Tubing leak- Prod Csg (packer at KOP) P external: Water P internal: Leak just below surf, 8.7 ppg packer fluid			X
Collapse Design			
Full Evacuation P external: Water gradient in cement, mud above TOC P internal: none	X	X	X
Cementing- Surf, Int, Prod Csg P external: Wet cement P internal: water	X	X	X
Tension Design			
100k lb overpull	X	X	X

5. **CEMENTING PROGRAM**

Slurry	Type	Cement Top	Cement Bottom	Weight (ppg)	Yield (sx/cu ft)	%Excess Open Hole	Sacks	Water gal/sk
Surface								
Tail	Class C	0'	450'	14.8	1.33	50	356	6.37
Intermediate								
Stage 2 Lead	50:50 Poz: Class C + Antifoam, Extender, Salt, Retarder	0'	1,100'	11.9	2.43	50	213	14.21
Stage 2 Tail	Class C + Antifoam, Retarder, Viscosifier	1,100'	2,100'	14.8	1.33	0	235	6.37
DV TOOL		2,100'						
Stage 1 Lead	50:50 Poz: Class H + Extender, Antifoam, Retarder, Salt, Viscosifier	2,100'	8,015'	11.9	2.43	100	1524	13.76
Stage 1 Tail	Class H + Retarder, Extender, Dispersant	8,015'	9,015'	15.6	1.21	50	389	5.54
Production								
Lead	50:50 Poz: Class H + Extender, Antifoam, Dispersant, , Retarder	7,015'	8,015'	14.5	1.21	100	430	5.54
Tail	Class H + Viscosifier, Antifoam, Dispersant, Fluid Loss, Retarder, Expanding Agent	8,015'	20,613'	15.6	1.2	50	3605	5.30
Pilot Hole								
Tail	Class C	9,500'	~~10,000'~~ 10,207	17.2	0.97	50-100	~~50~~-100 350 sacks -per R. Milligan 7-26-16	3.61

6. **MUD PROGRAM**

8.3 - 8.7 32 - 34 NC - NC

From	To	Type	Weight	F. Vis	Filtrate
0'	450'	Spud Mud	0	0	0
450'	9015'	OBM	9.0 - 9.5	50 -70	5.0 - 10
9015'	20,613'	OBM	10.0 - 13.5	50 -70	5.0 - 10

7. **TESTING, LOGGING, AND CORING**

TYPE	Logs	Interval	Timing	Vendor
Mudlogs	2 man mudlog	Int Csg to TD	Drillout of Int Csg	TBD
LWD	MWD Gamma	Int. and Prod. Hole	While Drilling	TBD
Wireline Logs	Quad Combo w/ Di-Pole Sonic, FMI,	Prod hole	After Intermediate hole	TBD

8. **ABNORMAL PRESSURES AND HYDROGEN SULFIDE**

PLEASE REFERENCE MDP

Schlumberger

#14H - Rev0

Chevron

Borehole:	Well:	Field:	Structure:
Original Borehole	HH SO 8 P2 14H	NM Eddy County (NAD 27)	TBD

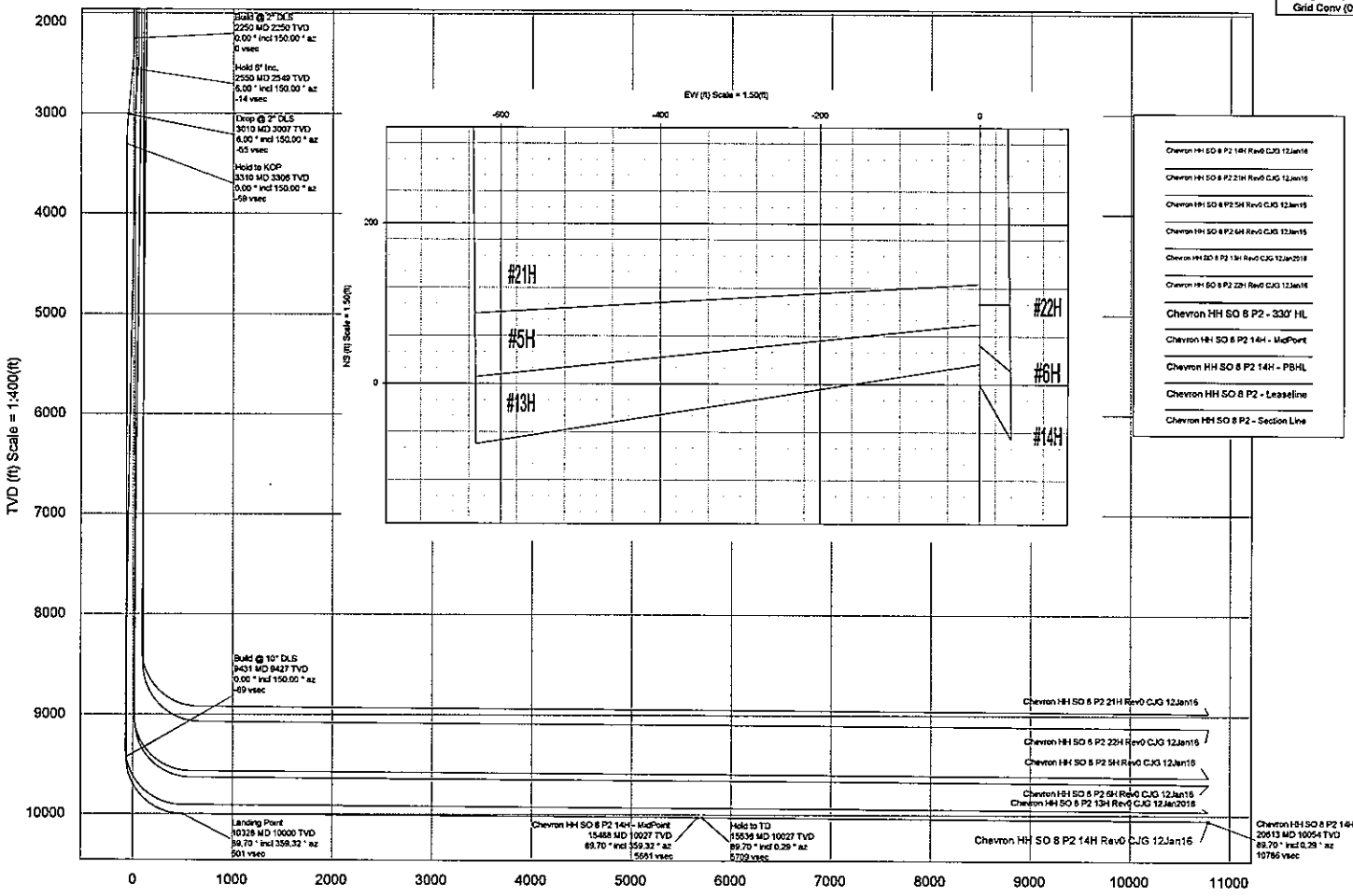
Gravity & Magnetic Parameters
Model: HDGM 2015 Dip: 59.774° Date: 06-Jan-2016
MagDec: 7.555° FS: 48138.973nT Gravity FS: 998.43mgn (9.80665 Based)

Surface Location NAD27 New Mexico State Plane, Eastern Zone, US Feet
Lat: N 32 2 55.48 Northing: 381479fUS Grid Conv: 0.0616°
Lon: W 104 13 2.25 Easting: 536953fUS Scale Fact: 0.99991057

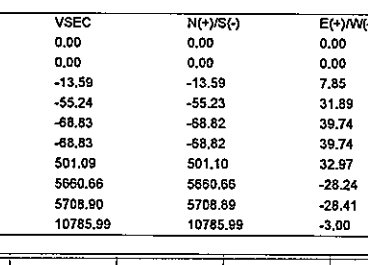
Miscellaneous
Slot: 10H SO 8 P2 14H TVD Ref: RKB(3280ft above MSL)
Plan: Rev0 CJG 12Jan16

Critical Points

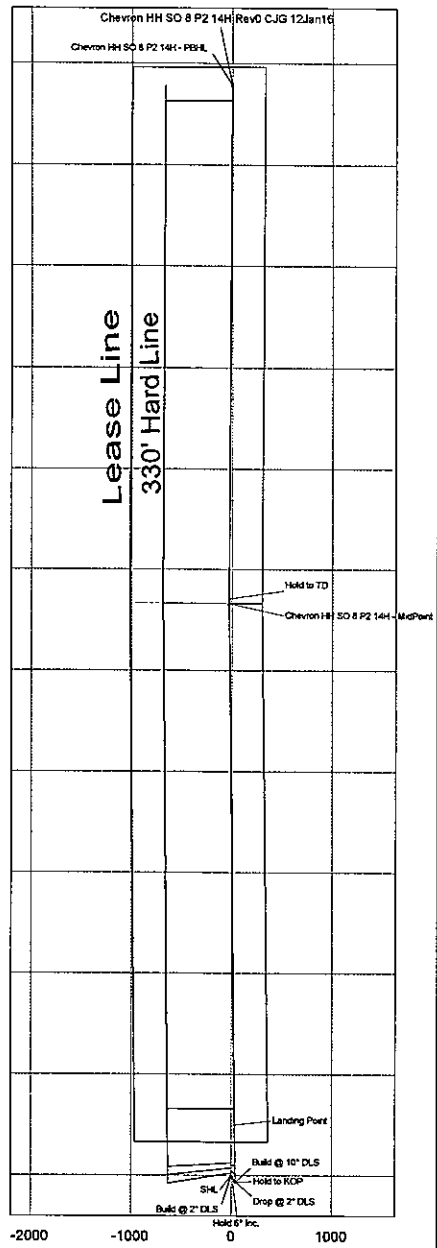
Critical Point	MD	INCL	AZIM	TVD	VSEC	N(+)/S(-)	E(+)/W(-)	DLS
SHL	0.00	0.00	150.00	0.00	0.00	0.00	0.00	
Build @ 2° DLS	2250.00	0.00	150.00	2250.00	0.00	0.00	0.00	0.00
Hold 6° Inc.	2550.00	6.00	150.00	2549.45	-13.59	-13.59	7.85	2.00
Drop @ 2° DLS	3010.00	6.00	150.00	3006.93	-55.24	-55.23	31.89	0.00
Hold to KOP	3310.00	0.00	150.00	3306.38	-68.83	-68.82	39.74	2.00
Build @ 10° DLS	9430.67	0.00	150.00	9427.05	-68.83	-68.82	39.74	0.00
Landing Point	10327.67	89.70	359.32	10000.00	501.09	501.10	32.97	10.00
Chevron HH SO 8 P2 14H - MidPoint	15487.66	89.70	359.32	10027.01	5660.66	5660.65	-28.24	0.00
Hold to TD	15535.90	89.70	0.28	10027.26	5708.90	5708.89	-28.41	2.00
Chevron HH SO 8 P2 14H - PBHL	20613.13	89.70	0.29	10053.85	10785.99	10785.99	-3.00	0.00



Chevron HH SO 8 P2 14H Rev0 CJG 12Jan16
Chevron HH SO 8 P2 21H Rev0 CJG 12Jan16
Chevron HH SO 8 P2 5H Rev0 CJG 12Jan16
Chevron HH SO 8 P2 6H Rev0 CJG 12Jan16
Chevron HH SO 8 P2 13H Rev0 CJG 12Jan2016
Chevron HH SO 8 P2 22H Rev0 CJG 12Jan16
Chevron HH SO 8 P2 - 330' HL
Chevron HH SO 8 P2 14H - MidPoint
Chevron HH SO 8 P2 14H - PBHL
Chevron HH SO 8 P2 - Leaseline
Chevron HH SO 8 P2 - Section Line



Grid North
Tot Corr (M->G 7.493°)
Mag Dec (7.555°)
Grid Conv (0.062°)



CONTROLLED

	Plan ref	Chevron HH SO 8 P2 14H Rev0 CJG 12Jan16
	Drawing ref	
	Copy number	of 3
	Date	12-Jan-2016

1	Originator	Colby Gannon
2	DEC Sign Off	
3	CC Sign Off	
4	Client	Chevron

Copy number for

Schlumberger

Chevron

Chevron HH SO 8 P2 14H Rev0 CJG 12Jan16 Proposal Geodetic Report

(Non-Def Plan)

Report Date:	January 12, 2016 - 02:36 PM	**Survey / DLS Computation:**	Minimum Curvature / Lubinski
Client:	Chevron	**Vertical Section Azimuth:**	359.985 ° (Grid North)
Field:	NM Eddy County (NAD 27)	**Vertical Section Origin:**	0.000 ft, 0.000 ft
Structure / Slot:	Chevron HH SO 8 P2 Pad / Chevron HH SO 8 P2 14H	**TVD Reference Datum:**	RKB
Well:	HH SO 8 P2 14H	**TVD Reference Elevation:**	3280.000 ft above MSL
Borehole:	Original Borehole	**Seabed / Ground Elevation:**	3247.000 ft above MSL
UWI / API#:	Unknown / Unknown	**Magnetic Declination:**	7.555 °
Survey Name:	Chevron HH SO 8 P2 14H Rev0 CJG 12Jan16	**Total Gravity Field Strength:**	998.4304mgn (9.80665 Based)
Survey Date:	January 08, 2016	**Gravity Model:**	GARM
Tort / AHD / DDI / ERD Ratio:	102.668 ° / 10934.747 ft / 6.362 / 1.088	**Total Magnetic Field Strength:**	48138.973 nT
Coordinate Reference System:	NAD27 New Mexico State Plane, Eastern Zone, US Feet	**Magnetic Dip Angle:**	59.774 °
Location Lat / Long:	N 32° 2' 55.49131", W 104° 13' 2.25309"	**Declination Date:**	January 08, 2016
Location Grid N/E Y/X:	N 381478.000 ftUS, E 535953.000 ftUS	**Magnetic Declination Model:**	HDGM 2015
CRS Grid Convergence Angle:	0.0616 °	**North Reference:**	Grid North
Grid Scale Factor:	0.99991057	**Grid Convergence Used:**	0.0616 °
Version / Patch:	2.8.572.0	**Total Corr Mag North->Grid North:**	7.4938 °
		Local Coord Referenced To:	Well Head

Comments	MD (ft)	Incl (°)	Azim Grid (°)	TVD (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLS (°/100ft)	Northing (ftUS)	Easting (ftUS)	Latitude (N/S ° ' ")	Longitude (E/W ° ' ")
SHL	0.00	0.00	150.00	0.00	0.00	0.00	0.00	N/A	381479.00	535953.00	N 32 2 55.49	W 104 13 2.25
	100.00	0.00	150.00	100.00	0.00	0.00	0.00	0.00	381479.00	535953.00	N 32 2 55.49	W 104 13 2.25
	200.00	0.00	150.00	200.00	0.00	0.00	0.00	0.00	381479.00	535953.00	N 32 2 55.49	W 104 13 2.25
	300.00	0.00	150.00	300.00	0.00	0.00	0.00	0.00	381479.00	535953.00	N 32 2 55.49	W 104 13 2.25
	400.00	0.00	150.00	400.00	0.00	0.00	0.00	0.00	381479.00	535953.00	N 32 2 55.49	W 104 13 2.25
	500.00	0.00	150.00	500.00	0.00	0.00	0.00	0.00	381479.00	535953.00	N 32 2 55.49	W 104 13 2.25
	600.00	0.00	150.00	600.00	0.00	0.00	0.00	0.00	381479.00	535953.00	N 32 2 55.49	W 104 13 2.25
	700.00	0.00	150.00	700.00	0.00	0.00	0.00	0.00	381479.00	535953.00	N 32 2 55.49	W 104 13 2.25
	800.00	0.00	150.00	800.00	0.00	0.00	0.00	0.00	381479.00	535953.00	N 32 2 55.49	W 104 13 2.25
	900.00	0.00	150.00	900.00	0.00	0.00	0.00	0.00	381479.00	535953.00	N 32 2 55.49	W 104 13 2.25
	1000.00	0.00	150.00	1000.00	0.00	0.00	0.00	0.00	381479.00	535953.00	N 32 2 55.49	W 104 13 2.25
	1100.00	0.00	150.00	1100.00	0.00	0.00	0.00	0.00	381479.00	535953.00	N 32 2 55.49	W 104 13 2.25
	1200.00	0.00	150.00	1200.00	0.00	0.00	0.00	0.00	381479.00	535953.00	N 32 2 55.49	W 104 13 2.25
	1300.00	0.00	150.00	1300.00	0.00	0.00	0.00	0.00	381479.00	535953.00	N 32 2 55.49	W 104 13 2.25
	1400.00	0.00	150.00	1400.00	0.00	0.00	0.00	0.00	381479.00	535953.00	N 32 2 55.49	W 104 13 2.25
	1500.00	0.00	150.00	1500.00	0.00	0.00	0.00	0.00	381479.00	535953.00	N 32 2 55.49	W 104 13 2.25
	1600.00	0.00	150.00	1600.00	0.00	0.00	0.00	0.00	381479.00	535953.00	N 32 2 55.49	W 104 13 2.25
	1700.00	0.00	150.00	1700.00	0.00	0.00	0.00	0.00	381479.00	535953.00	N 32 2 55.49	W 104 13 2.25
	1800.00	0.00	150.00	1800.00	0.00	0.00	0.00	0.00	381479.00	535953.00	N 32 2 55.49	W 104 13 2.25
	1900.00	0.00	150.00	1900.00	0.00	0.00	0.00	0.00	381479.00	535953.00	N 32 2 55.49	W 104 13 2.25
	2000.00	0.00	150.00	2000.00	0.00	0.00	0.00	0.00	381479.00	535953.00	N 32 2 55.49	W 104 13 2.25
	2100.00	0.00	150.00	2100.00	0.00	0.00	0.00	0.00	381479.00	535953.00	N 32 2 55.49	W 104 13 2.25
	2200.00	0.00	150.00	2200.00	0.00	0.00	0.00	0.00	381479.00	535953.00	N 32 2 55.49	W 104 13 2.25
Build @ 2° DLS	2250.00	0.00	150.00	2250.00	0.00	0.00	0.00	0.00	381479.00	535953.00	N 32 2 55.49	W 104 13 2.25
	2300.00	1.00	150.00	2300.00	-0.38	-0.38	0.22	2.00	381478.62	535953.22	N 32 2 55.49	W 104 13 2.25
	2400.00	3.00	150.00	2399.93	-3.40	-3.40	1.96	2.00	381475.60	535954.96	N 32 2 55.46	W 104 13 2.23
	2500.00	5.00	150.00	2499.68	-9.44	-9.44	5.45	2.00	381469.56	535958.45	N 32 2 55.40	W 104 13 2.19
Hold 6° Inc.	2550.00	6.00	150.00	2549.45	-13.59	-13.59	7.85	2.00	381465.41	535960.85	N 32 2 55.36	W 104 13 2.16
	2600.00	6.00	150.00	2599.18	-18.12	-18.12	10.46	0.00	381460.88	535963.46	N 32 2 55.31	W 104 13 2.13
	2700.00	6.00	150.00	2698.63	-27.17	-27.17	15.69	0.00	381451.83	535968.69	N 32 2 55.22	W 104 13 2.07
	2800.00	6.00	150.00	2798.08	-36.23	-36.22	20.91	0.00	381442.78	535973.91	N 32 2 55.13	W 104 13 2.01
	2900.00	6.00	150.00	2897.53	-45.28	-45.27	26.14	0.00	381433.73	535979.14	N 32 2 55.04	W 104 13 1.95
	3000.00	6.00	150.00	2996.99	-54.33	-54.33	31.37	0.00	381424.68	535984.36	N 32 2 54.95	W 104 13 1.89
Drop @ 2° DLS	3010.00	6.00	150.00	3006.93	-55.24	-55.23	31.89	0.00	381423.77	535984.89	N 32 2 54.94	W 104 13 1.88
	3100.00	4.20	150.00	3096.57	-62.17	-62.16	35.89	2.00	381416.85	535988.89	N 32 2 54.88	W 104 13 1.84
	3200.00	2.20	150.00	3196.41	-67.00	-66.99	38.68	2.00	381412.01	535991.68	N 32 2 54.83	W 104 13 1.80
	3300.00	0.20	150.00	3296.38	-68.82	-68.81	39.73	2.00	381410.20	535992.72	N 32 2 54.81	W 104 13 1.79
Hold to KOP	3310.00	0.00	150.00	3306.38	-68.83	-68.82	39.74	2.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	3400.00	0.00	150.00	3396.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	3500.00	0.00	150.00	3496.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	3600.00	0.00	150.00	3596.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	3700.00	0.00	150.00	3696.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	3800.00	0.00	150.00	3796.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	3900.00	0.00	150.00	3896.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	4000.00	0.00	150.00	3996.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	4100.00	0.00	150.00	4096.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	4200.00	0.00	150.00	4196.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	4300.00	0.00	150.00	4296.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	4400.00	0.00	150.00	4396.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	4500.00	0.00	150.00	4496.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	4600.00	0.00	150.00	4596.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	4700.00	0.00	150.00	4696.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	4800.00	0.00	150.00	4796.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	4900.00	0.00	150.00	4896.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	5000.00	0.00	150.00	4996.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	5100.00	0.00	150.00	5096.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	5200.00	0.00	150.00	5196.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	5300.00	0.00	150.00	5296.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	5400.00	0.00	150.00	5396.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	5500.00	0.00	150.00	5496.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	5600.00	0.00	150.00	5596.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	5700.00	0.00	150.00	5696.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	5800.00	0.00	150.00	5796.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	5900.00	0.00	150.00	5896.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79
	6000.00	0.00	150.00	5996.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13 1.79

Comments	MD (ft)	Incl (°)	Azim Grid (°)	TVD (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLS (°/100ft)	Northing (ftUS)	Easting (ftUS)	Latitude (N/S ° ' ")	Longitude (E/W ° ' ")	
	6100.00	0.00	150.00	6096.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	6200.00	0.00	150.00	6196.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	6300.00	0.00	150.00	6296.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	6400.00	0.00	150.00	6396.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	6500.00	0.00	150.00	6496.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	6600.00	0.00	150.00	6596.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	6700.00	0.00	150.00	6696.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	6800.00	0.00	150.00	6796.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	6900.00	0.00	150.00	6896.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	7000.00	0.00	150.00	6996.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	7100.00	0.00	150.00	7096.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	7200.00	0.00	150.00	7196.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	7300.00	0.00	150.00	7296.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	7400.00	0.00	150.00	7396.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	7500.00	0.00	150.00	7496.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	7600.00	0.00	150.00	7596.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	7700.00	0.00	150.00	7696.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	7800.00	0.00	150.00	7796.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	7900.00	0.00	150.00	7896.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	8000.00	0.00	150.00	7996.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	8100.00	0.00	150.00	8096.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	8200.00	0.00	150.00	8196.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	8300.00	0.00	150.00	8296.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	8400.00	0.00	150.00	8396.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	8500.00	0.00	150.00	8496.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	8600.00	0.00	150.00	8596.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	8700.00	0.00	150.00	8696.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	8800.00	0.00	150.00	8796.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	8900.00	0.00	150.00	8896.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	9000.00	0.00	150.00	8996.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	9100.00	0.00	150.00	9096.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	9200.00	0.00	150.00	9196.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	9300.00	0.00	150.00	9296.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	9400.00	0.00	150.00	9396.38	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
Build @ 10° DLS	9430.67	0.00	150.00	9427.05	-68.83	-68.82	39.74	0.00	381410.18	535992.73	N 32 2 54.81	W 104 13	1.79
	9500.00	6.93	359.32	9496.21	-64.64	-64.63	39.69	10.00	381414.37	535992.68	N 32 2 54.85	W 104 13	1.79
	9600.00	16.93	359.32	9593.93	-43.99	-43.98	39.44	10.00	381435.02	535992.44	N 32 2 55.06	W 104 13	1.80
	9700.00	26.93	359.32	9686.57	-6.69	-6.68	39.00	10.00	381472.32	535991.99	N 32 2 55.42	W 104 13	1.80
	9800.00	36.93	359.32	9771.33	46.14	46.14	38.37	10.00	381525.14	535991.37	N 32 2 55.95	W 104 13	1.81
	9900.00	46.93	359.32	9845.63	112.87	112.88	37.58	10.00	381591.87	535990.58	N 32 2 56.61	W 104 13	1.82
	10000.00	56.93	359.32	9907.21	191.49	191.50	36.65	10.00	381670.49	535989.64	N 32 2 57.39	W 104 13	1.82
	10100.00	66.93	359.32	9954.20	279.62	279.62	35.60	10.00	381758.60	535988.60	N 32 2 58.26	W 104 13	1.84
	10200.00	76.93	359.32	9985.17	374.56	374.57	34.47	10.00	381853.53	535987.47	N 32 2 59.20	W 104 13	1.85
	10300.00	86.93	359.32	9999.19	473.44	473.45	33.30	10.00	381952.40	535986.30	N 32 3 0.18	W 104 13	1.86
Landing Point	10327.67	89.70	359.32	10000.00	501.09	501.10	32.97	10.00	381980.05	535985.97	N 32 3 0.45	W 104 13	1.86
	10400.00	89.70	359.32	10000.38	573.41	573.42	32.12	0.00	382052.37	535985.11	N 32 3 1.17	W 104 13	1.87
	10500.00	89.70	359.32	10000.90	673.41	673.41	30.93	0.00	382152.35	535983.93	N 32 3 2.15	W 104 13	1.89
	10600.00	89.70	359.32	10001.43	773.40	773.41	29.74	0.00	382252.33	535982.74	N 32 3 3.14	W 104 13	1.90
	10700.00	89.70	359.32	10001.95	873.39	873.40	28.56	0.00	382352.32	535981.55	N 32 3 4.13	W 104 13	1.91
	10800.00	89.70	359.32	10002.47	973.38	973.39	27.37	0.00	382452.30	535980.37	N 32 3 5.12	W 104 13	1.92
	10900.00	89.70	359.32	10003.00	1073.37	1073.38	26.18	0.00	382552.28	535979.18	N 32 3 6.11	W 104 13	1.94
	11000.00	89.70	359.32	10003.52	1173.37	1173.37	25.00	0.00	382652.26	535977.99	N 32 3 7.10	W 104 13	1.95
	11100.00	89.70	359.32	10004.04	1273.36	1273.36	23.81	0.00	382752.25	535976.81	N 32 3 8.09	W 104 13	1.96
	11200.00	89.70	359.32	10004.57	1373.35	1373.36	22.62	0.00	382852.23	535975.62	N 32 3 9.08	W 104 13	1.97
	11300.00	89.70	359.32	10005.09	1473.34	1473.35	21.44	0.00	382952.21	535974.44	N 32 3 10.07	W 104 13	1.99
	11400.00	89.70	359.32	10005.61	1573.33	1573.34	20.25	0.00	383052.19	535973.25	N 32 3 11.06	W 104 13	2.00
	11500.00	89.70	359.32	10006.14	1673.32	1673.33	19.07	0.00	383152.18	535972.06	N 32 3 12.05	W 104 13	2.01
	11600.00	89.70	359.32	10006.66	1773.32	1773.32	17.88	0.00	383252.16	535970.88	N 32 3 13.04	W 104 13	2.02
	11700.00	89.70	359.32	10007.18	1873.31	1873.31	16.69	0.00	383352.14	535969.69	N 32 3 14.03	W 104 13	2.04
	11800.00	89.70	359.32	10007.71	1973.30	1973.30	15.51	0.00	383452.12	535968.50	N 32 3 15.02	W 104 13	2.05
	11900.00	89.70	359.32	10008.23	2073.29	2073.30	14.32	0.00	383552.11	535967.32	N 32 3 16.01	W 104 13	2.06
	12000.00	89.70	359.32	10008.75	2173.28	2173.29	13.13	0.00	383652.09	535966.13	N 32 3 17.00	W 104 13	2.07
	12100.00	89.70	359.32	10009.28	2273.28	2273.28	11.95	0.00	383752.07	535964.95	N 32 3 17.99	W 104 13	2.09
	12200.00	89.70	359.32	10009.80	2373.27	2373.27	10.76	0.00	383852.05	535963.76	N 32 3 18.98	W 104 13	2.10
	12300.00	89.70	359.32	10010.32	2473.26	2473.26	9.57	0.00	383952.04	535962.57	N 32 3 19.97	W 104 13	2.11
	12400.00	89.70	359.32	10010.85	2573.25	2573.25	8.39	0.00	384052.02	535961.39	N 32 3 20.96	W 104 13	2.12
	12500.00	89.70	359.32	10011.37	2673.24	2673.25	7.20	0.00	384152.00	535960.20	N 32 3 21.94	W 104 13	2.14
	12600.00	89.70	359.32	10011.89	2773.24	2773.24	6.02	0.00	384251.98	535959.01	N 32 3 22.93	W 104 13	2.15
	12700.00	89.70	359.32	10012.42	2873.23	2873.23	4.83	0.00	384351.97	535957.83	N 32 3 23.92	W 104 13	2.16
	12800.00	89.70	359.32	10012.94	2973.22	2973.22	3.64	0.00	384451.95	535956.64	N 32 3 24.91	W 104 13	2.17
	12900.00	89.70	359.32	10013.46	3073.21	3073.21	2.46	0.00	384551.93	535955.46	N 32 3 25.90	W 104 13	2.19
	13000.00	89.70	359.32	10013.99	3173.20	3173.20	1.27	0.00	384651.91	535954.27	N 32 3 26.89	W 104 13	2.20
	13100.00	89.70	359.32	10014.51	3273.20	3273.20	0.08	0.00	384751.90	535953.08	N 32 3 27.88	W 104 13	2.21
	13200.00	89.70	359.32	10015.04	3373.19	3373.19	-1.10	0.00	384851.88	535951.90	N 32 3 28.87	W 104 13	2.22
	13300.00	89.70	359.32	10015.56	3473.18	3473.18	-2.29	0.00	384951.86	535950.71	N 32 3 29.86	W 104 13	2.24
	13400.00	89.70	359.32	10016.08	3573.17	3573.17	-3.48	0.00	385051.84	535949.52	N 32 3 30.85	W 104 13	2.25
	13500.00	89.70	359.32	10016.61	3673.16	3673.16	-4.66	0.00	385151.83	535948.34	N 32 3 31.84	W 104 13	2.26
	13600.00	89.70	359.32	10017.13	3773.15	3773.15	-5.85	0.00	385251.81	535947.15	N 32 3 32.83	W 104 13	2.27
	13700.00	89.70	359.32	10017.65	3873.15	3873.14	-7.03	0.00	385351.79	535945.97	N 32 3 33.82	W 104 13	2.29
	13800.00	89.70	359.32	10018.18	3973.14	3973.14	-8.22	0.00	385451.77	535944.78	N 32 3 34.81	W 104 13	2.30
	13900.00	89.70	359.32	10018.70	4073.13	4073.13	-9.41	0.00	385551.76	535943.59	N 32 3 35.80	W 104 13	2.31
	14000.00	89.70	359.32	10019.22	4173.12	4173.12	-10.59	0.00	385651.74	535942.41	N 32 3 36.79	W 104 13	2.32
	14100.00	89.70	359.32	10019.75	4273.11	4273.11	-11.78	0.00	385751.72	535941.22	N 32 3 37.78	W 104 13	2.34
	14200.00	89.70	359.32	10020.27	4373.11	4373.10	-12.97	0.00	385851.70	535940.03	N 32 3 38.77	W 104 13	2.35
	14300.00	89.70	359.32	10020.79	4473.10	4473.09	-14.15	0.00	385951.69	535938.85	N 32 3 39.76	W 104 13	2.36
	14400.00	89.70	359.32	10021.32	4573.09	4573.09	-15.34	0.00	386051.67	535937.66	N 32 3 40.75	W 104 13	2.37
	14500.00	89.70	359.32	10021.84	4673.08	4673.08	-16.53	0.00	386151.65	535936.48	N 32 3 41.73	W 104 13	2.39
	14600.00	89.70	359.32	10022.36	4773.07	4773.07	-17.71	0.00	386251.63	535935.29	N 32 3 42.72	W 104 13	2.40

Comments	MD (ft)	Incl (°)	Azim Grid (°)	TVD (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLS (°/100ft)	Northing (ftUS)	Easting (ftUS)	Latitude (N/S ° ' ")	Longitude (E/W ° ' ")
	14700.00	89.70	359.32	10022.89	4873.07	4873.06	-18.90	0.00	386351.62	535934.10	N 32 3 43.71	W 104 13 2.41
	14800.00	89.70	359.32	10023.41	4973.06	4973.05	-20.08	0.00	386451.60	535932.92	N 32 3 44.70	W 104 13 2.42
	14900.00	89.70	359.32	10023.93	5073.05	5073.04	-21.27	0.00	386551.58	535931.73	N 32 3 45.69	W 104 13 2.44
	15000.00	89.70	359.32	10024.46	5173.04	5173.04	-22.46	0.00	386651.56	535930.54	N 32 3 46.68	W 104 13 2.45
	15100.00	89.70	359.32	10024.98	5273.03	5273.03	-23.64	0.00	386751.55	535929.36	N 32 3 47.67	W 104 13 2.46
	15200.00	89.70	359.32	10025.50	5373.02	5373.02	-24.83	0.00	386851.53	535928.17	N 32 3 48.66	W 104 13 2.47
	15300.00	89.70	359.32	10026.03	5473.02	5473.01	-26.02	0.00	386951.51	535926.99	N 32 3 49.65	W 104 13 2.49
	15400.00	89.70	359.32	10026.55	5573.01	5573.00	-27.20	0.00	387051.49	535925.80	N 32 3 50.64	W 104 13 2.50
Chevron HH SO 8 P2 14H - MidPoint	15487.66	89.70	359.32	10027.01	5660.66	5660.66	-28.24	0.00	387139.14	535924.76	N 32 3 51.51	W 104 13 2.51
	15500.00	89.70	359.57	10027.07	5673.00	5672.99	-28.36	2.00	387151.48	535924.64	N 32 3 51.63	W 104 13 2.51
Hold to TD	15535.90	89.70	0.29	10027.26	5708.90	5708.89	-28.41	2.00	387187.37	535924.59	N 32 3 51.99	W 104 13 2.51
	15600.00	89.70	0.29	10027.60	5773.00	5772.99	-28.09	0.00	387251.46	535924.91	N 32 3 52.62	W 104 13 2.51
	15700.00	89.70	0.29	10028.12	5873.00	5872.99	-27.59	0.00	387351.45	535925.41	N 32 3 53.61	W 104 13 2.50
	15800.00	89.70	0.29	10028.65	5972.99	5972.99	-27.09	0.00	387451.44	535925.91	N 32 3 54.60	W 104 13 2.49
	15900.00	89.70	0.29	10029.17	6072.99	6072.98	-26.60	0.00	387551.43	535926.41	N 32 3 55.59	W 104 13 2.49
	16000.00	89.70	0.29	10029.69	6172.99	6172.98	-26.10	0.00	387651.42	535926.90	N 32 3 56.58	W 104 13 2.48
	16100.00	89.70	0.29	10030.22	6272.98	6272.98	-25.60	0.00	387751.40	535927.40	N 32 3 57.57	W 104 13 2.47
	16200.00	89.70	0.29	10030.74	6372.98	6372.98	-25.10	0.00	387851.39	535927.90	N 32 3 58.56	W 104 13 2.47
	16300.00	89.70	0.29	10031.26	6472.98	6472.97	-24.60	0.00	387951.38	535928.40	N 32 3 59.55	W 104 13 2.46
	16400.00	89.70	0.29	10031.79	6572.98	6572.97	-24.11	0.00	388051.37	535928.90	N 32 4 0.54	W 104 13 2.45
	16500.00	89.70	0.29	10032.31	6672.97	6672.97	-23.61	0.00	388151.36	535929.39	N 32 4 1.53	W 104 13 2.44
	16600.00	89.70	0.29	10032.83	6772.97	6772.97	-23.11	0.00	388251.35	535929.89	N 32 4 2.51	W 104 13 2.44
	16700.00	89.70	0.29	10033.36	6872.97	6872.96	-22.61	0.00	388351.33	535930.39	N 32 4 3.50	W 104 13 2.43
	16800.00	89.70	0.29	10033.88	6972.97	6972.96	-22.11	0.00	388451.32	535930.89	N 32 4 4.49	W 104 13 2.42
	16900.00	89.70	0.29	10034.41	7072.96	7072.96	-21.61	0.00	388551.31	535931.39	N 32 4 5.48	W 104 13 2.42
	17000.00	89.70	0.29	10034.93	7172.96	7172.95	-21.11	0.00	388651.30	535931.89	N 32 4 6.47	W 104 13 2.41
	17100.00	89.70	0.29	10035.45	7272.96	7272.95	-20.61	0.00	388751.29	535932.39	N 32 4 7.46	W 104 13 2.40
	17200.00	89.70	0.29	10035.98	7372.95	7372.95	-20.11	0.00	388851.28	535932.89	N 32 4 8.45	W 104 13 2.39
	17300.00	89.70	0.29	10036.50	7472.95	7472.95	-19.62	0.00	388951.26	535933.39	N 32 4 9.44	W 104 13 2.39
	17400.00	89.70	0.29	10037.02	7572.95	7572.94	-19.12	0.00	389051.25	535933.89	N 32 4 10.43	W 104 13 2.38
	17500.00	89.70	0.29	10037.55	7672.95	7672.94	-18.62	0.00	389151.24	535934.39	N 32 4 11.42	W 104 13 2.37
	17600.00	89.70	0.29	10038.07	7772.94	7772.94	-18.12	0.00	389251.23	535934.89	N 32 4 12.41	W 104 13 2.37
	17700.00	89.70	0.29	10038.60	7872.94	7872.94	-17.62	0.00	389351.22	535935.39	N 32 4 13.40	W 104 13 2.36
	17800.00	89.70	0.29	10039.12	7972.94	7972.93	-17.12	0.00	389451.20	535935.89	N 32 4 14.39	W 104 13 2.35
	17900.00	89.70	0.29	10039.64	8072.94	8072.93	-16.62	0.00	389551.19	535936.39	N 32 4 15.38	W 104 13 2.35
	18000.00	89.70	0.29	10040.17	8172.93	8172.93	-16.12	0.00	389651.18	535936.89	N 32 4 16.37	W 104 13 2.34
	18100.00	89.70	0.29	10040.69	8272.93	8272.93	-15.62	0.00	389751.17	535937.39	N 32 4 17.36	W 104 13 2.33
	18200.00	89.70	0.29	10041.21	8372.93	8372.92	-15.11	0.00	389851.16	535937.89	N 32 4 18.35	W 104 13 2.32
	18300.00	89.70	0.29	10041.74	8472.92	8472.92	-14.61	0.00	389951.15	535938.39	N 32 4 19.34	W 104 13 2.32
	18400.00	89.70	0.29	10042.26	8572.92	8572.92	-14.11	0.00	390051.13	535938.89	N 32 4 20.33	W 104 13 2.31
	18500.00	89.70	0.29	10042.78	8672.92	8672.92	-13.61	0.00	390151.12	535939.39	N 32 4 21.32	W 104 13 2.30
	18600.00	89.70	0.29	10043.31	8772.92	8772.91	-13.11	0.00	390251.11	535939.89	N 32 4 22.31	W 104 13 2.30
	18700.00	89.70	0.29	10043.83	8872.91	8872.91	-12.61	0.00	390351.10	535940.39	N 32 4 23.30	W 104 13 2.29
	18800.00	89.70	0.29	10044.36	8972.91	8972.91	-12.11	0.00	390451.09	535940.89	N 32 4 24.28	W 104 13 2.28
	18900.00	89.70	0.29	10044.88	9072.91	9072.91	-11.61	0.00	390551.08	535941.39	N 32 4 25.27	W 104 13 2.27
	19000.00	89.70	0.29	10045.40	9172.90	9172.90	-11.11	0.00	390651.06	535941.89	N 32 4 26.26	W 104 13 2.27
	19100.00	89.70	0.29	10045.93	9272.90	9272.90	-10.60	0.00	390751.05	535942.40	N 32 4 27.25	W 104 13 2.26
	19200.00	89.70	0.29	10046.45	9372.90	9372.90	-10.10	0.00	390851.04	535942.90	N 32 4 28.24	W 104 13 2.25
	19300.00	89.70	0.29	10046.97	9472.90	9472.89	-9.60	0.00	390951.03	535943.40	N 32 4 29.23	W 104 13 2.25
	19400.00	89.70	0.29	10047.50	9572.89	9572.89	-9.10	0.00	391051.02	535943.90	N 32 4 30.22	W 104 13 2.24
	19500.00	89.70	0.29	10048.02	9672.89	9672.89	-8.60	0.00	391151.00	535944.40	N 32 4 31.21	W 104 13 2.23
	19600.00	89.70	0.29	10048.54	9772.89	9772.89	-8.09	0.00	391250.99	535944.91	N 32 4 32.20	W 104 13 2.23
	19700.00	89.70	0.29	10049.07	9872.89	9872.88	-7.59	0.00	391350.98	535945.41	N 32 4 33.19	W 104 13 2.22
	19800.00	89.70	0.29	10049.59	9972.88	9972.88	-7.09	0.00	391450.97	535945.91	N 32 4 34.18	W 104 13 2.21
	19900.00	89.70	0.29	10050.12	10072.88	10072.88	-6.59	0.00	391550.96	535946.41	N 32 4 35.17	W 104 13 2.20
	20000.00	89.70	0.29	10050.64	10172.88	10172.88	-6.08	0.00	391650.95	535946.92	N 32 4 36.16	W 104 13 2.20
	20100.00	89.70	0.29	10051.16	10272.87	10272.87	-5.58	0.00	391750.93	535947.42	N 32 4 37.15	W 104 13 2.19
	20200.00	89.70	0.29	10051.69	10372.87	10372.87	-5.08	0.00	391850.92	535947.92	N 32 4 38.14	W 104 13 2.18
	20300.00	89.70	0.29	10052.21	10472.87	10472.87	-4.58	0.00	391950.91	535948.42	N 32 4 39.13	W 104 13 2.18
	20400.00	89.70	0.29	10052.73	10572.87	10572.87	-4.07	0.00	392050.90	535948.93	N 32 4 40.12	W 104 13 2.17
	20500.00	89.70	0.29	10053.26	10672.86	10672.86	-3.57	0.00	392150.89	535949.43	N 32 4 41.11	W 104 13 2.16
	20600.00	89.70	0.29	10053.78	10772.86	10772.86	-3.07	0.00	392250.88	535949.93	N 32 4 42.10	W 104 13 2.15
Chevron HH SO 8 P2 14H - PBHL	20613.13	89.70	0.29	10053.85	10785.99	10785.99	-3.00	0.00	392264.00	535950.00	N 32 4 42.23	W 104 13 2.15

Survey Type: Non-Def Plan

Survey Error Model: ISCWSA Rev 0 *** 3-D 95.000% Confidence 2.7955 sigma
Survey Program:

Description	Part	MD From (ft)	MD To (ft)	EOU Freq (ft)	Hole Size (in)	Casing Diameter (in)	Survey Tool Type	Borehole / Survey
	1	0.000	33.000	1/100.000	30.000	30.000	SLB_MWD-STD-Depth Only	Original Borehole / Chevron HH SO 8 P2 14H Rev0 CJG 12Jan16
	1	33.000	20613.126	1/100.000	30.000	30.000	SLB_MWD-STD	Original Borehole / Chevron HH SO 8 P2 14H Rev0 CJG 12Jan16

Generic Hayhurst Development Pad Layout - Phase 1

H2S Monitor Locations
- Bop/Cellar
- Rig Floor
- Shaker Skid
- Bell Nipple

Flag Locations
- Sign-In Shack
- Rig Floor
- Dog House

10 Minute Escape Packs
- 1 at Pits
- 1 at Trip Tank
- 1 at Accumulator
- 4 at Rig Floor

45 Minute Escape Packs
- 2 at Briefing Area
- 2 at Alternate Briefing Area

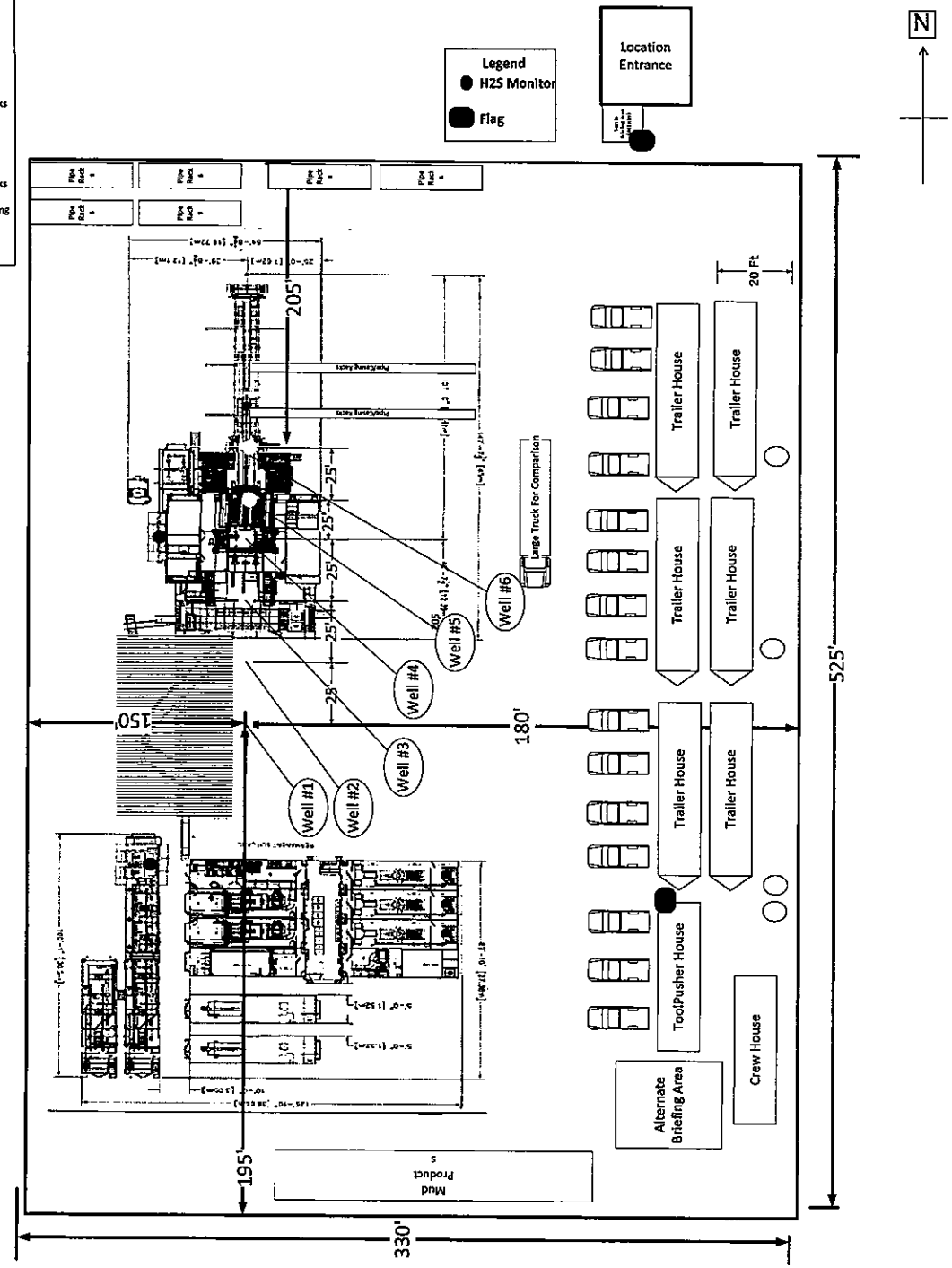
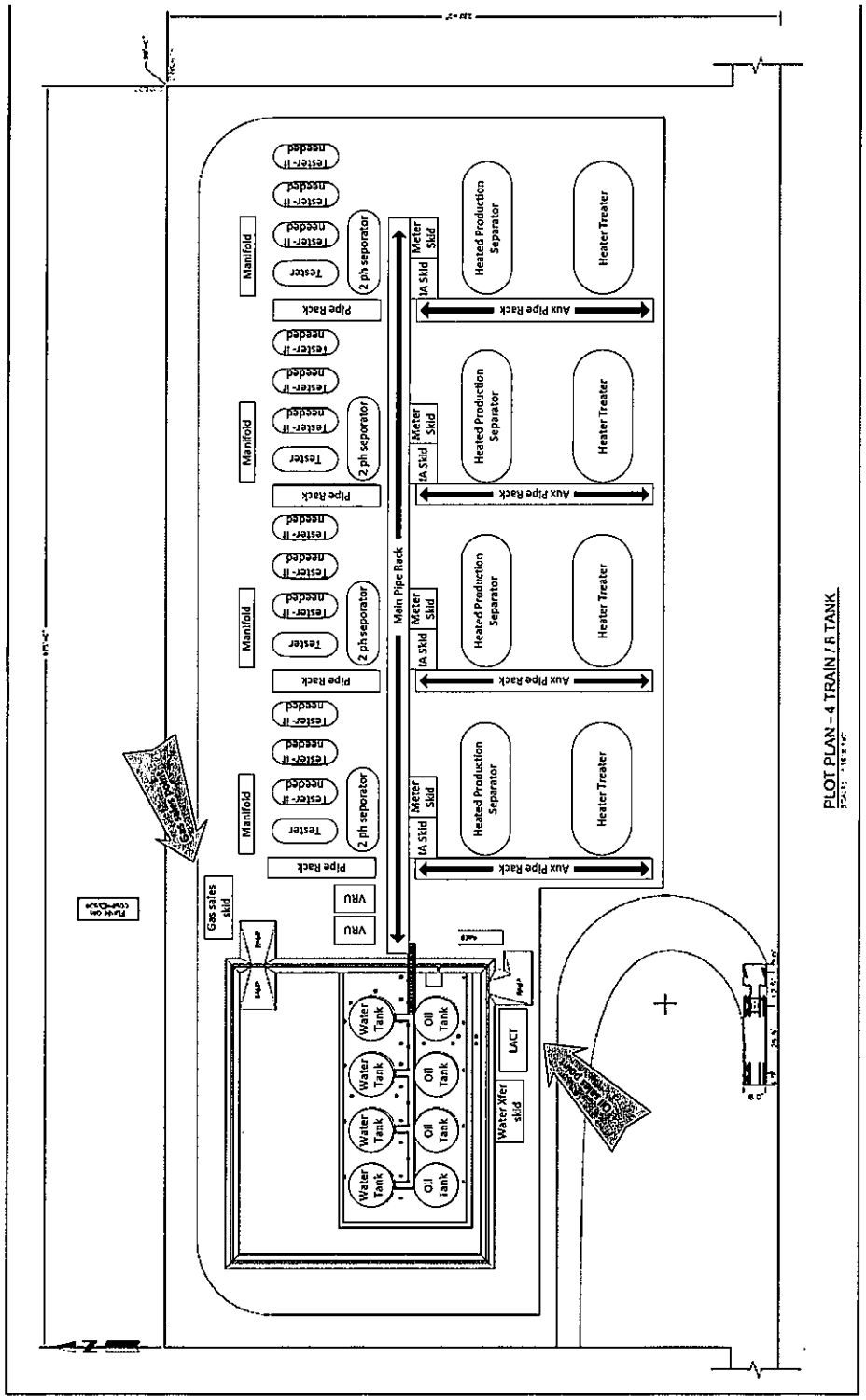


EXHIBIT 4


Main Pipe Rack
Aux Pipe Rack
Heated Production Separator
Heater Treater
Meter Skid
IA Skid
Manifold
Tester
needed
2 ph seporator
Pipe Rack
VRU
Gas sales skid
Water Tank
Oil Tank
LACT
Water Xfer skid
PLOT PLAN – 4 TRAIN / 8 TANK

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge

ROBERT L. LASTRAPES
NEW MEXICO
23006
1-8-2016
PROFESSIONAL SURVEYOR

Robert L. Lastrapes
Registration No. 23006

R 27 E

T 26 S

NW PAD CORNER		NE PAD CORNER		HH SO 8 P2 NO. 5H WELL	
X=	535,799 NAD 27	X=	536,129 NAD 27	X=	535,952 NAD 27
Y=	381,809	Y=	381,808	Y=	381,554
ELEVATION +3241' NAVD 88		ELEVATION +3247' NAVD 88		LAT.	32.048953
SW PAD CORNER		SE PAD CORNER		LONG.	104.217295
X=	535,805 NAD 27	X=	536,135 NAD 27	X=	577,136 NAD83
Y=	381,284	Y=	381,284	Y=	381,611
ELEVATION +3244' NAVD 88		ELEVATION +3256' NAVD 88		LAT.	32.049075
				LONG.	104.217789
				ELEVATION +3245' NAVD 88	

Sec. 8

Bureau of Land Management

EROSION CONTROL (STRAW WATTLES)

S 89°52'10" E 810.78'

Fnd. 2" Iron Pipe w/ Cap at the NW Corner of Section 17

TOPSOIL

280'

150'

180'

330'

HH SO 8 P2
No. 5H Well
255' FNL. 980' FWL

PROPOSED PAD
±3.98 Acres

CENTERLINE PROPOSED ACCESS ROAD (1)
24' X ±5,444.40'
±3.00 Acres
±329.96 Rods
(SEE PAGE 2)

Sec. 17

Bureau of Land Management

(Access Road 1) ± 4289.90', ±2.36 Acres, ±259.99 Rods

NAD 27 NEW MEXICO EAST ZONE

Scale: 1" = 300'

300' 0 150' 300'

INTERIM RECLAMATION

SURFACE USE PLAT

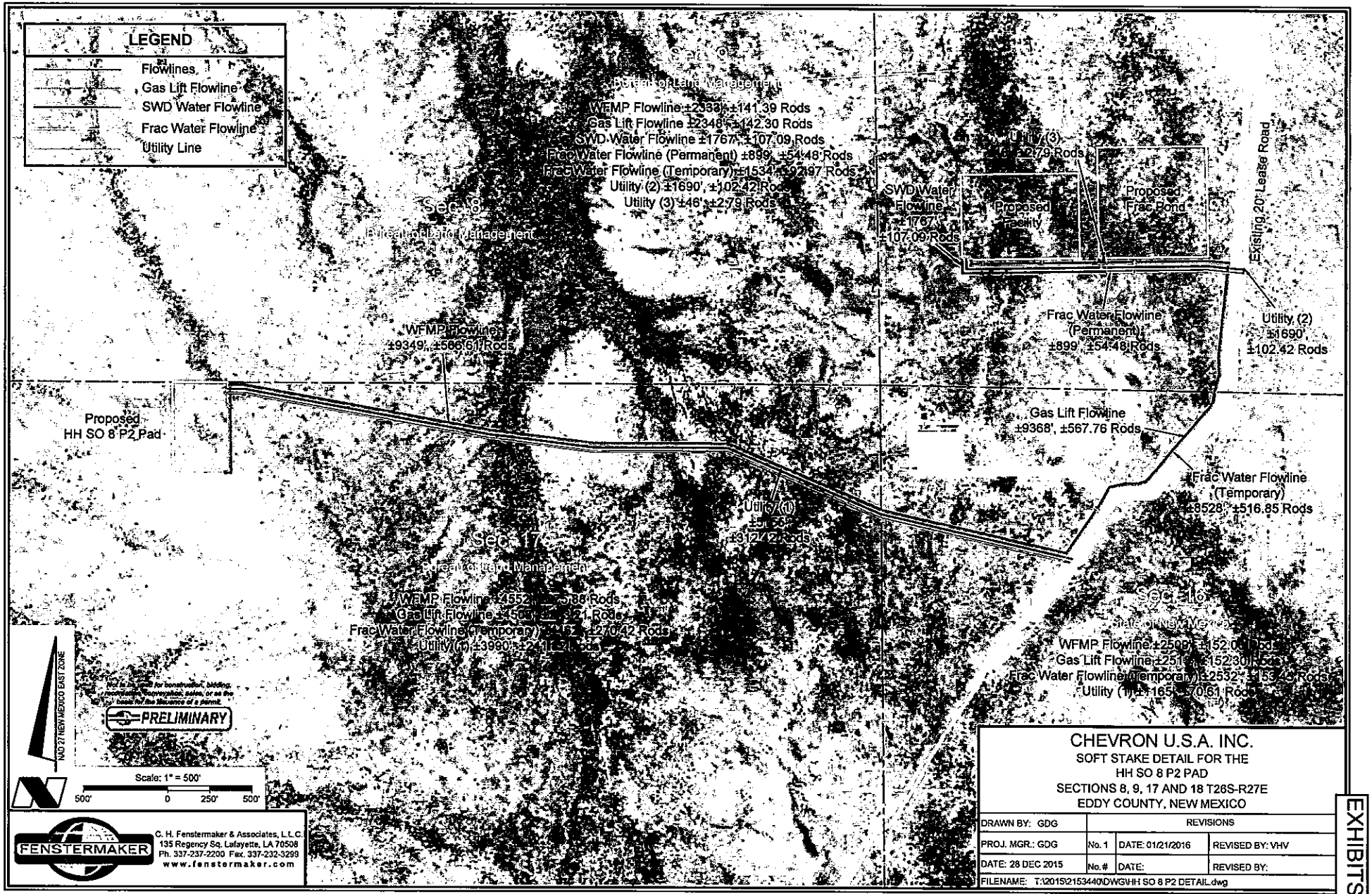
CHEVRON U.S.A. INC.

PROPOSED PADS, FRAC POND & ACCESS ROADS
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

PAGE 1 OF 3

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

DRAWN BY: LJG	REVISIONS		
PROJ. MGR.: GDG	No. 1	DATE: 1/7/2016	REVISED BY: MBD
DATE: 12/22/2015	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153438\DWG\HH SO 8 P2 5H_SUP.dwg			



CHEVRON U.S.A. INC.

SOFT STAKE DETAIL FOR THE
HH SO 8 P2 PAD
SECTIONS 8, 9, 17 AND 18 T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: GDG	REVISIONS		
PROJ. MGR.: GDG	No. 1	DATE: 01/21/2016	REVISED BY: VHV
DATE: 28 DEC 2015	No. #	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\HH SO 8 P2 DETAIL.dwg			

EXHIBITS 4&5

CHEVRON U.S.A. Inc
HH SO 8 P2 14H
NMNM 118108
SECTION 17, T26S-R27E (Off Lease SHL) SECTION 5, T26S, R27E
SHL 330' FNL & 960' FWL BHL 180' FNL & 996' FWL

APD Surface Use Plan of Operations

This Surface Use Plan of Operations has been designed to be reviewed in conjunction with Hayhurst Development Area (HDA) Master Development Plan

HDA Master Development Plan Reference Table

The contents referenced below apply to all HDA APD's

Existing Roads	Exhibit 1, MDP SUPO Page 1
Construction Materials	MDP SUPO Page 6
Methods for Handling Waste	MDP SUPO Page 6
Reclamation Objectives	MDP SUPO Page 6-8
Final Surface Reclamation	MDP SUPO Page 6-8

Driving Directions

- Driving Directions – From Malaga, New Mexico. The location is approximately 11.5 miles from the nearest town, which is Malaga, New Mexico. From Malaga, proceed South on Highway 285 approximately 11.5 miles and turn right (West) onto White City Rd and go approximately 7.5 miles on White City Road until the road reaches an intersection with a permanent sign reading "Chevron Access". Turn left onto this and travel 1 mile, then right and travel for another .5 miles to the well location.

New or Reconstructed Access Roads – (Exhibit 2, MDP SUPO Pg. 1)

- There will be 7172' of new road construction for this proposal.
- Ditches: See Exhibit 2 (To be submitted at later date)
- Culverts: See Exhibit 2 (To be submitted at later date)
- Road Cuts: See Exhibit 2 (To be submitted at later date)

Location of Existing Wells (Exhibit 3)

- 1-Mile radius map is attached

CHEVRON U.S.A. Inc
HH SO 8 P2 14H
NMNM 118108
SECTION 17, T26S-R27E (Off Lease SHL) SECTION 5, T26S, R27E
SHL 330' FNL & 960' FWL BHL 180' FNL & 996' FWL

Location of Existing and/or Proposed Production Facilities (Exhibit 4, MDP SUP Pg. 2)

- Facilities: Proposed production facilities located in the SW corner of Sec. 9, T26S-R27E where oil and gas sales will take place.
    - The proposed facility and frac pond is in Sec. 9, T26S-R27E
    - Gas purchaser pipeline is in place at the tank battery.
    - Open top tanks or open containments will be netted.
    - Open vent exhaust stacks will be modified to prevent birds or bats from entering, discourage perching, roosting, and nesting.
    - Facilities will have a secondary containment 1.5 times the holding capacity of largest storage tank.
    - All above ground structures will be painted non-reflective shale green for blending with surrounding environment.
    - The permanent water disposal system will be determined prior to construction of any water transfer pipeline. Until permanent water takeaway is available, produced water will be hauled off location in trucks. **Notification will be provided to BLM upon site selection and survey – plats (including SWD well information) will be provided.**
- Pipelines: See Detail – Exhibit 5
    - Pipelines Include:
        - 9,349' of Flowlines carrying production (buried)
        - 9,368' Gas Lift Line carrying pressurized gas (buried)
        - 1,767' SWD Line carrying produced water (buried)
        - 899' Permanent Frac water line carrying fresh water (buried)
        - 8528' Temporary Water line carrying fresh water (surface)
    - A ROW will be applied for through the State and BLM.
    - All construction activity will be confined to the approved ROW.
    - Pipeline will run parallel to the road and will stay within approved ROW.
- Power lines\Utility lines: 6,891' of new power lines

Location and Types of Water Supply (Exhibit 5, MDP SUPO Pg. 5)

- Proposed pond in Section 9, T26S-R27E will be utilized for fresh water.
- Fresh water will be obtained from a private water source.

Construction Materials (MDP SUPO Pg. 6)

- Location-specific caliche sources will be provided in post-application supplement

CHEVRON U.S.A. Inc
HH SO 8 P2 14H
NMNM 118108
SECTION 17, T26S-R27E (Off Lease SHL) SECTION 5, T26S, R27E
SHL 330' FNL & 960' FWL BHL 180' FNL & 996' FWL

Well Site Layout (Exhibit 6)

- Surveyor Plat (Exhibit 6a)
  - Exterior well pad dimensions are 525' x 330'
  - Interior well pad dimensions from point of entry (well head) of the well are N-330', S-195', E-180', W-150'. Total disturbance area needed for construction of well pad will be approximately 4 acres
  - Topsoil placement is on the west where interim reclamation is planned to be completed upon completion of well and evaluation of best management practices.
  - Cut and fill: will be minimal.
- Rig Layout (Exhibit 6b)

Plans for Surface Reclamation (Exhibit 6, MDP SUPA Pg. 8)

Interim Reclamation Procedures

- Reclaimed pad size: 200' x 325'
- See Exhibit for reclaimed pad layout, topsoil location & erosion control features

Surface Ownership

- BLM Surface
  - Surface Tenant – Phillip Stell
- **Nearest Post Office:** Malaga Post Office; 11.4 Miles north

Other Information

- On-site performed by BLM NRS: Paul Murphy 11/4/2015
- Cultural report attached: **Yes** Participating Agreement attached: N/A

CHEVRON U.S.A. Inc
HH SO 8 P2 14H
NMNM 118108
SECTION 17, T26S-R27E (Off Lease SHL) SECTION 5, T26S, R27E
SHL 330' FNL & 960' FWL BHL 180' FNL & 996' FWL

Chevron Representatives

Primary point of contact:
Jennifer Van Curen
Jennifer.VanCuren@arcadis-us.com
M- 432-270-8753

Chevron Functional Contacts

Project Manager Name: Sean Cheben Address: 1400 Smith Street Houston, TX 77002 Phone: (432) 664-6809 Email: Sean.Cheben@chevron.com	**Drilling Engineer** Name: Roderick Milligan Address: 1400 Smith Street Houston, TX 77002 Phone: (281) 413-9794 Email: RoderickMilligan@chevron.com
Surface Land Representative Name: Kevin Dickerson Address: 15 Smith Road Midland Texas 79705 Phone: (432) 687-7104 Email: Kevin.Dickerson@chevron.com	**Facility Lead** Name: Tyler Weaver Address: 1400 Smith Street Houston, TX 77002 Phone: (281) 384-8934 Email: tyler.weaver@chevron.com
Geologist Name: Jeff Fabre Address: 1400 Smith Street Houston, TX 77002 Phone: (713) 372-0523 Email: JeffreyFabre@chevron.com	**Regulatory Specialist** Cindy Herrera-Murillo Address: 1616 W. Bender Blvd, Hobbs, NM 88240 Office: (575) 263-0431 Email: CHerreraMurillo@chevron.com

CHEVRON U.S.A. Inc
HH SO 8 P2 14H
NMNM 118108
SECTION 17, T26S-R27E (Off Lease SHL) SECTION 5, T26S, R27E
SHL 330' FNL & 960' FWL BHL 180' FNL & 996' FWL

EXHIBITS:

Exhibit 1 -- Existing Roads

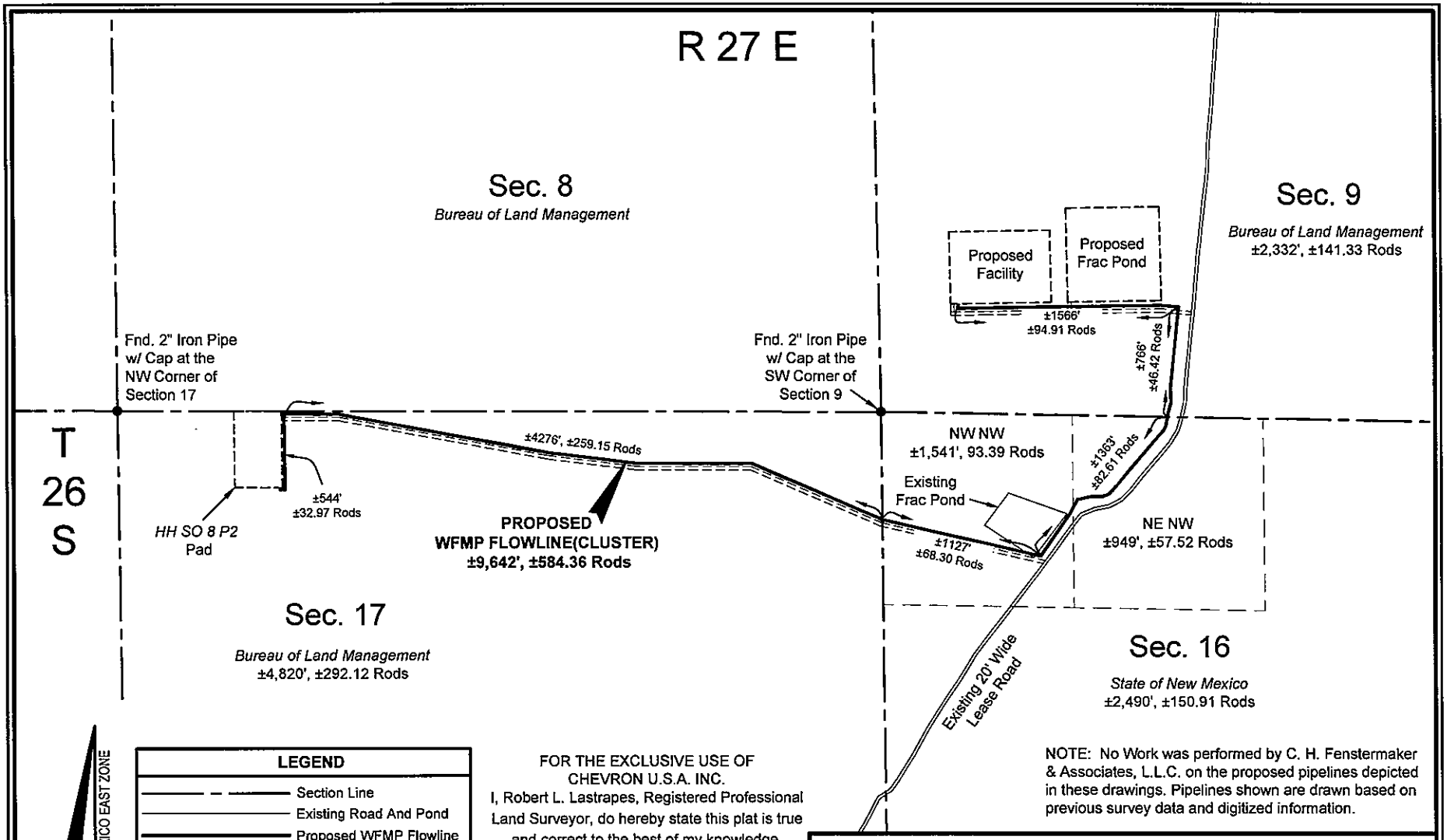
Exhibit 2 -- Survey Plat: New or Reconstructed Roads Map: if road is outside 600' x 600'.

Exhibit 3 -- 1-mile Radius Map

Exhibit 4 -- Location of Existing and/or Proposed Production Facilities (Tank Battery)

Exhibit 5 -- Survey Plat: Infrastructure: roads, pipelines, power lines, frac pond

Exhibit 6 -- Rig Layout: Well Site Layout Map / Diagram



FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

NOTE: No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED WFMP FLOWLINE(CLUSTER)
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No.23006

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\WFMP FL_SUP.dwg			

EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED WFMP FLOWLINE(CLUSTER)
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\WFMP FL_SUP.dwg			

R 27 E

NOTE: No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

Sec. 8

Bureau of Land Management

Sec. 9

Bureau of Land Management
±2,348', ±142.30 Rods

Proposed Facility

Proposed Frac Pond

±1585'
±96.06 Rods

±763'
±46.24 Rods

Fnd. 2" Iron Pipe w/ Cap at the NW Corner of Section 17

Fnd. 2" Iron Pipe w/ Cap at the SW Corner of Section 9

T 26 S

±4279', ±259.33 Rods

NW NW
±1,533', 92.91 Rods

±1380'
±83.63 Rods

Existing Frac Pond

±521'
±31.58 Rods

HH SO 8 P2 Pad

PROPOSED GAS LIFT FLOWLINE
±9,661', ±585.51 Rods

±1133'
±68.67 Rods

NE NW
±980', ±59.39 Rods

Sec. 17

Bureau of Land Management
±4,800', ±290.91 Rods

Sec. 16

State of New Mexico
±2,513', ±152.30 Rods

Existing 20' Wide Lease Road

NAD 27 NEW MEXICO EAST ZONE

LEGEND

- Section Line
- Existing Road And Pond
- Proposed Gas Lift Flowline
- Proposed Access Road, Frac Pump, Tank Battery, Compressor Station & Pad
- Found Occupation

Scale: 1" = 1000'

1000' 0 500' 1000'

FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

FENSTERMAKER

C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED GAS LIFT FLOWLINE
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Gas Lift FL_SUP.dwg			

EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

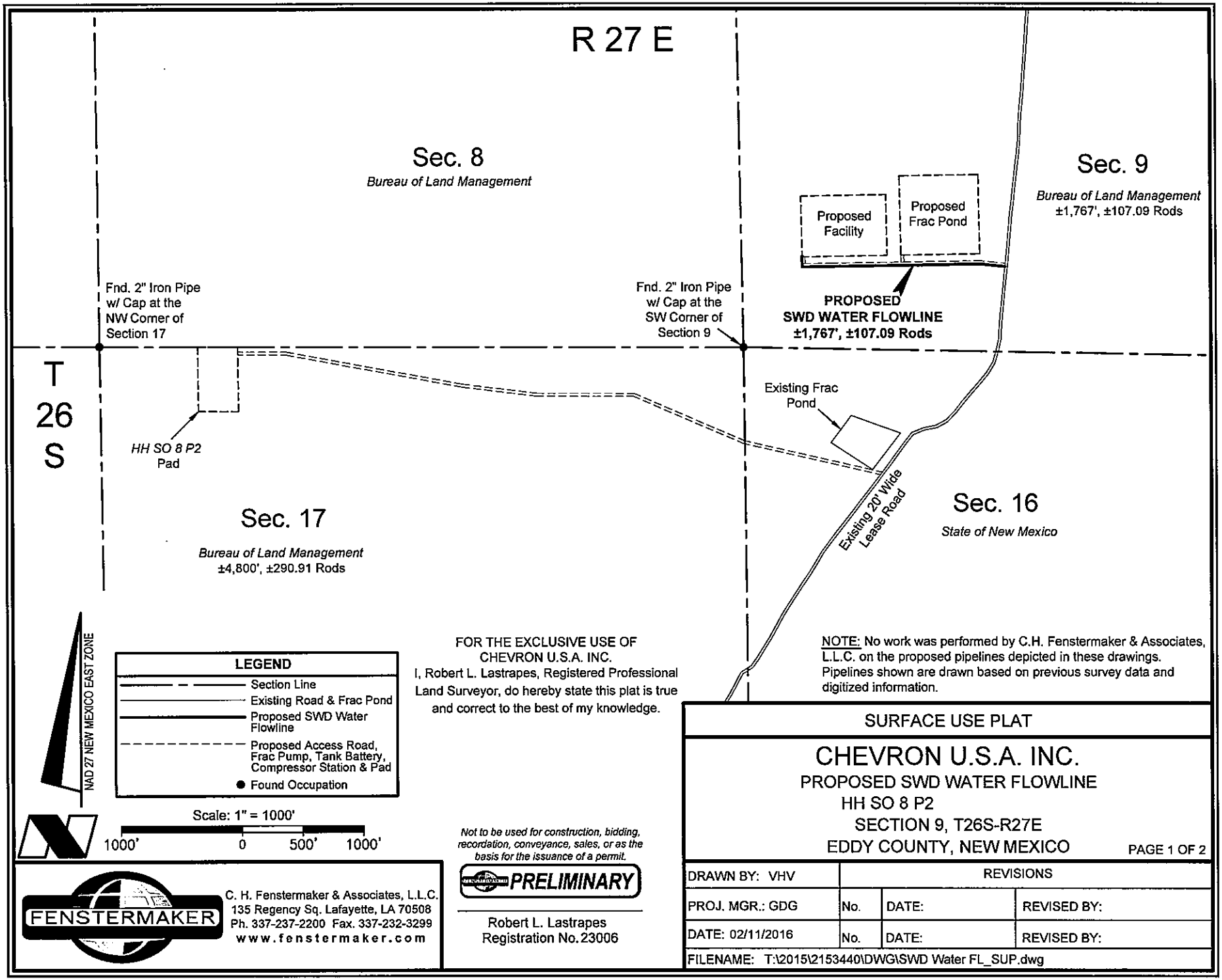
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED GAS LIFT FLOWLINE
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Gas Lift FL_SUP.dwg			



FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

NOTE: No work was performed by C.H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED SWD WATER FLOWLINE
HH SO 8 P2
SECTION 9, T26S-R27E
EDDY COUNTY, NEW MEXICO

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

DRAWN BY: VHV	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\SWD Water FL_SUP.dwg			

EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

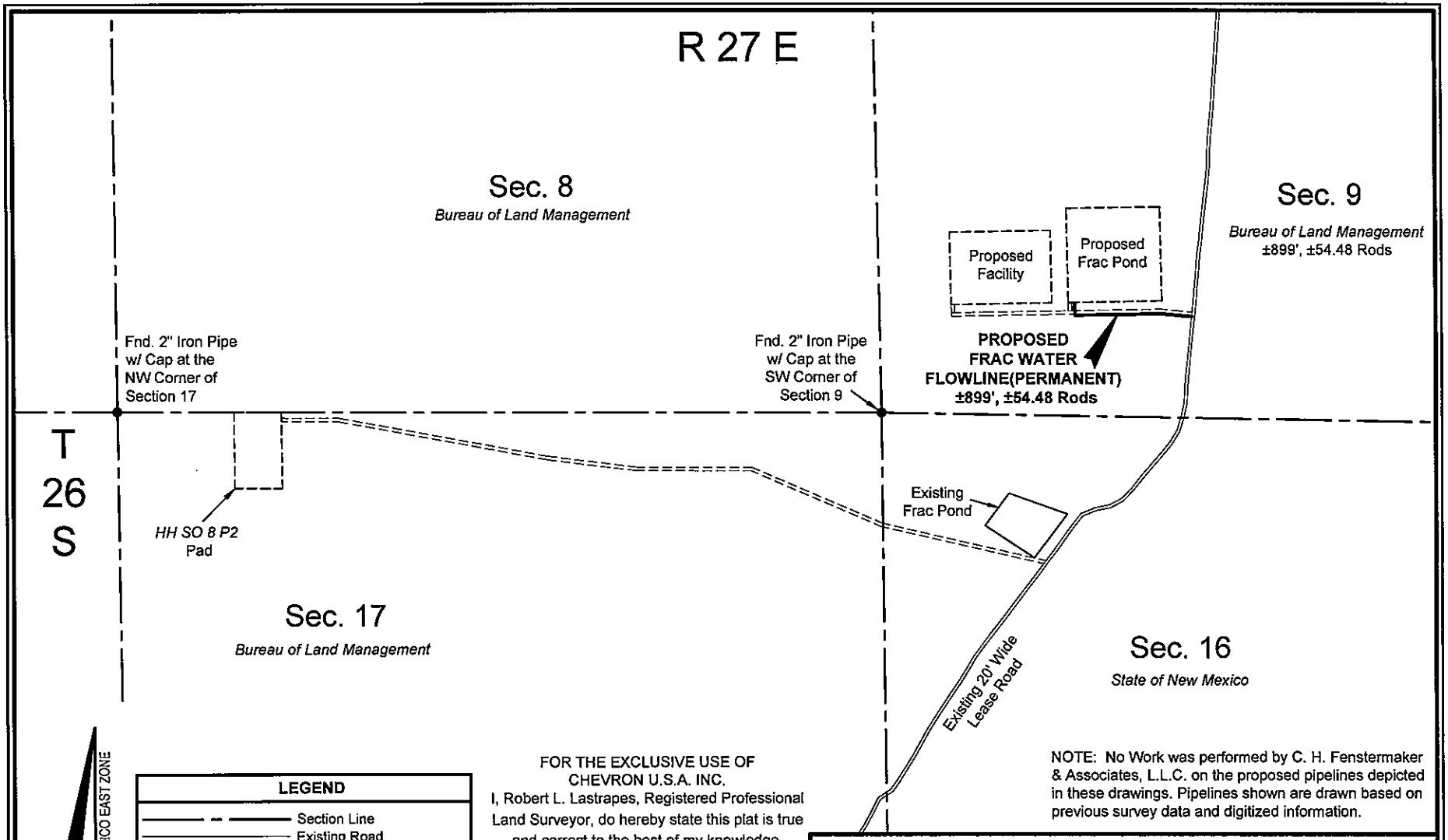
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED SWD WATER FLOWLINE
HH SO 8 P2
SECTION 9, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: VHV	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\SWD Water FL_SUP.dwg			



FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

NOTE: No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED FRAC WATER FLOWLINE(PERMANENT)
HH SO 8 P2
SECTION 9, T26S-R27E
EDDY COUNTY, NEW MEXICO

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Frac Water FL_Perm_SUP.dwg			

EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No.23006

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED FRAC WATER FLOWLINE(PERMANENT)
HH SO 8 P2
SECTION 9, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Frac Water FL_Perm_SUP.dwg			

R 27 E

NOTE: No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

Sec. 8
Bureau of Land Management

Sec. 9
Bureau of Land Management
±1,534', ±92.97 Rods

Proposed Facility

Proposed Frac Pond

±773'
±46.85 Rods

±761'
±46.12 Rods

Fnd. 2" Iron Pipe w/ Cap at the NW Corner of Section 17

Fnd. 2" Iron Pipe w/ Cap at the SW Corner of Section 9

T 26 S

±473', ±28.67 Rods

±473'
±28.67 Rods

HH SO 8 P2 Pad

PROPOSED FRAC WATER FLOWLINE(TEMPORARY) ±8,820', ±534.55 Rods

NW NW
±1,548', 93.82 Rods

±1423'
±86.24 Rods

Existing Frac Pond

NE NW
±984', ±59.64 Rods

±1109'
±67.21 Rods

Sec. 17
Bureau of Land Management
±4,754', ±288.12 Rods

Sec. 16
State of New Mexico
±2,532', ±153.45 Rods

Existing 20' Wide Lease Road

NAD 27 NEW MEXICO EAST ZONE

LEGEND

- Section Line
- Existing Road And Pond
- Proposed Frac Water Flowline(Temporary)
- Proposed Access Road, Frac Pump, Tank Battery, Compressor Station & Pad
- Found Occupation

Scale: 1" = 1000'

1000' 0 500' 1000'

FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED FRAC WATER FLOWLINE(TEMPORARY)
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Frac Water FL_Temp_SUP.dwg			

EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No.23006

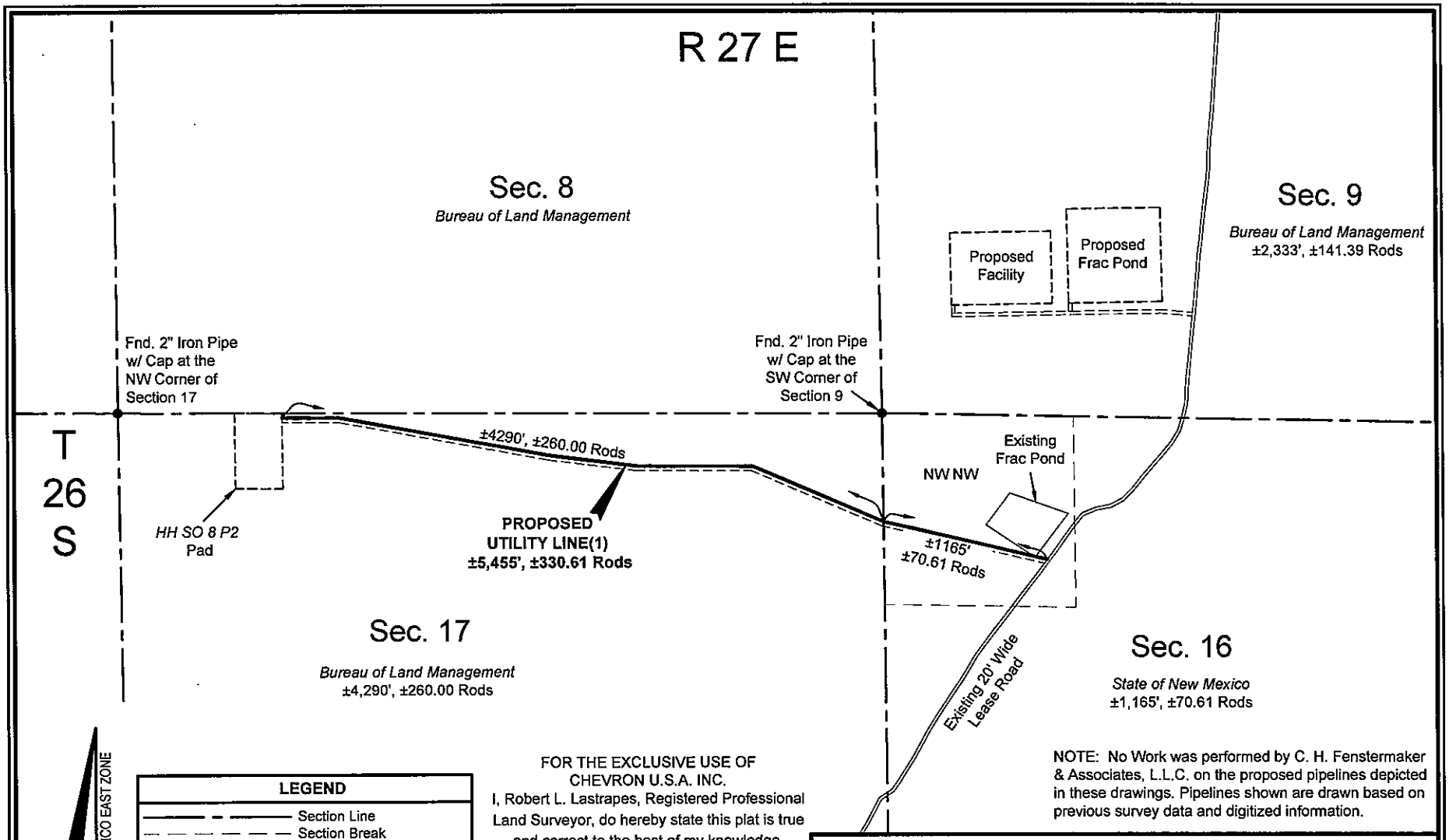
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED FRAC WATER FLOWLINE(TEMPORARY)
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Frac Water FL_Temp_SUP.dwg			



NAD 27 NEW MEXICO EAST ZONE

LEGEND

- Section Line
- Section Break
- Existing Road & Pond
- Proposed Utility Line(1)
- Proposed Access Road, Frac Pump, Tank Battery, Compressor Station & Pad
- Found Occupation

Scale: 1" = 1000'

1000' 0 500' 1000'

FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

NOTE: No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED UTILITY LINE(1)
HH SO 8 P2
SECTIONS 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No.23006

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Utility 1_SUP.dwg			

EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

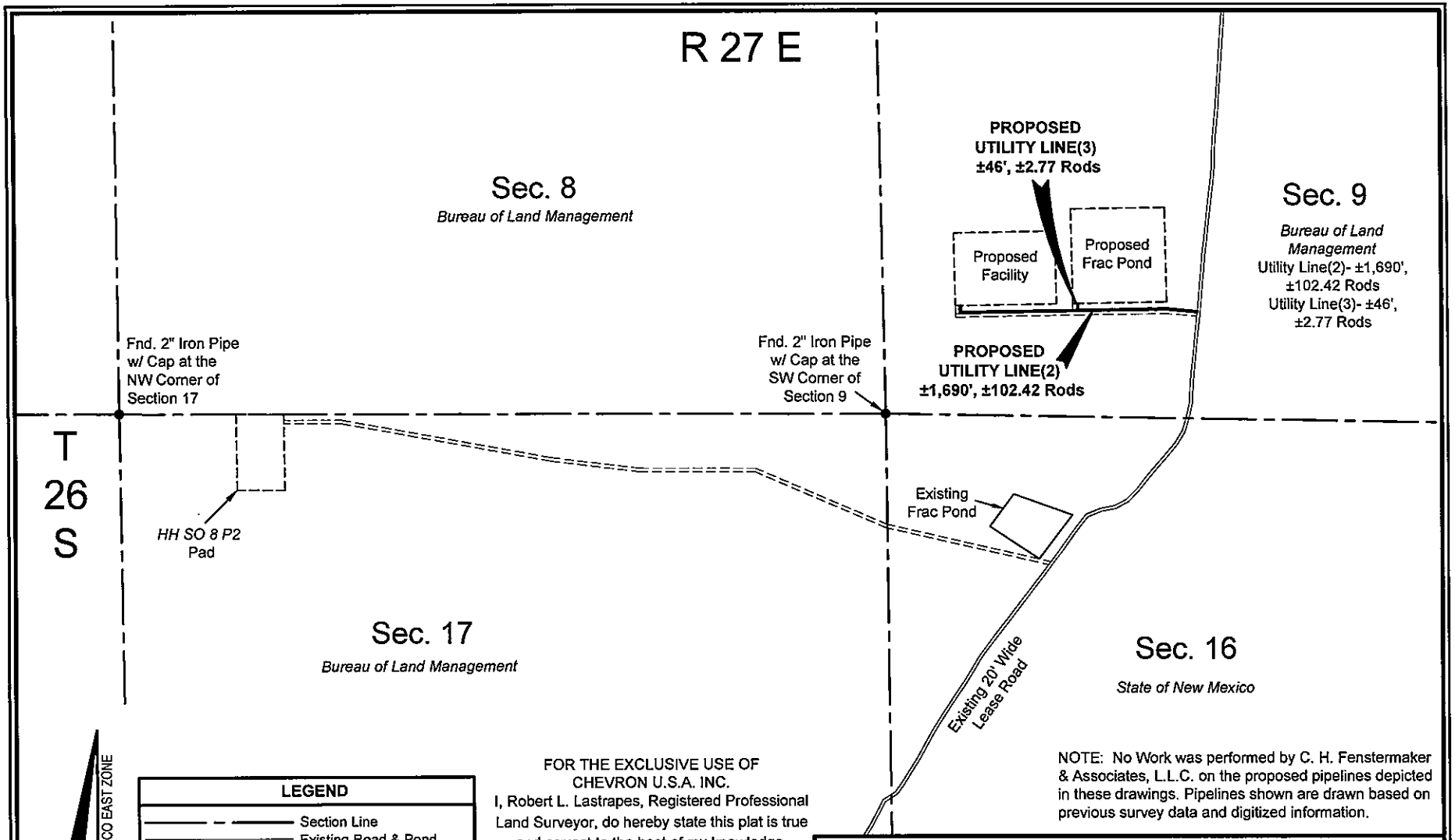
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED UTILITY LINE(1)
HH SO 8 P2
SECTIONS 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Utility 1_SUP.dwg			



FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

NOTE: No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED UTILITY LINE(2 & 3)
HH SO 8 P2
SECTION 9, T26S-R27E
EDDY COUNTY, NEW MEXICO

PAGE 1 OF 2

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Utility 2 and 3_SUP.dwg			

EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No.23006

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

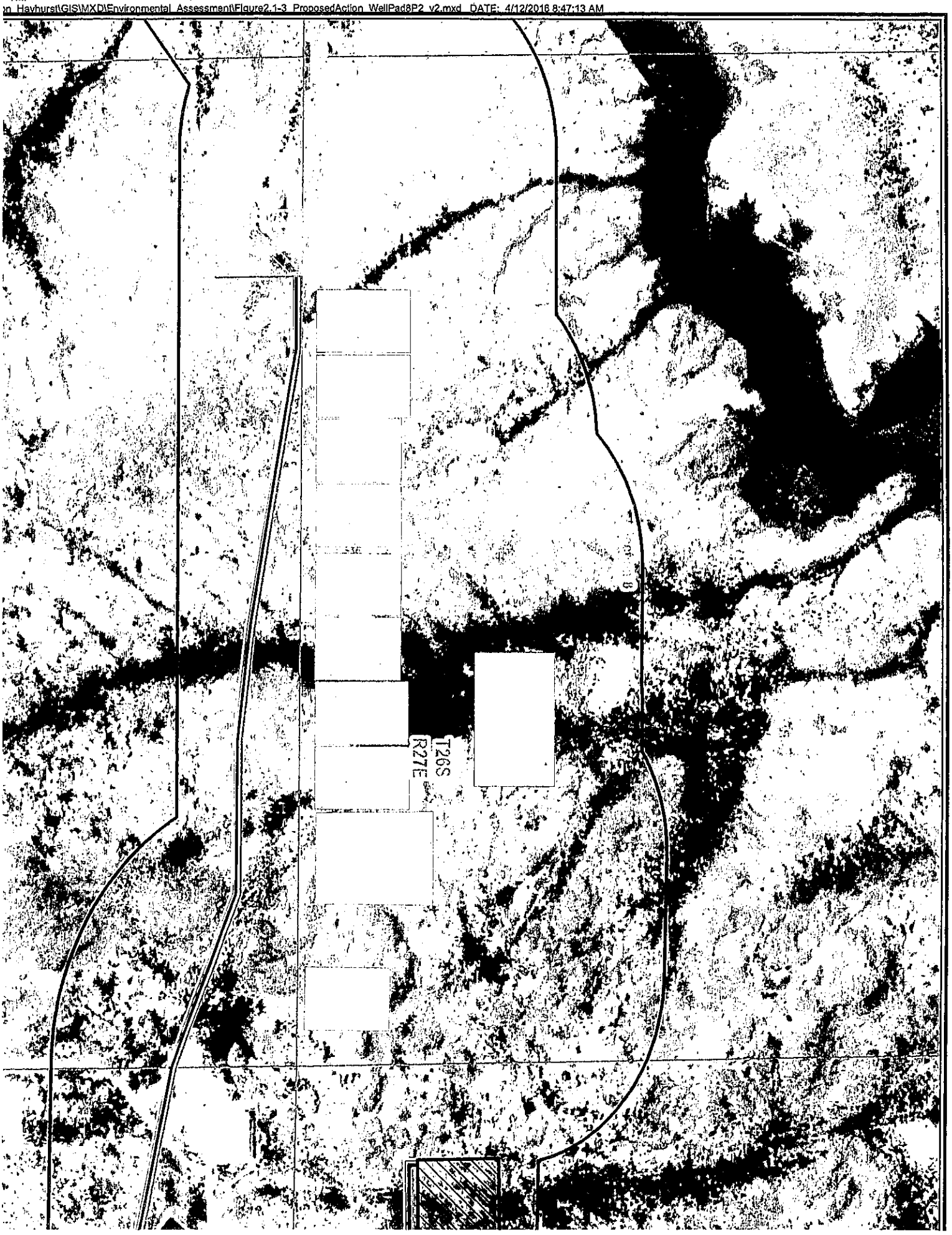
SURFACE USE PLAT

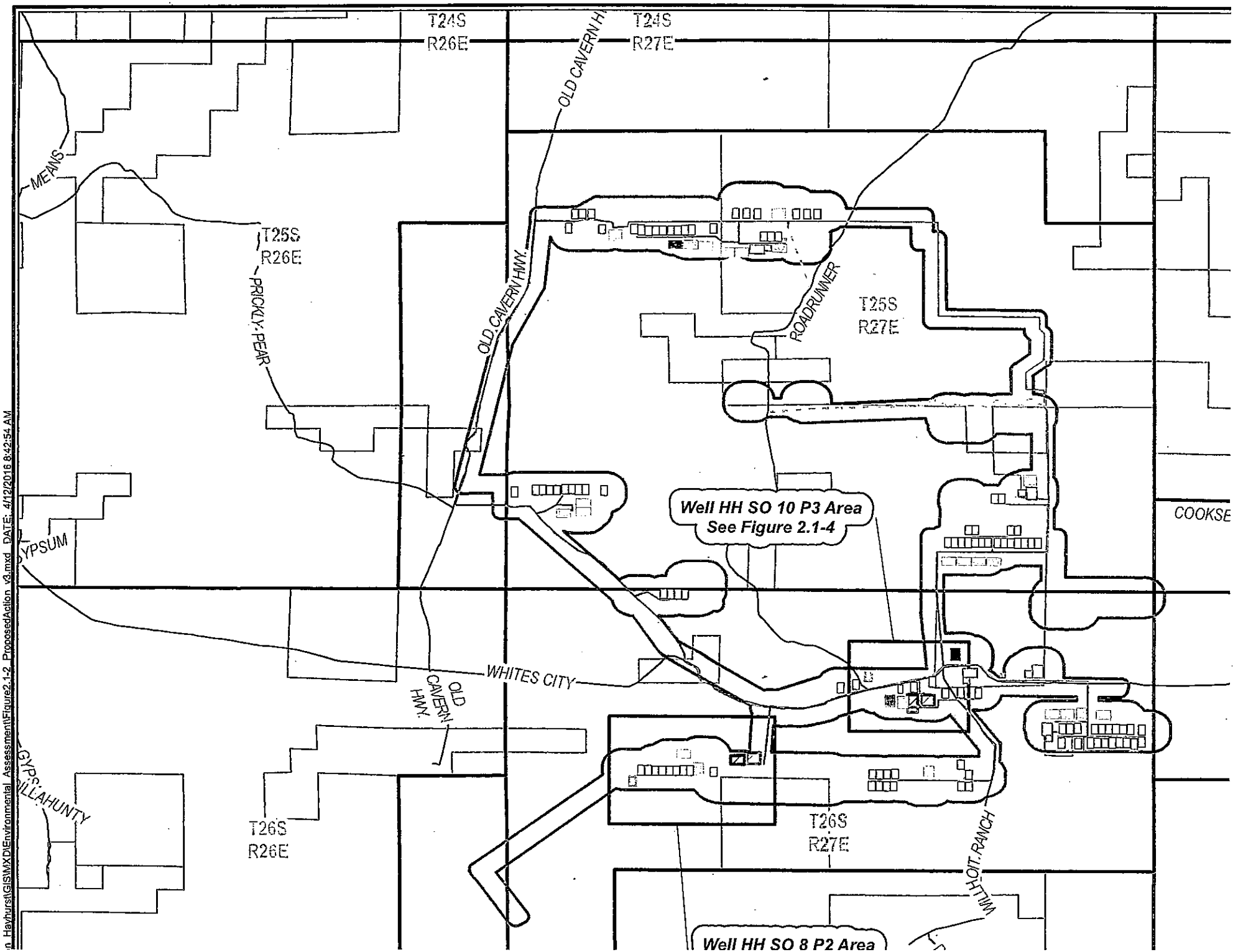
CHEVRON U.S.A. INC.

PROPOSED UTILITY LINE(2 & 3)
HH SO 8 P2
SECTION 9, T26S-R27E
EDDY COUNTY, NEW MEXICO

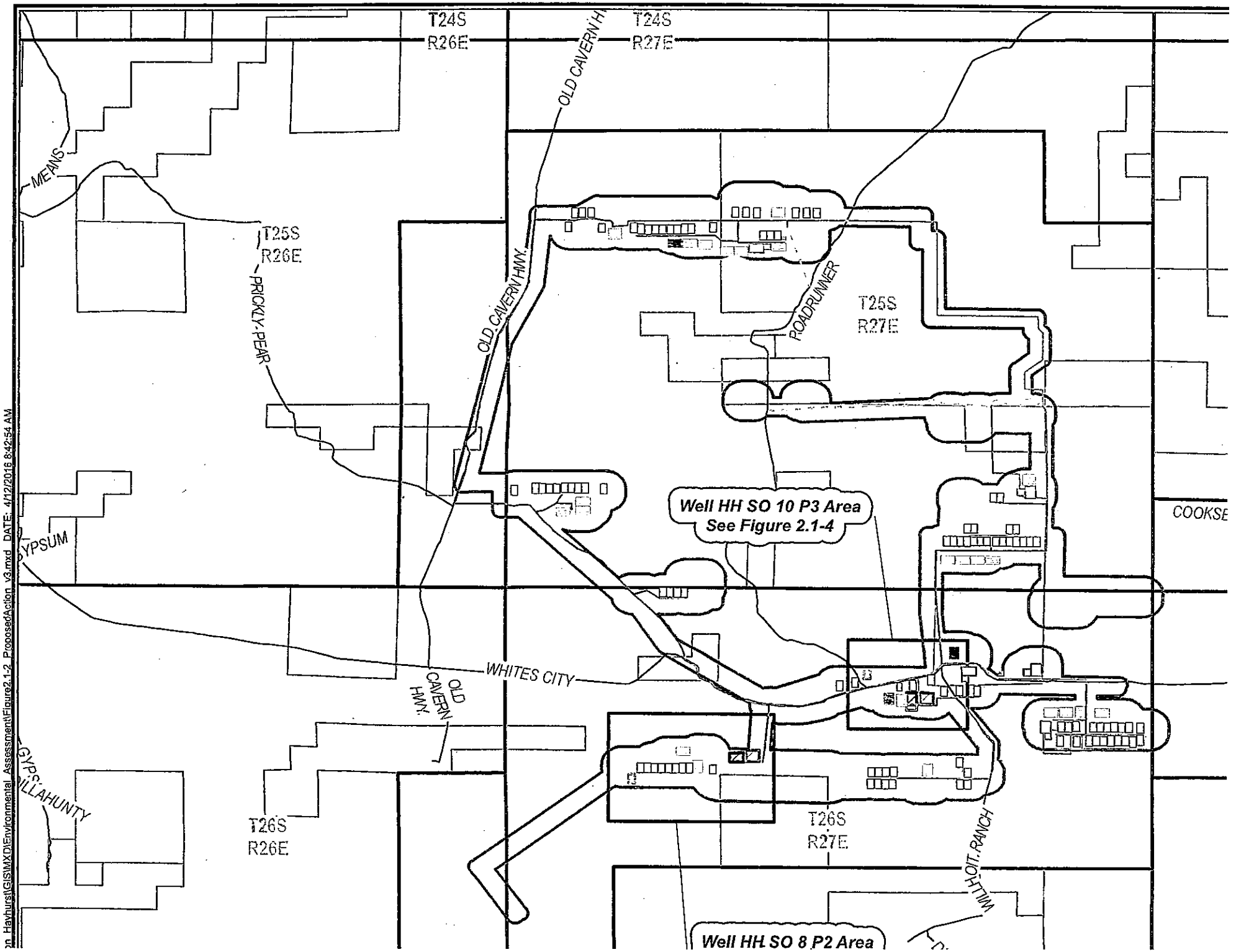
DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Utility 2 and 3_SUP.dwg			

TM:
on_Havhurst\GIS\MXD\Environmental_Assessment\Figure2.1-3_ProposedAction_WellPad8P2_v2.mxd DATE: 4/12/2016 8:47:13 AM

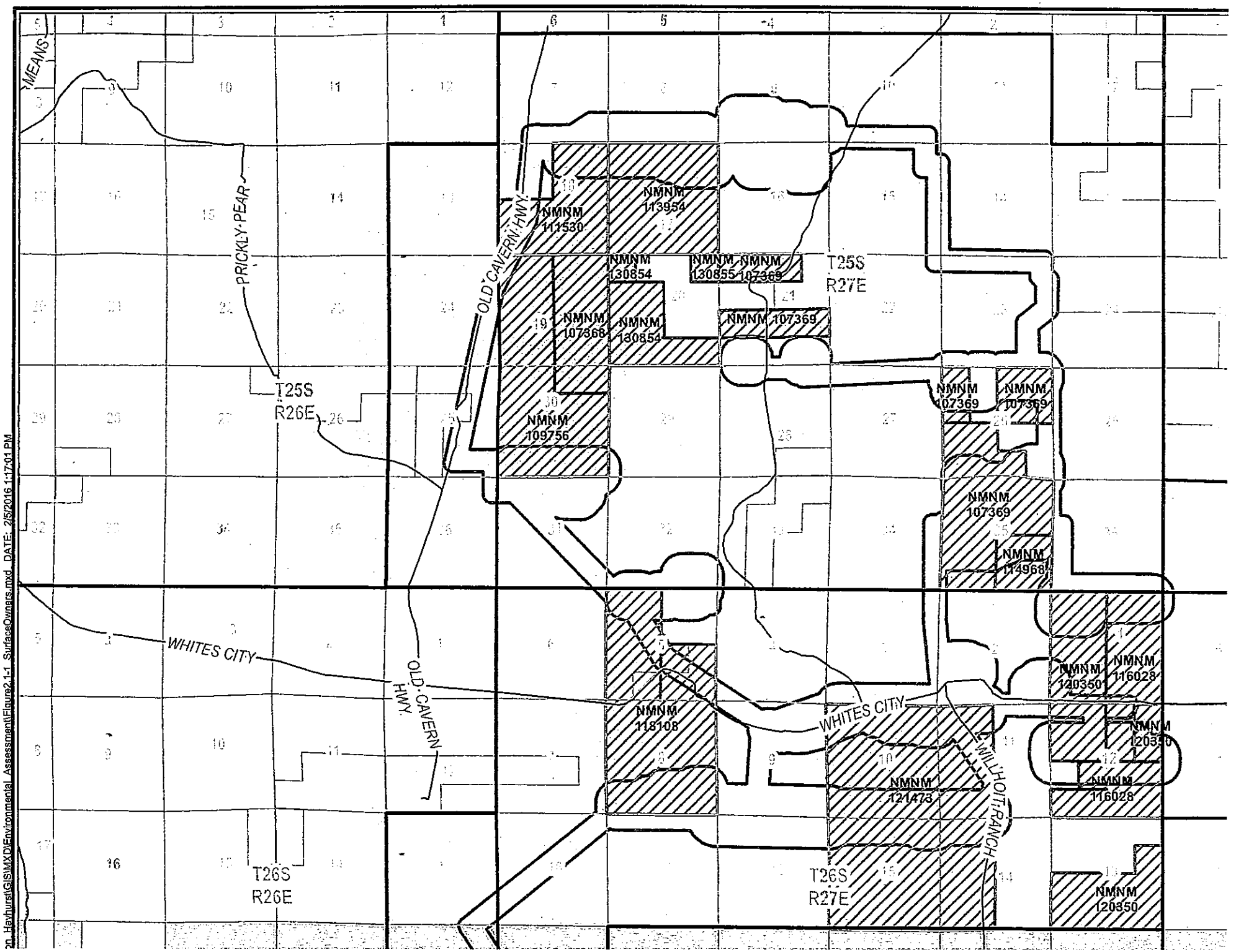




TM:
n_Hayhurst\GIS\MXD\Environmental_Assessment\Figure2.1-2_ProposedAction_v3.mxd DATE: 4/12/2016 8:42:54 AM

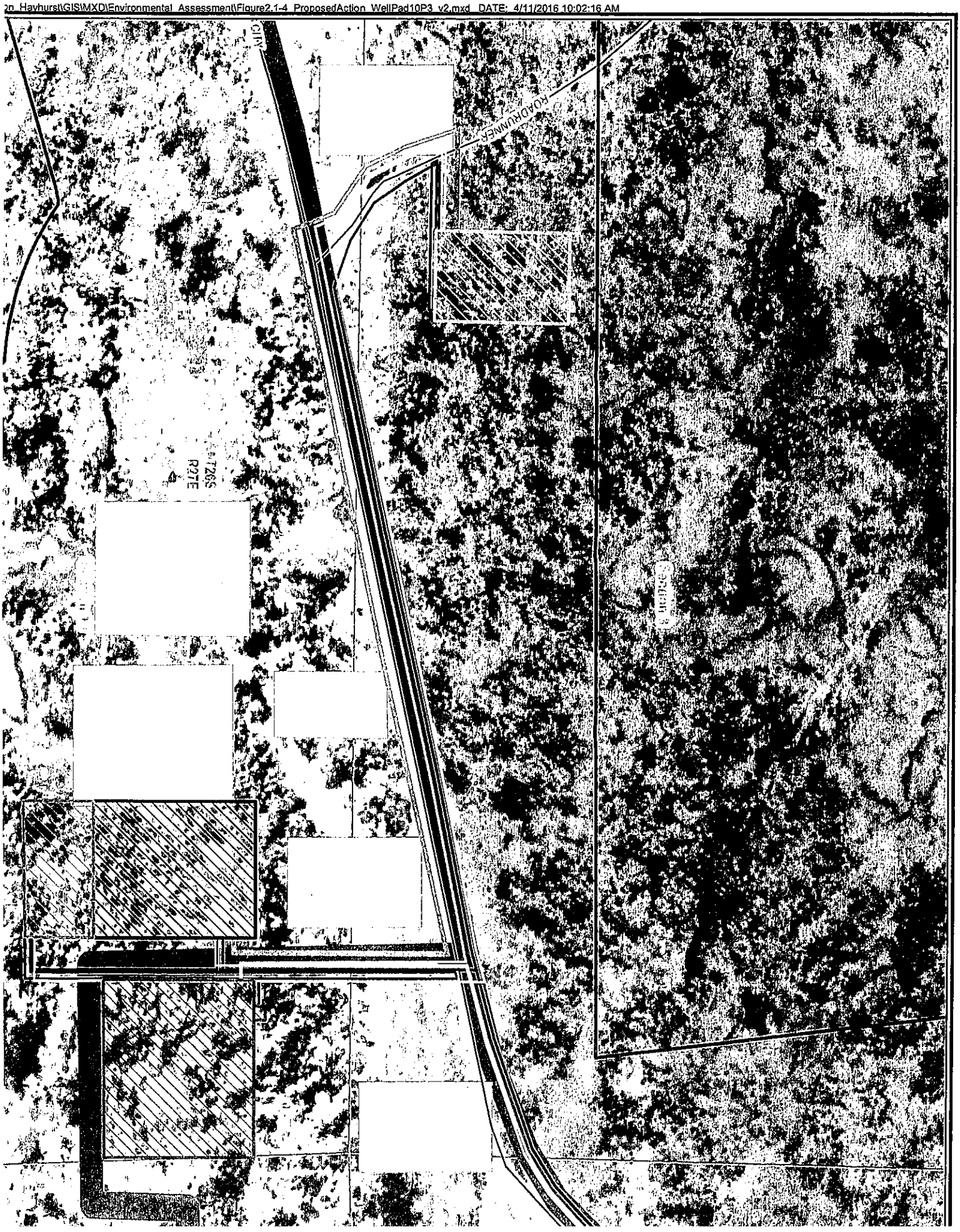


TM:
on Havhurst\GIS\MXD\Environmental Assessment\Figure2.1-2_ProposedAction_v3.mxd DATE: 4/12/2016 8:42:54 AM



TM:
2n_Havhurst\GIS\MXD\Environmental_Assessment\Figure2.1-1_SurfaceOwners.mxd DATE: 2/5/2016 1:17:01 PM

TM:
2n_Hayhurst\GIS\MXD\Environmental_Assessment\Figure2.1-4_ProposedAction_WellPad10P3_v2.mxd DATE: 4/11/2016 10:02:16 AM



CERTIFICATION

I hereby certify that I, or someone under my direct supervision, have inspected the drill site and access route proposed herein; that I am familiar with the conditions which currently exist; that I have full knowledge of state and federal laws applicable to this operation; that the statements made in this APD package are, to the best of my knowledge, true and correct; and, that the work associated with the operations proposed will be performed in conformity with this APD package and the terms and conditions under which it is approved. I also certify that I, or the company I represent, am responsible for the operations conducted under this application. These statements are subject to the provisions of 18 U.S.C. 1001 for the filing of a false statement.

Executed this 19th day of JANUARY, 2016

Name: _____

Sean Cheben-Project Manager

Address: 1400 Smith Street

Houston, TX 77002

Room 40125

Office: 713-372-9382

Email: Sean.Cheben@CHEVRON.COM

PECOS DISTRICT
CONDITIONS OF APPROVAL

OPERATOR'S NAME:	**Chevron USA Inc.**
LEASE NO.:	**NMNM-118108**
WELL NAME & NO.:	**HH SO 8 P2 14H**
SURFACE HOLE FOOTAGE:	**0330' FNL & 0960' FWL**
BOTTOM HOLE FOOTAGE	**0180' FNL & 0996' FWL Sec. 05, T. 26 S., R 27 E.**
LOCATION:	**Section 17, T. 26 S., R 27 E., NMPM**
COUNTY:	**Eddy County, New Mexico**

TABLE OF CONTENTS

Standard Conditions of Approval (COA) apply to this APD. If any deviations to these standards exist or special COAs are required, the section with the deviation or requirement will be checked below.

- ☐ **General Provisions**
- ☐ **Permit Expiration**
- ☐ **Archaeology, Paleontology, and Historical Sites**
- ☐ **Noxious Weeds**
- ☒ **Special Requirements**
  - Avian Protection
  - Raptor Nest
  - Cave/Karst
  - VRM
  - Cultural
- ☐ **Construction**
  - Notification
  - Topsoil
  - Closed Loop System
  - Federal Mineral Material Pits
  - Well Pads
  - Roads
- ☐ **Road Section Diagram**
- ☒ **Drilling**
  - Cement Requirements
  - High Cave/Karst
  - Logging Requirements
  - Waste Material and Fluids
- ☒ **Production (Post Drilling)**
  - Well Structures & Facilities
  - Pipelines
  - Electric Lines
- ☐ **Interim Reclamation**
- ☐ **Final Abandonment & Reclamation**

I. GENERAL PROVISIONS

The approval of the Application For Permit To Drill (APD) is in compliance with all applicable laws and regulations: 43 Code of Federal Regulations 3160, the lease terms, Onshore Oil and Gas Orders, Notices To Lessees, New Mexico Oil Conservation Division (NMOCD) Rules, National Historical Preservation Act As Amended, and instructions and orders of the Authorized Officer. Any request for a variance shall be submitted to the Authorized Officer on Form 3160-5, Sundry Notices and Report on Wells.

II. PERMIT EXPIRATION

If the permit terminates prior to drilling and drilling cannot be commenced within 60 days after expiration, an operator is required to submit Form 3160-5, Sundry Notices and Reports on Wells, requesting surface reclamation requirements for any surface disturbance. However, if the operator will be able to initiate drilling within 60 days after the expiration of the permit, the operator must have set the conductor pipe in order to allow for an extension of 60 days beyond the expiration date of the APD. (Filing of a Sundry Notice is required for this 60 day extension.)

III. ARCHAEOLOGICAL, PALEONTOLOGY & HISTORICAL SITES

Any cultural and/or paleontological resource discovered by the operator or by any person working on the operator's behalf shall immediately report such findings to the Authorized Officer. The operator is fully accountable for the actions of their contractors and subcontractors. The operator shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery shall be made by the Authorized Officer to determine the appropriate actions that shall be required to prevent the loss of significant cultural or scientific values of the discovery. The operator shall be held responsible for the cost of the proper mitigation measures that the Authorized Officer assesses after consultation with the operator on the evaluation and decisions of the discovery. Any unauthorized collection or disturbance of cultural or paleontological resources may result in a shutdown order by the Authorized Officer.

IV. NOXIOUS WEEDS

The operator shall be held responsible if noxious weeds become established within the areas of operations. Weed control shall be required on the disturbed land where noxious weeds exist, which includes the roads, pads, associated pipeline corridor, and adjacent land affected by the establishment of weeds due to this action. The operator shall consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies.

V. SPECIAL REQUIREMENT(S)

Avian Protection

Power lines shall be constructed and designed in accordance to standards outlined in "Suggested Practices for Avian Protection on Power lines: The State of the Art in 2006" Edison Electric Institute, APLIC, and the California Energy Commission 2006. The holder shall assume the burden and expense of proving that pole designs not shown in the above publication deter raptor perching, roosting, and nesting. Such proof shall be provided by a raptor expert approved by the Authorized Officer. The BLM reserves the right to require modification or additions to all power line structures placed on this right-of-way, should they be necessary to ensure the safety of large perching birds. The holder without liability or expense shall make such modifications and/or additions to the United States.

Raptor Nest Mitigation

- A BLM Wildlife Biologist must be contacted by the operator prior to construction activities to determine if the raptor nest is active.
- Raptor nests on special, natural habitat features, such as trees, large brush, cliff faces and escarpments, will be protected by not allowing surface disturbance within up to 200 meters of nests or by delaying activity for up to 90 days, or a combination of both. Exceptions to this requirement for raptor nests will be considered if the nests expected to be disturbed are inactive, the proposed activity is of short duration (e.g. habitat enhancement projects, fences, pipelines), and will not result in continuing activity in proximity to the nest.
- Exhaust noise from pump jack engines must be muffled or otherwise controlled so as not to exceed 75 db measured at 30 ft. from the source of the noise.

Visual Resource Management (VRM)

- Above-ground structures including meter housing that are not subject to safety requirements are painted a flat non-reflective paint color, Shale Green from the BLM Standard Environmental Color Chart (CC-001: June 2008)
- Chevron would use minimal light necessary for site safety, security, and operations.
- Light should be directed downward or only where needed.
- Low-pressure sodium lamps, such as yellow LED lighting (3,000 Kelvin or less) or equivalent, would be used to reduce sky glow and wildlife impacts.
- Properly shielded and mounted light fixtures would be used to reduce sky glow from upward pointing light, as well as trespass from light falling outside of desired area of illumination. Full cutoff shielding would be used during production.

Cave and Karst

** Depending on location, additional Drilling, Casing, and Cementing procedures may be required by engineering to protect critical karst groundwater recharge areas.

Cave/Karst Surface Mitigation

The following stipulations will be applied to minimize impacts during construction, drilling and production.

Construction:
In the advent that any underground voids are opened up during construction activities, construction activities will be halted and the BLM will be notified immediately.

No Blasting:
No blasting will be utilized for pad construction. The pad will be constructed and leveled by adding the necessary fill and caliche.

Pad Berming:
The entire perimeter of the well pad will be bermed to prevent oil, salt, and other chemical contaminants from leaving the well pad.

- The compacted berm shall be constructed at a minimum of 12 inches high with impermeable mineral material (e.g. caliche).
- No water flow from the uphill side(s) of the pad shall be allowed to enter the well pad.
- The topsoil stockpile shall be located outside the bermed well pad.
- Topsoil, either from the well pad or surrounding area, shall not be used to construct the berm.
- No storm drains, tubing or openings shall be placed in the berm.
- If fluid collects within the bermed area, the fluid must be vacuumed into a safe container and disposed of properly at a state approved facility.
- The integrity of the berm shall be maintained around the surfaced pad throughout the life of the well and around the downsized pad after interim reclamation has been completed.
- Any access road entering the well pad shall be constructed so that the integrity of the berm height surrounding the well pad is not compromised. (Any access road crossing the berm cannot be lower than the berm height.)

Tank Battery Liners and Berms:
Tank battery locations and all facilities will be lined and bermed. A 20 mil permanent liner will be installed with a 4 oz. felt backing to prevent tears or punctures. Tank battery berms must be large enough to contain 1 ½ times the content of the largest tank.

Leak Detection System:
A method of detecting leaks is required. The method could incorporate gauges to measure loss, situating values and lines so they can be visually inspected, or installing

electronic sensors to alarm when a leak is present. Leak detection plan will be submitted to BLM for approval.

Automatic Shut-off Systems:
Automatic shut off, check values, or similar systems will be installed for pipelines and tanks to minimize the effects of catastrophic line failures used in production or drilling.

Cave/Karst Subsurface Mitigation

The following stipulations will be applied to protect cave/karst and ground water concerns:

Rotary Drilling with Fresh Water:
Fresh water will be used as a circulating medium in zones where caves or karst features are expected. SEE ALSO: Drilling COAs for this well.

Directional Drilling:
Kick off for directional drilling will occur at least 100 feet below the bottom of the cave occurrence zone. SEE ALSO: Drilling COAs for this well.

Lost Circulation:
ALL lost circulation zones from the surface to the base of the cave occurrence zone will be logged and reported in the drilling report.

Regardless of the type of drilling machinery used, if a void of four feet or more and circulation losses greater than 70 percent occur simultaneously while drilling in any cave-bearing zone, the BLM will be notified immediately by the operator. The BLM will assess the situation and work with the operator on corrective actions to resolve the problem.

Abandonment Cementing:
Upon well abandonment in high cave karst areas additional plugging conditions of approval may be required. The BLM will assess the situation and work with the operator to ensure proper plugging of the wellbore.

Pressure Testing:
Annual pressure monitoring will be performed by the operator on all casing annuli and reported in a sundry notice. If the test results indicated a casing failure has occurred, remedial action will be undertaken to correct the problem to the BLM's approval.

VI. CONSTRUCTION

A. NOTIFICATION

The BLM shall administer compliance and monitor construction of the access road and well pad. Notify the Carlsbad Field Office at (575) 234-5909 at least 3 working days prior to commencing construction of the access road and/or well pad.

When construction operations are being conducted on this well, the operator shall have the approved APD and Conditions of Approval (COA) on the well site and they shall be made available upon request by the Authorized Officer.

B. TOPSOIL

The operator shall strip the top portion of the soil (root zone) from the entire well pad area and stockpile the topsoil along the edge of the well pad as depicted in the APD. The root zone is typically six (6) inches in depth. All the stockpiled topsoil will be redistributed over the interim reclamation areas. Topsoil shall not be used for berming the pad or facilities. For final reclamation, the topsoil shall be spread over the entire pad area for seeding preparation.

Other subsoil (below six inches) stockpiles must be completely segregated from the topsoil stockpile. Large rocks or subsoil clods (not evident in the surrounding terrain) must be buried within the approved area for interim and final reclamation.

C. CLOSED LOOP SYSTEM

Tanks are required for drilling operations: No Pits.

The operator shall properly dispose of drilling contents at an authorized disposal site.

D. FEDERAL MINERAL MATERIALS PIT

Payment shall be made to the BLM prior to removal of any federal mineral materials. Call the Carlsbad Field Office at (575) 234-5972.

E. WELL PAD SURFACING

Surfacing of the well pad is not required.

If the operator elects to surface the well pad, the surfacing material may be required to be removed at the time of reclamation.The well pad shall be constructed in a manner which creates the smallest possible surface disturbance, consistent with safety and operational needs.

F. EXCLOSURE FENCING (CELLARS & PITS)

Exclosure Fencing
The operator will install and maintain exclosure fencing for all open well cellars to prevent access to public, livestock, and large forms of wildlife before and after drilling operations until the pit is free of fluids and the operator initiates backfilling. (For examples of exclosure fencing design, refer to BLM's Oil and Gas Gold Book, Exclosure Fence Illustrations, Figure 1, Page 18.)

G. ON LEASE ACCESS ROADS

Road Width
The access road shall have a driving surface that creates the smallest possible surface disturbance and does not exceed fourteen (14) feet in width. The maximum width of surface disturbance, when constructing the access road, shall not exceed twenty-five (25) feet.

Surfacing
Surfacing material is not required on the new access road driving surface. If the operator elects to surface the new access road or pad, the surfacing material may be required to be removed at the time of reclamation.

Where possible, no improvements should be made on the unsurfaced access road other than to remove vegetation as necessary, road irregularities, safety issues, or to fill low areas that may sustain standing water.

The Authorized Officer reserves the right to require surfacing of any portion of the access road at any time deemed necessary. Surfacing may be required in the event the road deteriorates, erodes, road traffic increases, or it is determined to be beneficial for future field development. The surfacing depth and type of material will be determined at the time of notification.

Crowning
Crowning shall be done on the access road driving surface. The road crown shall have a grade of approximately 2% (i.e., a 1" crown on a 14' wide road). The road shall conform to Figure 1; cross section and plans for typical road construction.

Ditching
Ditching shall be required on both sides of the road.

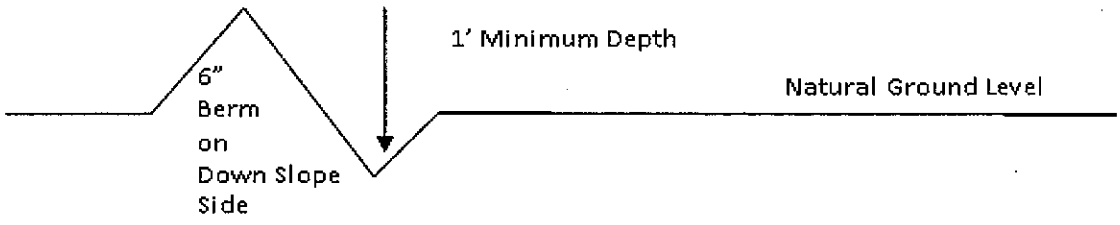
Turnouts
Vehicle turnouts shall be constructed on the road. Turnouts shall be intervisible with interval spacing distance less than 1000 feet. Turnouts shall conform to Figure 1; cross section and plans for typical road construction.

Drainage

Drainage control systems shall be constructed on the entire length of road (e.g. ditches, sidehill outsloping and insloping, lead-off ditches, culvert installation, and low water crossings).

A typical lead-off ditch has a minimum depth of 1 foot below and a berm of 6 inches above natural ground level. The berm shall be on the down-slope side of the lead-off ditch.

Cross Section of a Typical Lead-off Ditch



All lead-off ditches shall be graded to drain water with a 1 percent minimum to 3 percent maximum ditch slope. The spacing interval are variable for lead-off ditches and shall be determined according to the formula for spacing intervals of lead-off ditches, but may be amended depending upon existing soil types and centerline road slope (in %);

Formula for Spacing Interval of Lead-off Ditches

Example - On a 4% road slope that is 400 feet long, the water flow shall drain water into a lead-off ditch. Spacing interval shall be determined by the following formula:

400 foot road with 4% road slope: $\frac{400'}{4\%} + 100' = 200'$ lead-off ditch interval

Cattleguards

An appropriately sized cattleguard sufficient to carry out the project shall be installed and maintained at fence/road crossings. Any existing cattleguards on the access road route shall be repaired or replaced if they are damaged or have deteriorated beyond practical use. The operator shall be responsible for the condition of the existing cattleguards that are in place and are utilized during lease operations.

Fence Requirement

Where entry is granted across a fence line, the fence shall be braced and tied off on both sides of the passageway prior to cutting. The operator shall notify the private surface landowner or the grazing allotment holder prior to crossing any fences.

Public Access

Public access on this road shall not be restricted by the operator without specific written approval granted by the Authorized Officer.

Construction Steps

1. Salvage topsoil
2. Construct road
3. Redistribute topsoil
4. Revegetate slopes

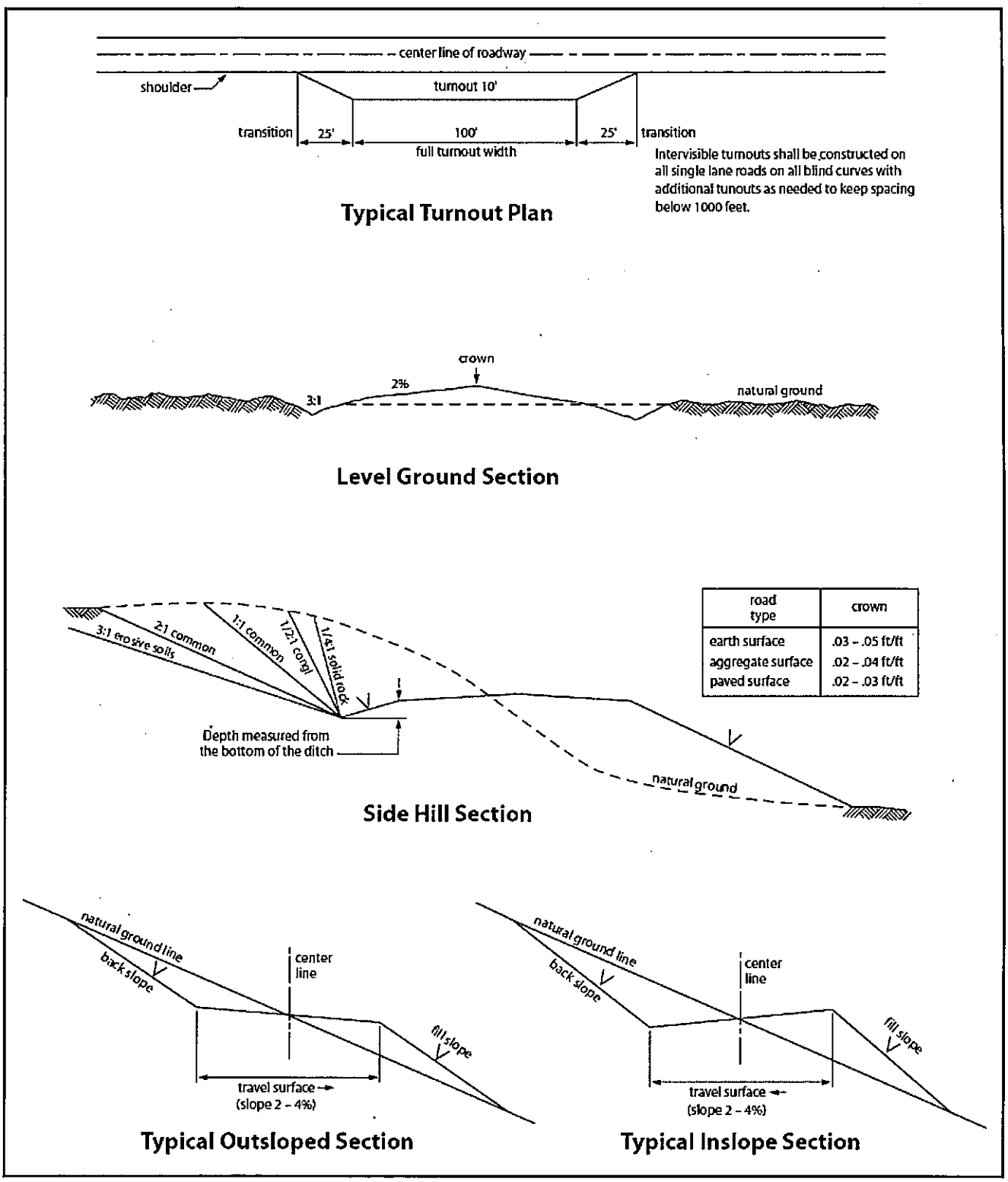


Figure 1. Cross-sections and plans for typical road sections representative of BLM resource or FS local and higher-class roads.

VII. DRILLING

A. DRILLING OPERATIONS REQUIREMENTS

The BLM is to be notified in advance for a representative to witness:

a. Spudding well (minimum of 24 hours)
b. Setting and/or Cementing of all casing strings (minimum of 4 hours)
c. BOPE tests (minimum of 4 hours)

☒ **Eddy County**

Call the Carlsbad Field Office, 620 East Greene St., Carlsbad, NM 88220, (575) 361-2822

1. **Hydrogen Sulfide (H2S) monitors shall be installed prior to drilling out the surface shoe. If H2S is detected in concentrations greater than 100 ppm, the Hydrogen Sulfide area shall meet Onshore Order 6 requirements, which includes equipment and personnel/public protection items. If Hydrogen Sulfide is encountered, provide measured values and formations to the BLM.**

2. Unless the production casing has been run and cemented or the well has been properly plugged, the drilling rig shall not be removed from over the hole without prior approval. **If the drilling rig is removed without approval – an Incident of Non-Compliance will be written and will be a "Major" violation.**

3. **The operator has proposed to drill multiple wells utilizing a skid/walking rig. Operator shall secure the wellbore on the current well, after installing and testing the wellhead, by installing a blind flange of like pressure rating to the wellhead and a pressure gauge that can be monitored while drilling is performed on the other wells.**

4. Floor controls are required for 3M or Greater systems. These controls will be on the rig floor, unobstructed, readily accessible to the driller and will be operational at all times during drilling and/or completion activities. Rig floor is defined as the area immediately around the rotary table; the area immediately above the substructure on which the draw works is located, this does not include the dog house or stairway area.

5. **The record of the drilling rate along with the GR/N well log run from TD to surface (horizontal well – vertical portion of hole) shall be submitted to the BLM office as well as all other logs run on the borehole 30 days from completion. If available, a digital copy of the logs is to be submitted in addition to the paper copies. The Rustler top and top and bottom of Salt are to be recorded on the Completion Report.**

B. CASING

Changes to the approved APD casing program need prior approval if the items substituted are of lesser grade or different casing size or are Non-API. The Operator can exchange the components of the proposal with that of superior strength (i.e. changing from J-55 to N-80, or from 36# to 40#). Changes to the approved cement program need prior approval if the altered cement plan has less

volume or strength or if the changes are substantial (i.e. Multistage tool, ECP, etc.). The initial wellhead installed on the well will remain on the well with spools used as needed.

Centralizers required on surface casing per Onshore Order 2.III.B.1.f.

Wait on cement (WOC) for Water Basin:
After cementing but before commencing any tests, the casing string shall stand cemented under pressure until both of the following conditions have been met: 1) cement reaches a minimum compressive strength of 500 psi at the shoe, 2) until cement has been in place at least 8 hours. WOC time will be recorded in the driller's log. See individual casing strings for details regarding lead cement slurry requirements.

Provide compressive strengths including hours to reach required 500 pounds compressive strength prior to cementing each casing string. Have well specific cement details onsite prior to pumping the cement for each casing string.

No pea gravel permitted for remedial or fall back remedial without prior authorization from the BLM engineer.

High Cave/Karst
Possibility of water flows in the Castillo and Salado.
Possibility of lost circulation in the Delaware.
Abnormal Pressures may be encountered when penetrating the 3rd Bone Spring Sandstone and all subsequent formations.

A MINIMUM OF TWO CASING STRINGS CEMENTED TO SURFACE IS REQUIRED IN HIGH CAVE/KARST AREAS. THE CEMENT MUST BE IN A SOLID SHEATH. THEREFORE, ONE INCH OPERATIONS ARE NOT SUFFICIENT TO PROTECT CAVE KARST RESOURCES. A CASING DESIGN THAT HAS A ONE INCH JOB PERFORMED DOES NOT COUNT AS A SOLID SHEATH. IF THE PRIMARY CEMENT JOB ON THE SURFACE CASING DOES NOT CIRCULATE, THEN THE NEXT TWO CASING STRINGS MUST BE CEMENTED TO SURFACE.

1. The **13-3/8** inch surface casing shall be set at approximately **450** feet (a minimum of 25 feet into the Rustler Anhydrite and above the salt) and cemented to the surface. **If salt is encountered, set casing at least 25 feet above the salt.**
    a. If cement does not circulate to the surface, the appropriate BLM office shall be notified and a temperature survey utilizing an electronic type temperature survey with surface log readout will be used or a cement bond log shall be run to verify the top of the cement. Temperature survey will be run a minimum of six hours after pumping cement and ideally between 8-10 hours after completing the cement job.

b. **Wait on cement (WOC) time for a primary cement job is to include the lead cement slurry.**
c. Wait on cement (WOC) time for a remedial job will be a minimum of 4 hours after bringing cement to surface or 500 pounds compressive strength, whichever is greater.
d. If cement falls back, remedial cementing will be done prior to drilling out that string.

Formation below the 13-3/8" shoe to be tested according to Onshore Order 2.III.B.1.i. Test to be done as a mud equivalency test using the mud weight necessary for the pore pressure of the formation below the shoe and the mud weight for the bottom of the hole. Report results to BLM office.

Intermediate casing shall be kept fluid filled while running into hole to meet BLM minimum collapse requirements.

2. The minimum required fill of cement behind the **9-5/8** inch intermediate casing is:

Operator has proposed DV tool at depth of 2100', but will adjust cement proportionately if moved. DV tool shall be set a minimum of 50' below previous shoe and a minimum of 200' above current shoe. Operator shall submit sundry if DV tool depth cannot be set in this range. If an ECP is used, it is to be set a minimum of 50' below the shoe to provide cement across the shoe. If it cannot be set below the shoe, a CBL shall be run to verify cement coverage.

a. First stage to DV tool:
☒ Cement to circulate. If cement does not circulate, contact the appropriate BLM office before proceeding with second stage cement job. Operator should have plans as to how they will achieve circulation on the next stage.
b. Second stage above DV tool:
☒ Cement to surface. If cement does not circulate see B.1.a, c-d above. **Wait on cement (WOC) time for a primary cement job is to include the lead cement slurry due to cave/karst. Excess calculates to 22% - Additional cement may be required.**

Formation below the 9-5/8" shoe to be tested according to Onshore Order 2.III.B.1.i. Test to be done as a mud equivalency test using the mud weight necessary for the pore pressure of the formation below the shoe (not the mud weight required to prevent dissolving the salt formation) and the mud weight for the bottom of the hole. Report results to BLM office.

The pilot hole plugging procedure is approved as written. Note plug top on Subsequent Report sundry of drilling activities.

Centralizers required on horizontal leg, must be type for horizontal service and a minimum of one every other joint.

3. The minimum required fill of cement behind the **5-1/2** inch production casing is:
   ☒ Cement as proposed by operator. Operator shall provide method of verification.

4. If hardband drill pipe is rotated inside casing, returns will be monitored for metal. If metal is found in samples, drill pipe will be pulled and rubber protectors which have a larger diameter than the tool joints of the drill pipe will be installed prior to continuing drilling operations.

C. PRESSURE CONTROL

1. All blowout preventer (BOP) and related equipment (BOPE) shall comply with well control requirements as described in Onshore Oil and Gas Order No. 2 and API 53.

2. Minimum working pressure of the blowout preventer (BOP) and related equipment (BOPE) required for drilling below the surface casing shoe shall be **10,000 (10M)** psi. **10M system requires an HCR valve, remote kill line and annular to match. The remote kill line is to be installed prior to testing the system and tested to stack pressure.** BOP/BOPE shall be tested after nipple up according to Onshore Order #2.

3. The appropriate BLM office shall be notified a minimum of 4 hours in advance for a representative to witness the tests.
   a. In a water basin, for all casing strings utilizing slips, these are to be set as soon as the crew and rig are ready and any fallback cement remediation has been done. The casing cut-off and BOP installation can be initiated four hours after installing the slips, which will be approximately six hours after bumping the plug. For those casing strings not using slips, the minimum wait time before cut-off is eight hours after bumping the plug. BOP/BOPE testing can begin after cut-off or once cement reaches 500 psi compressive strength (including lead when specified), whichever is greater. However, if the float does not hold, cut-off cannot be initiated until cement reaches 500 psi compressive strength (including lead when specified).
   b. The tests shall be done by an independent service company utilizing a test plug **not a cup or J-packer**.
   c. The test shall be run on a 5000 psi chart for a 2-3M BOP/BOP, on a 10000 psi chart for a 5M BOP/BOPE and on a 15000 psi chart for a 10M BOP/BOPE. If a linear chart is used, it shall be a one hour chart. A circular chart shall have a maximum 2 hour clock. If a twelve hour or twenty-four hour chart is used, tester shall make a notation that it is run with a two hour clock.
   d. The results of the test shall be reported to the appropriate BLM office.
   e. All tests are required to be recorded on a calibrated test chart. **A copy of the BOP/BOPE test chart and a copy of independent service company test will be submitted to the appropriate BLM office.**
   f. The BOP/BOPE test shall include a low pressure test from 250 to 300 psi. The test will be held for a minimum of 10 minutes if test is done with a test plug and 30 minutes without a test plug. This test shall be performed prior to the test at full stack pressure.

g. BOP/BOPE must be tested by an independent service company within 500 feet of the top of the **Wolfcamp** formation if the time between the setting of the intermediate casing and reaching this depth exceeds 20 days. This test does not exclude the test prior to drilling out the casing shoe as per Onshore Order No. 2.

D. DRILLING MUD

Mud system monitoring equipment, with derrick floor indicators and visual and audio alarms, shall be operating before drilling into the **Wolfcamp** formation, and shall be used until production casing is run and cemented.

E. DRILL STEM TEST

If drill stem tests are performed, Onshore Order 2.III.D shall be followed.

F. WASTE MATERIAL AND FLUIDS

All waste (i.e. drilling fluids, trash, salts, chemicals, sewage, gray water, etc.) created as a result of drilling operations and completion operations shall be safely contained and disposed of properly at a waste disposal facility. No waste material or fluid shall be disposed of on the well location or surrounding area.

Porto-johns and trash containers will be on-location during fracturing operations or any other crew-intensive operations.

JAM 072516

VIII. PRODUCTION (POST DRILLING)

A. WELL STRUCTURES & FACILITIES

Placement of Production Facilities

Production facilities should be placed on the well pad to allow for maximum interim recontouring and revegetation of the well location.

Exclosure Netting (Open-top Tanks)

Immediately following active drilling or completion operations, the operator will take actions necessary to prevent wildlife and livestock access, including avian wildlife, to all open-topped tanks that contain or have the potential to contain salinity sufficient to cause harm to wildlife or livestock, hydrocarbons, or Resource Conservation and Recovery Act of 1976-exempt hazardous substances. At a minimum, the operator will net, screen, or cover open-topped tanks to exclude wildlife and livestock and prevent mortality. If the operator uses netting, the operator will cover and secure the open portion of the tank to prevent wildlife entry. The operator will net, screen, or cover the tanks until the operator removes the tanks from the location or the tanks no longer contain substances that could be harmful to wildlife or livestock. Use a maximum netting mesh size of 1 ½ inches. The netting must not be in contact with fluids and must not have holes or gaps.

Chemical and Fuel Secondary Containment and Exclosure Screening

The operator will prevent all hazardous, poisonous, flammable, and toxic substances from coming into contact with soil and water. At a minimum, the operator will install and maintain an impervious secondary containment system for any tank or barrel containing hazardous, poisonous, flammable, or toxic substances sufficient to contain the contents of the tank or barrel and any drips, leaks, and anticipated precipitation. The operator will dispose of fluids within the containment system that do not meet applicable state or U. S. Environmental Protection Agency livestock water standards in accordance with state law; the operator must not drain the fluids to the soil or ground. The operator will design, construct, and maintain all secondary containment systems to prevent wildlife and livestock exposure to harmful substances. At a minimum, the operator will install effective wildlife and livestock exclosure systems such as fencing, netting, expanded metal mesh, lids, and grate covers. Use a maximum netting mesh size of 1 ½ inches.

Open-Vent Exhaust Stack Exclosures
The operator will construct, modify, equip, and maintain all open-vent exhaust stacks on production equipment to prevent birds and bats from entering, and to discourage perching, roosting, and nesting. (*Recommended exclosure structures on open-vent exhaust stacks are in the shape of a cone.*) Production equipment includes, but may not be limited to, tanks, heater-treaters, separators, dehydrators, flare stacks, in-line units, and compressor mufflers.

Containment Structures
Proposed production facilities such as storage tanks and other vessels will have a secondary containment structure that is constructed to hold the capacity of 1.5 times the largest tank, plus freeboard to account for precipitation, unless more stringent protective requirements are deemed necessary.

Painting Requirement
All above-ground structures including meter housing that are not subject to safety requirements shall be painted a flat non-reflective paint color, **Shale Green** from the BLM Standard Environmental Color Chart (CC-001: June 2008).

B. PIPELINES

BURIED PIPELINE STIPULATIONS

A copy of the application (Grant, APD, or Sundry Notice) and attachments, including conditions of approval, survey plat and/or map, will be on location during construction. BLM personnel may request to you a copy of your permit during construction to ensure compliance with all stipulations.

Holder agrees to comply with the following stipulations to the satisfaction of the Authorized Officer:

1. The Holder shall indemnify the United States against any liability for damage to life or property arising from the occupancy or use of public lands under this grant.

2. The Holder shall comply with all applicable Federal laws and regulations existing or hereafter enacted or promulgated. In any event, the holder shall comply with the Toxic Substances Control Act of 1976 as amended, 15 USC 2601 et seq. (1982) with regards to any toxic substances that are used, generated by or stored on the right-of-way or on facilities authorized under this right-of-way grant. (See 40 CFR Part 702-799 and especially, provisions on polychlorinated biphenyls, 40 CFR 761.1-761.193.) Additionally, any release of toxic substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act, section 102b. A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to the authorized officer concurrent with the filing of the reports to the involved Federal agency or State government.

3. The holder agrees to indemnify the United States against any liability arising from the release of any hazardous substance or hazardous waste (as these terms are defined in the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. 9601, et seq. or the Resource Conservation and Recovery Act, 42 U.S.C.6901, et seq.) on the Right-of-Way (unless the release or threatened release is wholly unrelated to the Right-of-Way holder's activity on the Right-of-Way), or resulting from the activity of the Right-of-Way holder on the Right-of-Way. This agreement applies without regard to whether a release is caused by the holder, its agent, or unrelated third parties.

4. If, during any phase of the construction, operation, maintenance, or termination of the pipeline, any oil or other pollutant should be discharged from the pipeline system, impacting Federal lands, the control and total removal, disposal, and cleaning up of such oil or other pollutant, wherever found, shall be the responsibility of holder, regardless of fault. Upon failure of holder to control, dispose of, or clean up such discharge on or affecting Federal lands, or to repair all damages resulting therefrom, on the Federal lands, the Authorized Officer may take such measures as he deems necessary to control and clean up the discharge and restore the area, including where appropriate, the aquatic environment and fish and wildlife habitats, at the full expense of the holder. Such action by the Authorized Officer shall not relieve holder of any responsibility as provided herein.

5. All construction and maintenance activity will be confined to the authorized right-of-way.

6. The pipeline will be buried with a minimum cover of **36** inches between the top of the pipe and ground level.

7. The maximum allowable disturbance for construction in this right-of-way will be **30** feet:

- Blading of vegetation within the right-of-way will be allowed: maximum width of blading operations will not exceed **20** feet. The trench is included in this area. (*Blading is defined as the complete removal of brush and ground vegetation.*)
- Clearing of brush species within the right-of-way will be allowed: maximum width of clearing operations will not exceed **30** feet. The trench and bladed area are included in this area. (*Clearing is defined as the removal of brush while leaving ground vegetation (grasses, weeds, etc.) intact. Clearing is best accomplished by holding the blade 4 to 6 inches above the ground surface.*)
- The remaining area of the right-of-way (if any) shall only be disturbed by compressing the vegetation. (*Compressing can be caused by vehicle tires, placement of equipment, etc.*)

8. The holder shall stockpile an adequate amount of topsoil where blading is allowed. The topsoil to be stripped is approximately ___6___ inches in depth. The topsoil will be segregated from other spoil piles from trench construction. The topsoil will be evenly distributed over the bladed area for the preparation of seeding.

9. The holder shall minimize disturbance to existing fences and other improvements on public lands. The holder is required to promptly repair improvements to at least their former state. Functional use of these improvements will be maintained at all times. The holder will contact the owner of any improvements prior to disturbing them. When necessary to pass through a fence line, the fence shall be braced on both sides of the passageway prior to cutting of the fence. No permanent gates will be allowed unless approved by the Authorized Officer.

10. Vegetation, soil, and rocks left as a result of construction or maintenance activity will be randomly scattered on this right-of-way and will not be left in rows, piles, or berms, unless otherwise approved by the Authorized Officer. The entire right-of-way shall be recontoured to match the surrounding landscape. The backfilled soil shall be compacted and a 6 inch berm will be left over the ditch line to allow for settling back to grade.

11. In those areas where erosion control structures are required to stabilize soil conditions, the holder will install such structures as are suitable for the specific soil conditions being encountered and which are in accordance with sound resource management practices.

12. The holder will reseed all disturbed areas. Seeding will be done according to the attached seeding requirements, using the following seed mix.

( ) seed mixture 1	( ) seed mixture 3
() seed mixture 2	(X) seed mixture 4
( ) seed mixture 2/LPC	( ) Aplomado Falcon Mixture

13. All above-ground structures not subject to safety requirements shall be painted by the holder to blend with the natural color of the landscape. The paint used shall be color which simulates "Standard Environmental Colors" – **Shale Green**, Munsell Soil Color No. 5Y 4/2.

14. The pipeline will be identified by signs at the point of origin and completion of the right-of-way and at all road crossings. At a minimum, signs will state the holder's name, BLM serial number, and the product being transported. All signs and information thereon will be posted in a permanent, conspicuous manner, and will be maintained in a legible condition for the life of the pipeline.

15. The holder shall not use the pipeline route as a road for purposes other than routine maintenance as determined necessary by the Authorized Officer in consultation with the holder before maintenance begins. The holder will take whatever steps are necessary to ensure that the pipeline route is not used as a roadway. As determined necessary during the life of the pipeline, the Authorized Officer may ask the holder to construct temporary deterrence structures.

16. Any cultural and/or paleontological resources (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the Authorized Officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery will be made by the Authorized Officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the Authorized Officer after consulting with the holder.

17. The operator shall be held responsible if noxious weeds become established within the areas of operations. Weed control shall be required on the disturbed land where noxious weeds exist, which includes associated roads, pipeline corridor and adjacent land affected by the establishment of weeds due to this action. The operator shall consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies.

18. Escape Ramps - The operator will construct and maintain pipeline/utility trenches [that are not otherwise fenced, screened, or netted] to prevent livestock, wildlife, and humans from becoming entrapped. At a minimum, the operator will construct and maintain escape ramps, ladders, or other methods of avian and terrestrial wildlife escape in the trenches according to the following criteria:

a. Any trench left open for eight (8) hours or less is not required to have escape ramps; however, before the trench is backfilled, the contractor/operator shall

inspect the trench for wildlife, remove all trapped wildlife, and release them at least 100 yards from the trench.

b. For trenches left open for eight (8) hours or more, earthen escape ramps (built at no more than a 30 degree slope and spaced no more than 500 feet apart) shall be placed in the trench.

C. ELECTRIC LINES

STANDARD STIPULATIONS FOR OVERHEAD ELECTRIC DISTRIBUTION LINES

A copy of the grant and attachments, including stipulations, survey plat and/or map, will be on location during construction. BLM personnel may request to you a copy of your permit during construction to ensure compliance with all stipulations.

Holder agrees to comply with the following stipulations to the satisfaction of the Authorized Officer:

1. The holder shall indemnify the United States against any liability for damage to life or property arising from the occupancy or use of public lands under this grant.

2. The holder shall comply with all applicable Federal laws and regulations existing or hereafter enacted or promulgated. In any event, the holder shall comply with the Toxic Substances Control Act of 1976 as amended, 15 USC 2601 et seq. (1982) with regards to any toxic substances that are used, generated by or stored on the right-of-way or on facilities authorized under this right-of-way grant. (See 40 CFR, Part 702-799 and especially, provisions on polychlorinated biphenyls, 40 CFR 761.1-761.193.) Additionally, any release of toxic substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR, Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act, section 102b. A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to the authorized officer concurrent with the filing of the reports to the involved Federal agency or State government.

3. The holder agrees to indemnify the United States against any liability arising from the release of any hazardous substance or hazardous waste (as these terms are defined in the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. 9601, et seq. or the Resource Conservation and Recovery Act, 42 U.S.C. 6901, et seq.) on the Right-of-Way (unless the release or threatened release is wholly unrelated to the Right-of-Way holder's activity on the Right-of-Way), or resulting from the activity of the Right-of-Way holder on the Right-of-Way. This agreement applies without regard to whether a release is caused by the holder, its agent, or unrelated third parties.

4. There will be no clearing or blading of the right-of-way unless otherwise agreed to in writing by the Authorized Officer.

5. Power lines shall be constructed and designed in accordance to standards outlined in

"Suggested Practices for Avian Protection on Power lines: The State of the Art in 2006" Edison Electric Institute, APLIC, and the California Energy Commission 2006 . The holder shall assume the burden and expense of proving that pole designs not shown in the above publication deter raptor perching, roosting, and nesting. Such proof shall be provided by a raptor expert approved by the Authorized Officer. The BLM reserves the right to require modification or additions to all powerline structures placed on this right-of-way, should they be necessary to ensure the safety of large perching birds. Such modifications and/or additions shall be made by the holder without liability or expense to the United States.

Raptor deterrence will consist of but not limited to the following: triangle perch discouragers shall be placed on each side of the cross arms and a nonconductive perching deterrence shall be placed on all vertical poles that extend past the cross arms.

6. The holder shall minimize disturbance to existing fences and other improvements on public lands. The holder is required to promptly repair improvements to at least their former state. Functional use of these improvements will be maintained at all times. The holder will contact the owner of any improvements prior to disturbing them. When necessary to pass through a fence line, the fence shall be braced on both sides of the passageway prior to cutting the fence. No permanent gates will be allowed unless approved by the Authorized Officer.

7. The BLM serial number assigned to this authorization shall be posted in a permanent, conspicuous manner where the power line crosses roads and at all serviced facilities. Numbers will be at least two inches high and will be affixed to the pole nearest the road crossing and at the facilities served.

8. Upon cancellation, relinquishment, or expiration of this grant, the holder shall comply with those abandonment procedures as prescribed by the Authorized Officer.

9. All surface structures (poles, lines, transformers, etc.) shall be removed within 180 days of abandonment, relinquishment, or termination of use of the serviced facility or facilities or within 180 days of abandonment, relinquishment, cancellation, or expiration of this grant, whichever comes first. This will not apply where the power line extends service to an active, adjoining facility or facilities.

10. Any cultural and/or paleontological resource (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the Authorized Officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery will be made by the Authorized Officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the Authorized Officer after consulting with the holder.

11. Special Stipulations:
    - For reclamation remove poles, lines, transformer, etc. and dispose of properly.
    - Fill in any holes from the poles removed.

IX. INTERIM RECLAMATION

During the life of the development, all disturbed areas not needed for active support of production operations should undergo interim reclamation in order to minimize the environmental impacts of development on other resources and uses.

Within six (6) months of well completion, operators should work with BLM surface management specialists (Jim Amos: 575-234-5909) to devise the best strategies to reduce the size of the location. Interim reclamation should allow for remedial well operations, as well as safe and efficient removal of oil and gas.

During reclamation, the removal of caliche is important to increasing the success of revegetating the site. Removed caliche that is free of contaminants may be used for road repairs, fire walls or for building other roads and locations. In order to operate the well or complete workover operations, it may be necessary to drive, park and operate on restored interim vegetation within the previously disturbed area. Disturbing revegetated areas for production or workover operations will be allowed. If there is significant disturbance and loss of vegetation, the area will need to be revegetated. Communicate with the appropriate BLM office for any exceptions/exemptions if needed.

All disturbed areas after they have been satisfactorily prepared need to be reseeded with the seed mixture provided below.

Upon completion of interim reclamation, the operator shall submit a Sundry Notices and Reports on Wells, Subsequent Report of Reclamation (Form 3160-5).

X. FINAL ABANDONMENT & RECLAMATION

At final abandonment, well locations, production facilities, and access roads must undergo "final" reclamation so that the character and productivity of the land are restored.

Earthwork for final reclamation must be completed within six (6) months of well plugging. All pads, pits, facility locations and roads must be reclaimed to a satisfactory revegetated, safe, and stable condition, unless an agreement is made with the landowner or BLM to keep the road and/or pad intact.

After all disturbed areas have been satisfactorily prepared, these areas need to be revegetated with the seed mixture provided below. Seeding should be accomplished by drilling on the contour whenever practical or by other approved methods. Seeding may need to be repeated until revegetation is successful, as determined by the BLM.

Operators shall contact a BLM surface protection specialist prior to surface abandonment operations for site specific objectives (Jim Amos: 575-234-5909).

Mixture 4, for Gypsum Sites

The holder shall seed all the disturbed areas with the seed mixture listed below. The seed mixture shall be planted in the amounts specified in pounds of pure live seed (PLS)* per acre. There shall be no primary or secondary noxious weeds in the seed mixture. Seed will be tested and the viability testing of seed will be done in accordance with State law(s) and within nine (9) months prior to purchase. Commercial seed will be either certified or registered seed. The seed container will be tagged in accordance with State law(s) and available for inspection by the authorized officer.

Seed will be planted using a drill equipped with a depth regulator to ensure proper depth of planting where drilling is possible. The seed mixture will be evenly and uniformly planted over the disturbed area (smaller/heavier seeds have a tendency to drop the bottom of the drill and are planted first). The holder shall take appropriate measures to ensure this does not occur. Where drilling is not possible, seed will be broadcast and the area shall be raked or chained to cover the seed. When broadcasting the seed, the pounds per acre are to be doubled. The seeding will be repeated until a satisfactory stand is established as determined by the authorized officer. Evaluation of growth will not be made before completion of at least one full growing season after seeding.

Species to be planted in pounds of pure live seed* per acre:

Species	lb/acre
Alkli Sacaton (*Sporobolus airoides*)	1.5
DWS~ Four-wing saltbush (*Atriplex canescens*)	8.0

~DWS: DeWinged Seed

*Pounds of pure live seed:

Pounds of seed **x** percent purity **x** percent germination = pounds pure live seed

United States Department of the Interior
Bureau of Land Management
Carlsbad Field Office

Refer to: 3160-3

To: AFM, Lands & Minerals, CFO
From: Geologist, CFO
Subject: Geologic Review of Application for Permit to Drill

ORIGINAL

Operator: Chevron USA Inc

Well Name and Number: HH SO 8 P2-14H

Potash: No

Location: SHL:330'/N.& 960'/W. SEC017 T026S, R027E.(NWNW)

County Eddy **Lease Number:** NMNM118108 **APD Received:** 2-18-2016

Ground Level Elevation: 3247 **Surface Geology:** Psl-Salado Formation

TVD: 9904 **MD:** 20551 **BH Mud Weight:** 13.5

BHP: 6953 **MASP:** 4774

1. Geologic Marker Tops (from reports on surrounding wells):

Geologic Marker	WELCH #004 3001501153 T26S R27E Sec 20 990FNL 330FEL Elevation Depth	WELCH ABV FEDERAL #001 3001501159 T26S R27E Sec 21 660FNL 760FWL Elevation Depth	BLAST BLA FEDERAL #001 3001536136 T26S R27E Sec 17 1980FSL 1650FEL Elevation Depth	Cluster State Com 1H 3001537547 T26S R27E Sec 16 380FNL 330FWL Elevation Depth	**Proposed Well** HH SO 8 P2-14H T026S, R027E.(NWNWSEC017 330'/N.& 960'/W Unit Elevation Estimated Depth
Top of Salt	-	-	0	0	0
Castile	432	-	-	480	525
Lamar	2040	2028	2137	2140	2015
Bell Canyon	2100	2062	2178	2200	2065
Bone Spring Lime	-	5690	5720	5740	5615
1st BS Sand	-	6570	6682	6684	6565
2nd BS Sand	-	7330	7350	7382	7245
3rd BS Sand	-	8410	8510	8537	8385
Wolfcamp	-	8763	8857	8894	8745
Strawn	-	11210	11248	-	11125

2. Fresh Water Information

a. Fresh Water: 350

b. Fresh Water Remarks:

NEPA Log No: IT4RM-P020-2016-1711-EA

Reference Number: NMNM118108

Project Lead: Paul Murphy

Recd Date: 09-30-2016

Project Type:

Project Title: HH SO 8 P2 14H

Applicant: Chevron USA Inc

Routing Started: 10-04-2016

NEPA Checklist

Resource/Activity	Not Present	Not Impacted	**May be Impacted	Reviewer	COAs/Stips Req	Sign Off Date
Wastes, Hazardous or Solid	○	◉	○	Paul Murphy	☐	10-04-2016
Public Health and Safety	○	◉	○			
Enivronmental Justice	○	◉	○			
General Topography/Surface Geology	○	◉	○	Paul Murphy	☐	10-04-2016
Socio Economics	○	◉	○			
Lands/Realty, ROW	○	◉	○	Robert Gomez	☑	10-06-2016
Access/Transportation	○	◉	○			
Vegetation/Forestry	○	○	◉			
Livestock Grazing	○	○	◉	Stephen Daly	☐	10-06-2016
Invasive, Non-Native Species	○	○	◉			
Soils	○	○	◉	Stephen Daly	☐	10-06-2016
Air Quality	○	○	◉			
Floodplains	○	◉	○			
Water Quality Surface/Ground	○	○	◉	Stephen Daly	☐	10-06-2016
Watershed	○	○	◉			
Mineral Materials	○	○	◉	Paul Murphy	☐	10-04-2016
Potash	◉	○	○	Paul Murphy	☐	10-04-2016
Endangered Species	◉	○	○			
Wetlands/Riparian Zones	◉	○	○	Cassandra Brooks	☐	10-06-2016
Special Status Species	◉	○	○			
Wildlife Habitat	○	○	◉			
Karst Resources	○	○	◉	Stan Allison	☑	10-07-2016
ACECs	○	◉	○	Cassandra Brooks	☐	10-06-2016
Wild/Scenic Rivers	◉	○	○			
Wilderness	◉	○	○	Stan Allison	☐	10-07-2016
Outdoor Recreation	○	○	◉			
Visual Resources	○	○	◉			
Native American Religious Concerns	◉ Unknown					
Cultural Resources	○	◉	○	Stephanie Bergman	☐	10-07-2016
Paleontology	◉ Unknown					

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Pecos District
Carlsbad Field Office
620 East Greene Street
Carlsbad, NM 88220

Hayhurst Master Development Plan Environmental Assessment

NEPA No. DOI-BLM-NM-P020-2016-1434-EA

Conditions of Approval

In order to ensure that the proponent's impacts are consistent with the operating parameters considered in the air quality analysis, Conditions of Approval (COA) will be applied to Applications for Permit to Drill requested under the Hayhurst Master Development Plan. These COAs are:

- All project activities including equipment emissions shall meet or exceed all state and federal standards for air quality as regulated by the New Mexico Environment Department Air Quality Bureau and the U.S. Environmental Protection Agency.

- The operator will implement a drill and completion rig schedule where Tier 4 (or equivalent) drill and completion rigs are phased in. The operator will not exceed four drill rigs at one time and will be 100% compliant with Tier 4 (or equivalent) standards in 2020.

- During the drilling phase, the operator will emit NOx emissions of 262.95 tons per year (tpy) or less from nonroad (mobile sources) between Year 1 and Year 3 and 220.7 tpy or less from nonroad (mobile sources) for the remainder of the drilling phase.

- The operator will emit 213.6 tpy or less of NOx emissions during production operations, as defined in the emission inventory analyzed in the Environmental Assessment. The operator will submit emissions and/or parameters with an Application for Permit to Drill or annual emissions inventory that show the NOx emissions are within the limits of the air quality analysis within the Environmental Assessment.

PECOS DISTRICT
CONDITIONS OF APPROVAL

OPERATOR'S NAME:	**Chevron USA Inc.**
LEASE NO.:	**NMNM-118108**
WELL NAME & NO.:	**HH SO 8 P2 14H**
SURFACE HOLE FOOTAGE:	**0330' FNL & 0960' FWL**
BOTTOM HOLE FOOTAGE	**0180' FNL & 0996' FWL Sec. 05, T. 26 S., R 27 E.**
LOCATION:	**Section 17, T. 26 S., R 27 E., NMPM**
COUNTY:	**Eddy County, New Mexico**

TABLE OF CONTENTS

Standard Conditions of Approval (COA) apply to this APD. If any deviations to these standards exist or special COAs are required, the section with the deviation or requirement will be checked below.

- ☐ **General Provisions**
- ☐ **Permit Expiration**
- ☐ **Archaeology, Paleontology, and Historical Sites**
- ☐ **Noxious Weeds**
- ☒ **Special Requirements**
  - Avian Protection
  - Raptor Nest
  - Cave/Karst
  - VRM
  - Cultural
- ☐ **Construction**
  - Notification
  - Topsoil
  - Closed Loop System
  - Federal Mineral Material Pits
  - Well Pads
  - Roads
- ☐ **Road Section Diagram**
- ☒ **Drilling**
  - Cement Requirements
  - High Cave/Karst
  - Logging Requirements
  - Waste Material and Fluids
- ☒ **Production (Post Drilling)**
  - Well Structures & Facilities
  - Pipelines
  - Electric Lines
- ☐ **Interim Reclamation**
- ☐ **Final Abandonment & Reclamation**

I. GENERAL PROVISIONS

The approval of the Application For Permit To Drill (APD) is in compliance with all applicable laws and regulations: 43 Code of Federal Regulations 3160, the lease terms, Onshore Oil and Gas Orders, Notices To Lessees, New Mexico Oil Conservation Division (NMOCD) Rules, National Historical Preservation Act As Amended, and instructions and orders of the Authorized Officer. Any request for a variance shall be submitted to the Authorized Officer on Form 3160-5, Sundry Notices and Report on Wells.

II. PERMIT EXPIRATION

If the permit terminates prior to drilling and drilling cannot be commenced within 60 days after expiration, an operator is required to submit Form 3160-5, Sundry Notices and Reports on Wells, requesting surface reclamation requirements for any surface disturbance. However, if the operator will be able to initiate drilling within 60 days after the expiration of the permit, the operator must have set the conductor pipe in order to allow for an extension of 60 days beyond the expiration date of the APD. (Filing of a Sundry Notice is required for this 60 day extension.)

III. ARCHAEOLOGICAL, PALEONTOLOGY & HISTORICAL SITES

Any cultural and/or paleontological resource discovered by the operator or by any person working on the operator's behalf shall immediately report such findings to the Authorized Officer. The operator is fully accountable for the actions of their contractors and subcontractors. The operator shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery shall be made by the Authorized Officer to determine the appropriate actions that shall be required to prevent the loss of significant cultural or scientific values of the discovery. The operator shall be held responsible for the cost of the proper mitigation measures that the Authorized Officer assesses after consultation with the operator on the evaluation and decisions of the discovery. Any unauthorized collection or disturbance of cultural or paleontological resources may result in a shutdown order by the Authorized Officer.

IV. NOXIOUS WEEDS

The operator shall be held responsible if noxious weeds become established within the areas of operations. Weed control shall be required on the disturbed land where noxious weeds exist, which includes the roads, pads, associated pipeline corridor, and adjacent land affected by the establishment of weeds due to this action. The operator shall consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies.

V. SPECIAL REQUIREMENT(S)

Avian Protection

Power lines shall be constructed and designed in accordance to standards outlined in "Suggested Practices for Avian Protection on Power lines: The State of the Art in 2006" Edison Electric Institute, APLIC, and the California Energy Commission 2006. The holder shall assume the burden and expense of proving that pole designs not shown in the above publication deter raptor perching, roosting, and nesting. Such proof shall be provided by a raptor expert approved by the Authorized Officer. The BLM reserves the right to require modification or additions to all power line structures placed on this right-of-way, should they be necessary to ensure the safety of large perching birds. The holder without liability or expense shall make such modifications and/or additions to the United States.

Raptor Nest Mitigation

- A BLM Wildlife Biologist must be contacted by the operator prior to construction activities to determine if the raptor nest is active.
- Raptor nests on special, natural habitat features, such as trees, large brush, cliff faces and escarpments, will be protected by not allowing surface disturbance within up to 200 meters of nests or by delaying activity for up to 90 days, or a combination of both. Exceptions to this requirement for raptor nests will be considered if the nests expected to be disturbed are inactive, the proposed activity is of short duration (e.g. habitat enhancement projects, fences, pipelines), and will not result in continuing activity in proximity to the nest.
- Exhaust noise from pump jack engines must be muffled or otherwise controlled so as not to exceed 75 db measured at 30 ft. from the source of the noise.

Visual Resource Management (VRM)

- Above-ground structures including meter housing that are not subject to safety requirements are painted a flat non-reflective paint color, Shale Green from the BLM Standard Environmental Color Chart (CC-001: June 2008)
- Chevron would use minimal light necessary for site safety, security, and operations.
- Light should be directed downward or only where needed.
- Low-pressure sodium lamps, such as yellow LED lighting (3,000 Kelvin or less) or equivalent, would be used to reduce sky glow and wildlife impacts.
- Properly shielded and mounted light fixtures would be used to reduce sky glow from upward pointing light, as well as trespass from light falling outside of desired area of illumination. Full cutoff shielding would be used during production.

Cave and Karst

** Depending on location, additional Drilling, Casing, and Cementing procedures may be required by engineering to protect critical karst groundwater recharge areas.

Cave/Karst Surface Mitigation

The following stipulations will be applied to minimize impacts during construction, drilling and production.

Construction:
In the advent that any underground voids are opened up during construction activities, construction activities will be halted and the BLM will be notified immediately.

No Blasting:
No blasting will be utilized for pad construction. The pad will be constructed and leveled by adding the necessary fill and caliche.

Pad Berming:
The entire perimeter of the well pad will be bermed to prevent oil, salt, and other chemical contaminants from leaving the well pad.

- The compacted berm shall be constructed at a minimum of 12 inches high with impermeable mineral material (e.g. caliche).
- No water flow from the uphill side(s) of the pad shall be allowed to enter the well pad.
- The topsoil stockpile shall be located outside the bermed well pad.
- Topsoil, either from the well pad or surrounding area, shall not be used to construct the berm.
- No storm drains, tubing or openings shall be placed in the berm.
- If fluid collects within the bermed area, the fluid must be vacuumed into a safe container and disposed of properly at a state approved facility.
- The integrity of the berm shall be maintained around the surfaced pad throughout the life of the well and around the downsized pad after interim reclamation has been completed.
- Any access road entering the well pad shall be constructed so that the integrity of the berm height surrounding the well pad is not compromised. (Any access road crossing the berm cannot be lower than the berm height.)

Tank Battery Liners and Berms:
Tank battery locations and all facilities will be lined and bermed. A 20 mil permanent liner will be installed with a 4 oz. felt backing to prevent tears or punctures. Tank battery berms must be large enough to contain 1 ½ times the content of the largest tank.

Leak Detection System:
A method of detecting leaks is required. The method could incorporate gauges to measure loss, situating values and lines so they can be visually inspected, or installing

electronic sensors to alarm when a leak is present. Leak detection plan will be submitted to BLM for approval.

Automatic Shut-off Systems:
Automatic shut off, check values, or similar systems will be installed for pipelines and tanks to minimize the effects of catastrophic line failures used in production or drilling.

Cave/Karst Subsurface Mitigation

The following stipulations will be applied to protect cave/karst and ground water concerns:

Rotary Drilling with Fresh Water:
Fresh water will be used as a circulating medium in zones where caves or karst features are expected. SEE ALSO: Drilling COAs for this well.

Directional Drilling:
Kick off for directional drilling will occur at least 100 feet below the bottom of the cave occurrence zone. SEE ALSO: Drilling COAs for this well.

Lost Circulation:
ALL lost circulation zones from the surface to the base of the cave occurrence zone will be logged and reported in the drilling report.

Regardless of the type of drilling machinery used, if a void of four feet or more and circulation losses greater than 70 percent occur simultaneously while drilling in any cave-bearing zone, the BLM will be notified immediately by the operator. The BLM will assess the situation and work with the operator on corrective actions to resolve the problem.

Abandonment Cementing:
Upon well abandonment in high cave karst areas additional plugging conditions of approval may be required. The BLM will assess the situation and work with the operator to ensure proper plugging of the wellbore.

Pressure Testing:
Annual pressure monitoring will be performed by the operator on all casing annuli and reported in a sundry notice. If the test results indicated a casing failure has occurred, remedial action will be undertaken to correct the problem to the BLM's approval.

VI. CONSTRUCTION

A. NOTIFICATION

The BLM shall administer compliance and monitor construction of the access road and well pad. Notify the Carlsbad Field Office at (575) 234-5909 at least 3 working days prior to commencing construction of the access road and/or well pad.

When construction operations are being conducted on this well, the operator shall have the approved APD and Conditions of Approval (COA) on the well site and they shall be made available upon request by the Authorized Officer.

B. TOPSOIL

The operator shall strip the top portion of the soil (root zone) from the entire well pad area and stockpile the topsoil along the edge of the well pad as depicted in the APD. The root zone is typically six (6) inches in depth. All the stockpiled topsoil will be redistributed over the interim reclamation areas. Topsoil shall not be used for berming the pad or facilities. For final reclamation, the topsoil shall be spread over the entire pad area for seeding preparation.

Other subsoil (below six inches) stockpiles must be completely segregated from the topsoil stockpile. Large rocks or subsoil clods (not evident in the surrounding terrain) must be buried within the approved area for interim and final reclamation.

C. CLOSED LOOP SYSTEM

Tanks are required for drilling operations: No Pits.

The operator shall properly dispose of drilling contents at an authorized disposal site.

D. FEDERAL MINERAL MATERIALS PIT

Payment shall be made to the BLM prior to removal of any federal mineral materials. Call the Carlsbad Field Office at (575) 234-5972.

E. WELL PAD SURFACING

Surfacing of the well pad is not required.

If the operator elects to surface the well pad, the surfacing material may be required to be removed at the time of reclamation.The well pad shall be constructed in a manner which creates the smallest possible surface disturbance, consistent with safety and operational needs.

F. EXCLOSURE FENCING (CELLARS & PITS)

Exclosure Fencing
The operator will install and maintain exclosure fencing for all open well cellars to prevent access to public, livestock, and large forms of wildlife before and after drilling operations until the pit is free of fluids and the operator initiates backfilling. (For examples of exclosure fencing design, refer to BLM's Oil and Gas Gold Book, Exclosure Fence Illustrations, Figure 1, Page 18.)

G. ON LEASE ACCESS ROADS

Road Width
The access road shall have a driving surface that creates the smallest possible surface disturbance and does not exceed fourteen (14) feet in width. The maximum width of surface disturbance, when constructing the access road, shall not exceed twenty-five (25) feet.

Surfacing
Surfacing material is not required on the new access road driving surface. If the operator elects to surface the new access road or pad, the surfacing material may be required to be removed at the time of reclamation.

Where possible, no improvements should be made on the unsurfaced access road other than to remove vegetation as necessary, road irregularities, safety issues, or to fill low areas that may sustain standing water.

The Authorized Officer reserves the right to require surfacing of any portion of the access road at any time deemed necessary. Surfacing may be required in the event the road deteriorates, erodes, road traffic increases, or it is determined to be beneficial for future field development. The surfacing depth and type of material will be determined at the time of notification.

Crowning
Crowning shall be done on the access road driving surface. The road crown shall have a grade of approximately 2% (i.e., a 1" crown on a 14' wide road). The road shall conform to Figure 1; cross section and plans for typical road construction.

Ditching
Ditching shall be required on both sides of the road.

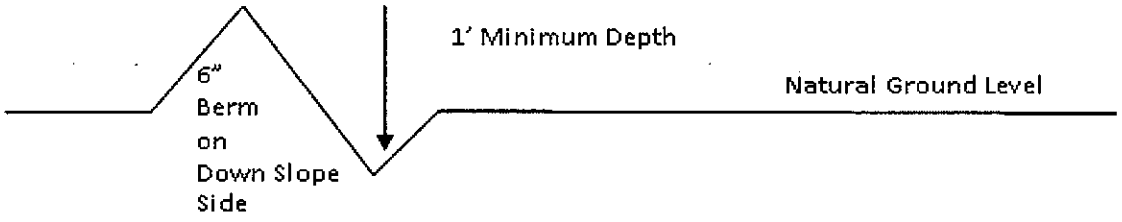
Turnouts
Vehicle turnouts shall be constructed on the road. Turnouts shall be intervisible with interval spacing distance less than 1000 feet. Turnouts shall conform to Figure 1; cross section and plans for typical road construction.

Drainage

Drainage control systems shall be constructed on the entire length of road (e.g. ditches, sidehill outsloping and insloping, lead-off ditches, culvert installation, and low water crossings).

A typical lead-off ditch has a minimum depth of 1 foot below and a berm of 6 inches above natural ground level. The berm shall be on the down-slope side of the lead-off ditch.

Cross Section of a Typical Lead-off Ditch



All lead-off ditches shall be graded to drain water with a 1 percent minimum to 3 percent maximum ditch slope. The spacing interval are variable for lead-off ditches and shall be determined according to the formula for spacing intervals of lead-off ditches, but may be amended depending upon existing soil types and centerline road slope (in %);

Formula for Spacing Interval of Lead-off Ditches

Example - On a 4% road slope that is 400 feet long, the water flow shall drain water into a lead-off ditch. Spacing interval shall be determined by the following formula:

400 foot road with 4% road slope: $\frac{400'}{4\%} + 100' = 200'$ lead-off ditch interval

Cattleguards

An appropriately sized cattleguard sufficient to carry out the project shall be installed and maintained at fence/road crossings. Any existing cattleguards on the access road route shall be repaired or replaced if they are damaged or have deteriorated beyond practical use. The operator shall be responsible for the condition of the existing cattleguards that are in place and are utilized during lease operations.

Fence Requirement

Where entry is granted across a fence line, the fence shall be braced and tied off on both sides of the passageway prior to cutting. The operator shall notify the private surface landowner or the grazing allotment holder prior to crossing any fences.

Public Access

Public access on this road shall not be restricted by the operator without specific written approval granted by the Authorized Officer.

Construction Steps

1. Salvage topsoil
2. Construct road
3. Redistribute topsoil
4. Revegetate slopes

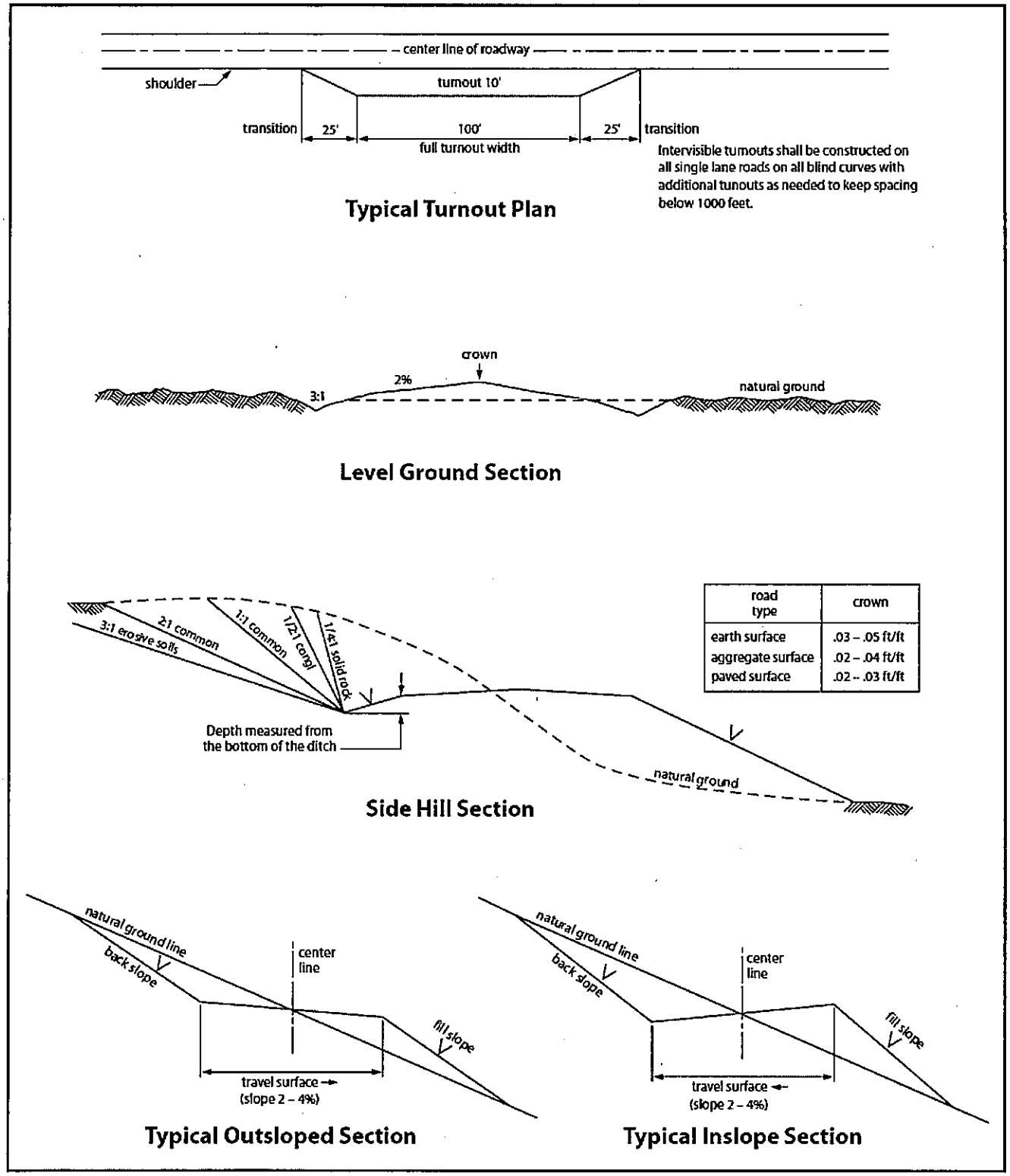


Figure 1. Cross-sections and plans for typical road sections representative of BLM resource or FS local and higher-class roads.

VII. DRILLING

A. DRILLING OPERATIONS REQUIREMENTS

The BLM is to be notified in advance for a representative to witness:

a. Spudding well (minimum of 24 hours)
b. Setting and/or Cementing of all casing strings (minimum of 4 hours)
c. BOPE tests (minimum of 4 hours)

☒ **Eddy County**
Call the Carlsbad Field Office, 620 East Greene St., Carlsbad, NM 88220, (575) 361-2822

1. **Hydrogen Sulfide (H2S) monitors shall be installed prior to drilling out the surface shoe. If H2S is detected in concentrations greater than 100 ppm, the Hydrogen Sulfide area shall meet Onshore Order 6 requirements, which includes equipment and personnel/public protection items. If Hydrogen Sulfide is encountered, provide measured values and formations to the BLM.**

2. Unless the production casing has been run and cemented or the well has been properly plugged, the drilling rig shall not be removed from over the hole without prior approval. **If the drilling rig is removed without approval – an Incident of Non-Compliance will be written and will be a "Major" violation.**

3. **The operator has proposed to drill multiple wells utilizing a skid/walking rig. Operator shall secure the wellbore on the current well, after installing and testing the wellhead, by installing a blind flange of like pressure rating to the wellhead and a pressure gauge that can be monitored while drilling is performed on the other wells.**

4. Floor controls are required for 3M or Greater systems. These controls will be on the rig floor, unobstructed, readily accessible to the driller and will be operational at all times during drilling and/or completion activities. Rig floor is defined as the area immediately around the rotary table; the area immediately above the substructure on which the draw works is located, this does not include the dog house or stairway area.

5. **The record of the drilling rate along with the GR/N well log run from TD to surface (horizontal well – vertical portion of hole) shall be submitted to the BLM office as well as all other logs run on the borehole 30 days from completion. If available, a digital copy of the logs is to be submitted in addition to the paper copies. The Rustler top and top and bottom of Salt are to be recorded on the Completion Report.**

B. CASING

Changes to the approved APD casing program need prior approval if the items substituted are of lesser grade or different casing size or are Non-API. The Operator can exchange the components of the proposal with that of superior strength (i.e. changing from J-55 to N-80, or from 36# to 40#). Changes to the approved cement program need prior approval if the altered cement plan has less volume or strength or if the changes are substantial (i.e. Multistage tool, ECP, etc.). The initial wellhead installed on the well will remain on the well with spools used as needed.

Centralizers required on surface casing per Onshore Order 2.III.B.1.f.

Wait on cement (WOC) for Water Basin:
After cementing but before commencing any tests, the casing string shall stand cemented under pressure until both of the following conditions have been met: 1) cement reaches a minimum compressive strength of 500 psi at the shoe, 2) until cement has been in place at least 8 hours. WOC time will be recorded in the driller's log. See individual casing strings for details regarding lead cement slurry requirements.

Provide compressive strengths including hours to reach required 500 pounds compressive strength prior to cementing each casing string. Have well specific cement details onsite prior to pumping the cement for each casing string.

No pea gravel permitted for remedial or fall back remedial without prior authorization from the BLM engineer.

High Cave/Karst
Possibility of water flows in the Castillo and Salado.
Possibility of lost circulation in the Delaware.
Abnormal Pressures may be encountered when penetrating the 3rd Bone Spring Sandstone and all subsequent formations.

A MINIMUM OF TWO CASING STRINGS CEMENTED TO SURFACE IS REQUIRED IN HIGH CAVE/KARST AREAS. THE CEMENT MUST BE IN A SOLID SHEATH. THEREFORE, ONE INCH OPERATIONS ARE NOT SUFFICIENT TO PROTECT CAVE KARST RESOURCES. A CASING DESIGN THAT HAS A ONE INCH JOB PERFORMED DOES NOT COUNT AS A SOLID SHEATH. IF THE PRIMARY CEMENT JOB ON THE SURFACE CASING DOES NOT CIRCULATE, THEN THE NEXT TWO CASING STRINGS MUST BE CEMENTED TO SURFACE.

1. The **13-3/8** inch surface casing shall be set at approximately **450** feet (a minimum of 25 feet into the Rustler Anhydrite and above the salt) and cemented to the surface. **If salt is encountered, set casing at least 25 feet above the salt.**

    a. If cement does not circulate to the surface, the appropriate BLM office shall be notified and a temperature survey utilizing an electronic type temperature survey with surface log readout will be used or a cement bond log shall be run to verify the top of the cement. Temperature survey will be run a minimum of six hours after pumping cement and ideally between 8-10 hours after completing the cement job.

    b. Wait on cement (WOC) time for a primary cement job is to include the lead cement slurry.

    c. Wait on cement (WOC) time for a remedial job will be a minimum of 4 hours after bringing cement to surface or 500 pounds compressive strength, whichever is greater.

    d. If cement falls back, remedial cementing will be done prior to drilling out that string.

Formation below the 13-3/8" shoe to be tested according to Onshore Order 2.III.B.1.i. Test to be done as a mud equivalency test using the mud weight necessary for the pore pressure of the formation below the shoe and the mud weight for the bottom of the hole. Report results to BLM office.

Intermediate casing shall be kept fluid filled while running into hole to meet BLM minimum collapse requirements.

2. The minimum required fill of cement behind the **9-5/8** inch intermediate casing is:

Operator has proposed DV tool at depth of 2100', but will adjust cement proportionately if moved. DV tool shall be set a minimum of 50' below previous shoe and a minimum of 200' above current shoe. Operator shall submit sundry if DV tool depth cannot be set in this range. If an ECP is used, it is to be set a minimum of 50' below the shoe to provide cement across the shoe. If it cannot be set below the shoe, a CBL shall be run to verify cement coverage.

a. First stage to DV tool:

☒ Cement to circulate. If cement does not circulate, contact the appropriate BLM office before proceeding with second stage cement job. Operator should have plans as to how they will achieve circulation on the next stage.

b. Second stage above DV tool:

☒ Cement to surface. If cement does not circulate see B.1.a, c-d above. **Wait on cement (WOC) time for a primary cement job is to include the lead cement slurry due to cave/karst. Excess calculates to 22% - Additional cement may be required.**

Formation below the 9-5/8" shoe to be tested according to Onshore Order 2.III.B.1.i. Test to be done as a mud equivalency test using the mud weight necessary for the pore pressure of the formation below the shoe (not the mud weight required to prevent dissolving the salt formation) and the mud weight for the bottom of the hole. Report results to BLM office.

The pilot hole plugging procedure is approved as written. Note plug top on Subsequent Report sundry of drilling activities.

Centralizers required on horizontal leg, must be type for horizontal service and a minimum of one every other joint.

3. The minimum required fill of cement behind the **5-1/2** inch production casing is:

   ☒ Cement as proposed by operator. Operator shall provide method of verification.

4. If hardband drill pipe is rotated inside casing, returns will be monitored for metal. If metal is found in samples, drill pipe will be pulled and rubber protectors which have a larger diameter than the tool joints of the drill pipe will be installed prior to continuing drilling operations.

C. PRESSURE CONTROL

1. All blowout preventer (BOP) and related equipment (BOPE) shall comply with well control requirements as described in Onshore Oil and Gas Order No. 2 and API 53.

2. Minimum working pressure of the blowout preventer (BOP) and related equipment (BOPE) required for drilling below the surface casing shoe shall be **10,000 (10M)** psi. **10M system requires an HCR valve, remote kill line and annular to match. The remote kill line is to be installed prior to testing the system and tested to stack pressure.** BOP/BOPE shall be tested after nipple up according to Onshore Order #2.

3. The appropriate BLM office shall be notified a minimum of 4 hours in advance for a representative to witness the tests.

    a. In a water basin, for all casing strings utilizing slips, these are to be set as soon as the crew and rig are ready and any fallback cement remediation has been done. The casing cut-off and BOP installation can be initiated four hours after installing the slips, which will be approximately six hours after bumping the plug. For those casing strings not using slips, the minimum wait time before cut-off is eight hours after bumping the plug. BOP/BOPE testing can begin after cut-off or once cement reaches 500 psi compressive strength (including lead when specified), whichever is greater. However, if the float does not hold, cut-off cannot be initiated until cement reaches 500 psi compressive strength (including lead when specified).

    b. The tests shall be done by an independent service company utilizing a test plug **not a cup or J-packer**.

    c. The test shall be run on a 5000 psi chart for a 2-3M BOP/BOP, on a 10000 psi chart for a 5M BOP/BOPE and on a 15000 psi chart for a 10M BOP/BOPE. If a linear chart is used, it shall be a one hour chart. A circular chart shall have a maximum 2 hour clock. If a twelve hour or twenty-four hour chart is used, tester shall make a notation that it is run with a two hour clock.

    d. The results of the test shall be reported to the appropriate BLM office.

    e. All tests are required to be recorded on a calibrated test chart. **A copy of the BOP/BOPE test chart and a copy of independent service company test will be submitted to the appropriate BLM office.**

    f. The BOP/BOPE test shall include a low pressure test from 250 to 300 psi. The test will be held for a minimum of 10 minutes if test is done with a test plug and 30 minutes without a test plug. This test shall be performed prior to the test at full stack pressure.

    g. BOP/BOPE must be tested by an independent service company within 500 feet of the top of the **Wolfcamp** formation if the time between the setting of the intermediate casing and reaching this depth exceeds 20 days. This test does not exclude the test prior to drilling out the casing shoe as per Onshore Order No. 2.

D. DRILLING MUD

Mud system monitoring equipment, with derrick floor indicators and visual and audio alarms, shall be operating before drilling into the **Wolfcamp** formation, and shall be used until production casing is run and cemented.

E. DRILL STEM TEST

If drill stem tests are performed, Onshore Order 2.III.D shall be followed.

F. WASTE MATERIAL AND FLUIDS

All waste (i.e. drilling fluids, trash, salts, chemicals, sewage, gray water, etc.) created as a result of drilling operations and completion operations shall be safely contained and disposed of properly at a waste disposal facility. No waste material or fluid shall be disposed of on the well location or surrounding area.

Porto-johns and trash containers will be on-location during fracturing operations or any other crew-intensive operations.

JAM 072516

VIII. PRODUCTION (POST DRILLING)

A. WELL STRUCTURES & FACILITIES

Placement of Production Facilities
Production facilities should be placed on the well pad to allow for maximum interim recontouring and revegetation of the well location.

Exclosure Netting (Open-top Tanks)
Immediately following active drilling or completion operations, the operator will take actions necessary to prevent wildlife and livestock access, including avian wildlife, to all open-topped tanks that contain or have the potential to contain salinity sufficient to cause harm to wildlife or livestock, hydrocarbons, or Resource Conservation and Recovery Act of 1976-exempt hazardous substances. At a minimum, the operator will net, screen, or cover open-topped tanks to exclude wildlife and livestock and prevent mortality. If the operator uses netting, the operator will cover and secure the open portion of the tank to prevent wildlife entry. The operator will net, screen, or cover the tanks until the operator removes the tanks from the location or the tanks no longer contain substances that could be harmful to wildlife or livestock. Use a maximum netting mesh size of 1 ½ inches. The netting must not be in contact with fluids and must not have holes or gaps.

Chemical and Fuel Secondary Containment and Exclosure Screening
The operator will prevent all hazardous, poisonous, flammable, and toxic substances from coming into contact with soil and water. At a minimum, the operator will install and maintain an impervious secondary containment system for any tank or barrel containing hazardous, poisonous, flammable, or toxic substances sufficient to contain the contents of the tank or barrel and any drips, leaks, and anticipated precipitation. The operator will dispose of fluids within the containment system that do not meet applicable state or U. S. Environmental Protection Agency livestock water standards in accordance with state law; the operator must not drain the fluids to the soil or ground. The operator will design, construct, and maintain all secondary containment systems to prevent wildlife and livestock exposure to harmful substances. At a minimum, the operator will install effective wildlife and livestock exclosure systems such as fencing, netting, expanded metal mesh, lids, and grate covers. Use a maximum netting mesh size of 1 ½ inches.

Open-Vent Exhaust Stack Exclosures
The operator will construct, modify, equip, and maintain all open-vent exhaust stacks on production equipment to prevent birds and bats from entering, and to discourage perching, roosting, and nesting. (*Recommended exclosure structures on open-vent exhaust stacks are in the shape of a cone.*) Production equipment includes, but may not be limited to, tanks, heater-treaters, separators, dehydrators, flare stacks, in-line units, and compressor mufflers.

Containment Structures
Proposed production facilities such as storage tanks and other vessels will have a secondary containment structure that is constructed to hold the capacity of 1.5 times the

largest tank, plus freeboard to account for precipitation, unless more stringent protective requirements are deemed necessary.

Painting Requirement
All above-ground structures including meter housing that are not subject to safety requirements shall be painted a flat non-reflective paint color, **Shale Green** from the BLM Standard Environmental Color Chart (CC-001: June 2008).

B. PIPELINES

BURIED PIPELINE STIPULATIONS

A copy of the application (Grant, APD, or Sundry Notice) and attachments, including conditions of approval, survey plat and/or map, will be on location during construction. BLM personnel may request to you a copy of your permit during construction to ensure compliance with all stipulations.

Holder agrees to comply with the following stipulations to the satisfaction of the Authorized Officer:

1. The Holder shall indemnify the United States against any liability for damage to life or property arising from the occupancy or use of public lands under this grant.

2. The Holder shall comply with all applicable Federal laws and regulations existing or hereafter enacted or promulgated. In any event, the holder shall comply with the Toxic Substances Control Act of 1976 as amended, 15 USC 2601 et seq. (1982) with regards to any toxic substances that are used, generated by or stored on the right-of-way or on facilities authorized under this right-of-way grant. (See 40 CFR Part 702-799 and especially, provisions on polychlorinated biphenyls, 40 CFR 761.1-761.193.) Additionally, any release of toxic substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act, section 102b. A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to the authorized officer concurrent with the filing of the reports to the involved Federal agency or State government.

3. The holder agrees to indemnify the United States against any liability arising from the release of any hazardous substance or hazardous waste (as these terms are defined in the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. 9601, et seq. or the Resource Conservation and Recovery Act, 42 U.S.C.6901, et seq.) on the Right-of-Way (unless the release or threatened release is wholly unrelated to the Right-of-Way holder's activity on the Right-of-Way), or resulting from the activity of the Right-of-Way holder on the Right-of-Way. This agreement applies without regard to whether a release is caused by the holder, its agent, or unrelated third parties.

4. If, during any phase of the construction, operation, maintenance, or termination of the pipeline, any oil or other pollutant should be discharged from the pipeline system, impacting Federal lands, the control and total removal, disposal, and cleaning up of such oil or other pollutant, wherever found, shall be the responsibility of holder, regardless of fault. Upon failure of holder to control, dispose of, or clean up such discharge on or affecting Federal lands, or to repair all damages resulting therefrom, on the Federal lands, the Authorized Officer may take such measures as he deems necessary to control and clean up the discharge and restore the area, including where appropriate, the aquatic environment and fish and wildlife habitats, at the full expense of the holder. Such action by the Authorized Officer shall not relieve holder of any responsibility as provided herein.

5. All construction and maintenance activity will be confined to the authorized right-of-way.

6. The pipeline will be buried with a minimum cover of **36** inches between the top of the pipe and ground level.

7. The maximum allowable disturbance for construction in this right-of-way will be **30** feet:

- Blading of vegetation within the right-of-way will be allowed: maximum width of blading operations will not exceed **20** feet. The trench is included in this area. (*Blading is defined as the complete removal of brush and ground vegetation.*)

- Clearing of brush species within the right-of-way will be allowed: maximum width of clearing operations will not exceed **30** feet. The trench and bladed area are included in this area. (*Clearing is defined as the removal of brush while leaving ground vegetation (grasses, weeds, etc.) intact. Clearing is best accomplished by holding the blade 4 to 6 inches above the ground surface.*)

- The remaining area of the right-of-way (if any) shall only be disturbed by compressing the vegetation. (*Compressing can be caused by vehicle tires, placement of equipment, etc.*)

8. The holder shall stockpile an adequate amount of topsoil where blading is allowed. The topsoil to be stripped is approximately 6 inches in depth. The topsoil will be segregated from other spoil piles from trench construction. The topsoil will be evenly distributed over the bladed area for the preparation of seeding.

9. The holder shall minimize disturbance to existing fences and other improvements on public lands. The holder is required to promptly repair improvements to at least their former state. Functional use of these improvements will be maintained at all times. The holder will contact the owner of any improvements prior to disturbing them. When necessary to pass through a fence line, the fence shall be braced on both sides of the passageway prior to cutting of the fence. No permanent gates will be allowed unless approved by the Authorized Officer.

10. Vegetation, soil, and rocks left as a result of construction or maintenance activity will be randomly scattered on this right-of-way and will not be left in rows, piles, or berms, unless otherwise approved by the Authorized Officer. The entire right-of-way shall be recontoured to match the surrounding landscape. The backfilled soil shall be compacted and a 6 inch berm will be left over the ditch line to allow for settling back to grade.

11. In those areas where erosion control structures are required to stabilize soil conditions, the holder will install such structures as are suitable for the specific soil conditions being encountered and which are in accordance with sound resource management practices.

12. The holder will reseed all disturbed areas. Seeding will be done according to the attached seeding requirements, using the following seed mix.

( ) seed mixture 1 ( ) seed mixture 3

() seed mixture 2 (X) seed mixture 4

( ) seed mixture 2/LPC ( ) Aplomado Falcon Mixture

13. All above-ground structures not subject to safety requirements shall be painted by the holder to blend with the natural color of the landscape. The paint used shall be color which simulates "Standard Environmental Colors" – **Shale Green**, Munsell Soil Color No. 5Y 4/2.

14. The pipeline will be identified by signs at the point of origin and completion of the right-of-way and at all road crossings. At a minimum, signs will state the holder's name, BLM serial number, and the product being transported. All signs and information thereon will be posted in a permanent, conspicuous manner, and will be maintained in a legible condition for the life of the pipeline.

15. The holder shall not use the pipeline route as a road for purposes other than routine maintenance as determined necessary by the Authorized Officer in consultation with the holder before maintenance begins. The holder will take whatever steps are necessary to

ensure that the pipeline route is not used as a roadway. As determined necessary during the life of the pipeline, the Authorized Officer may ask the holder to construct temporary deterrence structures.

16. Any cultural and/or paleontological resources (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the Authorized Officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery will be made by the Authorized Officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the Authorized Officer after consulting with the holder.

17. The operator shall be held responsible if noxious weeds become established within the areas of operations. Weed control shall be required on the disturbed land where noxious weeds exist, which includes associated roads, pipeline corridor and adjacent land affected by the establishment of weeds due to this action. The operator shall consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies.

18. Escape Ramps - The operator will construct and maintain pipeline/utility trenches [that are not otherwise fenced, screened, or netted] to prevent livestock, wildlife, and humans from becoming entrapped. At a minimum, the operator will construct and maintain escape ramps, ladders, or other methods of avian and terrestrial wildlife escape in the trenches according to the following criteria:

a. Any trench left open for eight (8) hours or less is not required to have escape ramps; however, before the trench is backfilled, the contractor/operator shall inspect the trench for wildlife, remove all trapped wildlife, and release them at least 100 yards from the trench.
b. For trenches left open for eight (8) hours or more, earthen escape ramps (built at no more than a 30 degree slope and spaced no more than 500 feet apart) shall be placed in the trench.

C. ELECTRIC LINES

STANDARD STIPULATIONS FOR OVERHEAD ELECTRIC DISTRIBUTION LINES

A copy of the grant and attachments, including stipulations, survey plat and/or map, will be on location during construction. BLM personnel may request to you a copy of your permit during construction to ensure compliance with all stipulations.

Holder agrees to comply with the following stipulations to the satisfaction of the Authorized Officer:

1. The holder shall indemnify the United States against any liability for damage to life or property arising from the occupancy or use of public lands under this grant.

2. The holder shall comply with all applicable Federal laws and regulations existing or hereafter enacted or promulgated. In any event, the holder shall comply with the Toxic Substances Control Act of 1976 as amended, 15 USC 2601 et seq. (1982) with regards to any toxic substances that are used, generated by or stored on the right-of-way or on facilities authorized under this right-of-way grant. (See 40 CFR, Part 702-799 and especially, provisions on polychlorinated biphenyls, 40 CFR 761.1-761.193.) Additionally, any release of toxic substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR, Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act, section 102b. A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to the authorized officer concurrent with the filing of the reports to the involved Federal agency or State government.

3. The holder agrees to indemnify the United States against any liability arising from the release of any hazardous substance or hazardous waste (as these terms are defined in the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. 9601, et seq. or the Resource Conservation and Recovery Act, 42 U.S.C. 6901, et seq.) on the Right-of-Way (unless the release or threatened release is wholly unrelated to the Right-of-Way holder's activity on the Right-of-Way), or resulting from the activity of the Right-of-Way holder on the Right-of-Way. This agreement applies without regard to whether a release is caused by the holder, its agent, or unrelated third parties.

4. There will be no clearing or blading of the right-of-way unless otherwise agreed to in writing by the Authorized Officer.

5. Power lines shall be constructed and designed in accordance to standards outlined in "Suggested Practices for Avian Protection on Power lines: The State of the Art in 2006" Edison Electric Institute, APLIC, and the California Energy Commission 2006 . The holder shall assume the burden and expense of proving that pole designs not shown in the above publication deter raptor perching, roosting, and nesting. Such proof shall be provided by a raptor expert approved by the Authorized Officer. The BLM reserves the right to require modification or additions to all powerline structures placed on this right-of-way, should they be necessary to ensure the safety of large perching birds. Such modifications and/or additions shall be made by the holder without liability or expense to the United States.

Raptor deterrence will consist of but not limited to the following: triangle perch discouragers shall be placed on each side of the cross arms and a nonconductive perching deterrence shall be placed on all vertical poles that extend past the cross arms.

6. The holder shall minimize disturbance to existing fences and other improvements on

public lands. The holder is required to promptly repair improvements to at least their former state. Functional use of these improvements will be maintained at all times. The holder will contact the owner of any improvements prior to disturbing them. When necessary to pass through a fence line, the fence shall be braced on both sides of the passageway prior to cutting the fence. No permanent gates will be allowed unless approved by the Authorized Officer.

7. The BLM serial number assigned to this authorization shall be posted in a permanent, conspicuous manner where the power line crosses roads and at all serviced facilities. Numbers will be at least two inches high and will be affixed to the pole nearest the road crossing and at the facilities served.

8. Upon cancellation, relinquishment, or expiration of this grant, the holder shall comply with those abandonment procedures as prescribed by the Authorized Officer.

9. All surface structures (poles, lines, transformers, etc.) shall be removed within 180 days of abandonment, relinquishment, or termination of use of the serviced facility or facilities or within 180 days of abandonment, relinquishment, cancellation, or expiration of this grant, whichever comes first. This will not apply where the power line extends service to an active, adjoining facility or facilities.

10. Any cultural and/or paleontological resource (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the Authorized Officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery will be made by the Authorized Officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the Authorized Officer after consulting with the holder.

11. Special Stipulations:
- For reclamation remove poles, lines, transformer, etc. and dispose of properly.
- Fill in any holes from the poles removed.

IX. INTERIM RECLAMATION

During the life of the development, all disturbed areas not needed for active support of production operations should undergo interim reclamation in order to minimize the environmental impacts of development on other resources and uses.

Within six (6) months of well completion, operators should work with BLM surface management specialists (Jim Amos: 575-234-5909) to devise the best strategies to reduce the size of the location. Interim reclamation should allow for remedial well operations, as well as safe and efficient removal of oil and gas.

During reclamation, the removal of caliche is important to increasing the success of revegetating the site. Removed caliche that is free of contaminants may be used for road repairs, fire walls or for building other roads and locations. In order to operate the well or complete workover operations, it may be necessary to drive, park and operate on restored interim vegetation within the previously disturbed area. Disturbing revegetated areas for production or workover operations will be allowed. If there is significant disturbance and loss of vegetation, the area will need to be revegetated. Communicate with the appropriate BLM office for any exceptions/exemptions if needed.

All disturbed areas after they have been satisfactorily prepared need to be reseeded with the seed mixture provided below.

Upon completion of interim reclamation, the operator shall submit a Sundry Notices and Reports on Wells, Subsequent Report of Reclamation (Form 3160-5).

X. FINAL ABANDONMENT & RECLAMATION

At final abandonment, well locations, production facilities, and access roads must undergo "final" reclamation so that the character and productivity of the land are restored.

Earthwork for final reclamation must be completed within six (6) months of well plugging. All pads, pits, facility locations and roads must be reclaimed to a satisfactory revegetated, safe, and stable condition, unless an agreement is made with the landowner or BLM to keep the road and/or pad intact.

After all disturbed areas have been satisfactorily prepared, these areas need to be revegetated with the seed mixture provided below. Seeding should be accomplished by drilling on the contour whenever practical or by other approved methods. Seeding may need to be repeated until revegetation is successful, as determined by the BLM.

Operators shall contact a BLM surface protection specialist prior to surface abandonment operations for site specific objectives (Jim Amos: 575-234-5909).

Mixture 4, for Gypsum Sites

The holder shall seed all the disturbed areas with the seed mixture listed below. The seed mixture shall be planted in the amounts specified in pounds of pure live seed (PLS)* per acre. There shall be no primary or secondary noxious weeds in the seed mixture. Seed will be tested and the viability testing of seed will be done in accordance with State law(s) and within nine (9) months prior to purchase. Commercial seed will be either certified or registered seed. The seed container will be tagged in accordance with State law(s) and available for inspection by the authorized officer.

Seed will be planted using a drill equipped with a depth regulator to ensure proper depth of planting where drilling is possible. The seed mixture will be evenly and uniformly planted over the disturbed area (smaller/heavier seeds have a tendency to drop the bottom of the drill and are planted first). The holder shall take appropriate measures to ensure this does not occur. Where drilling is not possible, seed will be broadcast and the area shall be raked or chained to cover the seed. When broadcasting the seed, the pounds per acre are to be doubled. The seeding will be repeated until a satisfactory stand is established as determined by the authorized officer. Evaluation of growth will not be made before completion of at least one full growing season after seeding.

Species to be planted in pounds of pure live seed* per acre:

Species	lb/acre
Alkli Sacaton (*Sporobolus airoides*)	1.5
DWS~ Four-wing saltbush (*Atriplex canescens*)	8.0

~DWS: DeWinged Seed

*Pounds of pure live seed:

Pounds of seed x percent purity x percent germination = pounds pure live seed

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Pecos District
Carlsbad Field Office
620 East Greene Street
Carlsbad, NM 88220

DECISION RECORD

for the

Hayhurst Master Development Plan Environmental Assessment

NEPA No. DOI-BLM-NM-P020-2016-1434-EA

I. Decision

I have decided to select the proposed action for implementation as described in the September 2016, Hayhurst Master Development Plan Environmental Assessment (EA). Based on my review of the EA and project record, I have concluded that the proposed action was analyzed in sufficient detail to allow me to make an informed decision. I have selected this alternative because the proposed treatments will allow reasonable access to oil and gas development.

II. Finding of No Significant Impact

I have reviewed the direct, indirect and cumulative effects of the proposed activities documented in the EA for the DOI-BLM-NM-P020-2016-1434-EA. I have also reviewed the project record for this analysis. The effects of the proposed action are disclosed in the Environmental Consequences sections of the EA. I have determined that the proposed action as described in the EA will not significantly affect the quality of the human environment. Accordingly, I have determined that the preparation of an Environmental Impact Statement is not necessary.

III. Other Alternatives Considered

No reasonable action alternative was substantially different in design or effects from the proposed action for this project. Therefore no other alternative was considered or analyzed.

IV. Public Involvement

The Carlsbad Field Office (CFO) publishes a NEPA log for public inspection. This log contains a list of proposed and approved actions in the field office. The log is located in the lobby of the CFO as well as on the BLM New Mexico website (http://www.blm.gov/nm/st/en/prog/planning/nepa_logs.html). The BLM also has an ePlanning website (https://eplanning.blm.gov/epl-front-office/eplanning/lup/lup_register.do) that allows the public to review and comment online on BLM NEPA and planning projects. Hard copies of the draft EA were also available at the BLM CFO as well as the BLM Santa Fe and Albuquerque Offices. The draft EA was be made available for a 30-day public review and comment period.

BLM CFO received a total of nine comment letters on the EA. Comments were categorized into issue statements that primarily focused on air resources, vegetation, wildlife, karst, night skies, visual resources, Areas of Critical Environmental Concern, Lands with Wilderness Characteristics, impacts to Carlsbad Caverns National Park, NEPA (e.g. level of documentation, alternatives), mitigation, and the

Resource Management Plan revision. Responses to comment issue statements are provided in Appendix F of the EA.

V. Appeals

This decision may be appealed to the Interior Board of Land Appeals (IBLA), Office of the Secretary, in accordance with the regulations contained in 43 CFR Part 4. Any appeal must be filed within 30 days of this decision. Any notice of appeal must be filed with George MacDonell, Carlsbad Field Manager, at 620 East Greene Street, Carlsbad, NM 88220. The appellant shall serve a copy of the notice of appeal and any statement of reasons, written arguments, or briefs on each adverse party named in the decision, not later than 15 days after filing such document (see 43 CFR 4.413(a)). Failure to serve within the time required will subject the appeal to summary dismissal (see 43 CFR 4.413(b)). If a statement of reasons for the appeal is not included with the notice, it must be filed with the IBLA, Office of Hearings and Appeals, U. S. Department of the Interior, 801 North Quincy St., Suite 300, Arlington, VA 22203 within 30 days after the notice of appeal is filed with the IBLA, Office of Hearings and Appeals, U.S. Department of the Interior, 801 North Quincy St., Suite 300 Arlington, VA 22203 within 30 days after the notice of appeal is filed with George MacDonell, Carlsbad Field Manger.

Notwithstanding the provisions of 43 CFR 4.21(a)(1), filing a notice of appeal under 43 CFR Part 4 does not automatically suspend the effect of the decision. If you wish to file a petition for a stay of the effectiveness of this decision during the time that your appeal is being reviewed by the Board, the petition for a stay must accompany your notice of appeal.

A petition for a stay is required to show sufficient justification based on the following standards:

(1) The relative harm to the parties if the stay is granted or denied;

(2) The likelihood of the appellant's success on the merits;

(3) The likelihood of immediate and irreparable harm if the stay is not granted; and

(4) Whether the public interest favors granting the stay.

In the event a request for stay or an appeal is filed, the person/party requesting the stay or filing the appeal must serve a copy of the appeal on the Office of the Field Solicitor, 1100 Old Santa Fe Trail, Santa Fe, NM 87505.

George MacDonell
Field Manager

10/7/16
Date

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Pecos District
Carlsbad Field Office
620 East Greene Street
Carlsbad, NM 88220

Finding of No Significant Impact
Hayhurst Master Development Plan
NEPA No. DOI-BLM-NM-P020-2016-1434-EA

FINDING OF NO SIGNIFICANT IMPACT:

I have determined that the proposed action, as described in the EA will not have any significant impact, individually or cumulatively, on the quality of the human environment. Because there would not be any significant impact, an environmental impact statement is not required.

In making this determination, I considered the following factors:

1. The activities described in the proposed action do not include any significant beneficial or adverse impacts (40 CFR 1508.27(b)(1)). The EA includes a description of the expected environmental consequences of implementation of the Master Development Plan, including construction and operation of well pads; production, storage, and compression facilities; water disposal and recycling facilities; gathering pipelines for oil, gas, and produced water; pipelines for fresh, brackish, or recycled water to support hydraulic fracturing operations; and upgraded and new access roads.

   In order to ensure that the proponent's impacts are consistent with the operating parameters considered in the air quality analysis, Conditions of Approval (COA) will be applied to Applications for Permit to Drill requested under the Hayhurst Master Development Plan. These COAs are:

   - All project activities including equipment emissions shall meet or exceed all state and federal standards for air quality as regulated by the New Mexico Environment Department Air Quality Bureau and the U.S. Environmental Protection Agency.

   - The operator will implement a drill and completion rig schedule where Tier 4 (or equivalent) drill and completion rigs are phased in. The operator will not exceed four drill rigs at one time and will be 100% compliant with Tier 4 (or equivalent) standards in 2020.

   - During the drilling phase, the operator will emit NOx emissions of 262.95 tons per year (tpy) or less from nonroad (mobile sources) between Year 1 and Year 3 and 220.7 tpy or less from nonroad (mobile sources) for the remainder of the drilling phase.

   - The operator will emit 213.6 tpy or less of NOx emissions during production operations, as defined in the emission inventory analyzed in the Environmental Assessment. The operator will submit emissions and/or parameters with an Application for Permit to Drill or annual emissions inventory that show the NOx emissions are within the limits of the air quality analysis within the Environmental Assessment.

2. The activities included in the proposed action would not significantly affect public health or safety (40 CFR 1508.27(b)(2)).

3. The proposed activities would not significantly affect any unique characteristics (40 CFR 1508.27(b)(3)) of the geographic area such as prime and unique farmlands, caves, wild and scenic rivers, designated wilderness areas, wilderness study areas, or areas of critical concern.

4. The activities described in the proposed action do not involve effects on the human environment that are likely to be highly controversial (40 CFR 1508.27(b)(4)).

5. The activities described in the proposed action do not involve effects that are highly uncertain or involve unique or unknown risks (40 CFR 1508.27(b)(5)).

6. My decision to implement these activities does not establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration (40 CFR 1508.27(b)(6)).

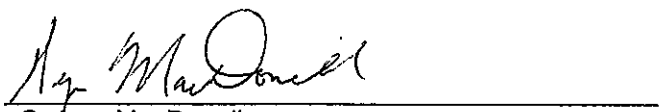
7. The effects of the Master Development Plan including construction and operation of well pads; production, storage, and compression facilities; water disposal and recycling facilities; gathering pipelines for oil, gas, and produced water; pipelines for fresh, brackish, or recycled water to support hydraulic fracturing operations; and upgraded and new access roads would not be significant, individually or cumulatively, when considered with the effects of other actions (40 CFR 1508.27(b)(7)). The EA discloses that there are no other connected or cumulative actions that would cause significant cumulative impacts.

8. I have determined that the activities described in the proposed action will not adversely affect or cause loss or destruction of scientific, cultural, or historical resources, including those listed in or eligible for listing in the National Register of Historic Places (40 CFR 1508.27(b)(8)).

9. The proposed activities are not likely to adversely affect any endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act (40 CFR 1508.27(b)(9)).

10. The proposed activities will not knowingly threaten any violation of Federal, State, or local law or requirements imposed for the protection of the environment (40 CFR 1508.27(b)(10)).

APPROVED:



George MacDonell
Field Manager
Carlsbad Field Office

10/7/16
Date

HOLLAND&HART LLP

Jordan L. Kessler
Associate
Phone (505) 988-4421
Fax (505) 983-6043
jlkessler@hollandhart.com

June 10, 2016

VIA CERTIFIED MAIL
RETURN RECEIPT REQUESTED

TO AFFECTED PARTIES

Re: Application of Chevron U.S.A. Inc. for administrative approval of an unorthodox location, Sections 5 and 8, Township 26 South, Range 27 East, N.M.P.M., Eddy County, New Mexico.
HH SO 8 P2 No. 14H Well

Ladies and Gentlemen:

Enclosed is a copy of the above-referenced application which was filed with the New Mexico Oil Conservation Division on this date. Any objection to this application must be filed in writing within twenty days from this date with the applicant and the New Mexico Oil Conservation Division, 1220 South St. Francis Drive, Santa Fe, New Mexico, 87505. If no objection is received within this twenty-day period, this application may be approved administratively by the Division.

If you have any questions about this application, please contact the following:

Amber Tarr Delach
Chevron U.S.A. Inc.
(713) 372-9877
ATarr@chevron.com

Sincerely,

Jordan L. Kessler
ATTORNEY FOR CHEVRON U.S.A. INC.

HOLLAND&HART LLP

Exhibit C is a list of the parties affected by the encroachment. A copy of this application with all attachments has been sent by certified mail to each affected party advising them that if they have an objection it must be filed in writing with the Division within 20 days from the date the Division receives the application. A courtesy copy of this application has also been provided to the Bureau of Land Management—Carlsbad and the New Mexico State Land Office.

Your attention to this application is appreciated

Sincerely,

Jordan L. Kessler
ATTORNEY FOR CHEVRON U.S.A. INC.

cc: Bureau of Land Management-Carlsbad
620 E. Green Street
Carlsbad, NM 88220

New Mexico State Land Office
P.O. Box 1148
Santa Fe, NM 87504

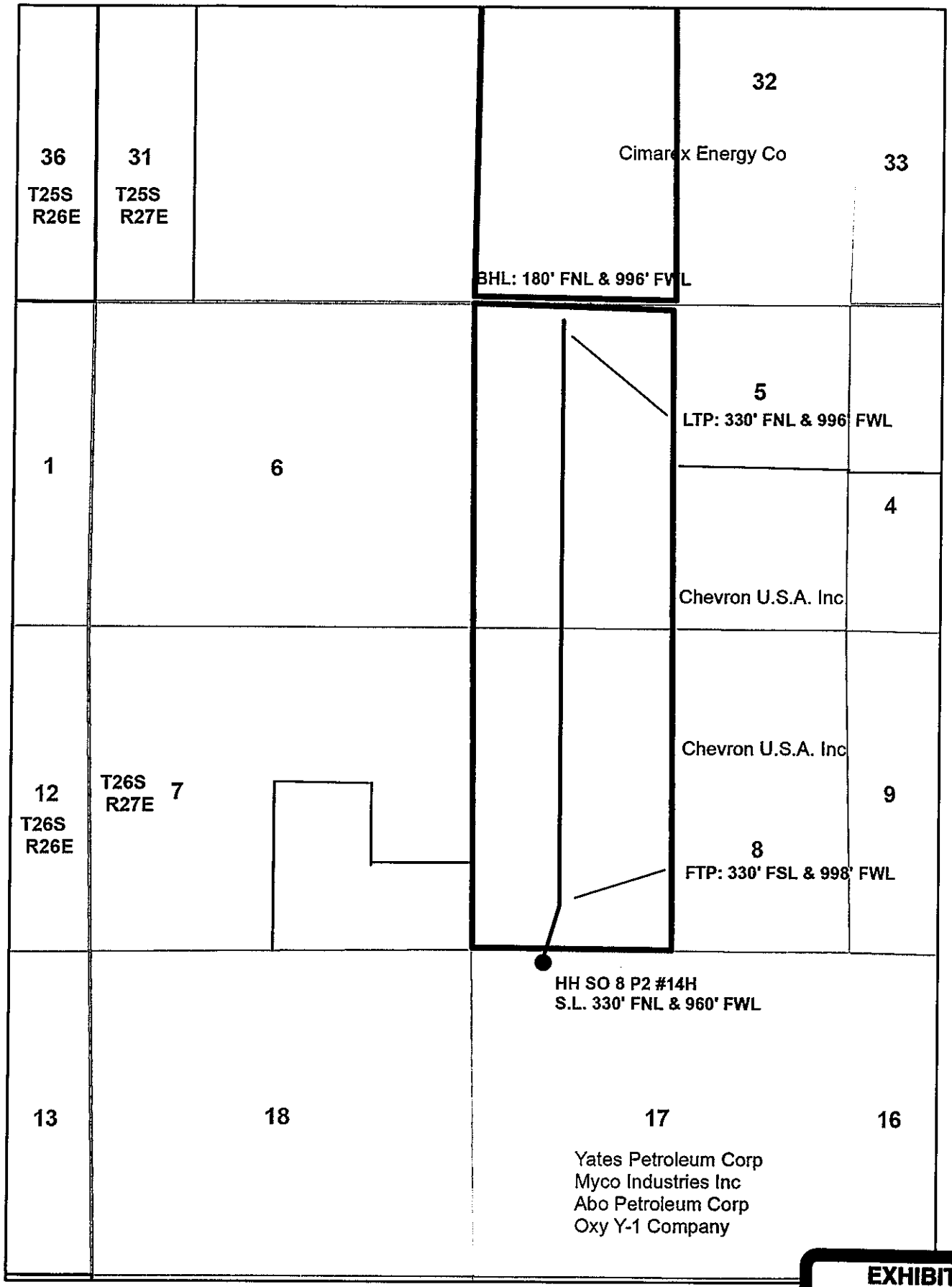

36
T25S
R26E
31
T25S
R27E
32
Cimarex Energy Co
33
BHL: 180' FNL & 996' FWL
5
LTP: 330' FNL & 996' FWL
1
6
4
Chevron U.S.A. Inc
Chevron U.S.A. Inc
12
T26S
R26E
T26S
R27E
7
9
8
FTP: 330' FSL & 998' FWL
HH SO 8 P2 #14H
S.L. 330' FNL & 960' FWL
13
18
17
16
Yates Petroleum Corp
Myco Industries Inc
Abo Petroleum Corp
Oxy Y-1 Company

EXHIBIT
B

DATE IN	SUSPENSE	ENGINEER	LOGGED IN	TYPE	APP NO.

ABOVE THIS LINE FOR DIVISION USE ONLY

NEW MEXICO OIL CONSERVATION DIVISION
- Engineering Bureau -
1220 South St. Francis Drive, Santa Fe, NM 87505

ADMINISTRATIVE APPLICATION CHECKLIST

THIS CHECKLIST IS MANDATORY FOR ALL ADMINISTRATIVE APPLICATIONS FOR EXCEPTIONS TO DIVISION RULES AND REGULATIONS WHICH REQUIRE PROCESSING AT THE DIVISION LEVEL IN SANTA FE

Application Acronyms:

[NSL-Non-Standard Location] [NSP-Non-Standard Proration Unit] [SD-Simultaneous Dedication]
[DHC-Downhole Commingling] [CTB-Lease Commingling] [PLC-Pool/Lease Commingling]
[PC-Pool Commingling] [OLS - Off-Lease Storage] [OLM-Off-Lease Measurement]
[WFX-Waterflood Expansion] [PMX-Pressure Maintenance Expansion]
[SWD-Salt Water Disposal] [IPI-Injection Pressure Increase]
[EOR-Qualified Enhanced Oil Recovery Certification] [PPR-Positive Production Response]

[1] **TYPE OF APPLICATION** - Check Those Which Apply for [A]

[A] Location - Spacing Unit - Simultaneous Dedication
☑ NSL ☐ NSP ☐ SD

Check One Only for [B] or [C]

[B] Commingling - Storage - Measurement
☐ DHC ☐ CTB ☐ PLC ☐ PC ☐ OLS ☐ OLM

[C] Injection - Disposal - Pressure Increase - Enhanced Oil Recovery
☐ WFX ☐ PMX ☐ SWD ☐ IPI ☐ EOR ☐ PPR

[D] Other: Specify _____

[2] **NOTIFICATION REQUIRED TO:** - Check Those Which Apply, or Does Not Apply

[A] ☐ Working, Royalty or Overriding Royalty Interest Owners

[B] ☑ Offset Operators, Leaseholders or Surface Owner

[C] ☐ Application is One Which Requires Published Legal Notice

[D] ☑ Notification and/or Concurrent Approval by BLM or SLO
U.S. Bureau of Land Management - Commissioner of Public Lands, State Land Office

[E] ☑ For all of the above, Proof of Notification or Publication is Attached, and/or,

[F] ☐ Waivers are Attached

[3] **SUBMIT ACCURATE AND COMPLETE INFORMATION REQUIRED TO PROCESS THE TYPE OF APPLICATION INDICATED ABOVE.**

[4] **CERTIFICATION:** I hereby certify that the information submitted with this application for administrative approval is **accurate** and **complete** to the best of my knowledge. I also understand that **no action** will be taken on this application until the required information and notifications are submitted to the Division.

Note: Statement must be completed by an individual with managerial and/or supervisory capacity.

Jordan L. Kessler		Attorney	6/10/16
Print or Type Name	Signature	Title	Date

jlkessler@hollandhart.com
e-mail Address

HAYHURST MDP EA – AIR QUALITY ANALYSIS MEETING (TELECONFERENCE)
MEETING NOTES
DATE: April 25, 2016 TIME: 8:30 AM MTN

Participants:

BLM:	Paul Murphy, David Herrell
Arcadis:	Rachel Cruz, Eric Hodek

Action Items:

- BLM CFO to determine if they can provide the number of authorized wells since 2012.
- BLM and Arcadis to coordinate with Forrest Cook of the BLM Colorado State Office.
- Arcadis to draft compliance with Memorandum of Understanding (MOU) in memorandum format.
- Arcadis to provide BLM a mitigation comparison

Meeting Notes:

- MOU - Air Quality Analyses and Mitigation for Federal Oil and Gas Decisions Through the National Environmental Policy Act (NEPA)
    - Discussed documenting compliance with the MOU in a memorandum format.
- Air Resources Technical Support Document (ARTSD) for the Resource Management Plant (RMP) Revision
    - The study accounts for the addition of 6,400 wells on federal lands with 800 well completions per year.
    - Arcadis and BLM agreed that this study accounts for Chevron's Hayhurst MDP. Dave mentioned that the reduction of planned development to 5,012 wells helps tremendously.
    - Paul Murphy to find out if BLM CFO can provide the number of authorized wells since 2012. With that data, Arcadis can clearly show that the Chevron Hayhust MDP falls within the scope of the existing study. STM / Red / Planned Area
    - Rachel Cruz asked if BLM knows how many wells Chevron and other operators are planning. Dave replied that the RFD Update Analysis will provide the best information and possibly the recently signed Ochoa Mine Project Environmental Impact Statement.
    - Table 4-11 (pg. 4-18) of the ARTSD shows the RFD emissions considered for modeling considering two alternatives. It is significant to note that there is a marked reduction (79%) in VOC emissions between the two alternatives (35,797 tpy vs. 7,391), but only a 1 ppb difference in maximum predicted impact. However, there is only a 1,600 tpy (17%) reduction in NOx emissions. This leads Arcadis to believe that ozone formation is being driven by NOx reductions, but there is no data presented in the report to evaluate this.
    - Arcadis will compare the Chevron inventory against the detailed project inventory from this study (Appendix I). Rachel will review documents and request from Dave if Arcadis does not have Appendix I.
    - Some scrutiny on NOx compared to ozone will be required particularly around comparing the drilling inventory from Chevron to Appendix I.

- Impacts and Standards of Significance
    - Ozone
        - The largest concern is the change in the ozone standard from 75 ppb to 70 ppb. The study shows that the maximum predicted concentrations will exceed 75 ppb for both future baseline and alternatives and shows no difference in maximum predicted concentration and baseline and RFDOTBX (Table 4-17 of AQTSD). However, it does predict a 1 ppb increase over baseline in the RFDOTB scenario. What is more concerning is the metrics in Table 4-19 and discussed on pg. 4-38. These metrics report the change in the frequency of events predicted to exceed 75 ppb and the spatial extent of cells (and cell-hours) that exceed 75 ppb. The report shows a 1-2% (depending on alternative) increase in both the frequency and spatial extent of 75 ppb or higher events. The author notes that with only a change of 1 ppb in maximum magnitude and only a 2-3% in frequency over baseline, that the impacts are insignificant. This presents a challenge for the following reasons.

          1. Monitoring data in the region is showing 67 – 69 ppb concentrations. A 1 ppb shift in values could have impacts on complying with the 70 ppb standard.

          2. As stated in the report, compliance with the ozone standard is based on the 3 year average of each year's highest of the 4th highest 8-hour average for each cell. There are 1,095 8-hr average periods in a year. Each 1% increase in the number of cell-hours above 75 ppb means up to 21 additional 8 hour averages above the 75 ppb standard per year which means a mathematically assured prediction that the Highest 4th High 8-hr average will exceed the 75 ppb standard.

          3. The metrics do not tell us anything about the change in frequency or spatial extent of impacts above a 70 ppb standard. It may be necessary to ask URS to re-run the metrics in Table 4-19 compared to a 70 ppb standard.

    - Cancer
        - One weakness may be that although the most likely exposure is less than 1 per million, the maximum exposure exceeds that standard by almost threefold, and that is not addressed in the discussion of significance.
        - National Air Toxics database is showing that background concentrations of benzene are increasing in the area.
        - Eric reviewed typical cancer mitigation. Dave was interested in reviewing further.

    - Greenhouse Gases
        - Magnitude of increased emissions from even the RFDOTBX is substantial when compared to the New Mexico GHG inventory (16%).
        - Consider comparing the proposed action GHG emissions to the update NM and National GHG emission inventory.

    - Coordination with BLM Colorado State Office
        - Dave will coordinate with Forrest Cook, with BLM Colorado State Office, who was involved with the ARTSD and not works for BLM. Dave asked that once Dave discusses the project with Forrest Cook, that Arcadis follow up with Forrest to discuss Arcadis' review of the ARTSD relevant to the Chevron Hayhusrt MDP.

- Mitigation
    - ARTSD includes two alternatives: "on-the-books" regulations (RFDOTB) and "on-the books with extra management" (RFDOTBX).
    - EPA will promulgate more stringent standards (NSPS OOOOa), likely in June.

- Dave asked Arcadis to coordinate with BLM CFO to review a copy of the draft RMP EIS air quality section to make sure that what is proposed in the Hayhurst MDP EA is in line with the direction that the CFO is heading.
- Dave asked Arcadis to compare the RFDOTBX to the NSPS OOOOa.

ATS-16-726

BLM Carlsbad Field Office

Form 3160-3
(June 2015)

FORM APPROVED
OMB No. 1004-0137
Expires: January 31, 2018

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

APPLICATION FOR PERMIT TO DRILL OR REENTER

UNORTHODOX LOCATION

5. Lease Serial No.	NMNM118108
6. If Indian, Allotee or Tribe Name	
7. If Unit or CA Agreement, Name and No.	
8. Lease Name and Well No.	HH SO 8 P2 _5H
9. API Well No.	5H

1a. Type of work: ☑ DRILL ☐ REENTER
1b. Type of Well: ☑ Oil Well ☐ Gas Well ☐ Other
1c. Type of Completion: ☐ Hydraulic Fracturing ☑ Single Zone ☐ Multiple Zone

2. Name of Operator: CHEVRON USA INC		
3a. Address: 1616 W. BENDER BLVD HOBBS, NM 88240	3b. Phone No. *(include area code)*: 575-263-0431	10. Field and Pool, or Exploratory: WILDCAT; WOLFCAMP
4. Location of Well *(Report location clearly and in accordance with any State requirements.*)* At surface 255' FNL & 960' FWL At proposed prod. zone 180' FNL & 330' FWL Sec. 05		11. Sec., T. R. M. or Blk. and Survey or Area: SEC17, T26S, R27E, UL D (SHL)
14. Distance in miles and direction from nearest town or post office*: 12.8 MILES FROM MALAGA, NEW MEXICO		12. County or Parish: EDDY / 13. State: NM
15. Distance from proposed* location to nearest property or lease line, ft. (Also to nearest drig. unit line, if any): 255' FSL	16. No of acres in lease: 1920 ACRES	17. Spacing Unit dedicated to this well: 320 ACRES
18. Distance from proposed location* to nearest well, drilling, completed, applied for, on this lease, ft.: 4300 FT SKEEN 2 SW	19. Proposed Depth: TD 9563' MD 20,126'	20. BLM/BIA Bond No. in file: CA 0329
21. Elevations (Show whether DF, KDB, RT, GL, etc.): 3245' GL	22. Approximate date work will start*: OCTOBER 2016	23. Estimated duration: 30 DAYS

24. Attachments

The following, completed in accordance with the requirements of Onshore Oil and Gas Order No. 1, and the Hydraulic Fracturing rule per 43 CFR 3162.3-3 (as applicable)

1. Well plat certified by a registered surveyor.
2. A Drilling Plan.
3. A Surface Use Plan (if the location is on National Forest System Lands, the SUPO must be filed with the appropriate Forest Service Office).
4. Bond to cover the operations unless covered by an existing bond on file (see Item 20 above).
5. Operator certification.
6. Such other site specific information and/or plans as may be requested by the BLM.

25. Signature: Cindy Herrera-Murillo	Name *(Printed/Typed)*: CINDY HERRERA-MURILLO	Date: 02/12/2016
Title: PERMITTING SPECIALIST		
Approved by *(Signature)*: /s/ George MacDonell	Name *(Printed/Typed)*: /s/George MacDonell	Date: 10/11/16
Title: FIELD MANAGER	Office: CARLSBAD FIELD OFFICE	

Application approval does not warrant or certify that the applicant holds legal or equitable title to those rights in the subject lease which would entitle the applicant to conduct operations thereon.
Conditions of approval, if any, are attached.

APPROVAL FOR TWO YEARS

Title 18 U.S.C. Section 1001 and Title 43 U.S.C. Section 1212, make it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious or fraudulent statements or representations as to any matter within its jurisdiction.

Carlsbad Controlled Water Basin

Witness Surface & Intermediate Casing

SEE ATTACHED FOR CONDITIONS OF APPROVAL

Approval Subject to General Requirements & Special Stipulations Attached

(Continued on page 2)

*(Instructions on page 2)

District I
1625 N French Dr, Hobbs, NM 88240
Phone: (575) 393-6161 Fax: (575) 393-0720
District II
811 S First St, Artesia, NM 88210
Phone: (575) 748-1283 Fax: (575) 748-9720
District III
1000 Rio Brazos Road, Aztec, NM 87410
Phone: (505) 334-6178 Fax: (505) 334-6170
District IV
1220 S St Francis Dr, Santa Fe, NM 87505
Phone: (505) 476-3460 Fax: (505) 476-3462

State of New Mexico
Energy, Minerals & Natural Resources Department
OIL CONSERVATION DIVISION
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-102
Revised August 1, 2011
Submit one copy to appropriate District Office

☐ AMENDED REPORT

WELL LOCATION AND ACREAGE DEDICATION PLAT

[1] API Number	[2] Pool Code	[3] Pool Name
		Wildcat; Wolfcamp

[4] Property Code	[5] Property Name	[6] Well Number
	HH SO 8 P2	5H

[7] OGRID No.	[8] Operator Name	[9] Elevation
4323	CHEVRON U.S.A. INC.	3245'

[10] Surface Location

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
D	17	26 SOUTH	27 EAST, N.M.P.M.		255'	NORTH	960'	WEST	EDDY

[11] Bottom Hole Location If Different From Surface

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
D	5	26 SOUTH	27 EAST, N.M.P.M.		180'	NORTH	330'	WEST	EDDY

[12] Dedicated Acres	[13] Joint or Infill	[14] Consolidation Code	[15] Order No.
320			

No allowable will be assigned to this completion until all interests have been consolidated or a non-standard unit has been approved by the division.

[16]

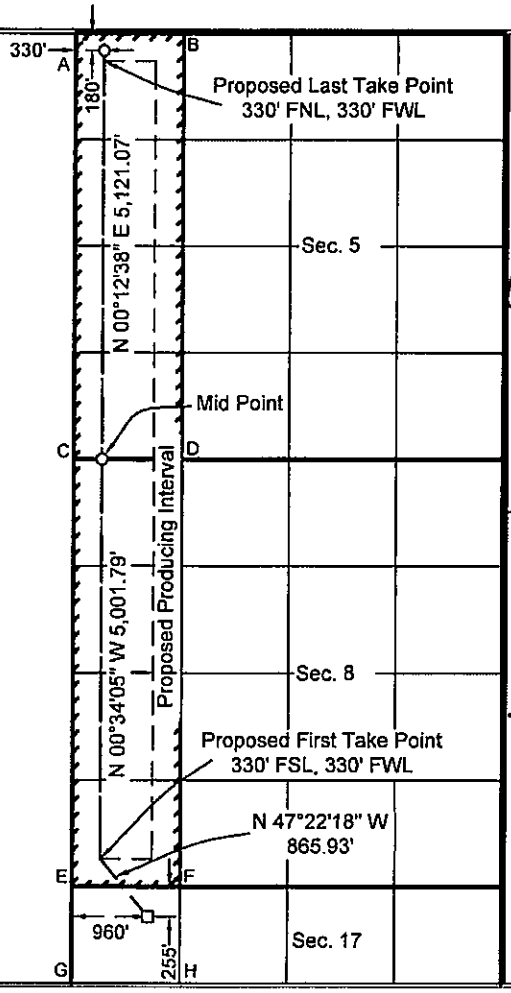
PROPOSED BOTTOM HOLE LOCATION		
X=	535,284	NAD 27
Y=	392,263	
LAT.	32.078395	
LONG.	104.219414	
X=	576,468	NAD83
Y=	392,320	
LAT.	32.078516	
LONG.	104.219909	

CORNER COORDINATES TABLE (NAD 27)

A - Y=392442.33, X=534954.83
B - Y=392444.24, X=536280.85
C - Y=387143.09, X=534935.36
D - Y=387137.83, X=536254.75
E - Y=381810.94, X=534988.20
F - Y=381808.02, X=536317.14
G - Y=380478.27, X=535007.69
H - Y=380475.74, X=536334.89

Mid Point
Y=387141.77, X=535265.35

HH SO 8 P2 5H WELL		
X=	535,952	NAD 27
Y=	381,554	
LAT.	32.048953	
LONG.	104.217295	
X=	577,136	NAD83
Y=	381,611	
LAT.	32.049075	
LONG.	104.217789	
ELEVATION +3245' NAVD 88		



[17] OPERATOR CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief, and that this organization either owns a working interest or unleased mineral interest in the land including the proposed bottom hole location or has a right to drill this well at this location pursuant to a contract with an owner of such a mineral or working interest, or to a voluntary pooling agreement or a compulsory pooling order heretofore entered by the division.

Cindy Herrera-Murillo 01/18/2016
Signature Date

Cindy Herrera-Murillo
Printed Name

Cherreramurillo@chevron.com
E-mail Address

[18] SURVEYOR CERTIFICATION

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my belief.

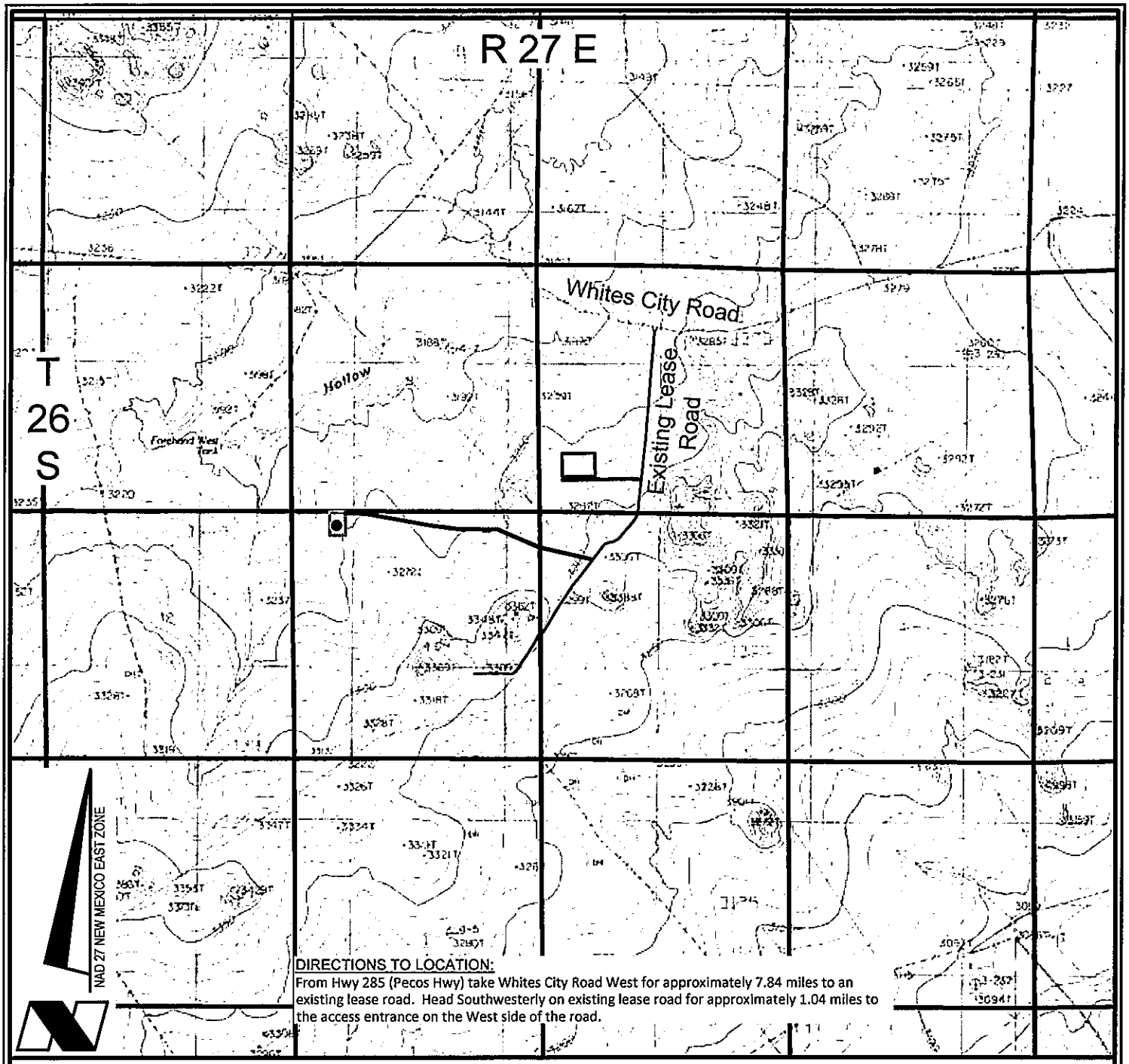
JAN. 5, 2016
Date of Survey

Signature and Seal of Professional Surveyor

ROBERT L. LASTRAPES
NEW MEXICO
23006
PROFESSIONAL SURVEYOR

23006
Certificate Number

EXHIBIT 1



DIRECTIONS TO LOCATION:
From Hwy 285 (Pecos Hwy) take Whites City Road West for approximately 7.84 miles to an existing lease road. Head Southwesterly on existing lease road for approximately 1.04 miles to the access entrance on the West side of the road.

VICINITY MAP

SCALE: 1" = 3000'
3000' 0 1500' 3000'

LEGEND

- Proposed Well
- Proposed Access Road
- Proposed Drillsite
- Existing Road
- Section Line
- Proposed Frac Pond
- Proposed Facility

CHEVRON U.S.A. INC.

HH SO 8 P2 NO. 5H WELL
LOCATED 255' FNL AND 960' FWL
SECTION 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

FENSTERMAKER
C.H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

DRAWN BY: MBD	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 01/07/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153438\DWG\HH SO 8 P2 5H_APD.dwg			

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

ROBERT L. LASTRAPES
NEW MEXICO
23006
1-19-2016
PROFESSIONAL SURVEYOR

Robert L. Lastrapes
Registration No. 23006

R 27 E

NW PAD CORNER		NE PAD CORNER		HH SO 8 P2 NO. 5H WELL	
X= 535,799	NAD 27	X= 536,129	NAD 27	X= 535,952	NAD 27
Y= 381,809		Y= 381,808		Y= 381,554	
ELEVATION +3241' NAVD 88		ELEVATION +3247' NAVD 88		LAT. 32.048953	
SW PAD CORNER		SE PAD CORNER		LONG. 104.217295	
X= 535,805	NAD 27	X= 536,135	NAD 27	X= 577,136	NAD83
Y= 381,284		Y= 381,284		Y= 381,611	
ELEVATION +3244' NAVD 88		ELEVATION +3256' NAVD 88		LAT. 32.049075	
				LONG. 104.217789	
				ELEVATION +3245' NAVD 88	

T 26 S

Sec. 8

Bureau of Land Management

S 89°52'10" E 810.78'

Fnd. 2" Iron Pipe w/ Cap at the NW Corner of Section 17

255'
52'
525'
150'
180'
270'
25'(Typ.)
330'

HH SO 8 P2
No. 5H Well
255' FNL, 960' FWL

PROPOSED PAD ±3.98 Acres

CENTERLINE PROPOSED ACCESS ROAD (1) 24' X ±5,444.40' ±3.00 Acres ±329.96 Rods (SEE PAGE 2)

Sec. 17

Bureau of Land Management

(Access Road 1) ± 4289.90', ±2.36 Acres, ±259.99 Rods

NAD 27 NEW MEXICO EAST ZONE

Scale: 1" = 300'

300' 0 150' 300'

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED PADS, FRAC POND & ACCESS ROADS
HH SO 8 P2 NO. 5H WELL
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

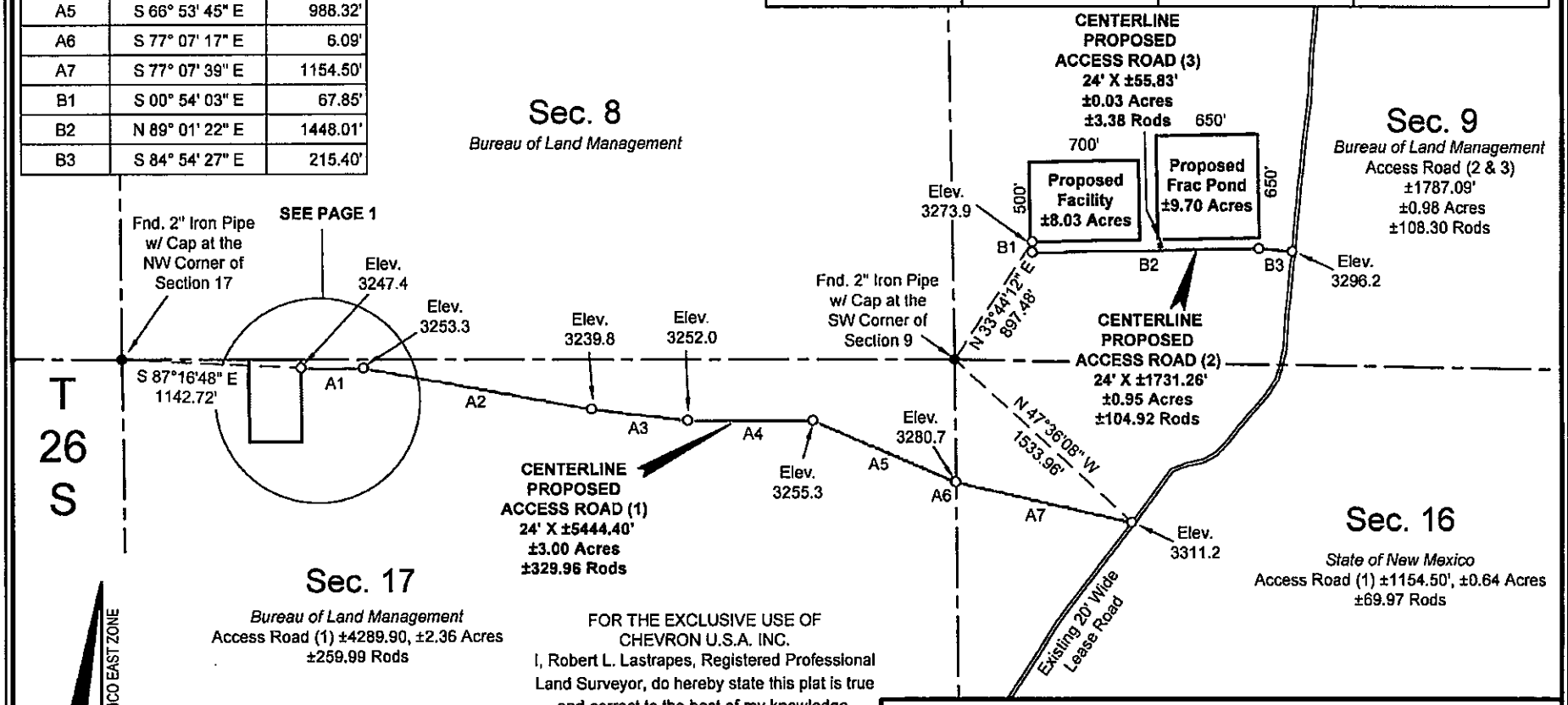
DRAWN BY: LJG	REVISIONS		
PROJ. MGR.: GDG	No. 1	DATE: 1/7/2016	REVISED BY: MBD
DATE: 12/22/2015	No. 2	DATE: 1/19/2016	REVISED BY: GDG
FILENAME: T:\2015\2153438\DWG\HH SO 8 P2 5H_SUP.dwg			

EXHIBITS 2&5

Centerline Proposed Access Roads		
COURSE	BEARING	DISTANCE
A1	S 89° 49' 39" E	398.61'
A2	S 79° 37' 12" E	1478.11'
A3	S 82° 59' 20" E	620.58'
A4	S 89° 50' 47" E	798.19'
A5	S 66° 53' 45" E	988.32'
A6	S 77° 07' 17" E	6.09'
A7	S 77° 07' 39" E	1154.50'
B1	S 00° 54' 03" E	67.85'
B2	N 89° 01' 22" E	1448.01'
B3	S 84° 54' 27" E	215.40'

R 27 E

NW FRAC POND CORNER	NE FRAC POND CORNER	NW FACILITY CORNER	NE FACILITY CORNER
X= 541,594 NAD 27 Y= 383,209	X= 542,244 NAD 27 Y= 383,220	X= 540,782 NAD 27 Y= 383,045	X= 541,482 NAD 27 Y= 383,057
ELEVATION +3264' NAVD 88	ELEVATION +3270' NAVD 88	ELEVATION +3263' NAVD 88	ELEVATION +3265' NAVD 88
SW FRAC POND CORNER	SE FRAC POND CORNER	SW FACILITY CORNER	SE FACILITY CORNER
X= 541,605 NAD 27 Y= 382,559	X= 542,255 NAD 27 Y= 382,570	X= 540,790 NAD 27 Y= 382,545	X= 541,490 NAD 27 Y= 382,557
ELEVATION +3278' NAVD 88	ELEVATION +3289' NAVD 88	ELEVATION +3274' NAVD 88	ELEVATION +3276' NAVD 88



NAD 27 NEW MEXICO EAST ZONE

Scale: 1" = 1000'

1000' 0 500' 1000'

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

ROBERT L. LASTRAPES NEW MEXICO 23006 PROFESSIONAL SURVEYOR 1-19-2016

Robert L. Lastrapes
Registration No. 23006

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED PADS, FRAC POND & ACCESS ROADS
HH SO 8 P2 NO. 5H WELL
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

DRAWN BY: LJG	REVISIONS		
PROJ. MGR.: GDG	No. 1	DATE: 1/7/2016	REVISED BY: MBD
DATE: 12/22/2015	No. 2	DATE: 1/19/2016	REVISED BY: GDG
FILENAME: T:\2015\2153438\DWG\HH SO 8 P2 5H_SUP.dwg			

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:
Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

NOTE:
Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call.
www.nmonecall.org

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

ROBERT L. LASTRAPES
NEW MEXICO
23006
1-19-2016
PROFESSIONAL SURVEYOR

Robert L. Lastrapes
Registration No. 23006

FENSTERMAKER

C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax 337-232-3299
www.fenstermaker.com

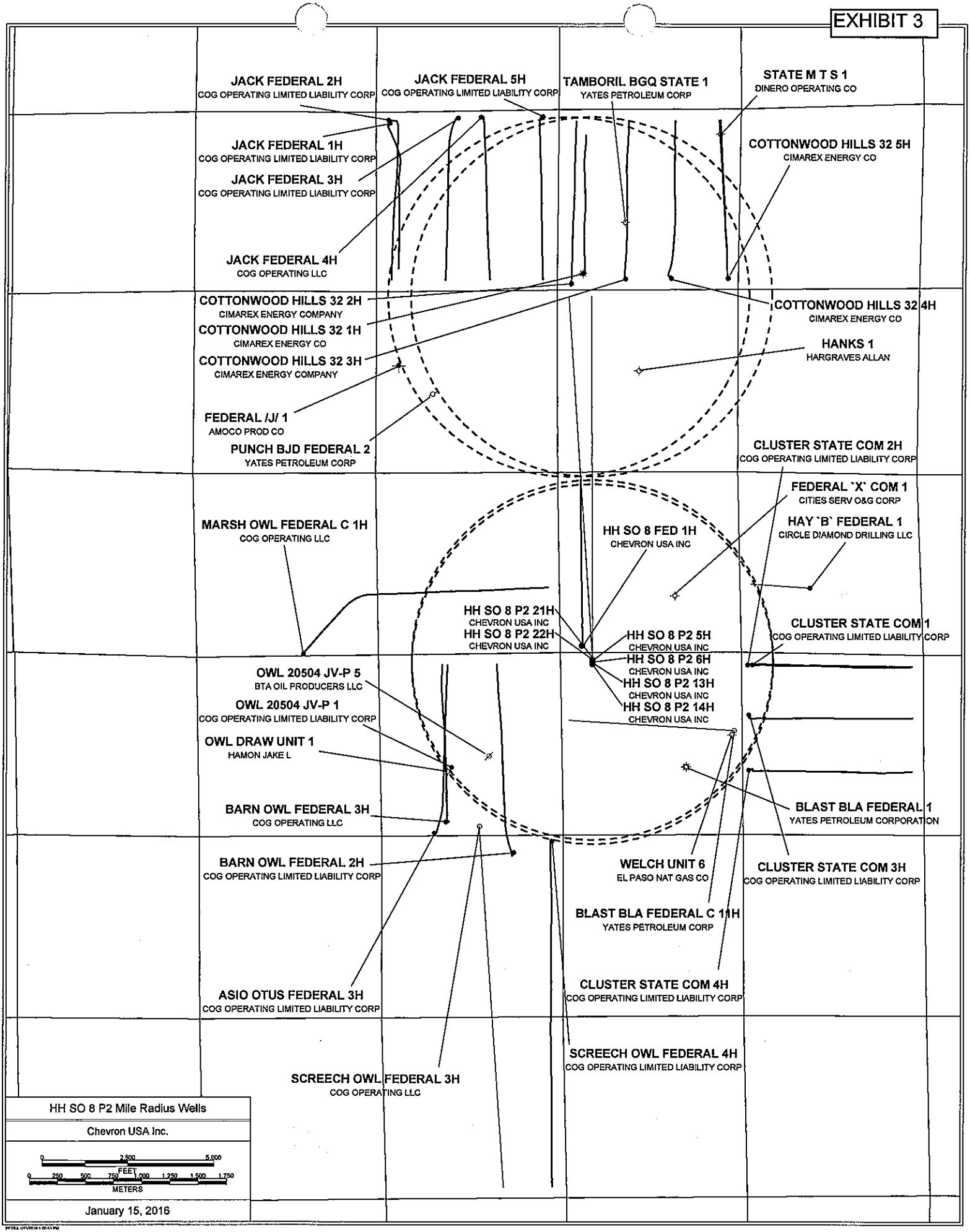
SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED PADS, FRAC POND & ACCESS ROADS
HH SO 8 P2 NO. 5H WELL
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: LJG	REVISIONS		
PROJ. MGR.: GDG	No. 1	DATE: 1/7/2016	REVISED BY: MBD
DATE: 12/22/2015	No. 2	DATE: 1/19/2016	REVISED BY: GDG
FILENAME: T:\2015\2153438\DWG\HH SO 8 P2 5H_SUP.dwg			

EXHIBIT 3


JACK FEDERAL 2H
COG OPERATING LIMITED LIABILITY CORP
JACK FEDERAL 5H
COG OPERATING LIMITED LIABILITY CORP
TAMBORIL BGQ STATE 1
YATES PETROLEUM CORP
STATE M T S 1
DINERO OPERATING CO
JACK FEDERAL 1H
COG OPERATING LIMITED LIABILITY CORP
JACK FEDERAL 3H
COG OPERATING LIMITED LIABILITY CORP
COTTONWOOD HILLS 32 5H
CIMAREX ENERGY CO
JACK FEDERAL 4H
COG OPERATING LLC
COTTONWOOD HILLS 32 2H
CIMAREX ENERGY COMPANY
COTTONWOOD HILLS 32 4H
CIMAREX ENERGY CO
COTTONWOOD HILLS 32 1H
CIMAREX ENERGY CO
HANKS 1
HARGRAVES ALLAN
COTTONWOOD HILLS 32 3H
CIMAREX ENERGY COMPANY
FEDERAL /J/ 1
AMOCO PROD CO
PUNCH BJD FEDERAL 2
YATES PETROLEUM CORP
CLUSTER STATE COM 2H
COG OPERATING LIMITED LIABILITY CORP
FEDERAL `X` COM 1
CITIES SERV O&G CORP
MARSH OWL FEDERAL C 1H
COG OPERATING LLC
HH SO 8 FED 1H
CHEVRON USA INC
HAY `B` FEDERAL 1
CIRCLE DIAMOND DRILLING LLC
HH SO 8 P2 21H
CHEVRON USA INC
HH SO 8 P2 22H
CHEVRON USA INC
HH SO 8 P2 5H
CHEVRON USA INC
CLUSTER STATE COM 1
COG OPERATING LIMITED LIABILITY CORP
HH SO 8 P2 6H
CHEVRON USA INC
HH SO 8 P2 13H
CHEVRON USA INC
OWL 20504 JV-P 5
BTA OIL PRODUCERS LLC
HH SO 8 P2 14H
CHEVRON USA INC
OWL 20504 JV-P 1
COG OPERATING LIMITED LIABILITY CORP
OWL DRAW UNIT 1
HAMON JAKE L
BLAST BLA FEDERAL 1
YATES PETROLEUM CORPORATION
BARN OWL FEDERAL 3H
COG OPERATING LLC
BARN OWL FEDERAL 2H
COG OPERATING LIMITED LIABILITY CORP
WELCH UNIT 6
EL PASO NAT GAS CO
CLUSTER STATE COM 3H
COG OPERATING LIMITED LIABILITY CORP
BLAST BLA FEDERAL C 1H
YATES PETROLEUM CORP
ASIO OTUS FEDERAL 3H
COG OPERATING LIMITED LIABILITY CORP
CLUSTER STATE COM 4H
COG OPERATING LIMITED LIABILITY CORP
SCREECH OWL FEDERAL 4H
COG OPERATING LIMITED LIABILITY CORP
SCREECH OWL FEDERAL 3H
COG OPERATING LLC
HH SO 8 P2 Mile Radius Wells
Chevron USA Inc.
0 2,500 5,000
FEET
0 250 500 750 1,000 1,250 1,500 1,750
METERS
January 15, 2016

1. **FORMATION TOPS**

The estimated tops of important geologic markers are as follows:

FORMATION	SUB-SEA TVD	KBTVD	MD
Castille		505	
Lamar		2395	
Bell		2310	
Cherry		3208	
Brushy		4450	
Bone Spring/Avalon		6299	
First Bone Spring Sand		6888	
First Bone Spring Shale		6914	
Second Bone Spring Sand		7621	
Harkey Sand		8123	
Third Bone Spring Sand		8617	
Wolfcamp A		9342	
Wolfcamp C		9563	
Lateral TVD Wolfcamp C		9563	20126.47'

2. **ESTIMATED DEPTH OF WATER, OIL, GAS & OTHER MINERAL BEARING FORMATIONS**

The estimated depths at which the top and bottom of the anticipated water, oil, gas, or other mineral bearing formations are expected to be encountered are as follows:

Substance	Formation	Depth
Deepest Expected Base of Fresh Water		450
Water	Castille	505
Water	Cherry Canyon	3208
Oil/Gas	Brushy Canyon	4450
Oil/Gas	Bone Spring Limestone	6888
Oil/Gas	First Bone Spring Shale	6914
Oil/Gas	Second Bone Spring Sand	7621
Oil/Gas	Harkey Sand	8123
Oil/Gas	Wolfcamp A	9342
Oil/Gas	Wolfcamp C	9563

All shows of fresh water and minerals will be reported and protected.

3. **BOP EQUIPMENT**

PLEASE REFERENCE MDP

10 M BOP after surface casing

Batch Drilling

4. **CASING PROGRAM**

Purpose	From	To	Hole Size	Csg Size	Weight	Grade	Thread	Condition
Surface	0'	450'	17-1/2"	13-3/8"	54.5 #	K-55	STC	New
Intermediate	0'	9,015'	12-1/4"	9-5/8"	40.0 #	L-80	TXP	New
Production	0'	20,126'	8-1/2"	5-1/2"	20.0 #	P-110	TXP	New

SF Calculations based on the following "Worst Case" casing design:

Surface Casing: 450'
Intermediate Casing: 9015'
Production Casing: 20126.47' MD/9,563' TVD (10,000' VS @ 89.7 deg inc)

Casing String	Min SF Burst	Min SF Collapse	Min SF Tension	Min SF Tri-Axial
Surface	1.82	5.11	3.97	2.31
Intermediate	1.45	1.32	1.78	1.84
Production	1.26	1.5	2.43	1.35

Min SF is the smallest of a group of safety factors that include the following considerations:

	Surf	Int	Prod
Burst Design			
Pressure Test- Surface, Int, Prod Csg P external: Water P internal: Test psi + next section heaviest mud in csg	X	X	X
Displace to Gas- Surf Csg P external: Water P internal: Dry Gas from Next Csg Point	X		
Frac at Shoe, Gas to Surf- Int Csg P external: Water P internal: Dry Gas, 15 ppg Frac Gradient		X	
Stimulation (Frac) Pressures- Prod Csg P external: Water P internal: Max inj pressure w/ heaviest injected fluid			X
Tubing leak- Prod Csg (packer at KOP) P external: Water P internal: Leak just below surf, 8.7 ppg packer fluid			X
Collapse Design			
Full Evacuation P external: Water gradient in cement, mud above TOC P internal: none	X	X	X
Cementing- Surf, Int, Prod Csg P external: Wet cement P internal: water	X	X	X
Tension Design			

5. **CEMENTING PROGRAM**

Slurry	Type	Cement Top	Cement Bottom	Weight	Yield	%Excess	Sacks	Water
Surface				(ppg)	(sx/cu ft)	Open Hole		gal/sk
Tail	Class C	0'	450'	14.8	1.33	50	356	6.37
Intermediate								
Stage 2 Lead	50:50 Poz: Class C + Antifoam, Extender, Salt, Retarder	0'	1,100'	11.9	2.43	50	213	14.21
Stage 2 Tail	Class C + Antifoam, Retarder, Viscosifier	1,100'	2,100'	14.8	1.33	0	235	6.37
DV TOOL		2,100'						
Stage 1 Lead	50:50 Poz: Class H + Extender, Antifoam, Retarder, Salt, Viscosifier	2,100'	8,015'	11.9	2.43	100	1524	13.76
Stage 1 Tail	Class H + Retarder, Extender, Dispersant	8,015'	9,015'	15.6	1.21	50	389	5.54
Production								
Lead	50:50 Poz: Class H + Extender, Antifoam, Dispersant, , Retarder	7,015'	8,015'	14.5	1.21	100	430	5.54
Tail	Class H + Viscosifier, Antifoam, Dispersant, Fluid Loss, Retarder, Expanding Agent	8,015'	20,126'	15.6	1.2	50	3465	5.30

6. **MUD PROGRAM**

From	To	Type	Weight	F. Vis	Filtrate
0'	450'	Spud Mud	8.3 - 8.7	32 - 34	NC - NC
450'	9015'	OBM	9.0 - 9.5	50 -70	5.0 - 10
9015'	20,126'	OBM	10.0 - 13.5	50 -70	5.0 - 10

7. **TESTING, LOGGING, AND CORING**

TYPE	Logs	Interval	Timing	Vendor
Mudlogs	2 man mudlog	Int Csg to TD	Drillout of Int Csg	TBD
LWD	MWD Gamma	Int. and Prod. Hole	While Drilling	TBD

8. **ABNORMAL PRESSURES AND HYDROGEN SULFIDE**

PLEASE REFERENCE MDP

Schlumberger

#5H - Rev0

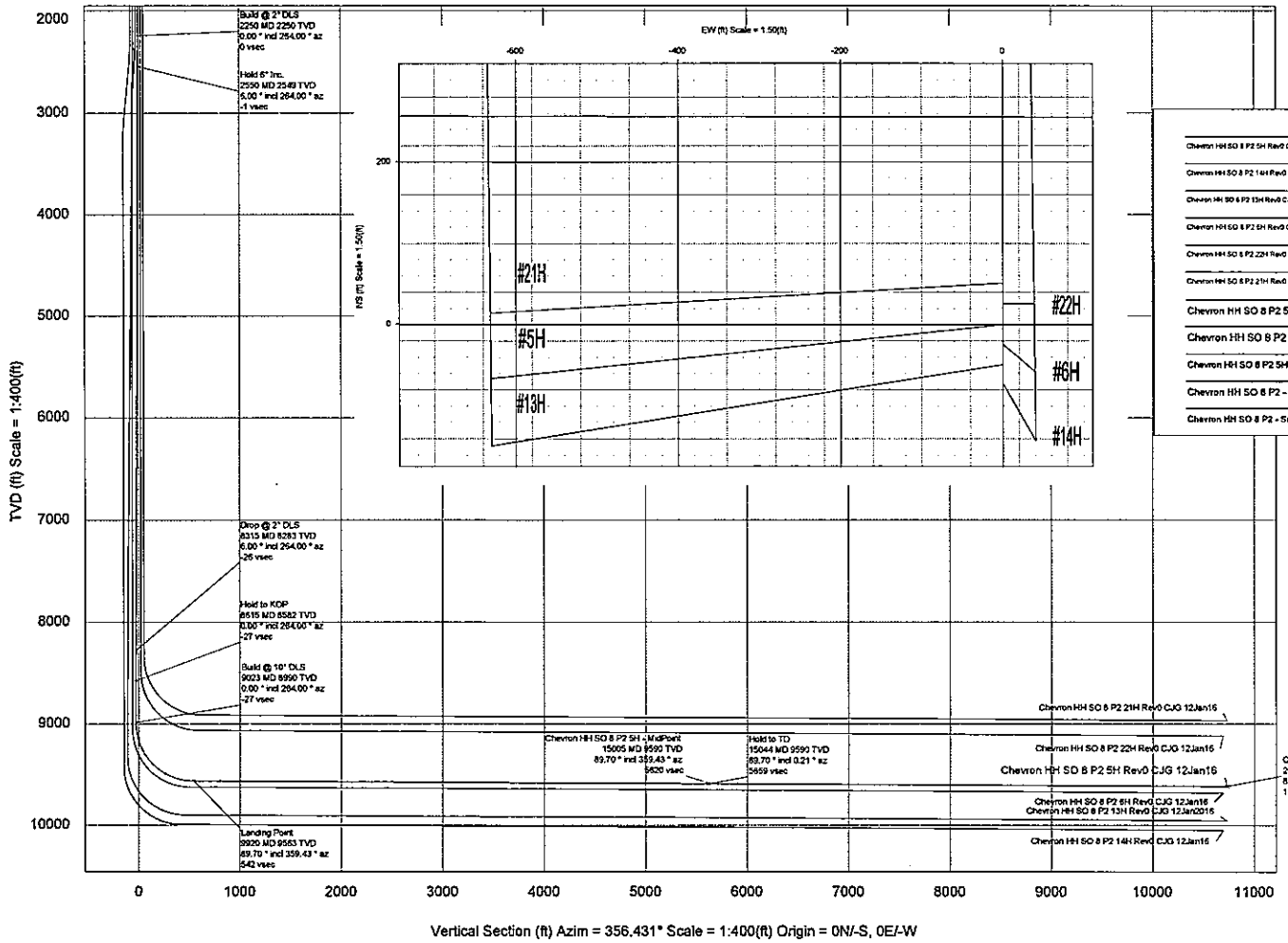
Chevron

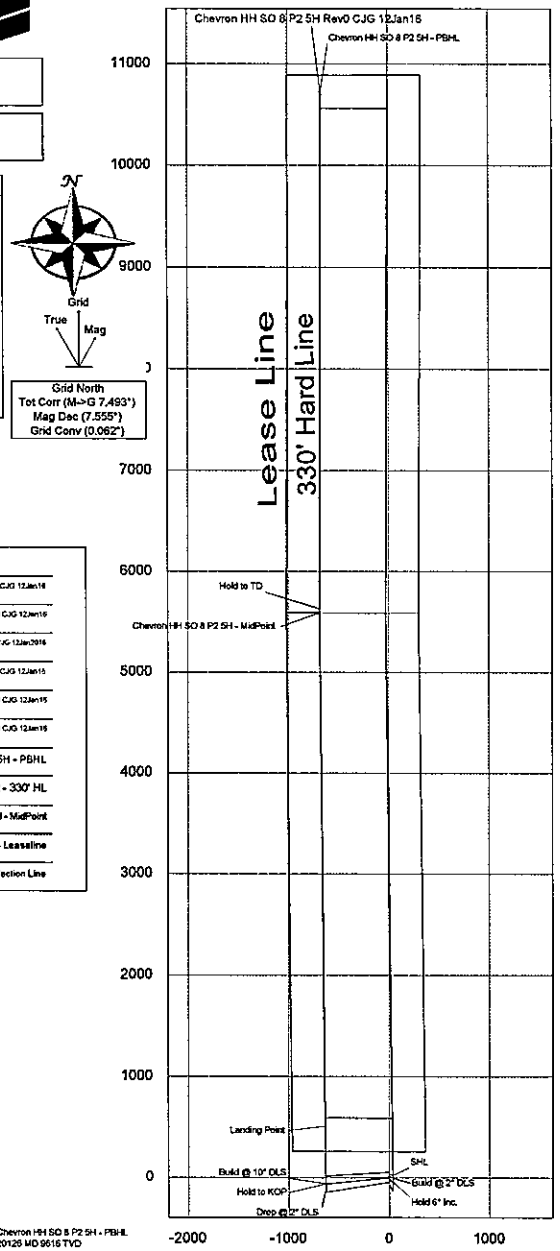
Borehole:	Well:	Field:	Structure:
Original Borehole	HH SO 8 P2 5H	NM Eddy County (NAD 27)	TBD

Gravity & Magnetic Parameters					Surface Location	NAD27 New Mexico State Plane, Eastern Zone, US Feet				Miscellaneous				
Model:	HDGM 2015	Dip:	59.776°	Date:	08-Jan-2016	Lat:	N 32 2 56.23	Northing:	381554ftUS	Grid Conv:	0.0618°	Slot:	HH SO 8 P2 5H	TVD Ref:	RKB(3278ft above MSL)
MagDec:	7.555°	FS:	48139.121nT	Gravity FS:	998.431mgn (9.80665 Based)	Lon:	W 104 13 2.28	Easting:	639962ftUS	Scale Fact:	0.99991057	Plan:	Rev0 CJG 12Jan16		

Critical Points

Critical Point	MD	INCL	AZIM	TVD	VSEC	N(+)/S(-)	E(+)/W(-)	DLS
SHL	0.00	0.00	264.00	0.00	0.00	0.00	0.00	
Build @ 2° DLS	2250.00	0.00	264.00	2250.00	0.00	0.00	0.00	0.00
Hold 6° Inc.	2550.00	6.00	264.00	2549.45	-0.67	-1.64	-15.61	2.00
Drop @ 2° DLS	8315.00	6.00	264.00	8282.87	-26.22	-64.63	-614.91	0.00
Hold to KOP	8615.00	0.00	264.00	8582.32	-26.89	-66.27	-630.52	2.00
Build @ 10° DLS	9022.73	0.00	264.00	8990.05	-26.89	-66.27	-630.52	0.00
Landing Point	9919.73	89.70	359.43	9563.00	542.29	503.66	-636.18	10.00
Chevron HH SO 8 P2 5H - MidPoint	15004.67	89.70	359.43	9589.60	5620.19	5588.28	-686.71	0.00
Hold to TD	15043.72	89.70	0.21	9589.80	5659.17	5627.33	-686.83	2.00
Chevron HH SO 8 P2 5H - PBHL	20126.47	89.70	0.21	9616.35	10730.79	10709.98	-668.06	0.00





CONTROLLED

1	Originator	Colby Gannon
2	DEC Sign Off	
3	CC Sign Off	
4	Client	Chevron

Schlumberger

Chevron

Chevron HH SO 8 P2 5H Rev0 CJG 12Jan16 Proposal Geodetic Report

(Non-Def Plan)

Report Date:	January 12, 2016 - 01:21 PM	**Survey / DLS Computation:**	Minimum Curvature / Lubinski
Client:	Chevron	**Vertical Section Azimuth:**	356.431 ° (Grid North)
Field:	NM Eddy County (NAD 27)	**Vertical Section Origin:**	0.000 ft, 0.000 ft
Structure / Slot:	Chevron HH SO 8 P2 Pad / Chevron HH SO 8 P2 5H	**TVD Reference Datum:**	RKB
Well:	HH SO 8 P2 5H	**TVD Reference Elevation:**	3278.000 ft above MSL
Borehole:	Original Borehole	**Seabed / Ground Elevation:**	3245.000 ft above MSL
UWI / API#:	Unknown / Unknown	**Magnetic Declination:**	7.555 °
Survey Name:	Chevron HH SO 8 P2 5H Rev0 CJG 12Jan16	**Total Gravity Field Strength:**	998.4306mgn (9.80665 Based)
Survey Date:	January 08, 2016	**Gravity Model:**	GARM
Tort / AHD / DDI / ERD Ratio:	102.483 ° / 11410.558 ft / 6.389 / 1.187	**Total Magnetic Field Strength:**	48139.121 nT
Coordinate Reference System:	NAD27 New Mexico State Plane, Eastern Zone, US Feet	**Magnetic Dip Angle:**	59.775 °
Location Lat / Long:	N 32° 2' 56.23357", W 104° 13' 2.26377"	**Declination Date:**	January 08, 2016
Location Grid N/E Y/X:	N 381554.000 ftUS, E 535952.000 ftUS	**Magnetic Declination Model:**	HDGM 2015
CRS Grid Convergence Angle:	0.0616 °	**North Reference:**	Grid North
Grid Scale Factor:	0.99991057	**Grid Convergence Used:**	0.0616 °
Version / Patch:	2.8.572.0	**Total Corr Mag North->Grid North:**	7.4939 °
		Local Coord Referenced To:	Well Head

Comments	MD (ft)	Incl (°)	Azim Grid (°)	TVD (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLS (°/100ft)	Northing (ftUS)	Easting (ftUS)	Latitude (N/S ° ' ")	Longitude (E/W ° ' ")
SHL	0.00	0.00	264.00	0.00	0.00	0.00	0.00	N/A	381554.00	535952.00	N 32 2 56.23	W 104 13 2.26
	100.00	0.00	264.00	100.00	0.00	0.00	0.00	0.00	381554.00	535952.00	N 32 2 56.23	W 104 13 2.26
	200.00	0.00	264.00	200.00	0.00	0.00	0.00	0.00	381554.00	535952.00	N 32 2 56.23	W 104 13 2.26
	300.00	0.00	264.00	300.00	0.00	0.00	0.00	0.00	381554.00	535952.00	N 32 2 56.23	W 104 13 2.26
	400.00	0.00	264.00	400.00	0.00	0.00	0.00	0.00	381554.00	535952.00	N 32 2 56.23	W 104 13 2.26
	500.00	0.00	264.00	500.00	0.00	0.00	0.00	0.00	381554.00	535952.00	N 32 2 56.23	W 104 13 2.26
	600.00	0.00	264.00	600.00	0.00	0.00	0.00	0.00	381554.00	535952.00	N 32 2 56.23	W 104 13 2.26
	700.00	0.00	264.00	700.00	0.00	0.00	0.00	0.00	381554.00	535952.00	N 32 2 56.23	W 104 13 2.26
	800.00	0.00	264.00	800.00	0.00	0.00	0.00	0.00	381554.00	535952.00	N 32 2 56.23	W 104 13 2.26
	900.00	0.00	264.00	900.00	0.00	0.00	0.00	0.00	381554.00	535952.00	N 32 2 56.23	W 104 13 2.26
	1000.00	0.00	264.00	1000.00	0.00	0.00	0.00	0.00	381554.00	535952.00	N 32 2 56.23	W 104 13 2.26
	1100.00	0.00	264.00	1100.00	0.00	0.00	0.00	0.00	381554.00	535952.00	N 32 2 56.23	W 104 13 2.26
	1200.00	0.00	264.00	1200.00	0.00	0.00	0.00	0.00	381554.00	535952.00	N 32 2 56.23	W 104 13 2.26
	1300.00	0.00	264.00	1300.00	0.00	0.00	0.00	0.00	381554.00	535952.00	N 32 2 56.23	W 104 13 2.26
	1400.00	0.00	264.00	1400.00	0.00	0.00	0.00	0.00	381554.00	535952.00	N 32 2 56.23	W 104 13 2.26
	1500.00	0.00	264.00	1500.00	0.00	0.00	0.00	0.00	381554.00	535952.00	N 32 2 56.23	W 104 13 2.26
	1600.00	0.00	264.00	1600.00	0.00	0.00	0.00	0.00	381554.00	535952.00	N 32 2 56.23	W 104 13 2.26
	1700.00	0.00	264.00	1700.00	0.00	0.00	0.00	0.00	381554.00	535952.00	N 32 2 56.23	W 104 13 2.26
	1800.00	0.00	264.00	1800.00	0.00	0.00	0.00	0.00	381554.00	535952.00	N 32 2 56.23	W 104 13 2.26
	1900.00	0.00	264.00	1900.00	0.00	0.00	0.00	0.00	381554.00	535952.00	N 32 2 56.23	W 104 13 2.26
	2000.00	0.00	264.00	2000.00	0.00	0.00	0.00	0.00	381554.00	535952.00	N 32 2 56.23	W 104 13 2.26
	2100.00	0.00	264.00	2100.00	0.00	0.00	0.00	0.00	381554.00	535952.00	N 32 2 56.23	W 104 13 2.26
	2200.00	0.00	264.00	2200.00	0.00	0.00	0.00	0.00	381554.00	535952.00	N 32 2 56.23	W 104 13 2.26
Build @ 2° DLS	2250.00	0.00	264.00	2250.00	0.00	0.00	0.00	0.00	381554.00	535952.00	N 32 2 56.23	W 104 13 2.26
	2300.00	1.00	264.00	2300.00	-0.02	-0.05	-0.43	2.00	381553.95	535951.57	N 32 2 56.23	W 104 13 2.27
	2400.00	3.00	264.00	2399.93	-0.17	-0.41	-3.90	2.00	381553.59	535948.10	N 32 2 56.23	W 104 13 2.31
	2500.00	5.00	264.00	2499.68	-0.46	-1.14	-10.84	2.00	381552.86	535941.16	N 32 2 56.22	W 104 13 2.39
Hold 6° Inc.	2550.00	6.00	264.00	2549.45	-0.67	-1.64	-15.61	2.00	381552.36	535936.39	N 32 2 56.22	W 104 13 2.45
	2600.00	6.00	264.00	2599.18	-0.89	-2.19	-20.81	0.00	381551.81	535931.20	N 32 2 56.21	W 104 13 2.51
	2700.00	6.00	264.00	2698.63	-1.33	-3.28	-31.20	0.00	381550.72	535920.80	N 32 2 56.20	W 104 13 2.63
	2800.00	6.00	264.00	2798.08	-1.77	-4.37	-41.60	0.00	381549.63	535910.41	N 32 2 56.19	W 104 13 2.75
	2900.00	6.00	264.00	2897.53	-2.22	-5.46	-51.99	0.00	381548.54	535900.01	N 32 2 56.18	W 104 13 2.87
	3000.00	6.00	264.00	2996.99	-2.66	-6.56	-62.39	0.00	381547.44	535889.62	N 32 2 56.17	W 104 13 2.99
	3100.00	6.00	264.00	3096.44	-3.10	-7.65	-72.78	0.00	381546.35	535879.22	N 32 2 56.16	W 104 13 3.11
	3200.00	6.00	264.00	3195.89	-3.55	-8.74	-83.18	0.00	381545.26	535868.83	N 32 2 56.15	W 104 13 3.23
	3300.00	6.00	264.00	3295.34	-3.99	-9.84	-93.57	0.00	381544.17	535858.43	N 32 2 56.14	W 104 13 3.35
	3400.00	6.00	264.00	3394.80	-4.43	-10.93	-103.97	0.00	381543.07	535848.04	N 32 2 56.13	W 104 13 3.47
	3500.00	6.00	264.00	3494.25	-4.88	-12.02	-114.37	0.00	381541.98	535837.64	N 32 2 56.12	W 104 13 3.59
	3600.00	6.00	264.00	3593.70	-5.32	-13.11	-124.76	0.00	381540.89	535827.25	N 32 2 56.11	W 104 13 3.71
	3700.00	6.00	264.00	3693.15	-5.76	-14.21	-135.16	0.00	381539.80	535816.86	N 32 2 56.09	W 104 13 3.83
	3800.00	6.00	264.00	3792.60	-6.21	-15.30	-145.55	0.00	381538.70	535806.46	N 32 2 56.08	W 104 13 3.96
	3900.00	6.00	264.00	3892.06	-6.65	-16.39	-155.95	0.00	381537.61	535796.07	N 32 2 56.07	W 104 13 4.08
	4000.00	6.00	264.00	3991.51	-7.09	-17.48	-166.34	0.00	381536.52	535785.67	N 32 2 56.06	W 104 13 4.20
	4100.00	6.00	264.00	4090.96	-7.54	-18.58	-176.74	0.00	381535.43	535775.28	N 32 2 56.05	W 104 13 4.32
	4200.00	6.00	264.00	4190.41	-7.98	-19.67	-187.13	0.00	381534.33	535764.88	N 32 2 56.04	W 104 13 4.44
	4300.00	6.00	264.00	4289.87	-8.42	-20.76	-197.53	0.00	381533.24	535754.49	N 32 2 56.03	W 104 13 4.56
	4400.00	6.00	264.00	4389.32	-8.87	-21.85	-207.93	0.00	381532.15	535744.09	N 32 2 56.02	W 104 13 4.68
	4500.00	6.00	264.00	4488.77	-9.31	-22.95	-218.32	0.00	381531.06	535733.70	N 32 2 56.01	W 104 13 4.80
	4600.00	6.00	264.00	4588.22	-9.75	-24.04	-228.72	0.00	381529.96	535723.30	N 32 2 56.00	W 104 13 4.92
	4700.00	6.00	264.00	4687.67	-10.20	-25.13	-239.11	0.00	381528.87	535712.91	N 32 2 55.99	W 104 13 5.04
	4800.00	6.00	264.00	4787.13	-10.64	-26.22	-249.51	0.00	381527.78	535702.51	N 32 2 55.98	W 104 13 5.16
	4900.00	6.00	264.00	4886.58	-11.08	-27.32	-259.90	0.00	381526.69	535692.12	N 32 2 55.97	W 104 13 5.28
	5000.00	6.00	264.00	4986.03	-11.53	-28.41	-270.30	0.00	381525.59	535681.73	N 32 2 55.96	W 104 13 5.40
	5100.00	6.00	264.00	5085.48	-11.97	-29.50	-280.70	0.00	381524.50	535671.33	N 32 2 55.94	W 104 13 5.53
	5200.00	6.00	264.00	5184.94	-12.41	-30.59	-291.09	0.00	381523.41	535660.94	N 32 2 55.93	W 104 13 5.65
	5300.00	6.00	264.00	5284.39	-12.86	-31.69	-301.49	0.00	381522.32	535650.54	N 32 2 55.92	W 104 13 5.77
	5400.00	6.00	264.00	5383.84	-13.30	-32.78	-311.88	0.00	381521.22	535640.15	N 32 2 55.91	W 104 13 5.89
	5500.00	6.00	264.00	5483.29	-13.74	-33.87	-322.28	0.00	381520.13	535629.75	N 32 2 55.90	W 104 13 6.01
	5600.00	6.00	264.00	5582.74	-14.19	-34.97	-332.67	0.00	381519.04	535619.36	N 32 2 55.89	W 104 13 6.13
	5700.00	6.00	264.00	5682.20	-14.63	-36.06	-343.07	0.00	381517.95	535608.96	N 32 2 55.88	W 104 13 6.25
	5800.00	6.00	264.00	5781.65	-15.07	-37.15	-353.46	0.00	381516.85	535598.57	N 32 2 55.87	W 104 13 6.37
	5900.00	6.00	264.00	5881.10	-15.52	-38.24	-363.86	0.00	381515.76	535588.17	N 32 2 55.86	W 104 13 6.49
	6000.00	6.00	264.00	5980.55	-15.96	-39.34	-374.26	0.00	381514.67	535577.78	N 32 2 55.85	W 104 13 6.61
	6100.00	6.00	264.00	6080.00	-16.40	-40.43	-384.65	0.00	381513.58	535567.38	N 32 2 55.84	W 104 13 6.73
	6200.00	6.00	264.00	6179.46	-16.85	-41.52	-395.05	0.00	381512.48	535556.99	N 32 2 55.83	W 104 13 6.85

Comments	MD (ft)	Incl (°)	Azim Grid (°)	TVD (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLS (°/100ft)	Northing (ftUS)	Easting (ftUS)	Latitude (N/S ° ' ")	Longitude (E/W ° ' ")
	6300.00	6.00	264.00	6278.91	-17.29	-42.61	-405.44	0.00	381511.39	535546.60	N 32 2 55.82	W 104 13 6.97
	6400.00	6.00	264.00	6378.36	-17.73	-43.71	-415.84	0.00	381510.30	535536.20	N 32 2 55.81	W 104 13 7.10
	6500.00	6.00	264.00	6477.81	-18.18	-44.80	-426.23	0.00	381509.21	535525.81	N 32 2 55.79	W 104 13 7.22
	6600.00	6.00	264.00	6577.27	-18.62	-45.89	-436.63	0.00	381508.11	535515.41	N 32 2 55.78	W 104 13 7.34
	6700.00	6.00	264.00	6676.72	-19.06	-46.98	-447.02	0.00	381507.02	535505.02	N 32 2 55.77	W 104 13 7.46
	6800.00	6.00	264.00	6776.17	-19.51	-48.08	-457.42	0.00	381505.93	535494.62	N 32 2 55.76	W 104 13 7.58
	6900.00	6.00	264.00	6875.62	-19.95	-49.17	-467.82	0.00	381504.84	535484.23	N 32 2 55.75	W 104 13 7.70
	7000.00	6.00	264.00	6975.07	-20.39	-50.26	-478.21	0.00	381503.74	535473.83	N 32 2 55.74	W 104 13 7.82
	7100.00	6.00	264.00	7074.53	-20.84	-51.35	-488.61	0.00	381502.65	535463.44	N 32 2 55.73	W 104 13 7.94
	7200.00	6.00	264.00	7173.98	-21.28	-52.45	-499.00	0.00	381501.56	535453.04	N 32 2 55.72	W 104 13 8.06
	7300.00	6.00	264.00	7273.43	-21.72	-53.54	-509.40	0.00	381500.47	535442.65	N 32 2 55.71	W 104 13 8.18
	7400.00	6.00	264.00	7372.88	-22.17	-54.63	-519.79	0.00	381499.37	535432.25	N 32 2 55.70	W 104 13 8.30
	7500.00	6.00	264.00	7472.34	-22.61	-55.73	-530.19	0.00	381498.28	535421.86	N 32 2 55.69	W 104 13 8.42
	7600.00	6.00	264.00	7571.79	-23.05	-56.82	-540.58	0.00	381497.19	535411.46	N 32 2 55.68	W 104 13 8.55
	7700.00	6.00	264.00	7671.24	-23.50	-57.91	-550.98	0.00	381496.09	535401.07	N 32 2 55.67	W 104 13 8.67
	7800.00	6.00	264.00	7770.69	-23.94	-59.00	-561.38	0.00	381495.00	535390.68	N 32 2 55.66	W 104 13 8.79
	7900.00	6.00	264.00	7870.14	-24.38	-60.10	-571.77	0.00	381493.91	535380.28	N 32 2 55.64	W 104 13 8.91
	8000.00	6.00	264.00	7969.60	-24.83	-61.19	-582.17	0.00	381492.82	535369.89	N 32 2 55.63	W 104 13 9.03
	8100.00	6.00	264.00	8069.05	-25.27	-62.28	-592.56	0.00	381491.72	535359.49	N 32 2 55.62	W 104 13 9.15
	8200.00	6.00	264.00	8168.50	-25.71	-63.37	-602.96	0.00	381490.63	535349.10	N 32 2 55.61	W 104 13 9.27
	8300.00	6.00	264.00	8267.95	-26.16	-64.47	-613.35	0.00	381489.54	535338.70	N 32 2 55.60	W 104 13 9.39
Drop @ 2° DLS	8315.00	6.00	264.00	8282.87	-26.22	-64.63	-614.91	0.00	381489.38	535337.14	N 32 2 55.60	W 104 13 9.41
	8400.00	4.30	264.00	8367.52	-26.55	-65.43	-622.50	2.00	381488.58	535329.56	N 32 2 55.59	W 104 13 9.50
	8500.00	2.30	264.00	8467.35	-26.79	-66.03	-628.23	2.00	381487.98	535323.83	N 32 2 55.59	W 104 13 9.56
	8600.00	0.30	264.00	8567.32	-26.89	-66.27	-630.48	2.00	381487.74	535321.58	N 32 2 55.58	W 104 13 9.59
Hold to KOP	8615.00	0.00	264.00	8582.32	-26.89	-66.27	-630.52	2.00	381487.74	535321.54	N 32 2 55.58	W 104 13 9.59
	8700.00	0.00	264.00	8667.32	-26.89	-66.27	-630.52	0.00	381487.74	535321.54	N 32 2 55.58	W 104 13 9.59
	8800.00	0.00	264.00	8767.32	-26.89	-66.27	-630.52	0.00	381487.74	535321.54	N 32 2 55.58	W 104 13 9.59
	8900.00	0.00	264.00	8867.32	-26.89	-66.27	-630.52	0.00	381487.74	535321.54	N 32 2 55.58	W 104 13 9.59
	9000.00	0.00	264.00	8967.32	-26.89	-66.27	-630.52	0.00	381487.74	535321.54	N 32 2 55.58	W 104 13 9.59
Build @ 10° DLS	9022.73	0.00	264.00	8990.05	-26.89	-66.27	-630.52	0.00	381487.74	535321.54	N 32 2 55.58	W 104 13 9.59
	9100.00	7.73	359.43	9067.09	-21.69	-61.07	-630.57	10.00	381492.94	535321.49	N 32 2 55.64	W 104 13 9.59
	9200.00	17.73	359.43	9164.51	0.28	-39.07	-630.79	10.00	381514.94	535321.27	N 32 2 55.85	W 104 13 9.59
	9300.00	27.73	359.43	9256.63	38.81	-0.48	-631.17	10.00	381553.52	535320.88	N 32 2 56.24	W 104 13 9.60
	9400.00	37.73	359.43	9340.64	92.73	53.51	-631.71	10.00	381607.51	535320.35	N 32 2 56.77	W 104 13 9.60
	9500.00	47.73	359.43	9414.01	160.41	121.27	-632.38	10.00	381675.26	535319.67	N 32 2 57.44	W 104 13 9.61
	9600.00	57.73	359.43	9474.50	239.77	200.74	-633.17	10.00	381754.73	535318.88	N 32 2 58.23	W 104 13 9.62
	9700.00	67.73	359.43	9520.26	328.42	289.51	-634.06	10.00	381843.48	535318.00	N 32 2 59.11	W 104 13 9.63
	9800.00	77.73	359.43	9549.91	423.66	384.87	-635.00	10.00	381938.84	535317.05	N 32 3 0.05	W 104 13 9.64
	9900.00	87.73	359.43	9562.56	522.59	483.94	-635.99	10.00	382037.89	535316.07	N 32 3 1.03	W 104 13 9.65
Landing Point	9919.73	89.70	359.43	9563.00	542.29	503.66	-636.18	10.00	382057.62	535315.87	N 32 3 1.22	W 104 13 9.65
	10000.00	89.70	359.43	9563.42	622.45	583.93	-636.98	0.00	382137.87	535315.08	N 32 3 2.02	W 104 13 9.66
	10100.00	89.70	359.43	9563.94	722.31	683.92	-637.98	0.00	382237.86	535314.08	N 32 3 3.01	W 104 13 9.67
	10200.00	89.70	359.43	9564.47	822.17	783.91	-638.97	0.00	382337.84	535313.09	N 32 3 4.00	W 104 13 9.68
	10300.00	89.70	359.43	9564.99	922.04	883.91	-639.96	0.00	382437.83	535312.10	N 32 3 4.99	W 104 13 9.69
	10400.00	89.70	359.43	9565.51	1021.90	983.90	-640.96	0.00	382537.81	535311.10	N 32 3 5.98	W 104 13 9.70
	10500.00	89.70	359.43	9566.04	1121.76	1083.90	-641.95	0.00	382637.80	535310.11	N 32 3 6.97	W 104 13 9.71
	10600.00	89.70	359.43	9566.56	1221.62	1183.89	-642.94	0.00	382737.78	535309.11	N 32 3 7.96	W 104 13 9.72
	10700.00	89.70	359.43	9567.08	1321.48	1283.88	-643.94	0.00	382837.77	535308.12	N 32 3 8.95	W 104 13 9.73
	10800.00	89.70	359.43	9567.60	1421.34	1383.88	-644.93	0.00	382937.75	535307.13	N 32 3 9.93	W 104 13 9.74
	10900.00	89.70	359.43	9568.13	1521.20	1483.87	-645.93	0.00	383037.73	535306.13	N 32 3 10.92	W 104 13 9.75
	11000.00	89.70	359.43	9568.65	1621.07	1583.86	-646.92	0.00	383137.72	535305.14	N 32 3 11.91	W 104 13 9.76
	11100.00	89.70	359.43	9569.17	1720.93	1683.86	-647.91	0.00	383237.70	535304.15	N 32 3 12.90	W 104 13 9.77
	11200.00	89.70	359.43	9569.70	1820.79	1783.85	-648.91	0.00	383337.69	535303.15	N 32 3 13.89	W 104 13 9.78
	11300.00	89.70	359.43	9570.22	1920.65	1883.84	-649.90	0.00	383437.67	535302.16	N 32 3 14.88	W 104 13 9.79
	11400.00	89.70	359.43	9570.74	2020.51	1983.84	-650.89	0.00	383537.66	535301.17	N 32 3 15.87	W 104 13 9.80
	11500.00	89.70	359.43	9571.27	2120.37	2083.83	-651.89	0.00	383637.64	535300.17	N 32 3 16.86	W 104 13 9.81
	11600.00	89.70	359.43	9571.79	2220.24	2183.83	-652.88	0.00	383737.63	535299.18	N 32 3 17.85	W 104 13 9.82
	11700.00	89.70	359.43	9572.31	2320.10	2283.82	-653.87	0.00	383837.61	535298.19	N 32 3 18.84	W 104 13 9.83
	11800.00	89.70	359.43	9572.84	2419.96	2383.81	-654.87	0.00	383937.60	535297.19	N 32 3 19.83	W 104 13 9.84
	11900.00	89.70	359.43	9573.36	2519.82	2483.81	-655.86	0.00	384037.58	535296.20	N 32 3 20.82	W 104 13 9.85
	12000.00	89.70	359.43	9573.88	2619.68	2583.80	-656.86	0.00	384137.56	535295.20	N 32 3 21.81	W 104 13 9.86
	12100.00	89.70	359.43	9574.41	2719.54	2683.79	-657.85	0.00	384237.55	535294.21	N 32 3 22.80	W 104 13 9.87
	12200.00	89.70	359.43	9574.93	2819.41	2783.79	-658.84	0.00	384337.53	535293.22	N 32 3 23.79	W 104 13 9.88
	12300.00	89.70	359.43	9575.45	2919.27	2883.78	-659.84	0.00	384437.52	535292.22	N 32 3 24.78	W 104 13 9.89
	12400.00	89.70	359.43	9575.97	3019.13	2983.78	-660.83	0.00	384537.50	535291.23	N 32 3 25.77	W 104 13 9.90
	12500.00	89.70	359.43	9576.50	3118.99	3083.77	-661.82	0.00	384637.49	535290.24	N 32 3 26.76	W 104 13 9.92
	12600.00	89.70	359.43	9577.02	3218.85	3183.76	-662.82	0.00	384737.47	535289.24	N 32 3 27.75	W 104 13 9.93
	12700.00	89.70	359.43	9577.54	3318.71	3283.76	-663.81	0.00	384837.46	535288.25	N 32 3 28.74	W 104 13 9.94
	12800.00	89.70	359.43	9578.07	3418.57	3383.75	-664.81	0.00	384937.44	535287.26	N 32 3 29.73	W 104 13 9.95
	12900.00	89.70	359.43	9578.59	3518.44	3483.74	-665.80	0.00	385037.43	535286.26	N 32 3 30.71	W 104 13 9.96
	13000.00	89.70	359.43	9579.11	3618.30	3583.74	-666.79	0.00	385137.41	535285.27	N 32 3 31.70	W 104 13 9.97
	13100.00	89.70	359.43	9579.64	3718.16	3683.73	-667.79	0.00	385237.39	535284.27	N 32 3 32.69	W 104 13 9.98
	13200.00	89.70	359.43	9580.16	3818.02	3783.73	-668.78	0.00	385337.38	535283.28	N 32 3 33.68	W 104 13 9.99
	13300.00	89.70	359.43	9580.68	3917.88	3883.72	-669.77	0.00	385437.36	535282.29	N 32 3 34.67	W 104 13 10.00
	13400.00	89.70	359.43	9581.21	4017.74	3983.71	-670.77	0.00	385537.35	535281.29	N 32 3 35.66	W 104 13 10.01
	13500.00	89.70	359.43	9581.73	4117.61	4083.71	-671.76	0.00	385637.33	535280.30	N 32 3 36.65	W 104 13 10.02
	13600.00	89.70	359.43	9582.25	4217.47	4183.70	-672.75	0.00	385737.32	535279.31	N 32 3 37.64	W 104 13 10.03
	13700.00	89.70	359.43	9582.78	4317.33	4283.69	-673.75	0.00	385837.30	535278.31	N 32 3 38.63	W 104 13 10.04
	13800.00	89.70	359.43	9583.30	4417.19	4383.69	-674.74	0.00	385937.29	535277.32	N 32 3 39.62	W 104 13 10.05
	13900.00	89.70	359.43	9583.82	4517.05	4483.68	-675.74	0.00	386037.27	535276.33	N 32 3 40.61	W 104 13 10.06
	14000.00	89.70	359.43	9584.34	4616.91	4583.67	-676.73	0.00	386137.26	535275.33	N 32 3 41.60	W 104 13 10.07
	14100.00	89.70	359.43	9584.87	4716.78	4683.67	-677.72	0.00	386237.24	535274.34	N 32 3 42.59	W 104 13 10.08
	14200.00	89.70	359.43	9585.39	4816.64	4783.66	-678.72	0.00	386337.22	535273.35	N 32 3 43.58	W 104 13 10.09
	14300.00	89.70	359.43	9585.91	4916.50	4883.66	-679.71	0.00	386437.21	535272.35	N 32 3 44.57	W 104 13 10.10
	14400.00	89.70	359.43	9586.44	5016.36	4983.65	-680.70	0.00	386537.19	535271.36	N 32 3 45.56	W 104 13 10.11
	14500.00	89.70	359.43	9586.96	5116.22	5083.64	-681.70	0.00	386637.18	535270.36	N 32 3 46.55	W 104 13 10.12
	14600.00	89.70	359.43	9587.48	5216.08	5183.64	-682.69	0.00	386737.16	535269.37	N 32 3 47.54	W 104 13 10.13

Comments	MD (ft)	Incl (°)	Azim Grid (°)	TVD (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLS (°/100ft)	Northing (ftUS)	Easting (ftUS)	Latitude (N/S ° ' ")	Longitude (E/W ° ' ")
	14700.00	89.70	359.43	9588.01	5315.95	5283.63	-683.69	0.00	386837.15	535268.38	N 32 3 48.53	W 104 13 10.14
	14800.00	89.70	359.43	9588.53	5415.81	5383.62	-684.68	0.00	386937.13	535267.38	N 32 3 49.52	W 104 13 10.15
	14900.00	89.70	359.43	9589.05	5515.67	5483.62	-685.67	0.00	387037.12	535266.39	N 32 3 50.51	W 104 13 10.16
	15000.00	89.70	359.43	9589.58	5615.53	5583.61	-686.67	0.00	387137.10	535265.40	N 32 3 51.49	W 104 13 10.17
Chevron HH SO 8 P2 5H - MidPoint	15004.67	89.70	359.43	9589.60	5620.19	5588.28	-686.71	0.00	387141.77	535265.35	N 32 3 51.54	W 104 13 10.17
Hold to TD	15043.72	89.70	0.21	9589.60	5659.17	5627.33	-686.63	2.00	387180.81	535265.23	N 32 3 51.93	W 104 13 10.17
	15100.00	89.70	0.21	9590.10	5715.33	5683.61	-686.63	0.00	387237.09	535265.44	N 32 3 52.48	W 104 13 10.17
	15200.00	89.70	0.21	9590.62	5815.11	5783.61	-686.26	0.00	387337.08	535265.81	N 32 3 53.47	W 104 13 10.17
	15300.00	89.70	0.21	9591.15	5914.89	5883.61	-685.89	0.00	387437.07	535266.17	N 32 3 54.46	W 104 13 10.16
	15400.00	89.70	0.21	9591.67	6014.67	5983.60	-685.52	0.00	387537.06	535266.54	N 32 3 55.45	W 104 13 10.15
	15500.00	89.70	0.21	9592.19	6114.45	6083.60	-685.15	0.00	387637.04	535266.91	N 32 3 56.44	W 104 13 10.15
	15600.00	89.70	0.21	9592.72	6214.24	6183.60	-684.78	0.00	387737.03	535267.28	N 32 3 57.43	W 104 13 10.14
	15700.00	89.70	0.21	9593.24	6314.02	6283.60	-684.41	0.00	387837.02	535267.65	N 32 3 58.42	W 104 13 10.14
	15800.00	89.70	0.21	9593.76	6413.80	6383.59	-684.04	0.00	387937.01	535268.02	N 32 3 59.41	W 104 13 10.13
	15900.00	89.70	0.21	9594.29	6513.58	6483.59	-683.67	0.00	388037.00	535268.39	N 32 4 0.40	W 104 13 10.13
	16000.00	89.70	0.21	9594.81	6613.36	6583.59	-683.30	0.00	388136.99	535268.76	N 32 4 1.39	W 104 13 10.12
	16100.00	89.70	0.21	9595.33	6713.14	6683.59	-682.93	0.00	388236.98	535269.13	N 32 4 2.38	W 104 13 10.12
	16200.00	89.70	0.21	9595.86	6812.92	6783.59	-682.56	0.00	388336.97	535269.50	N 32 4 3.37	W 104 13 10.11
	16300.00	89.70	0.21	9596.38	6912.70	6883.58	-682.19	0.00	388436.96	535269.87	N 32 4 4.36	W 104 13 10.11
	16400.00	89.70	0.21	9596.90	7012.48	6983.58	-681.83	0.00	388536.94	535270.24	N 32 4 5.35	W 104 13 10.10
	16500.00	89.70	0.21	9597.42	7112.26	7083.58	-681.46	0.00	388636.93	535270.61	N 32 4 6.34	W 104 13 10.09
	16600.00	89.70	0.21	9597.95	7212.05	7183.58	-681.09	0.00	388736.92	535270.98	N 32 4 7.33	W 104 13 10.09
	16700.00	89.70	0.21	9598.47	7311.83	7283.58	-680.72	0.00	388836.91	535271.35	N 32 4 8.32	W 104 13 10.08
	16800.00	89.70	0.21	9598.99	7411.61	7383.57	-680.35	0.00	388936.90	535271.71	N 32 4 9.31	W 104 13 10.08
	16900.00	89.70	0.21	9599.51	7511.39	7483.57	-679.98	0.00	389036.89	535272.08	N 32 4 10.30	W 104 13 10.07
	17000.00	89.70	0.21	9600.04	7611.17	7583.57	-679.61	0.00	389136.88	535272.45	N 32 4 11.29	W 104 13 10.07
	17100.00	89.70	0.21	9600.56	7710.95	7683.57	-679.24	0.00	389236.87	535272.82	N 32 4 12.28	W 104 13 10.06
	17200.00	89.70	0.21	9601.08	7810.73	7783.57	-678.87	0.00	389336.85	535273.19	N 32 4 13.26	W 104 13 10.06
	17300.00	89.70	0.21	9601.60	7910.51	7883.56	-678.50	0.00	389436.84	535273.56	N 32 4 14.25	W 104 13 10.05
	17400.00	89.70	0.21	9602.13	8010.29	7983.56	-678.13	0.00	389536.83	535273.93	N 32 4 15.24	W 104 13 10.04
	17500.00	89.70	0.21	9602.65	8110.07	8083.56	-677.76	0.00	389636.82	535274.30	N 32 4 16.23	W 104 13 10.04
	17600.00	89.70	0.21	9603.17	8209.86	8183.56	-677.39	0.00	389736.81	535274.67	N 32 4 17.22	W 104 13 10.03
	17700.00	89.70	0.21	9603.69	8309.64	8283.56	-677.02	0.00	389836.80	535275.04	N 32 4 18.21	W 104 13 10.03
	17800.00	89.70	0.21	9604.22	8409.42	8383.55	-676.65	0.00	389936.79	535275.41	N 32 4 19.20	W 104 13 10.02
	17900.00	89.70	0.21	9604.74	8509.20	8483.55	-676.28	0.00	390036.78	535275.78	N 32 4 20.19	W 104 13 10.02
	18000.00	89.70	0.21	9605.26	8608.98	8583.55	-675.92	0.00	390136.76	535276.15	N 32 4 21.18	W 104 13 10.01
	18100.00	89.70	0.21	9605.78	8708.76	8683.55	-675.55	0.00	390236.75	535276.52	N 32 4 22.17	W 104 13 10.01
	18200.00	89.70	0.21	9606.30	8808.54	8783.55	-675.18	0.00	390336.74	535276.89	N 32 4 23.16	W 104 13 10.00
	18300.00	89.70	0.21	9606.83	8908.32	8883.54	-674.81	0.00	390436.73	535277.25	N 32 4 24.15	W 104 13 9.99
	18400.00	89.70	0.21	9607.35	9008.10	8983.54	-674.44	0.00	390536.72	535277.62	N 32 4 25.14	W 104 13 9.99
	18500.00	89.70	0.21	9607.87	9107.88	9083.54	-674.07	0.00	390636.71	535277.99	N 32 4 26.13	W 104 13 9.98
	18600.00	89.70	0.21	9608.39	9207.67	9183.54	-673.70	0.00	390736.70	535278.36	N 32 4 27.12	W 104 13 9.98
	18700.00	89.70	0.21	9608.91	9307.45	9283.54	-673.33	0.00	390836.69	535278.73	N 32 4 28.11	W 104 13 9.97
	18800.00	89.70	0.21	9609.44	9407.23	9383.53	-672.96	0.00	390936.68	535279.10	N 32 4 29.10	W 104 13 9.97
	18900.00	89.70	0.21	9609.96	9507.01	9483.53	-672.59	0.00	391036.66	535279.47	N 32 4 30.09	W 104 13 9.96
	19000.00	89.70	0.21	9610.48	9606.79	9583.53	-672.22	0.00	391136.65	535279.84	N 32 4 31.08	W 104 13 9.96
	19100.00	89.70	0.21	9611.00	9706.57	9683.53	-671.85	0.00	391236.64	535280.21	N 32 4 32.07	W 104 13 9.95
	19200.00	89.70	0.21	9611.52	9806.35	9783.53	-671.48	0.00	391336.63	535280.58	N 32 4 33.06	W 104 13 9.95
	19300.00	89.70	0.21	9612.04	9906.13	9883.52	-671.11	0.00	391436.62	535280.95	N 32 4 34.05	W 104 13 9.94
	19400.00	89.70	0.21	9612.56	10005.91	9983.52	-670.74	0.00	391536.61	535281.32	N 32 4 35.03	W 104 13 9.93
	19500.00	89.70	0.21	9613.09	10105.69	10083.52	-670.38	0.00	391636.60	535281.69	N 32 4 36.02	W 104 13 9.93
	19600.00	89.70	0.21	9613.61	10205.48	10183.52	-670.01	0.00	391736.59	535282.06	N 32 4 37.01	W 104 13 9.92
	19700.00	89.70	0.21	9614.13	10305.26	10283.52	-669.64	0.00	391836.57	535282.42	N 32 4 38.00	W 104 13 9.92
	19800.00	89.70	0.21	9614.65	10405.04	10383.51	-669.27	0.00	391936.56	535282.79	N 32 4 38.99	W 104 13 9.91
	19900.00	89.70	0.21	9615.17	10504.82	10483.51	-668.90	0.00	392036.55	535283.16	N 32 4 39.98	W 104 13 9.91
	20000.00	89.70	0.21	9615.69	10604.60	10583.51	-668.53	0.00	392136.54	535283.53	N 32 4 40.97	W 104 13 9.90
	20100.00	89.70	0.21	9616.21	10704.38	10683.51	-668.16	0.00	392236.53	535283.90	N 32 4 41.96	W 104 13 9.90
Chevron HH SO 8 P2 5H - PBHL	20126.47	89.70	0.21	9616.35	10730.79	10709.98	-668.06	0.00	392263.00	535284.00	N 32 4 42.22	W 104 13 9.89

Survey Type: Non-Def Plan

Survey Error Model: ISCWSA Rev 0 *** 3-D 95.000% Confidence 2.7955 sigma
Survey Program:

Description	Part	MD From (ft)	MD To (ft)	EOU Freq (ft)	Hole Size (in)	Casing Diameter (in)	Survey Tool Type	Borehole / Survey
	1	0.000	33.000	1/100.000	30.000	30.000	SLB_MWD-STD-Depth Only	Original Borehole / Chevron HH SO 8 P2 5H Rev0 CJG 12Jan16
	1	33.000	20126.473	1/100.000	30.000	30.000	SLB_MWD-STD	Original Borehole / Chevron HH SO 8 P2 5H Rev0 CJG 12Jan16

Generic Hayhurst Development Pad Layout - Phase 1

H2S Monitor Locations
- Bop/Cellar
- Rig Floor
- Shaker Skid
- Bell Nipple

Flag Locations
- Sign-In Shack
- Rig Floor
- Dog House

10 Minute Escape Packs
- 1 at Pits
- 1 at Trip Tank
- 1 at Accumulator
- 4 at Rig Floor

45 Minute Escape Packs
- 2 at Briefing Area
- 2 at Alternate Briefing Area

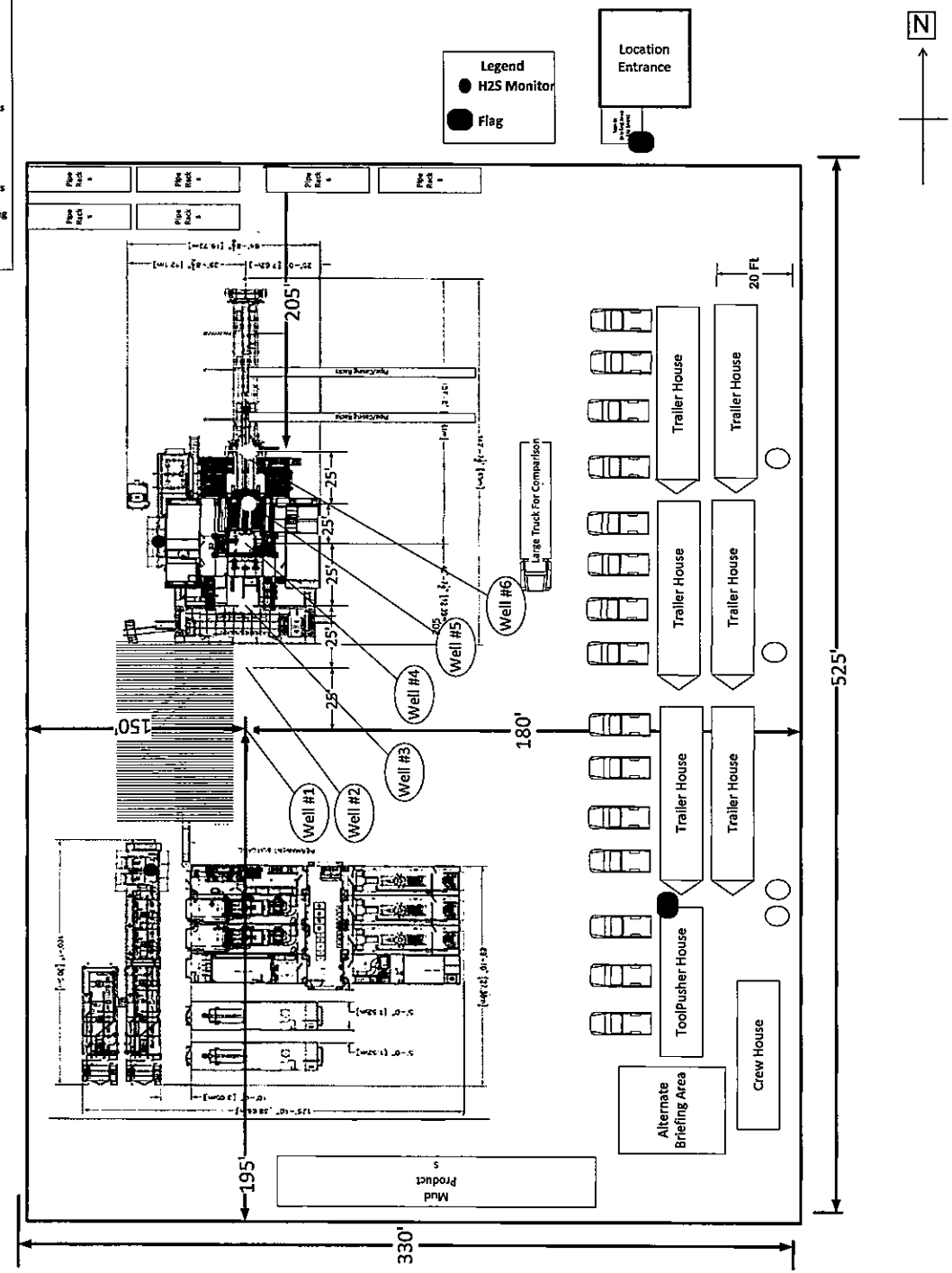
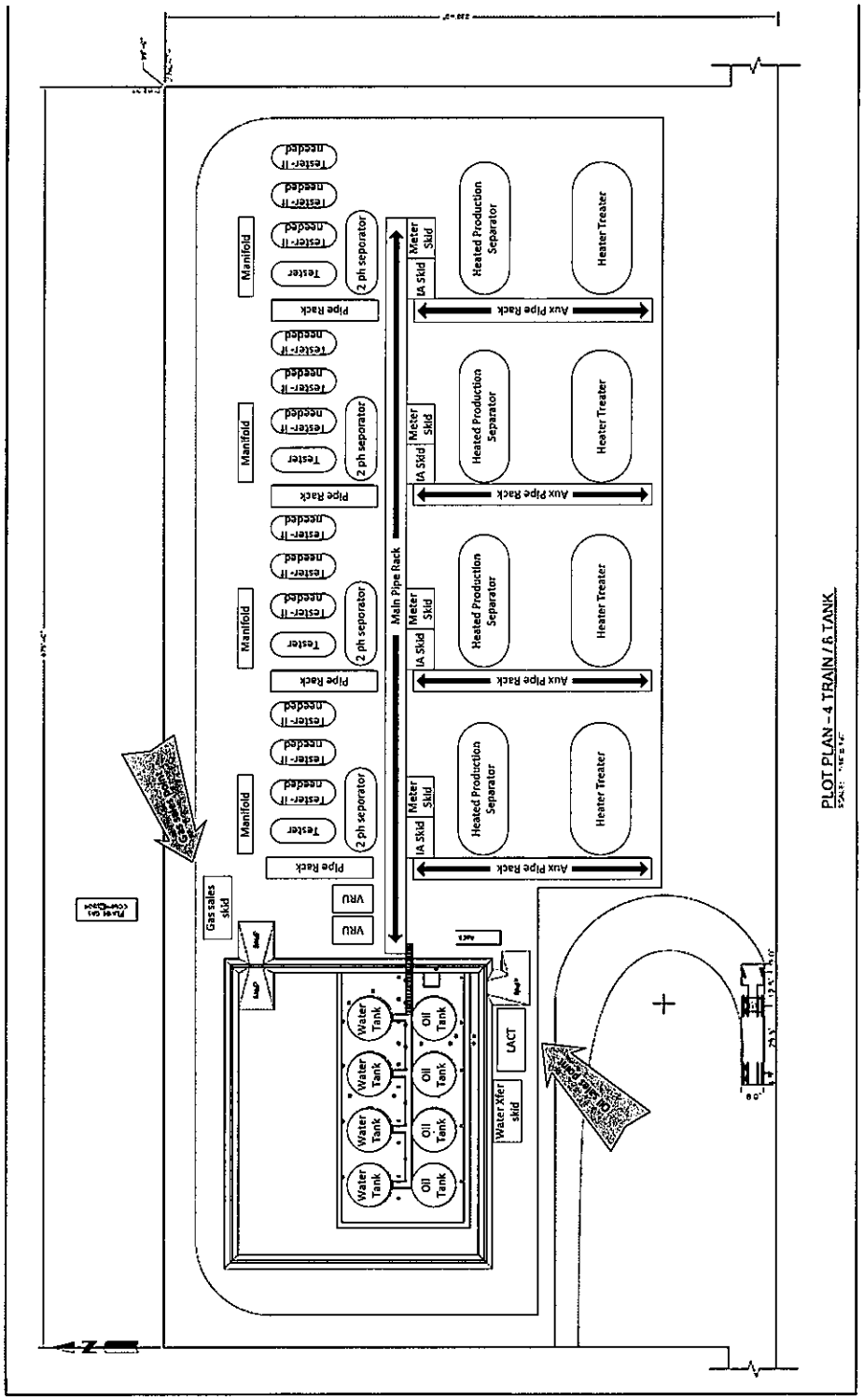


EXHIBIT 4


Heated Production Separator
Heater Treater
Aux Pipe Rack
IA Skid
Meter Skid
Main Pipe Rack
2 ph seporator
Manifold
Tester
needed
Pipe Rack
VRU
Gas sales skid
Water Tank
Oil Tank
LACT
Water Xfer skid
PLOT PLAN - 4 TRAIN / 8 TANK

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge

ROBERT L. LASTRAPES
NEW MEXICO
23006
1-8-2016
PROFESSIONAL SURVEYOR

Robert L. Lastrapes
Registration No. 23006

R 27 E

T 26 S

NW PAD CORNER		NE PAD CORNER		HH SO 8 P2 NO. 5H WELL	
X=	535,799 NAD 27	X=	536,129 NAD 27	X=	535,952 NAD 27
Y=	381,809	Y=	381,808	Y=	381,554
ELEVATION +3241' NAVD 88		ELEVATION +3247' NAVD 88		LAT.	32.048953
SW PAD CORNER		SE PAD CORNER		LONG.	104.217295
X=	535,805 NAD 27	X=	536,135 NAD 27	X=	577,136 NAD83
Y=	381,284	Y=	381,284	Y=	381,611
ELEVATION +3244' NAVD 88		ELEVATION +3256' NAVD 88		LAT.	32.049075
				LONG.	104.217789
				ELEVATION +3245' NAVD 88	

Sec. 8

Bureau of Land Management

EROSION CONTROL (STRAW WATTLES)

S 89°52'10" E 810.78'

Fnd. 2" Iron Pipe w/ Cap at the NW Corner of Section 17

TOPSOIL

280'

150'

180'

330'

HH SO 8 P2 No. 5H Well
255' FNL, 960' FWL

PROPOSED PAD
±3.98 Acres

CENTERLINE PROPOSED ACCESS ROAD (1)
24' X ±5,444.40'
±3.00 Acres
±329.96 Rods
(SEE PAGE 2)

Sec. 17

Bureau of Land Management

(Access Road 1) ± 4289.90', ±2.36 Acres, ±259.99 Rods

NAD 27 NEW MEXICO EAST ZONE

Scale: 1" = 300'

300' 0 150' 300'

INTERIM RECLAMATION

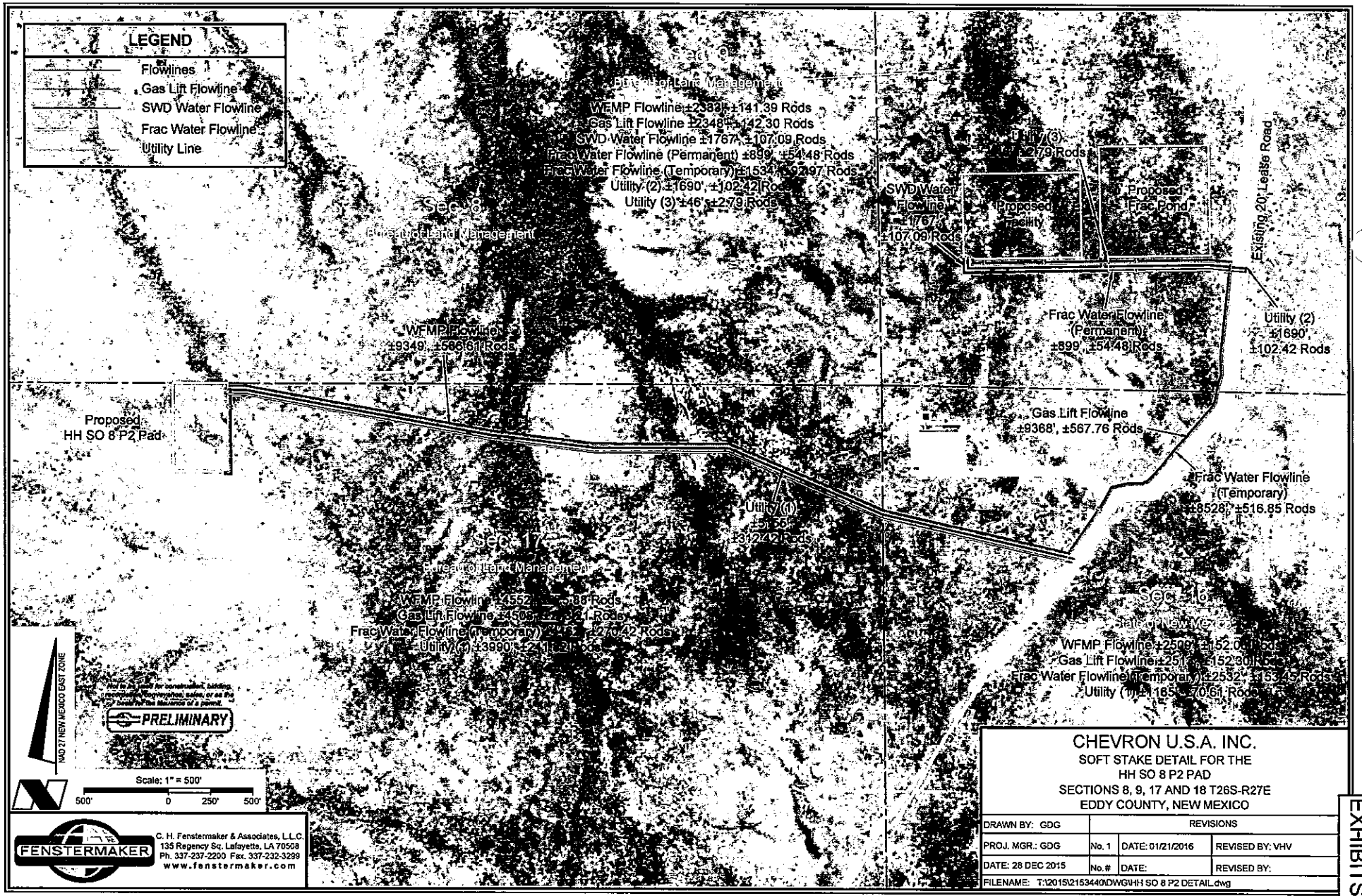
SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED PADS, FRAC POND & ACCESS ROADS
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: LJG	REVISIONS		
PROJ. MGR.: GDG	No. 1	DATE: 1/7/2016	REVISED BY: MBD
DATE: 12/22/2015	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153438\DWG\HH SO 8 P2 5H_SUP.dwg			

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com



CHEVRON U.S.A. INC.

SOFT STAKE DETAIL FOR THE
HH SO 8 P2 PAD
SECTIONS 8, 9, 17 AND 18 T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: GDG	REVISIONS		
PROJ. MGR.: GDG	No. 1	DATE: 01/21/2016	REVISED BY: VHV
DATE: 28 DEC 2015	No.#	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\HH SO 8 P2 DETAIL.dwg			

EXHIBITS 4&5

CHEVRON U.S.A. Inc
HH SO 8 P2 5H
NMNM 118108
SECTION 17, T26S-R27E (Off Lease SHL) SECTION 5, T26S, R27E
SHL 255' FNL & 960' FWL BHL 180' FNL & 330' FWL

APD Surface Use Plan of Operations

This Surface Use Plan of Operations has been designed to be reviewed in conjunction with Hayhurst Development Area (HDA) Master Development Plan

HDA Master Development Plan Reference Table
The contents referenced below apply to all HDA APD's

Existing Roads	Exhibit 1, MDP SUPO Page 1
Construction Materials	MDP SUPO Page 6
Methods for Handling Waste	MDP SUPO Page 6
Reclamation Objectives	MDP SUPO Page 6-8
Final Surface Reclamation	MDP SUPO Page 6-8

Driving Directions

- Driving Directions – From Malaga, New Mexico. The location is approximately 11.5 miles from the nearest town, which is Malaga, New Mexico. From Malaga, proceed South on Highway 285 approximately 11.5 miles and turn right (West) onto White City Rd and go approximately 7.5 miles on White City Road until the road reaches an intersection with a permanent sign reading "Chevron Access". Turn left onto this and travel 1 mile, then right and travel for another .5 miles to the well location.

New or Reconstructed Access Roads – (Exhibit 2, MDP SUPO Pg. 1)

- There will be 7172' of new road construction for this proposal.
- Ditches: See Exhibit 2 (To be submitted at later date)
- Culverts: See Exhibit 2 (To be submitted at later date)
- Road Cuts: See Exhibit 2 (To be submitted at later date)

Location of Existing Wells (Exhibit 3)

- 1-Mile radius map is attached

CHEVRON U.S.A. Inc
HH SO 8 P2 5H
NMNM 118108
SECTION 17, T26S-R27E (Off Lease SHL) SECTION 5, T26S, R27E
SHL 255' FNL & 960' FWL BHL 180' FNL & 330' FWL

Location of Existing and/or Proposed Production Facilities (Exhibit 4, MDP SUP Pg. 2)

- Facilities: Proposed production facilities located in the SW corner of Sec. 9, T26S-R27E where oil and gas sales will take place.
    - The proposed facility and frac pond is in Sec. 9, T26S-R27E
    - Gas purchaser pipeline is in place at the tank battery.
    - Open top tanks or open containments will be netted.
    - Open vent exhaust stacks will be modified to prevent birds or bats from entering, discourage perching, roosting, and nesting.
    - Facilities will have a secondary containment 1.5 times the holding capacity of largest storage tank.
    - All above ground structures will be painted non-reflective shale green for blending with surrounding environment.
    - The permanent water disposal system will be determined prior to construction of any water transfer pipeline. Until permanent water takeaway is available, produced water will be hauled off location in trucks. **Notification will be provided to BLM upon site selection and survey – plats (including SWD well information) will be provided.**
- Pipelines: See Detail – Exhibit 5
    - Pipelines Include:
        - 9,349' of Flowlines carrying production (buried)
        - 9,368' Gas Lift Line carrying pressurized gas (buried)
        - 1,767' SWD Line carrying produced water (buried)
        - 899' Permanent Frac water line carrying fresh water (buried)
        - 8528' Temporary Water line carrying fresh water (surface)
    - A ROW will be applied for through the State and BLM.
    - All construction activity will be confined to the approved ROW.
    - Pipeline will run parallel to the road and will stay within approved ROW.
- Power lines\Utility lines: 6,891' of new power lines

Location and Types of Water Supply (Exhibit 5, MDP SUPO Pg. 5)

- Proposed pond in Section 9, T26S-R27E will be utilized for fresh water.
- Fresh water will be obtained from a private water source.

Construction Materials (MDP SUPO Pg. 6)

- Location-specific caliche sources will be provided in post-application supplement

CHEVRON U.S.A. Inc
HH SO 8 P2 5H
NMNM 118108
SECTION 17, T26S-R27E (Off Lease SHL) SECTION 5, T26S, R27E
SHL 255' FNL & 960' FWL BHL 180' FNL & 330' FWL

Well Site Layout (Exhibit 6)

- Surveyor Plat (Exhibit 6a)
  - Exterior well pad dimensions are 525' x 330'
  - Interior well pad dimensions from point of entry (well head) of the well are N-255', S-270', E-180', W-150'. Total disturbance area needed for construction of well pad will be approximately 4 acres
  - Topsoil placement is on the west where interim reclamation is planned to be completed upon completion of well and evaluation of best management practices.
  - Cut and fill: will be minimal.
- Rig Layout (Exhibit 6b)

Plans for Surface Reclamation (Exhibit 6, MDP SUPA Pg. 8)

Interim Reclamation Procedures

- Reclaimed pad size: 200' x 325'
- See Exhibit for reclaimed pad layout, topsoil location & erosion control features

Surface Ownership

- BLM Surface
  - Surface Tenant – Phillip Stell
- **Nearest Post Office:** Malaga Post Office; 11.4 Miles north

Other Information

- On-site performed by BLM NRS: Paul Murphy 11/4/2015
- Cultural report attached: **Yes** Participating Agreement attached: N/A

CHEVRON U.S.A. Inc
HH SO 8 P2 5H
NMNM 118108
SECTION 17, T26S-R27E (Off Lease SHL) SECTION 5, T26S, R27E
SHL 255' FNL & 960' FWL BHL 180' FNL & 330' FWL

Chevron Representatives

Primary point of contact:
Jennifer Van Curen
Jennifer.VanCuren@arcadis-us.com
M- 432-270-8753

Chevron Functional Contacts

Project Manager Name: Sean Cheben Address: 1400 Smith Street Houston, TX 77002 Phone: (432) 664-6809 Email: Sean.Cheben@chevron.com	**Drilling Engineer** Name: Roderick Milligan Address: 1400 Smith Street Houston, TX 77002 Phone: (281) 413-9794 Email: RoderickMilligan@chevron.com
Surface Land Representative Name: Kevin Dickerson Address: 15 Smith Road Midland Texas 79705 Phone: (432) 687-7104 Email: Kevin.Dickerson@chevron.com	**Facility Lead** Name: Tyler Weaver Address: 1400 Smith Street Houston, TX 77002 Phone: (281) 384-8934 Email: tyler.weaver@chevron.com
Geologist Name: Jeff Fabre Address: 1400 Smith Street Houston, TX 77002 Phone: (713) 372-0523 Email: JeffreyFabre@chevron.com	**Regulatory Specialist** Cindy Herrera-Murillo Address: 1616 W. Bender Blvd, Hobbs, NM 88240 Office: (575) 263-0431 Email: CHerreraMurillo@chevron.com

CHEVRON U.S.A. Inc
HH SO 8 P2 5H
NMNM 118108
SECTION 17, T26S-R27E (Off Lease SHL) SECTION 5, T26S, R27E
SHL 255' FNL & 960' FWL BHL 180' FNL & 330' FWL

EXHIBITS:

Exhibit 1 -- Existing Roads

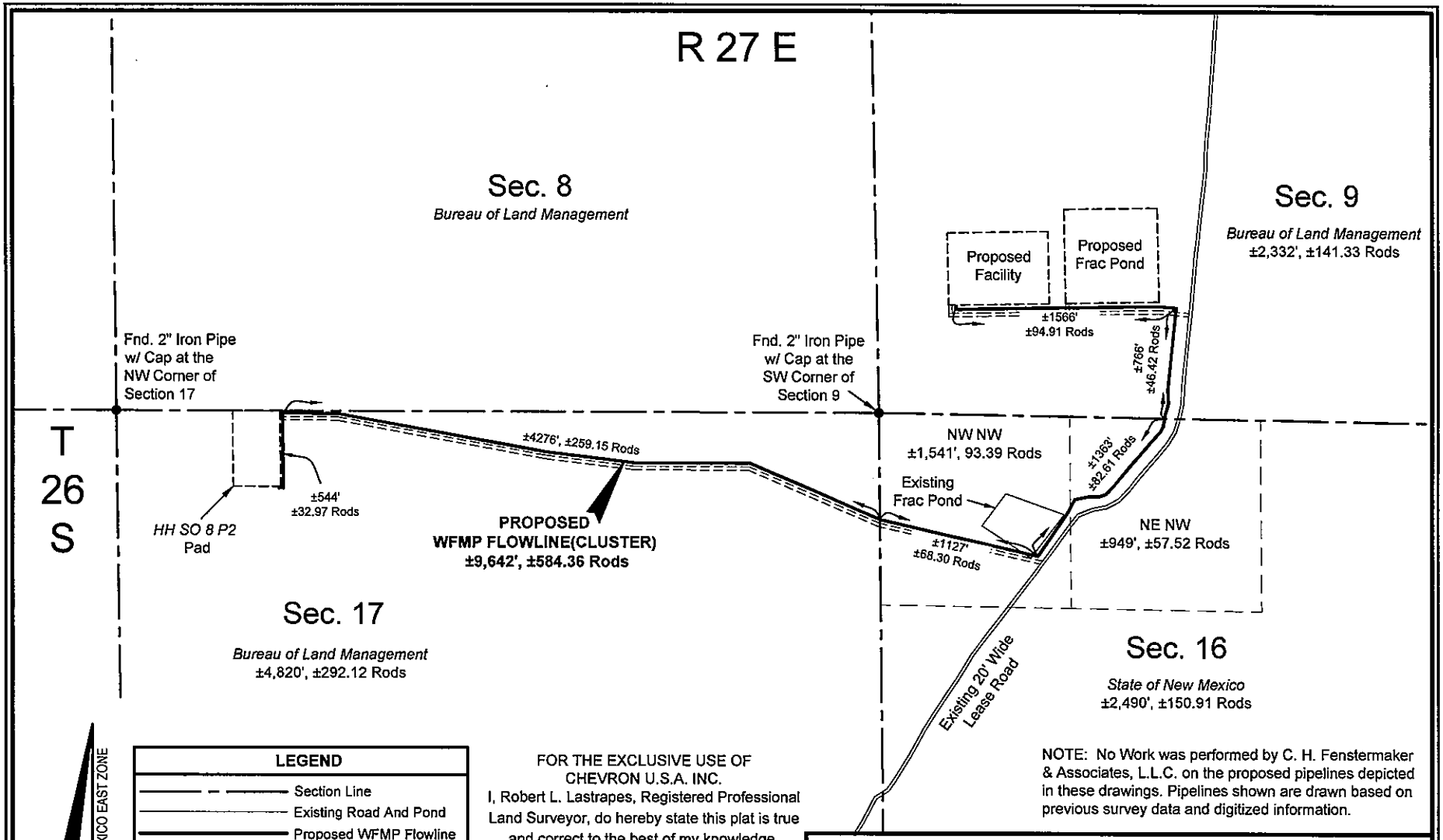
Exhibit 2 -- Survey Plat: New or Reconstructed Roads Map: if road is outside 600' x 600'.

Exhibit 3 -- 1-mile Radius Map

Exhibit 4 -- Location of Existing and/or Proposed Production Facilities (Tank Battery)

Exhibit 5 -- Survey Plat: Infrastructure: roads, pipelines, power lines, frac pond

Exhibit 6 -- Rig Layout: Well Site Layout Map / Diagram



FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

NOTE: No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED WFMP FLOWLINE(CLUSTER)
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\WFMP FL_SUP.dwg			

EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No.23006

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED WFMP FLOWLINE(CLUSTER)
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\WFMP FL_SUP.dwg			

R 27 E

NOTE: No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

Sec. 8
Bureau of Land Management

Sec. 9
Bureau of Land Management
±2,348', ±142.30 Rods

Proposed Facility

Proposed Frac Pond

±1585'
±96.06 Rods

±763'
±46.24 Rods

Fnd. 2" Iron Pipe w/ Cap at the NW Corner of Section 17

Fnd. 2" Iron Pipe w/ Cap at the SW Corner of Section 9

T 26 S

±4279', ±259.33 Rods

NW NW
±1,533', 92.91 Rods

±1380'
±83.63 Rods

Existing Frac Pond

±521'
±31.58 Rods

HH SO 8 P2
Pad

PROPOSED GAS LIFT FLOWLINE
±9,661', ±585.51 Rods

±1133'
±68.67 Rods

NE NW
±980', ±59.39 Rods

Sec. 17
Bureau of Land Management
±4,800', ±290.91 Rods

Sec. 16
State of New Mexico
±2,513', ±152.30 Rods

Existing 20' Wide Lease Road

NAD 27 NEW MEXICO EAST ZONE

LEGEND

- Section Line
- Existing Road And Pond
- Proposed Gas Lift Flowline
- Proposed Access Road, Frac Pump, Tank Battery, Compressor Station & Pad
- Found Occupation

Scale: 1" = 1000'

1000' 0 500' 1000'

FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED GAS LIFT FLOWLINE
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Gas Lift FL_SUP.dwg			

EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

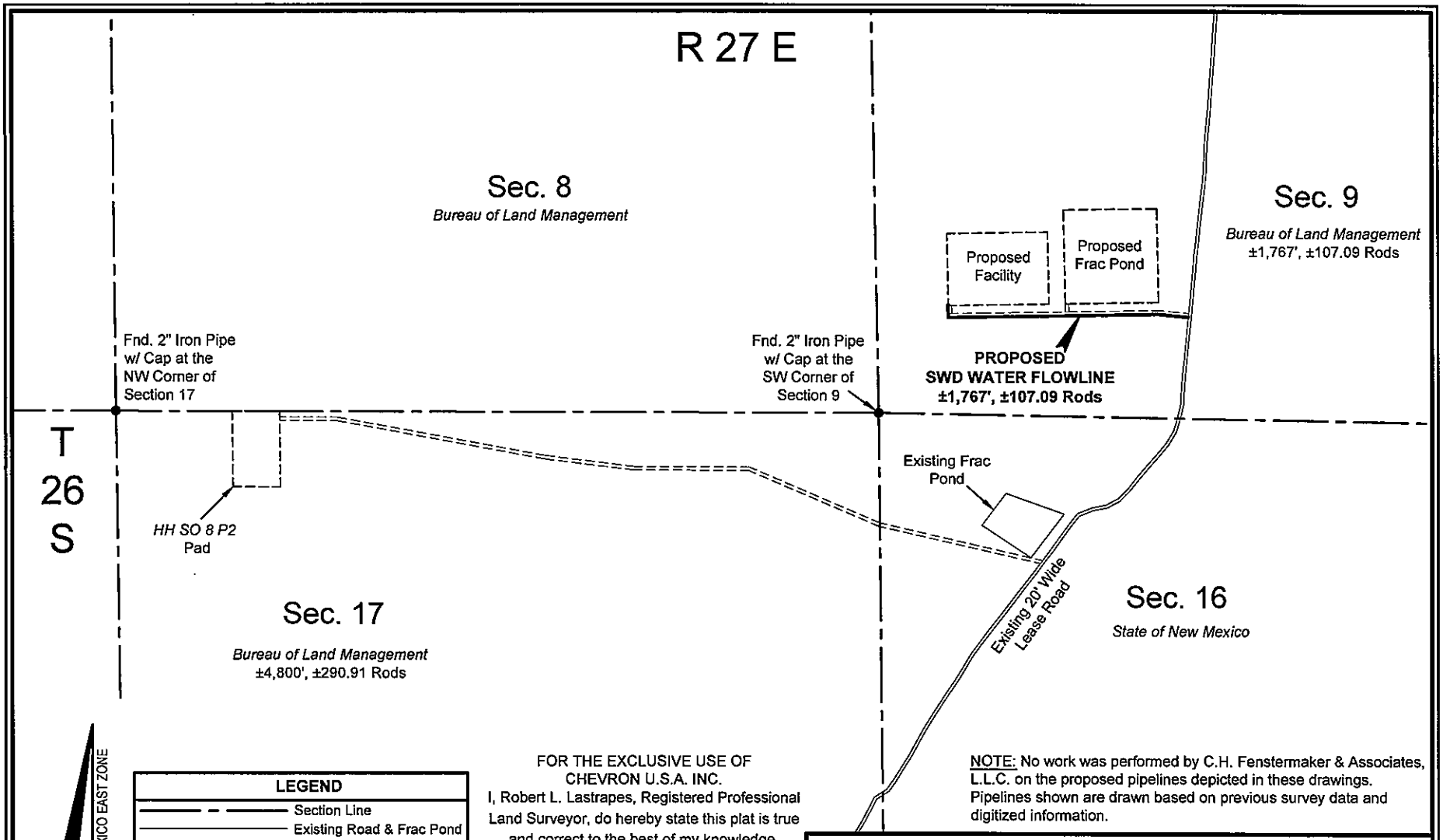
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED GAS LIFT FLOWLINE
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Gas Lift FL_SUP.dwg			



FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

NOTE: No work was performed by C.H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED SWD WATER FLOWLINE
HH SO 8 P2
SECTION 9, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: VHV	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\SWD Water FL_SUP.dwg			

EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

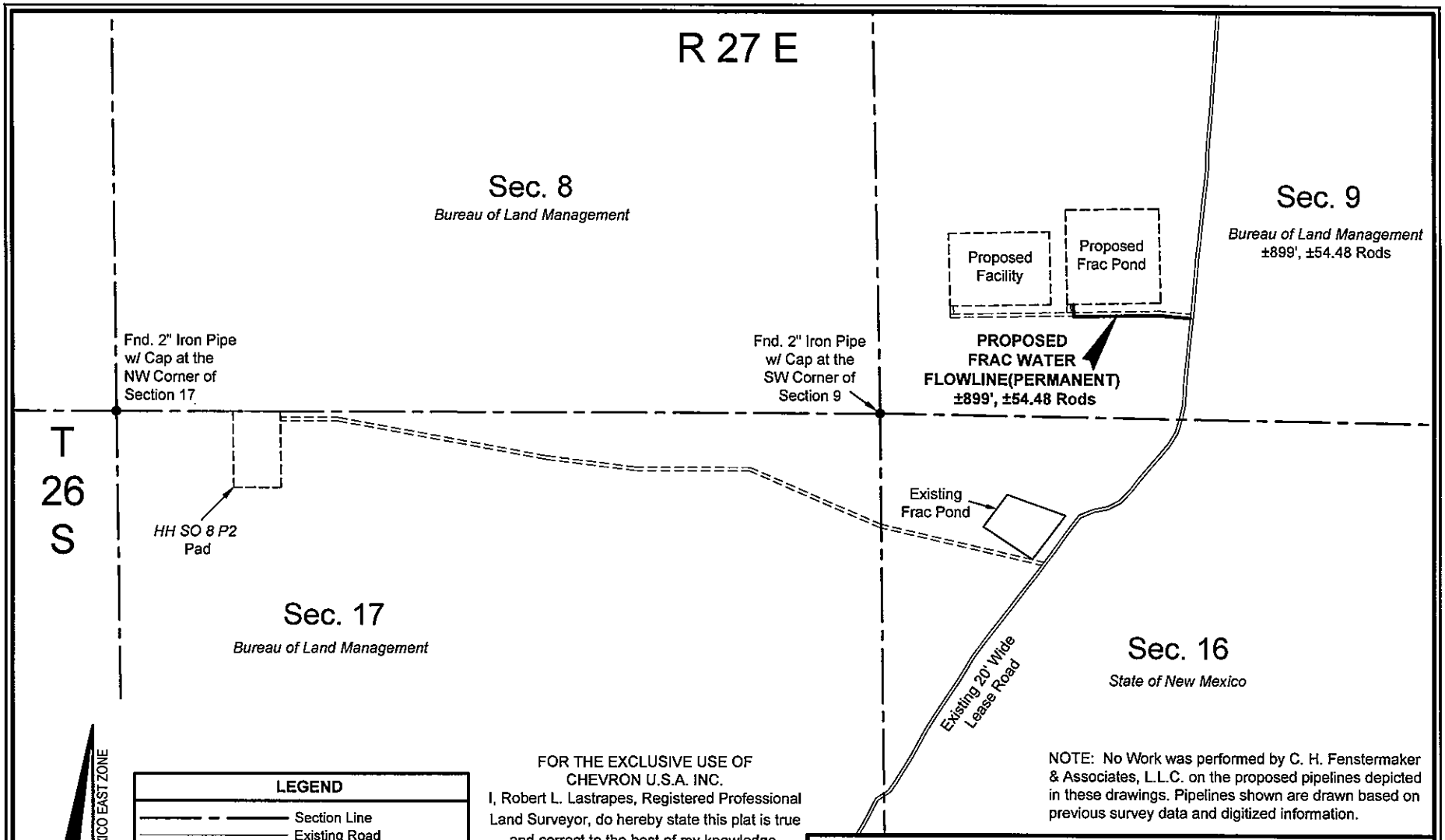
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED SWD WATER FLOWLINE
HH SO 8 P2
SECTION 9, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: VHV	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\SWD Water FL_SUP.dwg			



FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

NOTE: No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED FRAC WATER FLOWLINE(PERMANENT)
HH SO 8 P2
SECTION 9, T26S-R27E
EDDY COUNTY, NEW MEXICO

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No.23006

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Frac Water FL_Perm_SUP.dwg			

EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No.23006

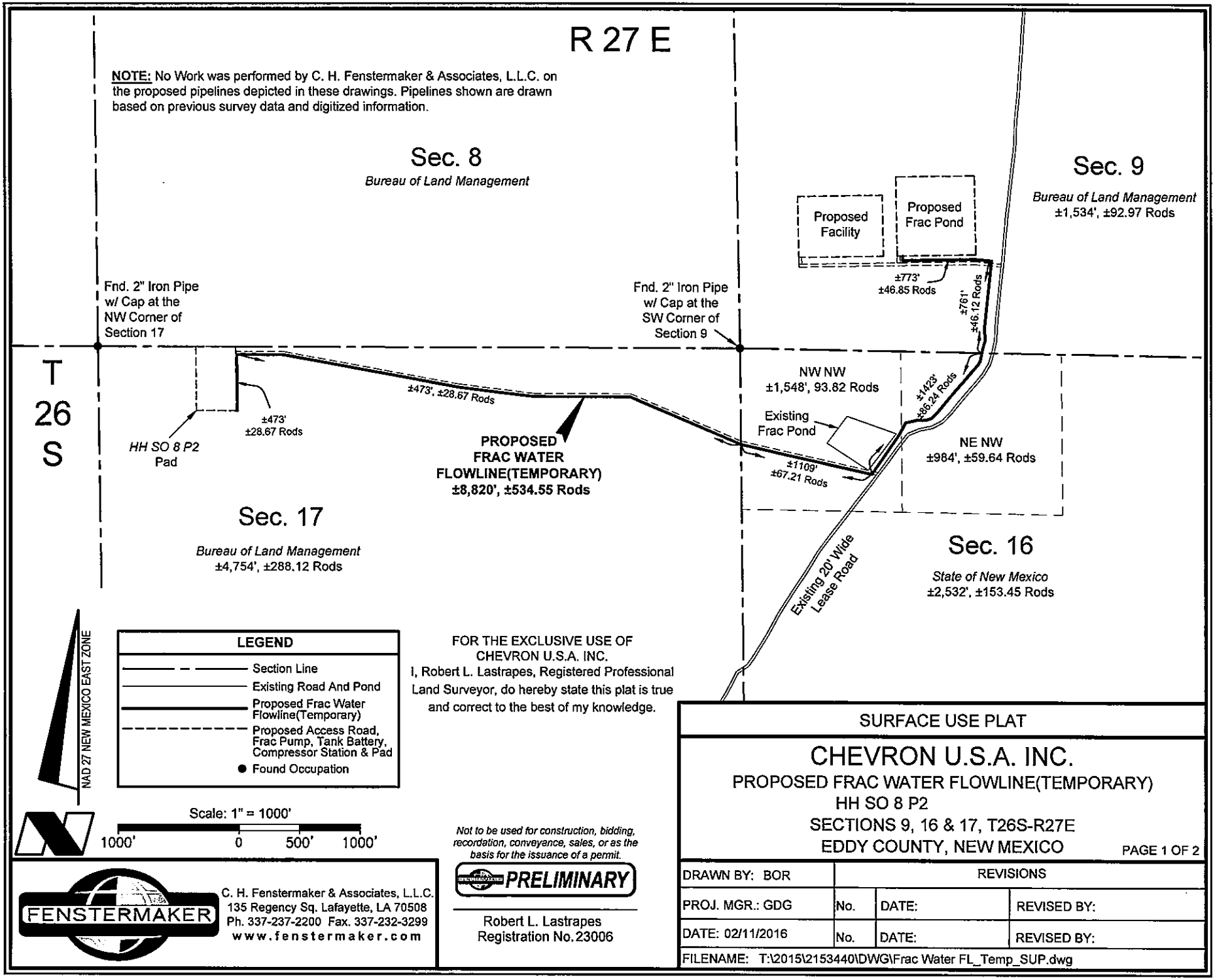
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED FRAC WATER FLOWLINE(PERMANENT)
HH SO 8 P2
SECTION 9, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Frac Water FL_Perm_SUP.dwg			



FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED FRAC WATER FLOWLINE(TEMPORARY)
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Frac Water FL_Temp_SUP.dwg			

EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No.23006

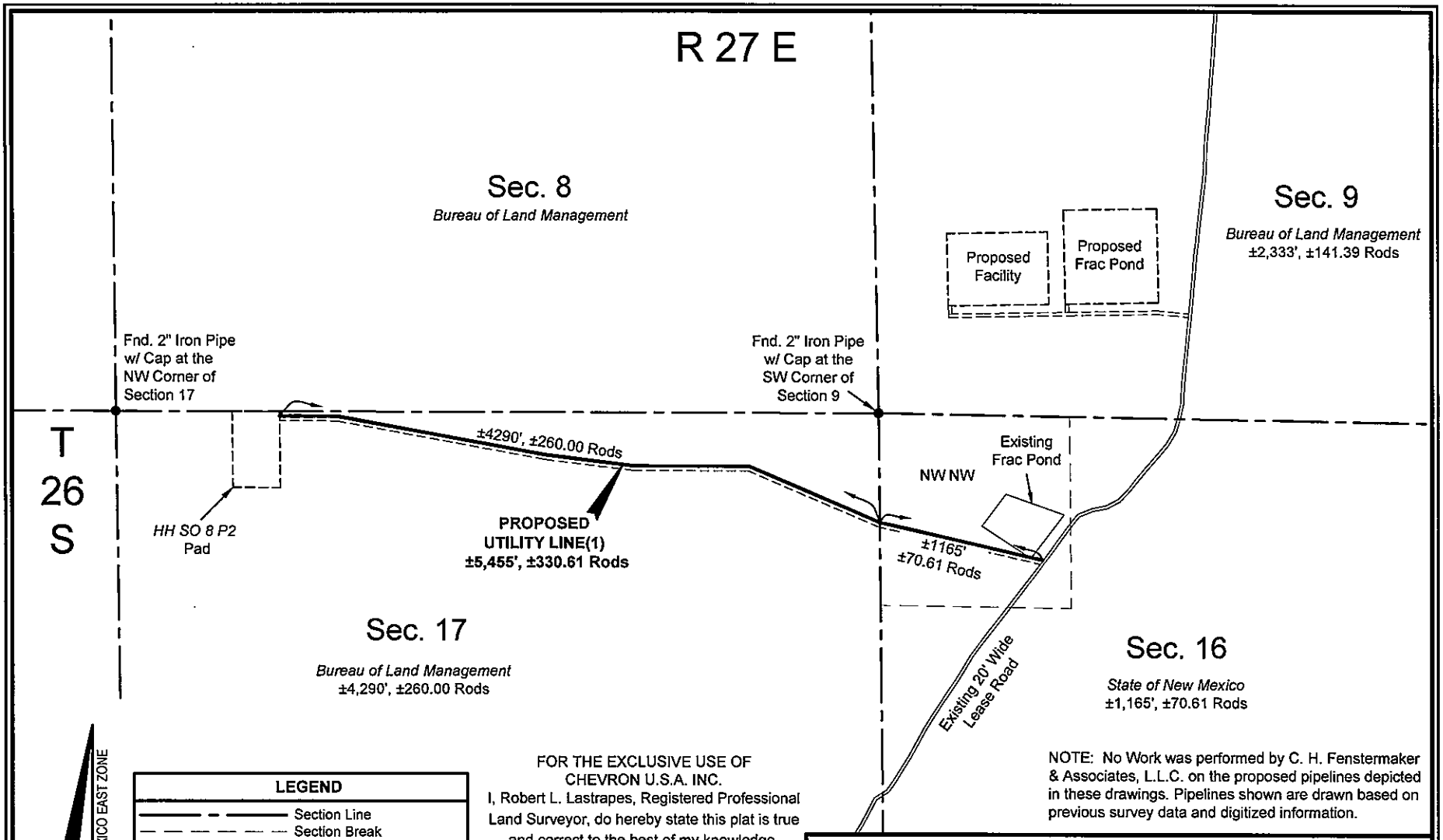
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED FRAC WATER FLOWLINE(TEMPORARY)
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Frac Water FL_Temp_SUP.dwg			



FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

NOTE: No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED UTILITY LINE(1)
HH SO 8 P2
SECTIONS 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Utility 1_SUP.dwg			

EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No.23006

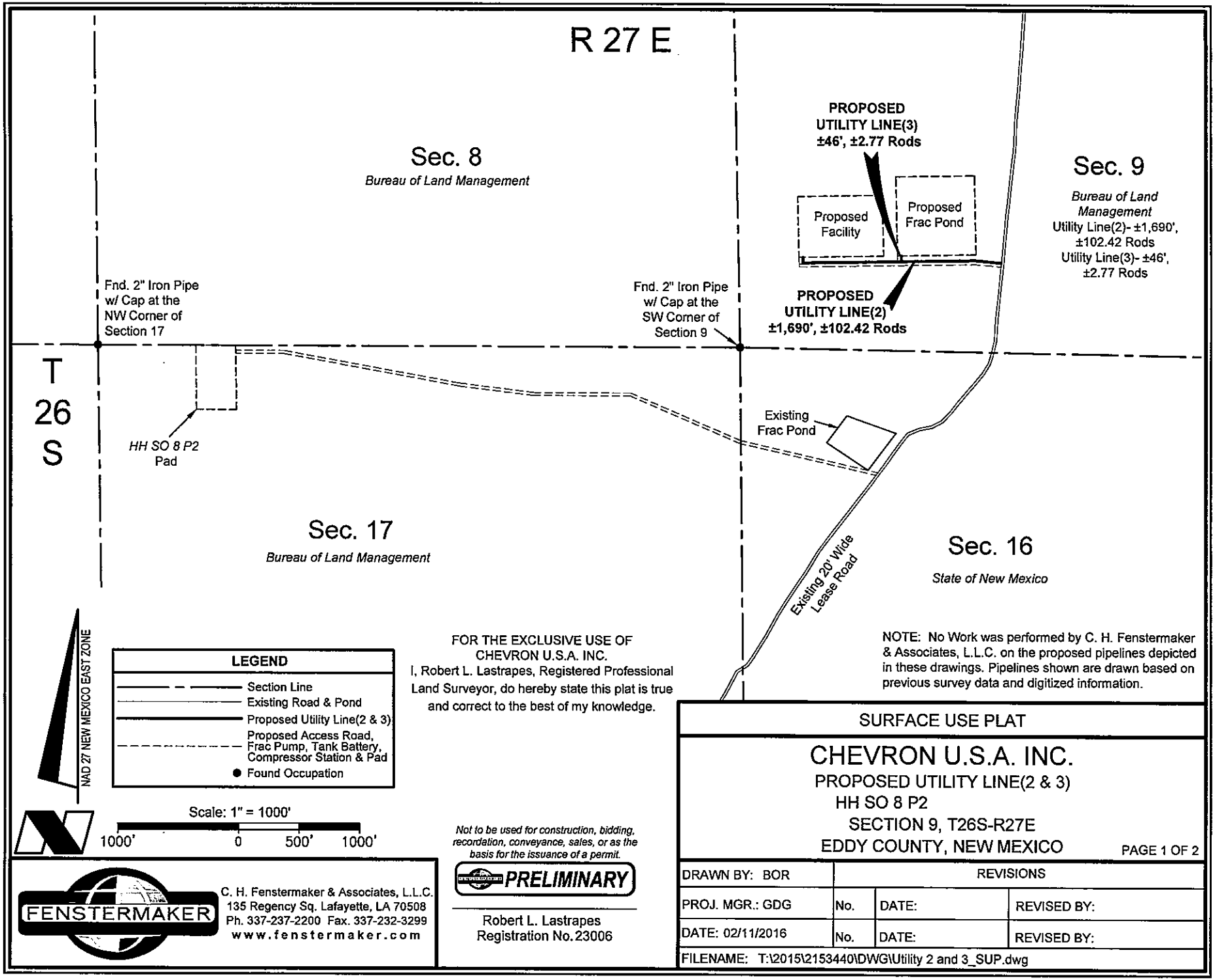
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED UTILITY LINE(1)
HH SO 8 P2
SECTIONS 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Utility 1_SUP.dwg			



FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

NOTE: No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED UTILITY LINE(2 & 3)
HH SO 8 P2
SECTION 9, T26S-R27E
EDDY COUNTY, NEW MEXICO

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Utility 2 and 3_SUP.dwg			

EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No.23006

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED UTILITY LINE(2 & 3)
HH SO 8 P2
SECTION 9, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Utility 2 and 3_SUP.dwg			

CERTIFICATION

I hereby certify that I, or someone under my direct supervision, have inspected the drill site and access route proposed herein; that I am familiar with the conditions which currently exist; that I have full knowledge of state and federal laws applicable to this operation; that the statements made in this APD package are, to the best of my knowledge, true and correct; and, that the work associated with the operations proposed will be performed in conformity with this APD package and the terms and conditions under which it is approved. I also certify that I, or the company I represent, am responsible for the operations conducted under this application. These statements are subject to the provisions of 18 U.S.C. 1001 for the filing of a false statement.

Executed this 19th day of JANUARY, 2016

Name: _____

Sean Cheben-Project Manager

Address: 1400 Smith Street

Houston, TX 77002

Room 40125

Office: 713-372-9382

Email: Sean.Cheben@CHEVRON.COM

PECOS DISTRICT
CONDITIONS OF APPROVAL

OPERATOR'S NAME:	**Chevron USA Inc.**
LEASE NO.:	**NMNM-118108**
WELL NAME & NO.:	**HH SO 8 P2 5H**
SURFACE HOLE FOOTAGE:	**0255' FNL & 0960' FWL**
BOTTOM HOLE FOOTAGE	**0180' FNL & 0330' FWL Sec. 05, T. 26 S., R 27 E.**
LOCATION:	**Section 17, T. 26 S., R 27 E., NMPM**
COUNTY:	**Eddy County, New Mexico**

TABLE OF CONTENTS

Standard Conditions of Approval (COA) apply to this APD. If any deviations to these standards exist or special COAs are required, the section with the deviation or requirement will be checked below.

- ☐ **General Provisions**
- ☐ **Permit Expiration**
- ☐ **Archaeology, Paleontology, and Historical Sites**
- ☐ **Noxious Weeds**
- ☒ **Special Requirements**
  - Raptor Nest
  - Avian Protection
  - Cave/Karst
  - VRM
  - Cultural
- ☐ **Construction**
  - Notification
  - Topsoil
  - Closed Loop System
  - Federal Mineral Material Pits
  - Well Pads
  - Roads
- ☐ **Road Section Diagram**
- ☒ **Drilling**
  - Cement Requirements
  - High Cave/Karst
  - Logging Requirements
  - Waste Material and Fluids
- ☒ **Production (Post Drilling)**
  - Well Structures & Facilities
  - Pipelines
  - Electric Lines
- ☐ **Interim Reclamation**
- ☐ **Final Abandonment & Reclamation**

I. GENERAL PROVISIONS

The approval of the Application For Permit To Drill (APD) is in compliance with all applicable laws and regulations: 43 Code of Federal Regulations 3160, the lease terms, Onshore Oil and Gas Orders, Notices To Lessees, New Mexico Oil Conservation Division (NMOCD) Rules, National Historical Preservation Act As Amended, and instructions and orders of the Authorized Officer. Any request for a variance shall be submitted to the Authorized Officer on Form 3160-5, Sundry Notices and Report on Wells.

II. PERMIT EXPIRATION

If the permit terminates prior to drilling and drilling cannot be commenced within 60 days after expiration, an operator is required to submit Form 3160-5, Sundry Notices and Reports on Wells, requesting surface reclamation requirements for any surface disturbance. However, if the operator will be able to initiate drilling within 60 days after the expiration of the permit, the operator must have set the conductor pipe in order to allow for an extension of 60 days beyond the expiration date of the APD. (Filing of a Sundry Notice is required for this 60 day extension.)

III. ARCHAEOLOGICAL, PALEONTOLOGY & HISTORICAL SITES

Any cultural and/or paleontological resource discovered by the operator or by any person working on the operator's behalf shall immediately report such findings to the Authorized Officer. The operator is fully accountable for the actions of their contractors and subcontractors. The operator shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery shall be made by the Authorized Officer to determine the appropriate actions that shall be required to prevent the loss of significant cultural or scientific values of the discovery. The operator shall be held responsible for the cost of the proper mitigation measures that the Authorized Officer assesses after consultation with the operator on the evaluation and decisions of the discovery. Any unauthorized collection or disturbance of cultural or paleontological resources may result in a shutdown order by the Authorized Officer.

IV. NOXIOUS WEEDS

The operator shall be held responsible if noxious weeds become established within the areas of operations. Weed control shall be required on the disturbed land where noxious weeds exist, which includes the roads, pads, associated pipeline corridor, and adjacent land affected by the establishment of weeds due to this action. The operator shall consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies.

V. SPECIAL REQUIREMENT(S)

Avian Protection

Power lines shall be constructed and designed in accordance to standards outlined in "Suggested Practices for Avian Protection on Power lines: The State of the Art in 2006" Edison Electric Institute, APLIC, and the California Energy Commission 2006. The holder shall assume the burden and expense of proving that pole designs not shown in the above publication deter raptor perching, roosting, and nesting. Such proof shall be provided by a raptor expert approved by the Authorized Officer. The BLM reserves the right to require modification or additions to all power line structures placed on this right-of-way, should they be necessary to ensure the safety of large perching birds. The holder without liability or expense shall make such modifications and/or additions to the United States.

Raptor Nest Mitigation

- A BLM Wildlife Biologist must be contacted by the operator prior to construction activities to determine if the raptor nest is active.
- Raptor nests on special, natural habitat features, such as trees, large brush, cliff faces and escarpments, will be protected by not allowing surface disturbance within up to 200 meters of nests or by delaying activity for up to 90 days, or a combination of both. Exceptions to this requirement for raptor nests will be considered if the nests expected to be disturbed are inactive, the proposed activity is of short duration (e.g. habitat enhancement projects, fences, pipelines), and will not result in continuing activity in proximity to the nest.
- Exhaust noise from pump jack engines must be muffled or otherwise controlled so as not to exceed 75 db measured at 30 ft. from the source of the noise.

Visual Resource Management (VRM)

- Above-ground structures including meter housing that are not subject to safety requirements are painted a flat non-reflective paint color, Shale Green from the BLM Standard Environmental Color Chart (CC-001: June 2008)
- Chevron would use minimal light necessary for site safety, security, and operations.
- Light should be directed downward or only where needed.
- Low-pressure sodium lamps, such as yellow LED lighting (3,000 Kelvin or less) or equivalent, would be used to reduce sky glow and wildlife impacts.
- Properly shielded and mounted light fixtures would be used to reduce sky glow from upward pointing light, as well as trespass from light falling outside of desired area of illumination. Full cutoff shielding would be used during production.

Cave and Karst

** Depending on location, additional Drilling, Casing, and Cementing procedures may be required by engineering to protect critical karst groundwater recharge areas.

Cave/Karst Surface Mitigation

The following stipulations will be applied to minimize impacts during construction, drilling and production.

Construction:
In the advent that any underground voids are opened up during construction activities, construction activities will be halted and the BLM will be notified immediately.

No Blasting:
No blasting will be utilized for pad construction. The pad will be constructed and leveled by adding the necessary fill and caliche.

Pad Berming:
The entire perimeter of the well pad will be bermed to prevent oil, salt, and other chemical contaminants from leaving the well pad.

- The compacted berm shall be constructed at a minimum of 12 inches high with impermeable mineral material (e.g. caliche).
- No water flow from the uphill side(s) of the pad shall be allowed to enter the well pad.
- The topsoil stockpile shall be located outside the bermed well pad.
- Topsoil, either from the well pad or surrounding area, shall not be used to construct the berm.
- No storm drains, tubing or openings shall be placed in the berm.
- If fluid collects within the bermed area, the fluid must be vacuumed into a safe container and disposed of properly at a state approved facility.
- The integrity of the berm shall be maintained around the surfaced pad throughout the life of the well and around the downsized pad after interim reclamation has been completed.
- Any access road entering the well pad shall be constructed so that the integrity of the berm height surrounding the well pad is not compromised. (Any access road crossing the berm cannot be lower than the berm height.)

Tank Battery Liners and Berms:
Tank battery locations and all facilities will be lined and bermed. A 20 mil permanent liner will be installed with a 4 oz. felt backing to prevent tears or punctures. Tank battery berms must be large enough to contain 1 ½ times the content of the largest tank.

Leak Detection System:

A method of detecting leaks is required. The method could incorporate gauges to measure loss, situating values and lines so they can be visually inspected, or installing electronic sensors to alarm when a leak is present. Leak detection plan will be submitted to BLM for approval.

Automatic Shut-off Systems:
Automatic shut off, check values, or similar systems will be installed for pipelines and tanks to minimize the effects of catastrophic line failures used in production or drilling.

Cave/Karst Subsurface Mitigation

The following stipulations will be applied to protect cave/karst and ground water concerns:

Rotary Drilling with Fresh Water:
Fresh water will be used as a circulating medium in zones where caves or karst features are expected. SEE ALSO: Drilling COAs for this well.

Directional Drilling:
Kick off for directional drilling will occur at least 100 feet below the bottom of the cave occurrence zone. SEE ALSO: Drilling COAs for this well.

Lost Circulation:
ALL lost circulation zones from the surface to the base of the cave occurrence zone will be logged and reported in the drilling report.

Regardless of the type of drilling machinery used, if a void of four feet or more and circulation losses greater than 70 percent occur simultaneously while drilling in any cave-bearing zone, the BLM will be notified immediately by the operator. The BLM will assess the situation and work with the operator on corrective actions to resolve the problem.

Abandonment Cementing:
Upon well abandonment in high cave karst areas additional plugging conditions of approval may be required. The BLM will assess the situation and work with the operator to ensure proper plugging of the wellbore.

Pressure Testing:
Annual pressure monitoring will be performed by the operator on all casing annuli and reported in a sundry notice. If the test results indicated a casing failure has occurred, remedial action will be undertaken to correct the problem to the BLM's approval.

VI. CONSTRUCTION

A. NOTIFICATION

The BLM shall administer compliance and monitor construction of the access road and well pad. Notify the Carlsbad Field Office at (575) 234-5909 at least 3 working days prior to commencing construction of the access road and/or well pad.

When construction operations are being conducted on this well, the operator shall have the approved APD and Conditions of Approval (COA) on the well site and they shall be made available upon request by the Authorized Officer.

B. TOPSOIL

The operator shall strip the top portion of the soil (root zone) from the entire well pad area and stockpile the topsoil along the edge of the well pad as depicted in the APD. The root zone is typically six (6) inches in depth. All the stockpiled topsoil will be redistributed over the interim reclamation areas. Topsoil shall not be used for berming the pad or facilities. For final reclamation, the topsoil shall be spread over the entire pad area for seeding preparation.

Other subsoil (below six inches) stockpiles must be completely segregated from the topsoil stockpile. Large rocks or subsoil clods (not evident in the surrounding terrain) must be buried within the approved area for interim and final reclamation.

C. CLOSED LOOP SYSTEM

Tanks are required for drilling operations: No Pits.

The operator shall properly dispose of drilling contents at an authorized disposal site.

D. FEDERAL MINERAL MATERIALS PIT

Payment shall be made to the BLM prior to removal of any federal mineral materials. Call the Carlsbad Field Office at (575) 234-5972.

E. WELL PAD SURFACING

Surfacing of the well pad is not required.

If the operator elects to surface the well pad, the surfacing material may be required to be removed at the time of reclamation.The well pad shall be constructed in a manner which creates the smallest possible surface disturbance, consistent with safety and operational needs.

F. EXCLOSURE FENCING (CELLARS & PITS)

Exclosure Fencing
The operator will install and maintain exclosure fencing for all open well cellars to prevent access to public, livestock, and large forms of wildlife before and after drilling operations until the pit is free of fluids and the operator initiates backfilling. (For examples of exclosure fencing design, refer to BLM's Oil and Gas Gold Book, Exclosure Fence Illustrations, Figure 1, Page 18.)

G. ON LEASE ACCESS ROADS

Road Width
The access road shall have a driving surface that creates the smallest possible surface disturbance and does not exceed fourteen (14) feet in width. The maximum width of surface disturbance, when constructing the access road, shall not exceed twenty-five (25) feet.

Surfacing
Surfacing material is not required on the new access road driving surface. If the operator elects to surface the new access road or pad, the surfacing material may be required to be removed at the time of reclamation.

Where possible, no improvements should be made on the unsurfaced access road other than to remove vegetation as necessary, road irregularities, safety issues, or to fill low areas that may sustain standing water.

The Authorized Officer reserves the right to require surfacing of any portion of the access road at any time deemed necessary. Surfacing may be required in the event the road deteriorates, erodes, road traffic increases, or it is determined to be beneficial for future field development. The surfacing depth and type of material will be determined at the time of notification.

Crowning
Crowning shall be done on the access road driving surface. The road crown shall have a grade of approximately 2% (i.e., a 1" crown on a 14' wide road). The road shall conform to Figure 1; cross section and plans for typical road construction.

Ditching
Ditching shall be required on both sides of the road.

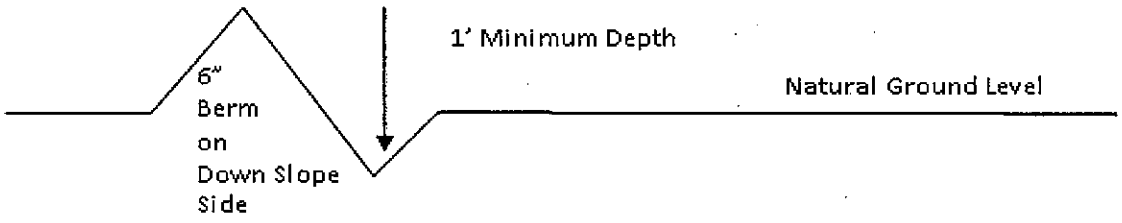
Turnouts
Vehicle turnouts shall be constructed on the road. Turnouts shall be intervisible with interval spacing distance less than 1000 feet. Turnouts shall conform to Figure 1; cross section and plans for typical road construction.

Drainage

Drainage control systems shall be constructed on the entire length of road (e.g. ditches, sidehill outsloping and insloping, lead-off ditches, culvert installation, and low water crossings).

A typical lead-off ditch has a minimum depth of 1 foot below and a berm of 6 inches above natural ground level. The berm shall be on the down-slope side of the lead-off ditch.

Cross Section of a Typical Lead-off Ditch



All lead-off ditches shall be graded to drain water with a 1 percent minimum to 3 percent maximum ditch slope. The spacing interval are variable for lead-off ditches and shall be determined according to the formula for spacing intervals of lead-off ditches, but may be amended depending upon existing soil types and centerline road slope (in %);

Formula for Spacing Interval of Lead-off Ditches

Example - On a 4% road slope that is 400 feet long, the water flow shall drain water into a lead-off ditch. Spacing interval shall be determined by the following formula:

400 foot road with 4% road slope: $\frac{400'}{4\%} + 100' = 200'$ lead-off ditch interval

Cattleguards

An appropriately sized cattleguard sufficient to carry out the project shall be installed and maintained at fence/road crossings. Any existing cattleguards on the access road route shall be repaired or replaced if they are damaged or have deteriorated beyond practical use. The operator shall be responsible for the condition of the existing cattleguards that are in place and are utilized during lease operations.

Fence Requirement

Where entry is granted across a fence line, the fence shall be braced and tied off on both sides of the passageway prior to cutting. The operator shall notify the private surface landowner or the grazing allotment holder prior to crossing any fences.

Public Access

Public access on this road shall not be restricted by the operator without specific written approval granted by the Authorized Officer.

Construction Steps

1. Salvage topsoil
2. Construct road
3. Redistribute topsoil
4. Revegetate slopes

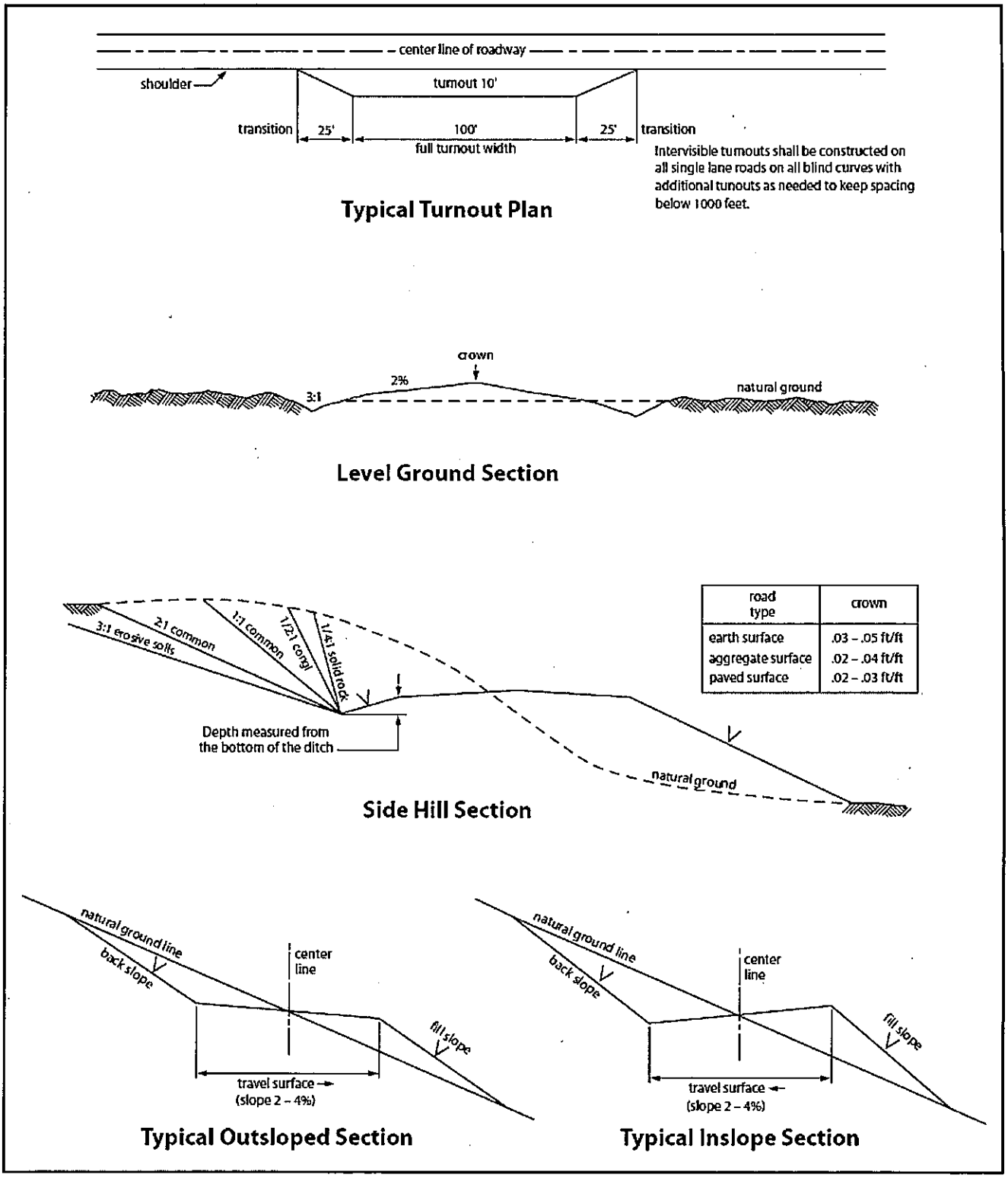


Figure 1. Cross-sections and plans for typical road sections representative of BLM resource or FS local and higher-class roads.

VII. DRILLING

A. DRILLING OPERATIONS REQUIREMENTS

The BLM is to be notified in advance for a representative to witness:

a. Spudding well (minimum of 24 hours)
b. Setting and/or Cementing of all casing strings (minimum of 4 hours)
c. BOPE tests (minimum of 4 hours)

☒ **Eddy County**

Call the Carlsbad Field Office, 620 East Greene St., Carlsbad, NM 88220, (575) 361-2822

1. **Hydrogen Sulfide (H2S) monitors shall be installed prior to drilling out the surface shoe. If H2S is detected in concentrations greater than 100 ppm, the Hydrogen Sulfide area shall meet Onshore Order 6 requirements, which includes equipment and personnel/public protection items. If Hydrogen Sulfide is encountered, provide measured values and formations to the BLM.**

2. Unless the production casing has been run and cemented or the well has been properly plugged, the drilling rig shall not be removed from over the hole without prior approval. **If the drilling rig is removed without approval – an Incident of Non-Compliance will be written and will be a "Major" violation.**

3. **The operator has proposed to drill multiple wells utilizing a skid/walking rig. Operator shall secure the wellbore on the current well, after installing and testing the wellhead, by installing a blind flange of like pressure rating to the wellhead and a pressure gauge that can be monitored while drilling is performed on the other wells.**

4. Floor controls are required for 3M or Greater systems. These controls will be on the rig floor, unobstructed, readily accessible to the driller and will be operational at all times during drilling and/or completion activities. Rig floor is defined as the area immediately around the rotary table; the area immediately above the substructure on which the draw works is located, this does not include the dog house or stairway area.

5. **The record of the drilling rate along with the GR/N well log run from TD to surface (horizontal well – vertical portion of hole) shall be submitted to the BLM office as well as all other logs run on the borehole 30 days from completion. If available, a digital copy of the logs is to be submitted in addition to the paper copies. The Rustler top and top and bottom of Salt are to be recorded on the Completion Report.**

B. CASING

Changes to the approved APD casing program need prior approval if the items substituted are of lesser grade or different casing size or are Non-API. The Operator can exchange the components of the proposal with that of superior strength (i.e. changing from J-55 to N-80, or from 36# to 40#). Changes to the approved cement program need prior approval if the altered cement plan has less

volume or strength or if the changes are substantial (i.e. Multistage tool, ECP, etc.). The initial wellhead installed on the well will remain on the well with spools used as needed.

Centralizers required on surface casing per Onshore Order 2.III.B.1.f.

Wait on cement (WOC) for Water Basin:
After cementing but before commencing any tests, the casing string shall stand cemented under pressure until both of the following conditions have been met: 1) cement reaches a minimum compressive strength of 500 psi at the shoe, 2) until cement has been in place at least 8 hours. WOC time will be recorded in the driller's log. See individual casing strings for details regarding lead cement slurry requirements.

Provide compressive strengths including hours to reach required 500 pounds compressive strength prior to cementing each casing string. Have well specific cement details onsite prior to pumping the cement for each casing string.

No pea gravel permitted for remedial or fall back remedial without prior authorization from the BLM engineer.
High Cave/Karst
Possibility of water flows in the Castillo and Salado.
Possibility of lost circulation in the Delaware.
Abnormal Pressures may be encountered when penetrating the 3rd Bone Spring Sandstone and all subsequent formations.

A MINIMUM OF TWO CASING STRINGS CEMENTED TO SURFACE IS REQUIRED IN HIGH CAVE/KARST AREAS. THE CEMENT MUST BE IN A SOLID SHEATH. THEREFORE, ONE INCH OPERATIONS ARE NOT SUFFICIENT TO PROTECT CAVE KARST RESOURCES. A CASING DESIGN THAT HAS A ONE INCH JOB PERFORMED DOES NOT COUNT AS A SOLID SHEATH. IF THE PRIMARY CEMENT JOB ON THE SURFACE CASING DOES NOT CIRCULATE, THEN THE NEXT TWO CASING STRINGS MUST BE CEMENTED TO SURFACE.

1. The **13-3/8** inch surface casing shall be set at approximately **450** feet (a minimum of 25 feet into the Rustler Anhydrite and above the salt) and cemented to the surface. **If salt is encountered, set casing at least 25 feet above the salt.**
    a. If cement does not circulate to the surface, the appropriate BLM office shall be notified and a temperature survey utilizing an electronic type temperature survey with surface log readout will be used or a cement bond log shall be run to verify the top of the cement. Temperature survey will be run a minimum of six hours after pumping cement and ideally between 8-10 hours after completing the cement job.
    b. Wait on cement (WOC) time for a primary cement job is to include the lead cement slurry.

c. Wait on cement (WOC) time for a remedial job will be a minimum of 4 hours after bringing cement to surface or 500 pounds compressive strength, whichever is greater.
d. If cement falls back, remedial cementing will be done prior to drilling out that string.

Formation below the 13-3/8" shoe to be tested according to Onshore Order 2.III.B.1.i. Test to be done as a mud equivalency test using the mud weight necessary for the pore pressure of the formation below the shoe and the mud weight for the bottom of the hole. Report results to BLM office.

Intermediate casing shall be kept fluid filled while running into hole to meet BLM minimum collapse requirements.

2. The minimum required fill of cement behind the **9-5/8** inch intermediate casing is:

Operator has proposed DV tool at depth of 2100', but will adjust cement proportionately if moved. DV tool shall be set a minimum of 50' below previous shoe and a minimum of 200' above current shoe. Operator shall submit sundry if DV tool depth cannot be set in this range. If an ECP is used, it is to be set a minimum of 50' below the shoe to provide cement across the shoe. If it cannot be set below the shoe, a CBL shall be run to verify cement coverage.

a. First stage to DV tool:
☒ Cement to circulate. If cement does not circulate, contact the appropriate BLM office before proceeding with second stage cement job. Operator should have plans as to how they will achieve circulation on the next stage.
b. Second stage above DV tool:
☒ Cement to surface. If cement does not circulate see B.1.a, c-d above. **Wait on cement (WOC) time for a primary cement job is to include the lead cement slurry due to cave/karst. Excess calculates to 22% - Additional cement may be required.**

Formation below the 9-5/8" shoe to be tested according to Onshore Order 2.III.B.1.i. Test to be done as a mud equivalency test using the mud weight necessary for the pore pressure of the formation below the shoe (not the mud weight required to prevent dissolving the salt formation) and the mud weight for the bottom of the hole. Report results to BLM office.

Centralizers required on horizontal leg, must be type for horizontal service and a minimum of one every other joint.

3. The minimum required fill of cement behind the **5-1/2** inch production casing is:
☒ Cement as proposed by operator. Operator shall provide method of verification.

4. If hardband drill pipe is rotated inside casing, returns will be monitored for metal. If metal is found in samples, drill pipe will be pulled and rubber protectors which have a larger diameter than the tool joints of the drill pipe will be installed prior to continuing drilling operations.

C. PRESSURE CONTROL

1. All blowout preventer (BOP) and related equipment (BOPE) shall comply with well control requirements as described in Onshore Oil and Gas Order No. 2 and API 53.

2. Minimum working pressure of the blowout preventer (BOP) and related equipment (BOPE) required for drilling below the surface casing shoe shall be **10,000 (10M)** psi. **10M system requires an HCR valve, remote kill line and annular to match. The remote kill line is to be installed prior to testing the system and tested to stack pressure.** BOP/BOPE shall be tested after nipple up according to Onshore Order #2.

3. The appropriate BLM office shall be notified a minimum of 4 hours in advance for a representative to witness the tests.
    a. In a water basin, for all casing strings utilizing slips, these are to be set as soon as the crew and rig are ready and any fallback cement remediation has been done. The casing cut-off and BOP installation can be initiated four hours after installing the slips, which will be approximately six hours after bumping the plug. For those casing strings not using slips, the minimum wait time before cut-off is eight hours after bumping the plug. BOP/BOPE testing can begin after cut-off or once cement reaches 500 psi compressive strength (including lead when specified), whichever is greater. However, if the float does not hold, cut-off cannot be initiated until cement reaches 500 psi compressive strength (including lead when specified).
    b. The tests shall be done by an independent service company utilizing a test plug **not a cup or J-packer**.
    c. The test shall be run on a 5000 psi chart for a 2-3M BOP/BOP, on a 10000 psi chart for a 5M BOP/BOPE and on a 15000 psi chart for a 10M BOP/BOPE. If a linear chart is used, it shall be a one hour chart. A circular chart shall have a maximum 2 hour clock. If a twelve hour or twenty-four hour chart is used, tester shall make a notation that it is run with a two hour clock.
    d. The results of the test shall be reported to the appropriate BLM office.
    e. All tests are required to be recorded on a calibrated test chart. **A copy of the BOP/BOPE test chart and a copy of independent service company test will be submitted to the appropriate BLM office.**
    f. The BOP/BOPE test shall include a low pressure test from 250 to 300 psi. The test will be held for a minimum of 10 minutes if test is done with a test plug and 30 minutes without a test plug. This test shall be performed prior to the test at full stack pressure.
    g. BOP/BOPE must be tested by an independent service company within 500 feet of the top of the **Wolfcamp** formation if the time between the setting of

the intermediate casing and reaching this depth exceeds 20 days. This test does not exclude the test prior to drilling out the casing shoe as per Onshore Order No. 2.

D. DRILLING MUD

Mud system monitoring equipment, with derrick floor indicators and visual and audio alarms, shall be operating before drilling into the **Wolfcamp** formation, and shall be used until production casing is run and cemented.

E. DRILL STEM TEST

If drill stem tests are performed, Onshore Order 2.III.D shall be followed.

F. WASTE MATERIAL AND FLUIDS

All waste (i.e. drilling fluids, trash, salts, chemicals, sewage, gray water, etc.) created as a result of drilling operations and completion operations shall be safely contained and disposed of properly at a waste disposal facility. No waste material or fluid shall be disposed of on the well location or surrounding area.

Porto-johns and trash containers will be on-location during fracturing operations or any other crew-intensive operations.

JAM 072516

VIII. PRODUCTION (POST DRILLING)

A. WELL STRUCTURES & FACILITIES

Placement of Production Facilities

Production facilities should be placed on the well pad to allow for maximum interim recontouring and revegetation of the well location.

Exclosure Netting (Open-top Tanks)

Immediately following active drilling or completion operations, the operator will take actions necessary to prevent wildlife and livestock access, including avian wildlife, to all open-topped tanks that contain or have the potential to contain salinity sufficient to cause harm to wildlife or livestock, hydrocarbons, or Resource Conservation and Recovery Act of 1976-exempt hazardous substances. At a minimum, the operator will net, screen, or cover open-topped tanks to exclude wildlife and livestock and prevent mortality. If the operator uses netting, the operator will cover and secure the open portion of the tank to prevent wildlife entry. The operator will net, screen, or cover the tanks until the operator removes the tanks from the location or the tanks no longer contain substances that could be harmful to wildlife or livestock. Use a maximum netting mesh size of 1 ½ inches. The netting must not be in contact with fluids and must not have holes or gaps.

Chemical and Fuel Secondary Containment and Exclosure Screening

The operator will prevent all hazardous, poisonous, flammable, and toxic substances from coming into contact with soil and water. At a minimum, the operator will install and maintain an impervious secondary containment system for any tank or barrel containing hazardous, poisonous, flammable, or toxic substances sufficient to contain the contents of the tank or barrel and any drips, leaks, and anticipated precipitation. The operator will dispose of fluids within the containment system that do not meet applicable state or U. S. Environmental Protection Agency livestock water standards in accordance with state law; the operator must not drain the fluids to the soil or ground. The operator will design, construct, and maintain all secondary containment systems to prevent wildlife and livestock exposure to harmful substances. At a minimum, the operator will install effective wildlife and livestock exclosure systems such as fencing, netting, expanded metal mesh, lids, and grate covers. Use a maximum netting mesh size of 1 ½ inches.

Open-Vent Exhaust Stack Exclosures
The operator will construct, modify, equip, and maintain all open-vent exhaust stacks on production equipment to prevent birds and bats from entering, and to discourage perching, roosting, and nesting. (*Recommended exclosure structures on open-vent exhaust stacks are in the shape of a cone.*) Production equipment includes, but may not be limited to, tanks, heater-treaters, separators, dehydrators, flare stacks, in-line units, and compressor mufflers.

Containment Structures
Proposed production facilities such as storage tanks and other vessels will have a secondary containment structure that is constructed to hold the capacity of 1.5 times the largest tank, plus freeboard to account for precipitation, unless more stringent protective requirements are deemed necessary.

Painting Requirement
All above-ground structures including meter housing that are not subject to safety requirements shall be painted a flat non-reflective paint color, **Shale Green** from the BLM Standard Environmental Color Chart (CC-001: June 2008).

B. PIPELINES

BURIED PIPELINE STIPULATIONS

A copy of the application (Grant, APD, or Sundry Notice) and attachments, including conditions of approval, survey plat and/or map, will be on location during construction. BLM personnel may request to you a copy of your permit during construction to ensure compliance with all stipulations.

Holder agrees to comply with the following stipulations to the satisfaction of the Authorized Officer:

1. The Holder shall indemnify the United States against any liability for damage to life or property arising from the occupancy or use of public lands under this grant.

2. The Holder shall comply with all applicable Federal laws and regulations existing or hereafter enacted or promulgated. In any event, the holder shall comply with the Toxic Substances Control Act of 1976 as amended, 15 USC 2601 et seq. (1982) with regards to any toxic substances that are used, generated by or stored on the right-of-way or on facilities authorized under this right-of-way grant. (See 40 CFR Part 702-799 and especially, provisions on polychlorinated biphenyls, 40 CFR 761.1-761.193.) Additionally, any release of toxic substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act, section 102b. A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to the authorized officer concurrent with the filing of the reports to the involved Federal agency or State government.

3. The holder agrees to indemnify the United States against any liability arising from the release of any hazardous substance or hazardous waste (as these terms are defined in the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. 9601, et seq. or the Resource Conservation and Recovery Act, 42 U.S.C.6901, et seq.) on the Right-of-Way (unless the release or threatened release is wholly unrelated to the Right-of-Way holder's activity on the Right-of-Way), or resulting from the activity of the Right-of-Way holder on the Right-of-Way. This agreement applies without regard to whether a release is caused by the holder, its agent, or unrelated third parties.

4. If, during any phase of the construction, operation, maintenance, or termination of the pipeline, any oil or other pollutant should be discharged from the pipeline system, impacting Federal lands, the control and total removal, disposal, and cleaning up of such oil or other pollutant, wherever found, shall be the responsibility of holder, regardless of fault. Upon failure of holder to control, dispose of, or clean up such discharge on or affecting Federal lands, or to repair all damages resulting therefrom, on the Federal lands, the Authorized Officer may take such measures as he deems necessary to control and clean up the discharge and restore the area, including where appropriate, the aquatic environment and fish and wildlife habitats, at the full expense of the holder. Such action by the Authorized Officer shall not relieve holder of any responsibility as provided herein.

5. All construction and maintenance activity will be confined to the authorized right-of-way.

6. The pipeline will be buried with a minimum cover of **36** inches between the top of the pipe and ground level.

7. The maximum allowable disturbance for construction in this right-of-way will be **30** feet:

- Blading of vegetation within the right-of-way will be allowed: maximum width of blading operations will not exceed **20** feet. The trench is included in this area. (*Blading is defined as the complete removal of brush and ground vegetation.*)

- Clearing of brush species within the right-of-way will be allowed: maximum width of clearing operations will not exceed **30** feet. The trench and bladed area are included in this area. (*Clearing is defined as the removal of brush while leaving ground vegetation (grasses, weeds, etc.) intact. Clearing is best accomplished by holding the blade 4 to 6 inches above the ground surface.*)
- The remaining area of the right-of-way (if any) shall only be disturbed by compressing the vegetation. (*Compressing can be caused by vehicle tires, placement of equipment, etc.*)

8. The holder shall stockpile an adequate amount of topsoil where blading is allowed. The topsoil to be stripped is approximately ___6___ inches in depth. The topsoil will be segregated from other spoil piles from trench construction. The topsoil will be evenly distributed over the bladed area for the preparation of seeding.

9. The holder shall minimize disturbance to existing fences and other improvements on public lands. The holder is required to promptly repair improvements to at least their former state. Functional use of these improvements will be maintained at all times. The holder will contact the owner of any improvements prior to disturbing them. When necessary to pass through a fence line, the fence shall be braced on both sides of the passageway prior to cutting of the fence. No permanent gates will be allowed unless approved by the Authorized Officer.

10. Vegetation, soil, and rocks left as a result of construction or maintenance activity will be randomly scattered on this right-of-way and will not be left in rows, piles, or berms, unless otherwise approved by the Authorized Officer. The entire right-of-way shall be recontoured to match the surrounding landscape. The backfilled soil shall be compacted and a 6 inch berm will be left over the ditch line to allow for settling back to grade.

11. In those areas where erosion control structures are required to stabilize soil conditions, the holder will install such structures as are suitable for the specific soil conditions being encountered and which are in accordance with sound resource management practices.

12. The holder will reseed all disturbed areas. Seeding will be done according to the attached seeding requirements, using the following seed mix.

( ) seed mixture 1	( ) seed mixture 3
() seed mixture 2	(X) seed mixture 4
( ) seed mixture 2/LPC	( ) Aplomado Falcon Mixture

13. All above-ground structures not subject to safety requirements shall be painted by the holder to blend with the natural color of the landscape. The paint used shall be color which simulates "Standard Environmental Colors" – **Shale Green**, Munsell Soil Color No. 5Y 4/2.

14. The pipeline will be identified by signs at the point of origin and completion of the right-of-way and at all road crossings. At a minimum, signs will state the holder's name, BLM serial number, and the product being transported. All signs and information thereon will be posted in a permanent, conspicuous manner, and will be maintained in a legible condition for the life of the pipeline.

15. The holder shall not use the pipeline route as a road for purposes other than routine maintenance as determined necessary by the Authorized Officer in consultation with the holder before maintenance begins. The holder will take whatever steps are necessary to ensure that the pipeline route is not used as a roadway. As determined necessary during the life of the pipeline, the Authorized Officer may ask the holder to construct temporary deterrence structures.

16. Any cultural and/or paleontological resources (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the Authorized Officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery will be made by the Authorized Officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the Authorized Officer after consulting with the holder.

17. The operator shall be held responsible if noxious weeds become established within the areas of operations. Weed control shall be required on the disturbed land where noxious weeds exist, which includes associated roads, pipeline corridor and adjacent land affected by the establishment of weeds due to this action. The operator shall consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies.

18. Escape Ramps - The operator will construct and maintain pipeline/utility trenches [that are not otherwise fenced, screened, or netted] to prevent livestock, wildlife, and humans from becoming entrapped. At a minimum, the operator will construct and maintain escape ramps, ladders, or other methods of avian and terrestrial wildlife escape in the trenches according to the following criteria:

a. Any trench left open for eight (8) hours or less is not required to have escape ramps; however, before the trench is backfilled, the contractor/operator shall inspect the trench for wildlife, remove all trapped wildlife, and release them at least 100 yards from the trench.

b. For trenches left open for eight (8) hours or more, earthen escape ramps (built at no more than a 30 degree slope and spaced no more than 500 feet apart) shall be placed in the trench.

C. ELECTRIC LINES

STANDARD STIPULATIONS FOR OVERHEAD ELECTRIC DISTRIBUTION LINES

A copy of the grant and attachments, including stipulations, survey plat and/or map, will be on location during construction. BLM personnel may request to you a copy of your permit during construction to ensure compliance with all stipulations.

Holder agrees to comply with the following stipulations to the satisfaction of the Authorized Officer:

1. The holder shall indemnify the United States against any liability for damage to life or property arising from the occupancy or use of public lands under this grant.

2. The holder shall comply with all applicable Federal laws and regulations existing or hereafter enacted or promulgated. In any event, the holder shall comply with the Toxic Substances Control Act of 1976 as amended, 15 USC 2601 et seq. (1982) with regards to any toxic substances that are used, generated by or stored on the right-of-way or on facilities authorized under this right-of-way grant. (See 40 CFR, Part 702-799 and especially, provisions on polychlorinated biphenyls, 40 CFR 761.1-761.193.) Additionally, any release of toxic substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR, Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act, section 102b. A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to the authorized officer concurrent with the filing of the reports to the involved Federal agency or State government.

3. The holder agrees to indemnify the United States against any liability arising from the release of any hazardous substance or hazardous waste (as these terms are defined in the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. 9601, et seq. or the Resource Conservation and Recovery Act, 42 U.S.C. 6901, et seq.) on the Right-of-Way (unless the release or threatened release is wholly unrelated to the Right-of-Way holder's activity on the Right-of-Way), or resulting from the activity of the Right-of-Way holder on the Right-of-Way. This agreement applies without regard to whether a release is caused by the holder, its agent, or unrelated third parties.

4. There will be no clearing or blading of the right-of-way unless otherwise agreed to in writing by the Authorized Officer.

5. Power lines shall be constructed and designed in accordance to standards outlined in "Suggested Practices for Avian Protection on Power lines: The State of the Art in 2006" Edison Electric Institute, APLIC, and the California Energy Commission 2006 . The

holder shall assume the burden and expense of proving that pole designs not shown in the above publication deter raptor perching, roosting, and nesting. Such proof shall be provided by a raptor expert approved by the Authorized Officer. The BLM reserves the right to require modification or additions to all powerline structures placed on this right-of-way, should they be necessary to ensure the safety of large perching birds. Such modifications and/or additions shall be made by the holder without liability or expense to the United States.

Raptor deterrence will consist of but not limited to the following: triangle perch discouragers shall be placed on each side of the cross arms and a nonconductive perching deterrence shall be placed on all vertical poles that extend past the cross arms.

6. The holder shall minimize disturbance to existing fences and other improvements on public lands. The holder is required to promptly repair improvements to at least their former state. Functional use of these improvements will be maintained at all times. The holder will contact the owner of any improvements prior to disturbing them. When necessary to pass through a fence line, the fence shall be braced on both sides of the passageway prior to cutting the fence. No permanent gates will be allowed unless approved by the Authorized Officer.

7. The BLM serial number assigned to this authorization shall be posted in a permanent, conspicuous manner where the power line crosses roads and at all serviced facilities. Numbers will be at least two inches high and will be affixed to the pole nearest the road crossing and at the facilities served.

8. Upon cancellation, relinquishment, or expiration of this grant, the holder shall comply with those abandonment procedures as prescribed by the Authorized Officer.

9. All surface structures (poles, lines, transformers, etc.) shall be removed within 180 days of abandonment, relinquishment, or termination of use of the serviced facility or facilities or within 180 days of abandonment, relinquishment, cancellation, or expiration of this grant, whichever comes first. This will not apply where the power line extends service to an active, adjoining facility or facilities.

10. Any cultural and/or paleontological resource (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the Authorized Officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery will be made by the Authorized Officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the Authorized Officer after consulting with the holder.

11. Special Stipulations:

- For reclamation remove poles, lines, transformer, etc. and dispose of properly.

- Fill in any holes from the poles removed.

IX. INTERIM RECLAMATION

During the life of the development, all disturbed areas not needed for active support of production operations should undergo interim reclamation in order to minimize the environmental impacts of development on other resources and uses.

Within six (6) months of well completion, operators should work with BLM surface management specialists (Jim Amos: 575-234-5909) to devise the best strategies to reduce the size of the location. Interim reclamation should allow for remedial well operations, as well as safe and efficient removal of oil and gas.

During reclamation, the removal of caliche is important to increasing the success of revegetating the site. Removed caliche that is free of contaminants may be used for road repairs, fire walls or for building other roads and locations. In order to operate the well or complete workover operations, it may be necessary to drive, park and operate on restored interim vegetation within the previously disturbed area. Disturbing revegetated areas for production or workover operations will be allowed. If there is significant disturbance and loss of vegetation, the area will need to be revegetated. Communicate with the appropriate BLM office for any exceptions/exemptions if needed.

All disturbed areas after they have been satisfactorily prepared need to be reseeded with the seed mixture provided below.

Upon completion of interim reclamation, the operator shall submit a Sundry Notices and Reports on Wells, Subsequent Report of Reclamation (Form 3160-5).

X. FINAL ABANDONMENT & RECLAMATION

At final abandonment, well locations, production facilities, and access roads must undergo "final" reclamation so that the character and productivity of the land are restored.

Earthwork for final reclamation must be completed within six (6) months of well plugging. All pads, pits, facility locations and roads must be reclaimed to a satisfactory revegetated, safe, and stable condition, unless an agreement is made with the landowner or BLM to keep the road and/or pad intact.

After all disturbed areas have been satisfactorily prepared, these areas need to be revegetated with the seed mixture provided below. Seeding should be accomplished by drilling on the contour whenever practical or by other approved methods. Seeding may need to be repeated until revegetation is successful, as determined by the BLM.

Operators shall contact a BLM surface protection specialist prior to surface abandonment operations for site specific objectives (Jim Amos: 575-234-5909).

Mixture 4, for Gypsum Sites

The holder shall seed all the disturbed areas with the seed mixture listed below. The seed mixture shall be planted in the amounts specified in pounds of pure live seed (PLS)* per acre. There shall be no primary or secondary noxious weeds in the seed mixture. Seed will be tested and the viability testing of seed will be done in accordance with State law(s) and within nine (9) months prior to purchase. Commercial seed will be either certified or registered seed. The seed container will be tagged in accordance with State law(s) and available for inspection by the authorized officer.

Seed will be planted using a drill equipped with a depth regulator to ensure proper depth of planting where drilling is possible. The seed mixture will be evenly and uniformly planted over the disturbed area (smaller/heavier seeds have a tendency to drop the bottom of the drill and are planted first). The holder shall take appropriate measures to ensure this does not occur. Where drilling is not possible, seed will be broadcast and the area shall be raked or chained to cover the seed. When broadcasting the seed, the pounds per acre are to be doubled. The seeding will be repeated until a satisfactory stand is established as determined by the authorized officer. Evaluation of growth will not be made before completion of at least one full growing season after seeding.

Species to be planted in pounds of pure live seed* per acre:

Species	lb/acre
Alkli Sacaton (*Sporobolus airoides*)	1.5
DWS~ Four-wing saltbush (*Atriplex canescens*)	8.0

~DWS: DeWinged Seed

*Pounds of pure live seed:

Pounds of seed x percent purity x percent germination = pounds pure live seed

United States Department of the Interior
Bureau of Land Management
Carlsbad Field Office

Refer to: 3160-3

To: AFM, Lands & Minerals, CFO
From: Geologist, CFO
Subject: Geologic Review of Application for Permit to Drill

ORIGINAL

Operator: Chevron USA Inc

Well Name and Number: HH SO 8 P2-5H

Potash: No

Location: SHL:225'/N.& 960'/W. SEC017 T026S, R027E.(SESW)

County Eddy **Lease Number:** NMNM118108 **APD Received:** 2-18-2016

Ground Level Elevation: 3245 **Surface Geology:** Psl-Salado Formation

TVD: 9563 **MD:** 20126 **BH Mud Weight:** 13.5

BHP: 6713 **MASP:** 4609

1. Geologic Marker Tops (from reports on surrounding wells):

Geologic Marker	WELCH #004 3001501153 T26S R27E Sec 20 990FNL 330FEL Elevation Depth	WELCH ABV FEDERAL #001 3001501159 T26S R27E Sec 21 660FNL 760FWL Elevation Depth	BLAST BLA FEDERAL #001 3001536136 T26S R27E Sec 17 1980FSL 1650FEL Elevation Depth	Cluster State Com 1H 3001537547 T26S R27E Sec 16 380FNL 330FWL Elevation Depth	**Proposed Well** HH SO 8 P2-5H T026S, R027E.(SESWSEC017 225'/N.& 960'/W Unit Elevation Estimated Depth
Top of Salt	-	-	0	0	0
Castile	432	-	-	480	525
Lamar	2040	2028	2137	2140	2015
Bell Canyon	2100	2062	2178	2200	2065
Bone Spring Lime	-	5690	5720	5740	5615
1st BS Sand	-	6570	6682	6684	6565
2nd BS Sand	-	7330	7350	7382	7245
3rd BS Sand	-	8410	8510	8537	8385
Wolfcamp	-	8763	8857	8894	8745
Strawn	-	11210	11248	-	11125

2. Fresh Water Information

a. Fresh Water: 350

b. Fresh Water Remarks:

NEPA Log No: IT4RM-P020-2016-1711-EA

Project Type:

Reference Number: NMNM118108

Project Title: HH SO 8 P2 5H

Project Lead: Paul Murphy

Applicant: Chevron USA Inc

Recd Date: 09-30-2016

Routing Started: 10-04-2016

NEPA Checklist

Resource/Activity	Not Present	Not Impacted	**May be Impacted	Reviewer	COAs/Stips Req	Sign Off Date
Wastes, Hazardous or Solid	○	◉	○	Paul Murphy	☐	10-04-2016
Public Health and Safety	○	◉	○			
Enivronmental Justice	○	◉	○	Paul Murphy	☐	10-04-2016
General Topography/Surface Geology	○	◉	○			
Socio Economics	○	◉	○			
Lands/Realty, ROW	○	◉	○	Robert Gomez	☑	10-06-2016
Access/Transportation	○	◉	○			
Vegetation/Forestry	○	○	◉	Stephen Daly	☐	10-06-2016
Livestock Grazing	○	○	◉			
Invasive, Non-Native Species	○	○	◉			
Soils	○	○	◉	Stephen Daly	☐	10-06-2016
Air Quality	○	○	◉			
Floodplains	○	◉	○	Stephen Daly	☐	10-06-2016
Water Quality Surface/Ground	○	○	◉			
Watershed	○	○	◉			
Mineral Materials	○	○	◉	Paul Murphy	☐	10-04-2016
Potash	◉	○	○	Paul Murphy	☐	10-04-2016
Endangered Species	◉	○	○	Cassandra Brooks	☐	10-06-2016
Wetlands/Riparian Zones	◉	○	○			
Special Status Species	◉	○	○			
Wildlife Habitat	○	○	◉			
Karst Resources	○	○	◉	Stan Allison	☑	10-07-2016
ACECs	○	◉	○	Cassandra Brooks	☐	10-06-2016
Wild/Scenic Rivers	◉	○	○	Stan Allison	☐	10-07-2016
Wilderness	◉	○	○			
Outdoor Recreation	○	○	◉			
Visual Resources	○	○	◉			
Native American Religious Concerns	◉ Unknown					
Cultural Resources	○	◉	○	Stephanie Bergman	☐	10-07-2016
Paleontology	◉ Unknown					

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Pecos District
Carlsbad Field Office
620 East Greene Street
Carlsbad, NM 88220

Hayhurst Master Development Plan Environmental Assessment

NEPA No. DOI-BLM-NM-P020-2016-1434-EA

Conditions of Approval

In order to ensure that the proponent's impacts are consistent with the operating parameters considered in the air quality analysis, Conditions of Approval (COA) will be applied to Applications for Permit to Drill requested under the Hayhurst Master Development Plan. These COAs are:

- All project activities including equipment emissions shall meet or exceed all state and federal standards for air quality as regulated by the New Mexico Environment Department Air Quality Bureau and the U.S. Environmental Protection Agency.

- The operator will implement a drill and completion rig schedule where Tier 4 (or equivalent) drill and completion rigs are phased in. The operator will not exceed four drill rigs at one time and will be 100% compliant with Tier 4 (or equivalent) standards in 2020.

- During the drilling phase, the operator will emit NOx emissions of 262.95 tons per year (tpy) or less from nonroad (mobile sources) between Year 1 and Year 3 and 220.7 tpy or less from nonroad (mobile sources) for the remainder of the drilling phase.

- The operator will emit 213.6 tpy or less of NOx emissions during production operations, as defined in the emission inventory analyzed in the Environmental Assessment. The operator will submit emissions and/or parameters with an Application for Permit to Drill or annual emissions inventory that show the NOx emissions are within the limits of the air quality analysis within the Environmental Assessment.

PECOS DISTRICT
CONDITIONS OF APPROVAL

OPERATOR'S NAME:	**Chevron USA Inc.**
LEASE NO.:	**NMNM-118108**
WELL NAME & NO.:	**HH SO 8 P2 5H**
SURFACE HOLE FOOTAGE:	**0255' FNL & 0960' FWL**
BOTTOM HOLE FOOTAGE	**0180' FNL & 0330' FWL Sec. 05, T. 26 S., R 27 E.**
LOCATION:	**Section 17, T. 26 S., R 27 E., NMPM**
COUNTY:	**Eddy County, New Mexico**

TABLE OF CONTENTS

Standard Conditions of Approval (COA) apply to this APD. If any deviations to these standards exist or special COAs are required, the section with the deviation or requirement will be checked below.

- ☐ **General Provisions**
- ☐ **Permit Expiration**
- ☐ **Archaeology, Paleontology, and Historical Sites**
- ☐ **Noxious Weeds**
- ☒ **Special Requirements**
  - Raptor Nest
  - Avian Protection
  - Cave/Karst
  - VRM
  - Cultural
- ☐ **Construction**
  - Notification
  - Topsoil
  - Closed Loop System
  - Federal Mineral Material Pits
  - Well Pads
  - Roads
- ☐ **Road Section Diagram**
- ☒ **Drilling**
  - Cement Requirements
  - High Cave/Karst
  - Logging Requirements
  - Waste Material and Fluids
- ☒ **Production (Post Drilling)**
  - Well Structures & Facilities
  - Pipelines
  - Electric Lines
- ☐ **Interim Reclamation**
- ☐ **Final Abandonment & Reclamation**

I. GENERAL PROVISIONS

The approval of the Application For Permit To Drill (APD) is in compliance with all applicable laws and regulations: 43 Code of Federal Regulations 3160, the lease terms, Onshore Oil and Gas Orders, Notices To Lessees, New Mexico Oil Conservation Division (NMOCD) Rules, National Historical Preservation Act As Amended, and instructions and orders of the Authorized Officer. Any request for a variance shall be submitted to the Authorized Officer on Form 3160-5, Sundry Notices and Report on Wells.

II. PERMIT EXPIRATION

If the permit terminates prior to drilling and drilling cannot be commenced within 60 days after expiration, an operator is required to submit Form 3160-5, Sundry Notices and Reports on Wells, requesting surface reclamation requirements for any surface disturbance. However, if the operator will be able to initiate drilling within 60 days after the expiration of the permit, the operator must have set the conductor pipe in order to allow for an extension of 60 days beyond the expiration date of the APD. (Filing of a Sundry Notice is required for this 60 day extension.)

III. ARCHAEOLOGICAL, PALEONTOLOGY & HISTORICAL SITES

Any cultural and/or paleontological resource discovered by the operator or by any person working on the operator's behalf shall immediately report such findings to the Authorized Officer. The operator is fully accountable for the actions of their contractors and subcontractors. The operator shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery shall be made by the Authorized Officer to determine the appropriate actions that shall be required to prevent the loss of significant cultural or scientific values of the discovery. The operator shall be held responsible for the cost of the proper mitigation measures that the Authorized Officer assesses after consultation with the operator on the evaluation and decisions of the discovery. Any unauthorized collection or disturbance of cultural or paleontological resources may result in a shutdown order by the Authorized Officer.

IV. NOXIOUS WEEDS

The operator shall be held responsible if noxious weeds become established within the areas of operations. Weed control shall be required on the disturbed land where noxious weeds exist, which includes the roads, pads, associated pipeline corridor, and adjacent land affected by the establishment of weeds due to this action. The operator shall consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies.

V. SPECIAL REQUIREMENT(S)

Avian Protection

Power lines shall be constructed and designed in accordance to standards outlined in "Suggested Practices for Avian Protection on Power lines: The State of the Art in 2006" Edison Electric Institute, APLIC, and the California Energy Commission 2006. The holder shall assume the burden and expense of proving that pole designs not shown in the above publication deter raptor perching, roosting, and nesting. Such proof shall be provided by a raptor expert approved by the Authorized Officer. The BLM reserves the right to require modification or additions to all power line structures placed on this right-of-way, should they be necessary to ensure the safety of large perching birds. The holder without liability or expense shall make such modifications and/or additions to the United States.

Raptor Nest Mitigation

- A BLM Wildlife Biologist must be contacted by the operator prior to construction activities to determine if the raptor nest is active.
- Raptor nests on special, natural habitat features, such as trees, large brush, cliff faces and escarpments, will be protected by not allowing surface disturbance within up to 200 meters of nests or by delaying activity for up to 90 days, or a combination of both. Exceptions to this requirement for raptor nests will be considered if the nests expected to be disturbed are inactive, the proposed activity is of short duration (e.g. habitat enhancement projects, fences, pipelines), and will not result in continuing activity in proximity to the nest.
- Exhaust noise from pump jack engines must be muffled or otherwise controlled so as not to exceed 75 db measured at 30 ft. from the source of the noise.

Visual Resource Management (VRM)

- Above-ground structures including meter housing that are not subject to safety requirements are painted a flat non-reflective paint color, Shale Green from the BLM Standard Environmental Color Chart (CC-001: June 2008)
- Chevron would use minimal light necessary for site safety, security, and operations.
- Light should be directed downward or only where needed.
- Low-pressure sodium lamps, such as yellow LED lighting (3,000 Kelvin or less) or equivalent, would be used to reduce sky glow and wildlife impacts.
- Properly shielded and mounted light fixtures would be used to reduce sky glow from upward pointing light, as well as trespass from light falling outside of desired area of illumination. Full cutoff shielding would be used during production.

Cave and Karst

** Depending on location, additional Drilling, Casing, and Cementing procedures may be required by engineering to protect critical karst groundwater recharge areas.

Cave/Karst Surface Mitigation

The following stipulations will be applied to minimize impacts during construction, drilling and production.

Construction:
In the advent that any underground voids are opened up during construction activities, construction activities will be halted and the BLM will be notified immediately.

No Blasting:
No blasting will be utilized for pad construction. The pad will be constructed and leveled by adding the necessary fill and caliche.

Pad Berming:
The entire perimeter of the well pad will be bermed to prevent oil, salt, and other chemical contaminants from leaving the well pad.

- The compacted berm shall be constructed at a minimum of 12 inches high with impermeable mineral material (e.g. caliche).
- No water flow from the uphill side(s) of the pad shall be allowed to enter the well pad.
- The topsoil stockpile shall be located outside the bermed well pad.
- Topsoil, either from the well pad or surrounding area, shall not be used to construct the berm.
- No storm drains, tubing or openings shall be placed in the berm.
- If fluid collects within the bermed area, the fluid must be vacuumed into a safe container and disposed of properly at a state approved facility.
- The integrity of the berm shall be maintained around the surfaced pad throughout the life of the well and around the downsized pad after interim reclamation has been completed.
- Any access road entering the well pad shall be constructed so that the integrity of the berm height surrounding the well pad is not compromised. (Any access road crossing the berm cannot be lower than the berm height.)

Tank Battery Liners and Berms:
Tank battery locations and all facilities will be lined and bermed. A 20 mil permanent liner will be installed with a 4 oz. felt backing to prevent tears or punctures. Tank battery berms must be large enough to contain 1 ½ times the content of the largest tank.

Leak Detection System:

A method of detecting leaks is required. The method could incorporate gauges to measure loss, situating values and lines so they can be visually inspected, or installing electronic sensors to alarm when a leak is present. Leak detection plan will be submitted to BLM for approval.

Automatic Shut-off Systems:
Automatic shut off, check values, or similar systems will be installed for pipelines and tanks to minimize the effects of catastrophic line failures used in production or drilling.

Cave/Karst Subsurface Mitigation

The following stipulations will be applied to protect cave/karst and ground water concerns:

Rotary Drilling with Fresh Water:
Fresh water will be used as a circulating medium in zones where caves or karst features are expected. SEE ALSO: Drilling COAs for this well.

Directional Drilling:
Kick off for directional drilling will occur at least 100 feet below the bottom of the cave occurrence zone. SEE ALSO: Drilling COAs for this well.

Lost Circulation:
ALL lost circulation zones from the surface to the base of the cave occurrence zone will be logged and reported in the drilling report.

Regardless of the type of drilling machinery used, if a void of four feet or more and circulation losses greater than 70 percent occur simultaneously while drilling in any cave-bearing zone, the BLM will be notified immediately by the operator. The BLM will assess the situation and work with the operator on corrective actions to resolve the problem.

Abandonment Cementing:
Upon well abandonment in high cave karst areas additional plugging conditions of approval may be required. The BLM will assess the situation and work with the operator to ensure proper plugging of the wellbore.

Pressure Testing:
Annual pressure monitoring will be performed by the operator on all casing annuli and reported in a sundry notice. If the test results indicated a casing failure has occurred, remedial action will be undertaken to correct the problem to the BLM's approval.

VI. CONSTRUCTION

A. NOTIFICATION

The BLM shall administer compliance and monitor construction of the access road and well pad. Notify the Carlsbad Field Office at (575) 234-5909 at least 3 working days prior to commencing construction of the access road and/or well pad.

When construction operations are being conducted on this well, the operator shall have the approved APD and Conditions of Approval (COA) on the well site and they shall be made available upon request by the Authorized Officer.

B. TOPSOIL

The operator shall strip the top portion of the soil (root zone) from the entire well pad area and stockpile the topsoil along the edge of the well pad as depicted in the APD. The root zone is typically six (6) inches in depth. All the stockpiled topsoil will be redistributed over the interim reclamation areas. Topsoil shall not be used for berming the pad or facilities. For final reclamation, the topsoil shall be spread over the entire pad area for seeding preparation.

Other subsoil (below six inches) stockpiles must be completely segregated from the topsoil stockpile. Large rocks or subsoil clods (not evident in the surrounding terrain) must be buried within the approved area for interim and final reclamation.

C. CLOSED LOOP SYSTEM

Tanks are required for drilling operations: No Pits.

The operator shall properly dispose of drilling contents at an authorized disposal site.

D. FEDERAL MINERAL MATERIALS PIT

Payment shall be made to the BLM prior to removal of any federal mineral materials. Call the Carlsbad Field Office at (575) 234-5972.

E. WELL PAD SURFACING

Surfacing of the well pad is not required.

If the operator elects to surface the well pad, the surfacing material may be required to be removed at the time of reclamation.The well pad shall be constructed in a manner which creates the smallest possible surface disturbance, consistent with safety and operational needs.

F. EXCLOSURE FENCING (CELLARS & PITS)

Exclosure Fencing
The operator will install and maintain exclosure fencing for all open well cellars to prevent access to public, livestock, and large forms of wildlife before and after drilling operations until the pit is free of fluids and the operator initiates backfilling. (For examples of exclosure fencing design, refer to BLM's Oil and Gas Gold Book, Exclosure Fence Illustrations, Figure 1, Page 18.)

G. ON LEASE ACCESS ROADS

Road Width
The access road shall have a driving surface that creates the smallest possible surface disturbance and does not exceed fourteen (14) feet in width. The maximum width of surface disturbance, when constructing the access road, shall not exceed twenty-five (25) feet.

Surfacing
Surfacing material is not required on the new access road driving surface. If the operator elects to surface the new access road or pad, the surfacing material may be required to be removed at the time of reclamation.

Where possible, no improvements should be made on the unsurfaced access road other than to remove vegetation as necessary, road irregularities, safety issues, or to fill low areas that may sustain standing water.

The Authorized Officer reserves the right to require surfacing of any portion of the access road at any time deemed necessary. Surfacing may be required in the event the road deteriorates, erodes, road traffic increases, or it is determined to be beneficial for future field development. The surfacing depth and type of material will be determined at the time of notification.

Crowning
Crowning shall be done on the access road driving surface. The road crown shall have a grade of approximately 2% (i.e., a 1" crown on a 14' wide road). The road shall conform to Figure 1; cross section and plans for typical road construction.

Ditching
Ditching shall be required on both sides of the road.

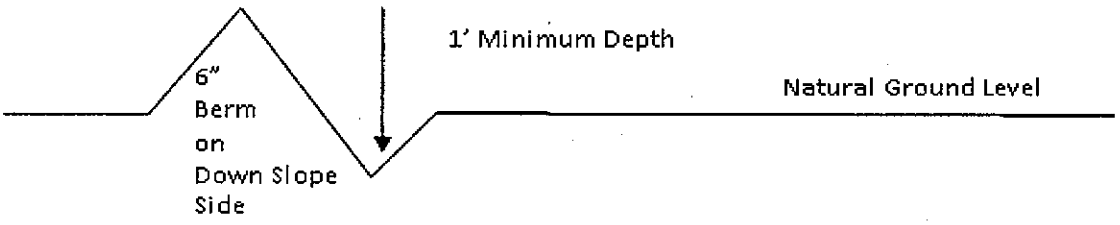
Turnouts
Vehicle turnouts shall be constructed on the road. Turnouts shall be intervisible with interval spacing distance less than 1000 feet. Turnouts shall conform to Figure 1; cross section and plans for typical road construction.

Drainage

Drainage control systems shall be constructed on the entire length of road (e.g. ditches, sidehill outsloping and insloping, lead-off ditches, culvert installation, and low water crossings).

A typical lead-off ditch has a minimum depth of 1 foot below and a berm of 6 inches above natural ground level. The berm shall be on the down-slope side of the lead-off ditch.

Cross Section of a Typical Lead-off Ditch



All lead-off ditches shall be graded to drain water with a 1 percent minimum to 3 percent maximum ditch slope. The spacing interval are variable for lead-off ditches and shall be determined according to the formula for spacing intervals of lead-off ditches, but may be amended depending upon existing soil types and centerline road slope (in %);

Formula for Spacing Interval of Lead-off Ditches

Example - On a 4% road slope that is 400 feet long, the water flow shall drain water into a lead-off ditch. Spacing interval shall be determined by the following formula:

400 foot road with 4% road slope: $\frac{400'}{4\%} + 100' = 200'$ lead-off ditch interval

Cattleguards

An appropriately sized cattleguard sufficient to carry out the project shall be installed and maintained at fence/road crossings. Any existing cattleguards on the access road route shall be repaired or replaced if they are damaged or have deteriorated beyond practical use. The operator shall be responsible for the condition of the existing cattleguards that are in place and are utilized during lease operations.

Fence Requirement

Where entry is granted across a fence line, the fence shall be braced and tied off on both sides of the passageway prior to cutting. The operator shall notify the private surface landowner or the grazing allotment holder prior to crossing any fences.

Public Access

Public access on this road shall not be restricted by the operator without specific written approval granted by the Authorized Officer.

Construction Steps

1. Salvage topsoil
2. Construct road
3. Redistribute topsoil
4. Revegetate slopes

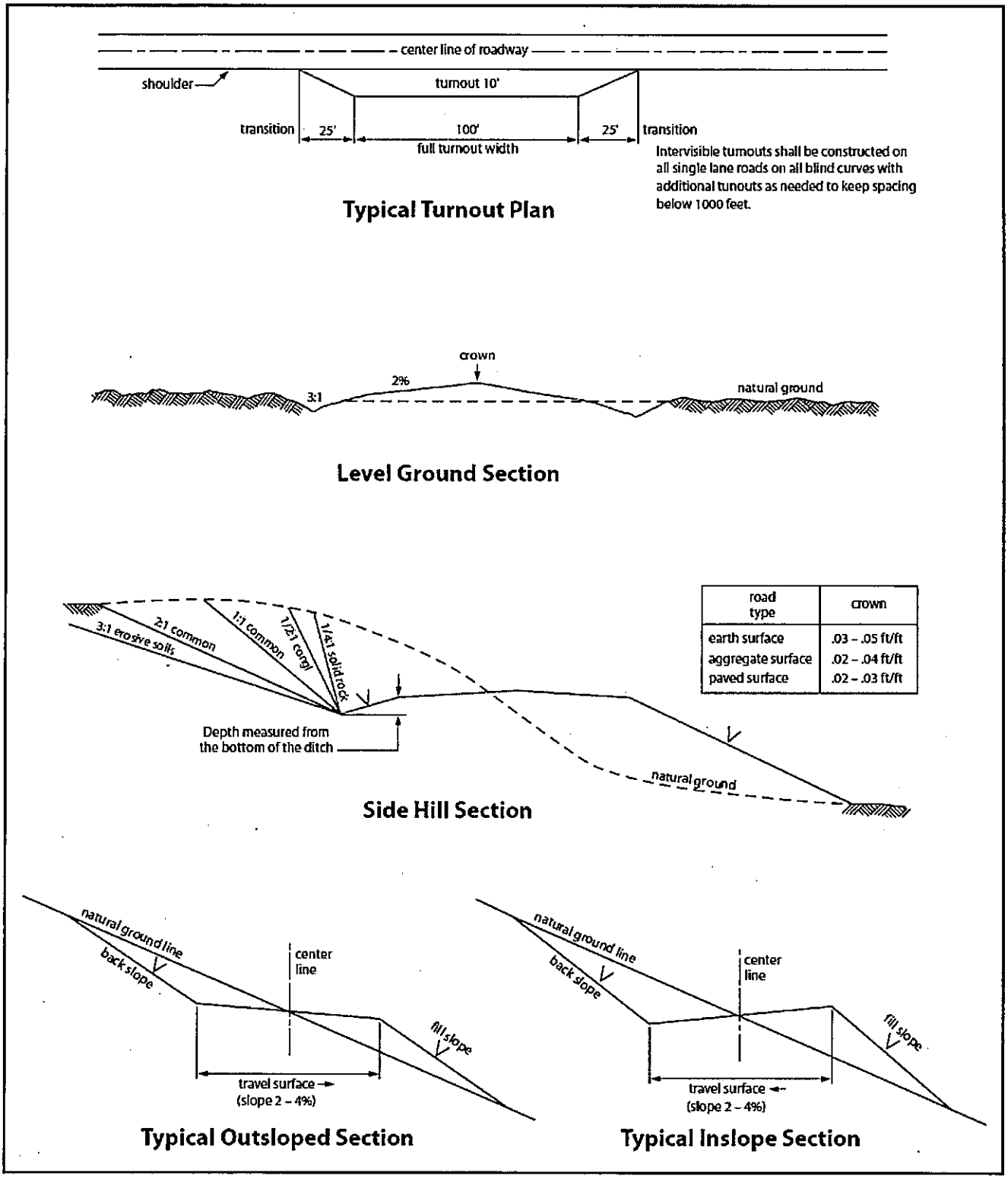


Figure 1. Cross-sections and plans for typical road sections representative of BLM resource or FS local and higher-class roads.

VII. DRILLING

A. DRILLING OPERATIONS REQUIREMENTS

The BLM is to be notified in advance for a representative to witness:

a. Spudding well (minimum of 24 hours)
b. Setting and/or Cementing of all casing strings (minimum of 4 hours)
c. BOPE tests (minimum of 4 hours)

☒ **Eddy County**
Call the Carlsbad Field Office, 620 East Greene St., Carlsbad, NM 88220, (575) 361-2822

1. **Hydrogen Sulfide (H2S) monitors shall be installed prior to drilling out the surface shoe. If H2S is detected in concentrations greater than 100 ppm, the Hydrogen Sulfide area shall meet Onshore Order 6 requirements, which includes equipment and personnel/public protection items. If Hydrogen Sulfide is encountered, provide measured values and formations to the BLM.**

2. Unless the production casing has been run and cemented or the well has been properly plugged, the drilling rig shall not be removed from over the hole without prior approval. **If the drilling rig is removed without approval – an Incident of Non-Compliance will be written and will be a "Major" violation.**

3. **The operator has proposed to drill multiple wells utilizing a skid/walking rig. Operator shall secure the wellbore on the current well, after installing and testing the wellhead, by installing a blind flange of like pressure rating to the wellhead and a pressure gauge that can be monitored while drilling is performed on the other wells.**

4. Floor controls are required for 3M or Greater systems. These controls will be on the rig floor, unobstructed, readily accessible to the driller and will be operational at all times during drilling and/or completion activities. Rig floor is defined as the area immediately around the rotary table; the area immediately above the substructure on which the draw works is located, this does not include the dog house or stairway area.

5. **The record of the drilling rate along with the GR/N well log run from TD to surface (horizontal well – vertical portion of hole) shall be submitted to the BLM office as well as all other logs run on the borehole 30 days from completion. If available, a digital copy of the logs is to be submitted in addition to the paper copies. The Rustler top and top and bottom of Salt are to be recorded on the Completion Report.**

B. CASING

Changes to the approved APD casing program need prior approval if the items substituted are of lesser grade or different casing size or are Non-API. The Operator can exchange the components of the proposal with that of superior strength (i.e. changing from J-55 to N-80, or from 36# to 40#). Changes to the approved cement program need prior approval if the altered cement plan has less volume or strength or if the changes are substantial (i.e. Multistage tool, ECP, etc.). The initial wellhead installed on the well will remain on the well with spools used as needed.

Centralizers required on surface casing per Onshore Order 2.III.B.1.f.

Wait on cement (WOC) for Water Basin:
After cementing but before commencing any tests, the casing string shall stand cemented under pressure until both of the following conditions have been met: 1) cement reaches a minimum compressive strength of 500 psi at the shoe, 2) until cement has been in place at least 8 hours. WOC time will be recorded in the driller's log. See individual casing strings for details regarding lead cement slurry requirements.

Provide compressive strengths including hours to reach required 500 pounds compressive strength prior to cementing each casing string. Have well specific cement details onsite prior to pumping the cement for each casing string.

No pea gravel permitted for remedial or fall back remedial without prior authorization from the BLM engineer.

High Cave/Karst
Possibility of water flows in the Castillo and Salado.
Possibility of lost circulation in the Delaware.
Abnormal Pressures may be encountered when penetrating the 3rd Bone Spring Sandstone and all subsequent formations.

A MINIMUM OF TWO CASING STRINGS CEMENTED TO SURFACE IS REQUIRED IN HIGH CAVE/KARST AREAS. THE CEMENT MUST BE IN A SOLID SHEATH. THEREFORE, ONE INCH OPERATIONS ARE NOT SUFFICIENT TO PROTECT CAVE KARST RESOURCES. A CASING DESIGN THAT HAS A ONE INCH JOB PERFORMED DOES NOT COUNT AS A SOLID SHEATH. IF THE PRIMARY CEMENT JOB ON THE SURFACE CASING DOES NOT CIRCULATE, THEN THE NEXT TWO CASING STRINGS MUST BE CEMENTED TO SURFACE.

1. The **13-3/8** inch surface casing shall be set at approximately **450** feet (a minimum of 25 feet into the Rustler Anhydrite and above the salt) and cemented to the surface. **If salt is encountered, set casing at least 25 feet above the salt.**

    a. If cement does not circulate to the surface, the appropriate BLM office shall be notified and a temperature survey utilizing an electronic type temperature survey with surface log readout will be used or a cement bond log shall be run to verify the top of the cement. Temperature survey will be run a minimum of six hours after pumping cement and ideally between 8-10 hours after completing the cement job.

    b. Wait on cement (WOC) time for a primary cement job is to include the lead cement slurry.

    c. Wait on cement (WOC) time for a remedial job will be a minimum of 4 hours after bringing cement to surface or 500 pounds compressive strength, whichever is greater.

    d. If cement falls back, remedial cementing will be done prior to drilling out that string.

Formation below the 13-3/8" shoe to be tested according to Onshore Order 2.III.B.1.i. Test to be done as a mud equivalency test using the mud weight necessary for the pore pressure of the formation below the shoe and the mud weight for the bottom of the hole. Report results to BLM office.

Intermediate casing shall be kept fluid filled while running into hole to meet BLM minimum collapse requirements.

2. The minimum required fill of cement behind the **9-5/8** inch intermediate casing is:

Operator has proposed DV tool at depth of 2100', but will adjust cement proportionately if moved. DV tool shall be set a minimum of 50' below previous shoe and a minimum of 200' above current shoe. Operator shall submit sundry if DV tool depth cannot be set in this range. If an ECP is used, it is to be set a minimum of 50' below the shoe to provide cement across the shoe. If it cannot be set below the shoe, a CBL shall be run to verify cement coverage.

a. First stage to DV tool:

☒ Cement to circulate. If cement does not circulate, contact the appropriate BLM office before proceeding with second stage cement job. Operator should have plans as to how they will achieve circulation on the next stage.

b. Second stage above DV tool:

☒ Cement to surface. If cement does not circulate see B.1.a, c-d above. **Wait on cement (WOC) time for a primary cement job is to include the lead cement slurry due to cave/karst. Excess calculates to 22% - Additional cement may be required.**

Formation below the 9-5/8" shoe to be tested according to Onshore Order 2.III.B.1.i. Test to be done as a mud equivalency test using the mud weight necessary for the pore pressure of the formation below the shoe (not the mud weight required to prevent dissolving the salt formation) and the mud weight for the bottom of the hole. Report results to BLM office.

Centralizers required on horizontal leg, must be type for horizontal service and a minimum of one every other joint.

3. The minimum required fill of cement behind the **5-1/2** inch production casing is:

   ☒ Cement as proposed by operator. Operator shall provide method of verification.

4. If hardband drill pipe is rotated inside casing, returns will be monitored for metal. If metal is found in samples, drill pipe will be pulled and rubber protectors which have a larger diameter than the tool joints of the drill pipe will be installed prior to continuing drilling operations.

C. PRESSURE CONTROL

1. All blowout preventer (BOP) and related equipment (BOPE) shall comply with well control requirements as described in Onshore Oil and Gas Order No. 2 and API 53.

2. Minimum working pressure of the blowout preventer (BOP) and related equipment (BOPE) required for drilling below the surface casing shoe shall be **10,000 (10M)** psi. **10M system requires an HCR valve, remote kill line and annular to match. The remote kill line is to be installed prior to testing the system and tested to stack pressure.** BOP/BOPE shall be tested after nipple up according to Onshore Order #2.

3. The appropriate BLM office shall be notified a minimum of 4 hours in advance for a representative to witness the tests.

   a. In a water basin, for all casing strings utilizing slips, these are to be set as soon as the crew and rig are ready and any fallback cement remediation has been done. The casing cut-off and BOP installation can be initiated four hours after installing the slips, which will be approximately six hours after bumping the plug. For those casing strings not using slips, the minimum wait time before cut-off is eight hours after bumping the plug. BOP/BOPE testing can begin after cut-off or once cement reaches 500 psi compressive strength (including lead when specified), whichever is greater. However, if the float does not hold, cut-off cannot be initiated until cement reaches 500 psi compressive strength (including lead when specified).

   b. The tests shall be done by an independent service company utilizing a test plug **not a cup or J-packer**.

   c. The test shall be run on a 5000 psi chart for a 2-3M BOP/BOP, on a 10000 psi chart for a 5M BOP/BOPE and on a 15000 psi chart for a 10M BOP/BOPE. If a linear chart is used, it shall be a one hour chart. A circular chart shall have a maximum 2 hour clock. If a twelve hour or twenty-four hour chart is used, tester shall make a notation that it is run with a two hour clock.

   d. The results of the test shall be reported to the appropriate BLM office.

   e. All tests are required to be recorded on a calibrated test chart. **A copy of the BOP/BOPE test chart and a copy of independent service company test will be submitted to the appropriate BLM office.**

   f. The BOP/BOPE test shall include a low pressure test from 250 to 300 psi. The test will be held for a minimum of 10 minutes if test is done with a test plug and 30 minutes without a test plug. This test shall be performed prior to the test at full stack pressure.

   g. BOP/BOPE must be tested by an independent service company within 500 feet of the top of the **Wolfcamp** formation if the time between the setting of the intermediate casing and reaching this depth exceeds 20 days. This test does not exclude the test prior to drilling out the casing shoe as per Onshore Order No. 2.

D. DRILLING MUD

Mud system monitoring equipment, with derrick floor indicators and visual and audio alarms, shall be operating before drilling into the **Wolfcamp** formation, and shall be used until production casing is run and cemented.

E. DRILL STEM TEST

If drill stem tests are performed, Onshore Order 2.III.D shall be followed.

F. WASTE MATERIAL AND FLUIDS

All waste (i.e. drilling fluids, trash, salts, chemicals, sewage, gray water, etc.) created as a result of drilling operations and completion operations shall be safely contained and disposed of properly at a waste disposal facility. No waste material or fluid shall be disposed of on the well location or surrounding area.

Porto-johns and trash containers will be on-location during fracturing operations or any other crew-intensive operations.

JAM 072516

VIII. PRODUCTION (POST DRILLING)

A. WELL STRUCTURES & FACILITIES

Placement of Production Facilities
Production facilities should be placed on the well pad to allow for maximum interim recontouring and revegetation of the well location.

Exclosure Netting (Open-top Tanks)
Immediately following active drilling or completion operations, the operator will take actions necessary to prevent wildlife and livestock access, including avian wildlife, to all open-topped tanks that contain or have the potential to contain salinity sufficient to cause harm to wildlife or livestock, hydrocarbons, or Resource Conservation and Recovery Act of 1976-exempt hazardous substances. At a minimum, the operator will net, screen, or cover open-topped tanks to exclude wildlife and livestock and prevent mortality. If the operator uses netting, the operator will cover and secure the open portion of the tank to prevent wildlife entry. The operator will net, screen, or cover the tanks until the operator removes the tanks from the location or the tanks no longer contain substances that could be harmful to wildlife or livestock. Use a maximum netting mesh size of 1 ½ inches. The netting must not be in contact with fluids and must not have holes or gaps.

Chemical and Fuel Secondary Containment and Exclosure Screening
The operator will prevent all hazardous, poisonous, flammable, and toxic substances from coming into contact with soil and water. At a minimum, the operator will install and maintain an impervious secondary containment system for any tank or barrel containing hazardous, poisonous, flammable, or toxic substances sufficient to contain the contents of the tank or barrel and any drips, leaks, and anticipated precipitation. The operator will dispose of fluids within the containment system that do not meet applicable state or U. S. Environmental Protection Agency livestock water standards in accordance with state law; the operator must not drain the fluids to the soil or ground. The operator will design, construct, and maintain all secondary containment systems to prevent wildlife and livestock exposure to harmful substances. At a minimum, the operator will install effective wildlife and livestock exclosure systems such as fencing, netting, expanded metal mesh, lids, and grate covers. Use a maximum netting mesh size of 1 ½ inches.

Open-Vent Exhaust Stack Exclosures
The operator will construct, modify, equip, and maintain all open-vent exhaust stacks on production equipment to prevent birds and bats from entering, and to discourage perching, roosting, and nesting. (*Recommended exclosure structures on open-vent exhaust stacks are in the shape of a cone.*) Production equipment includes, but may not be limited to, tanks, heater-treaters, separators, dehydrators, flare stacks, in-line units, and compressor mufflers.

Containment Structures
Proposed production facilities such as storage tanks and other vessels will have a secondary containment structure that is constructed to hold the capacity of 1.5 times the

largest tank, plus freeboard to account for precipitation, unless more stringent protective requirements are deemed necessary.

Painting Requirement
All above-ground structures including meter housing that are not subject to safety requirements shall be painted a flat non-reflective paint color, **Shale Green** from the BLM Standard Environmental Color Chart (CC-001: June 2008).

B. PIPELINES

BURIED PIPELINE STIPULATIONS

A copy of the application (Grant, APD, or Sundry Notice) and attachments, including conditions of approval, survey plat and/or map, will be on location during construction. BLM personnel may request to you a copy of your permit during construction to ensure compliance with all stipulations.

Holder agrees to comply with the following stipulations to the satisfaction of the Authorized Officer:

1. The Holder shall indemnify the United States against any liability for damage to life or property arising from the occupancy or use of public lands under this grant.

2. The Holder shall comply with all applicable Federal laws and regulations existing or hereafter enacted or promulgated. In any event, the holder shall comply with the Toxic Substances Control Act of 1976 as amended, 15 USC 2601 et seq. (1982) with regards to any toxic substances that are used, generated by or stored on the right-of-way or on facilities authorized under this right-of-way grant. (See 40 CFR Part 702-799 and especially, provisions on polychlorinated biphenyls, 40 CFR 761.1-761.193.) Additionally, any release of toxic substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act, section 102b. A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to the authorized officer concurrent with the filing of the reports to the involved Federal agency or State government.

3. The holder agrees to indemnify the United States against any liability arising from the release of any hazardous substance or hazardous waste (as these terms are defined in the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. 9601, et seq. or the Resource Conservation and Recovery Act, 42 U.S.C.6901, et seq.) on the Right-of-Way (unless the release or threatened release is wholly unrelated to the Right-of-Way holder's activity on the Right-of-Way), or resulting from the activity of the Right-of-Way holder on the Right-of-Way. This agreement applies without regard to whether a release is caused by the holder, its agent, or unrelated third parties.

4. If, during any phase of the construction, operation, maintenance, or termination of the pipeline, any oil or other pollutant should be discharged from the pipeline system, impacting Federal lands, the control and total removal, disposal, and cleaning up of such oil or other pollutant, wherever found, shall be the responsibility of holder, regardless of fault. Upon failure of holder to control, dispose of, or clean up such discharge on or affecting Federal lands, or to repair all damages resulting therefrom, on the Federal lands, the Authorized Officer may take such measures as he deems necessary to control and clean up the discharge and restore the area, including where appropriate, the aquatic environment and fish and wildlife habitats, at the full expense of the holder. Such action by the Authorized Officer shall not relieve holder of any responsibility as provided herein.

5. All construction and maintenance activity will be confined to the authorized right-of-way.

6. The pipeline will be buried with a minimum cover of **36** inches between the top of the pipe and ground level.

7. The maximum allowable disturbance for construction in this right-of-way will be **30** feet:

- Blading of vegetation within the right-of-way will be allowed: maximum width of blading operations will not exceed **20** feet. The trench is included in this area. (*Blading is defined as the complete removal of brush and ground vegetation.*)

- Clearing of brush species within the right-of-way will be allowed: maximum width of clearing operations will not exceed **30** feet. The trench and bladed area are included in this area. (*Clearing is defined as the removal of brush while leaving ground vegetation (grasses, weeds, etc.) intact. Clearing is best accomplished by holding the blade 4 to 6 inches above the ground surface.*)

- The remaining area of the right-of-way (if any) shall only be disturbed by compressing the vegetation. (*Compressing can be caused by vehicle tires, placement of equipment, etc.*)

8. The holder shall stockpile an adequate amount of topsoil where blading is allowed. The topsoil to be stripped is approximately 6 inches in depth. The topsoil will be segregated from other spoil piles from trench construction. The topsoil will be evenly distributed over the bladed area for the preparation of seeding.

9. The holder shall minimize disturbance to existing fences and other improvements on public lands. The holder is required to promptly repair improvements to at least their former state. Functional use of these improvements will be maintained at all times. The holder will contact the owner of any improvements prior to disturbing them. When necessary to pass through a fence line, the fence shall be braced on both sides of the passageway prior to cutting of the fence. No permanent gates will be allowed unless approved by the Authorized Officer.

10. Vegetation, soil, and rocks left as a result of construction or maintenance activity will be randomly scattered on this right-of-way and will not be left in rows, piles, or berms, unless otherwise approved by the Authorized Officer. The entire right-of-way shall be recontoured to match the surrounding landscape. The backfilled soil shall be compacted and a 6 inch berm will be left over the ditch line to allow for settling back to grade.

11. In those areas where erosion control structures are required to stabilize soil conditions, the holder will install such structures as are suitable for the specific soil conditions being encountered and which are in accordance with sound resource management practices.

12. The holder will reseed all disturbed areas. Seeding will be done according to the attached seeding requirements, using the following seed mix.

( ) seed mixture 1 ( ) seed mixture 3

() seed mixture 2 (X) seed mixture 4

( ) seed mixture 2/LPC ( ) Aplomado Falcon Mixture

13. All above-ground structures not subject to safety requirements shall be painted by the holder to blend with the natural color of the landscape. The paint used shall be color which simulates "Standard Environmental Colors" – **Shale Green**, Munsell Soil Color No. 5Y 4/2.

14. The pipeline will be identified by signs at the point of origin and completion of the right-of-way and at all road crossings. At a minimum, signs will state the holder's name, BLM serial number, and the product being transported. All signs and information thereon will be posted in a permanent, conspicuous manner, and will be maintained in a legible condition for the life of the pipeline.

15. The holder shall not use the pipeline route as a road for purposes other than routine maintenance as determined necessary by the Authorized Officer in consultation with the holder before maintenance begins. The holder will take whatever steps are necessary to

ensure that the pipeline route is not used as a roadway. As determined necessary during the life of the pipeline, the Authorized Officer may ask the holder to construct temporary deterrence structures.

16. Any cultural and/or paleontological resources (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the Authorized Officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery will be made by the Authorized Officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the Authorized Officer after consulting with the holder.

17. The operator shall be held responsible if noxious weeds become established within the areas of operations. Weed control shall be required on the disturbed land where noxious weeds exist, which includes associated roads, pipeline corridor and adjacent land affected by the establishment of weeds due to this action. The operator shall consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies.

18. Escape Ramps - The operator will construct and maintain pipeline/utility trenches [that are not otherwise fenced, screened, or netted] to prevent livestock, wildlife, and humans from becoming entrapped. At a minimum, the operator will construct and maintain escape ramps, ladders, or other methods of avian and terrestrial wildlife escape in the trenches according to the following criteria:

a. Any trench left open for eight (8) hours or less is not required to have escape ramps; however, before the trench is backfilled, the contractor/operator shall inspect the trench for wildlife, remove all trapped wildlife, and release them at least 100 yards from the trench.
b. For trenches left open for eight (8) hours or more, earthen escape ramps (built at no more than a 30 degree slope and spaced no more than 500 feet apart) shall be placed in the trench.

C. ELECTRIC LINES

STANDARD STIPULATIONS FOR OVERHEAD ELECTRIC DISTRIBUTION LINES

A copy of the grant and attachments, including stipulations, survey plat and/or map, will be on location during construction. BLM personnel may request to you a copy of your permit during construction to ensure compliance with all stipulations.

Holder agrees to comply with the following stipulations to the satisfaction of the Authorized Officer:

1. The holder shall indemnify the United States against any liability for damage to life or property arising from the occupancy or use of public lands under this grant.

2. The holder shall comply with all applicable Federal laws and regulations existing or hereafter enacted or promulgated. In any event, the holder shall comply with the Toxic Substances Control Act of 1976 as amended, 15 USC 2601 et seq. (1982) with regards to any toxic substances that are used, generated by or stored on the right-of-way or on facilities authorized under this right-of-way grant. (See 40 CFR, Part 702-799 and especially, provisions on polychlorinated biphenyls, 40 CFR 761.1-761.193.) Additionally, any release of toxic substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR, Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act, section 102b. A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to the authorized officer concurrent with the filing of the reports to the involved Federal agency or State government.

3. The holder agrees to indemnify the United States against any liability arising from the release of any hazardous substance or hazardous waste (as these terms are defined in the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. 9601, et seq. or the Resource Conservation and Recovery Act, 42 U.S.C. 6901, et seq.) on the Right-of-Way (unless the release or threatened release is wholly unrelated to the Right-of-Way holder's activity on the Right-of-Way), or resulting from the activity of the Right-of-Way holder on the Right-of-Way. This agreement applies without regard to whether a release is caused by the holder, its agent, or unrelated third parties.

4. There will be no clearing or blading of the right-of-way unless otherwise agreed to in writing by the Authorized Officer.

5. Power lines shall be constructed and designed in accordance to standards outlined in "Suggested Practices for Avian Protection on Power lines: The State of the Art in 2006" Edison Electric Institute, APLIC, and the California Energy Commission 2006 . The holder shall assume the burden and expense of proving that pole designs not shown in the above publication deter raptor perching, roosting, and nesting. Such proof shall be provided by a raptor expert approved by the Authorized Officer. The BLM reserves the right to require modification or additions to all powerline structures placed on this right-of-way, should they be necessary to ensure the safety of large perching birds. Such modifications and/or additions shall be made by the holder without liability or expense to the United States.

Raptor deterrence will consist of but not limited to the following: triangle perch discouragers shall be placed on each side of the cross arms and a nonconductive perching deterrence shall be placed on all vertical poles that extend past the cross arms.

6. The holder shall minimize disturbance to existing fences and other improvements on

public lands. The holder is required to promptly repair improvements to at least their former state. Functional use of these improvements will be maintained at all times. The holder will contact the owner of any improvements prior to disturbing them. When necessary to pass through a fence line, the fence shall be braced on both sides of the passageway prior to cutting the fence. No permanent gates will be allowed unless approved by the Authorized Officer.

7. The BLM serial number assigned to this authorization shall be posted in a permanent, conspicuous manner where the power line crosses roads and at all serviced facilities. Numbers will be at least two inches high and will be affixed to the pole nearest the road crossing and at the facilities served.

8. Upon cancellation, relinquishment, or expiration of this grant, the holder shall comply with those abandonment procedures as prescribed by the Authorized Officer.

9. All surface structures (poles, lines, transformers, etc.) shall be removed within 180 days of abandonment, relinquishment, or termination of use of the serviced facility or facilities or within 180 days of abandonment, relinquishment, cancellation, or expiration of this grant, whichever comes first. This will not apply where the power line extends service to an active, adjoining facility or facilities.

10. Any cultural and/or paleontological resource (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the Authorized Officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery will be made by the Authorized Officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the Authorized Officer after consulting with the holder.

11. Special Stipulations:
- For reclamation remove poles, lines, transformer, etc. and dispose of properly.
- Fill in any holes from the poles removed.

IX. INTERIM RECLAMATION

During the life of the development, all disturbed areas not needed for active support of production operations should undergo interim reclamation in order to minimize the environmental impacts of development on other resources and uses.

Within six (6) months of well completion, operators should work with BLM surface management specialists (Jim Amos: 575-234-5909) to devise the best strategies to reduce the size of the location. Interim reclamation should allow for remedial well operations, as well as safe and efficient removal of oil and gas.

During reclamation, the removal of caliche is important to increasing the success of revegetating the site. Removed caliche that is free of contaminants may be used for road repairs, fire walls or for building other roads and locations. In order to operate the well or complete workover operations, it may be necessary to drive, park and operate on restored interim vegetation within the previously disturbed area. Disturbing revegetated areas for production or workover operations will be allowed. If there is significant disturbance and loss of vegetation, the area will need to be revegetated. Communicate with the appropriate BLM office for any exceptions/exemptions if needed.

All disturbed areas after they have been satisfactorily prepared need to be reseeded with the seed mixture provided below.

Upon completion of interim reclamation, the operator shall submit a Sundry Notices and Reports on Wells, Subsequent Report of Reclamation (Form 3160-5).

X. FINAL ABANDONMENT & RECLAMATION

At final abandonment, well locations, production facilities, and access roads must undergo "final" reclamation so that the character and productivity of the land are restored.

Earthwork for final reclamation must be completed within six (6) months of well plugging. All pads, pits, facility locations and roads must be reclaimed to a satisfactory revegetated, safe, and stable condition, unless an agreement is made with the landowner or BLM to keep the road and/or pad intact.

After all disturbed areas have been satisfactorily prepared, these areas need to be revegetated with the seed mixture provided below. Seeding should be accomplished by drilling on the contour whenever practical or by other approved methods. Seeding may need to be repeated until revegetation is successful, as determined by the BLM.

Operators shall contact a BLM surface protection specialist prior to surface abandonment operations for site specific objectives (Jim Amos: 575-234-5909).

Mixture 4, for Gypsum Sites

The holder shall seed all the disturbed areas with the seed mixture listed below. The seed mixture shall be planted in the amounts specified in pounds of pure live seed (PLS)* per acre. There shall be no primary or secondary noxious weeds in the seed mixture. Seed will be tested and the viability testing of seed will be done in accordance with State law(s) and within nine (9) months prior to purchase. Commercial seed will be either certified or registered seed. The seed container will be tagged in accordance with State law(s) and available for inspection by the authorized officer.

Seed will be planted using a drill equipped with a depth regulator to ensure proper depth of planting where drilling is possible. The seed mixture will be evenly and uniformly planted over the disturbed area (smaller/heavier seeds have a tendency to drop the bottom of the drill and are planted first). The holder shall take appropriate measures to ensure this does not occur. Where drilling is not possible, seed will be broadcast and the area shall be raked or chained to cover the seed. When broadcasting the seed, the pounds per acre are to be doubled. The seeding will be repeated until a satisfactory stand is established as determined by the authorized officer. Evaluation of growth will not be made before completion of at least one full growing season after seeding.

Species to be planted in pounds of pure live seed* per acre:

Species	lb/acre
Alkli Sacaton (*Sporobolus airoides*)	1.5
DWS~ Four-wing saltbush (*Atriplex canescens*)	8.0

~DWS: DeWinged Seed

*Pounds of pure live seed:

Pounds of seed **x** percent purity **x** percent germination = pounds pure live seed

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Pecos District
Carlsbad Field Office
620 East Greene Street
Carlsbad, NM 88220

DECISION RECORD

for the

Hayhurst Master Development Plan Environmental Assessment

NEPA No. DOI-BLM-NM-P020-2016-1434-EA

I. Decision

I have decided to select the proposed action for implementation as described in the September 2016, Hayhurst Master Development Plan Environmental Assessment (EA). Based on my review of the EA and project record, I have concluded that the proposed action was analyzed in sufficient detail to allow me to make an informed decision. I have selected this alternative because the proposed treatments will allow reasonable access to oil and gas development.

II. Finding of No Significant Impact

I have reviewed the direct, indirect and cumulative effects of the proposed activities documented in the EA for the DOI-BLM-NM-P020-2016-1434-EA. I have also reviewed the project record for this analysis. The effects of the proposed action are disclosed in the Environmental Consequences sections of the EA. I have determined that the proposed action as described in the EA will not significantly affect the quality of the human environment. Accordingly, I have determined that the preparation of an Environmental Impact Statement is not necessary.

III. Other Alternatives Considered

No reasonable action alternative was substantially different in design or effects from the proposed action for this project. Therefore no other alternative was considered or analyzed.

IV. Public Involvement

The Carlsbad Field Office (CFO) publishes a NEPA log for public inspection. This log contains a list of proposed and approved actions in the field office. The log is located in the lobby of the CFO as well as on the BLM New Mexico website (http://www.blm.gov/nm/st/en/prog/planning/nepa_logs.html). The BLM also has an ePlanning website (https://eplanning.blm.gov/epl-front-office/eplanning/lup/lup_register.do) that allows the public to review and comment online on BLM NEPA and planning projects. Hard copies of the draft EA were also available at the BLM CFO as well as the BLM Santa Fe and Albuquerque Offices. The draft EA was be made available for a 30-day public review and comment period.

BLM CFO received a total of nine comment letters on the EA. Comments were categorized into issue statements that primarily focused on air resources, vegetation, wildlife, karst, night skies, visual resources, Areas of Critical Environmental Concern, Lands with Wilderness Characteristics, impacts to Carlsbad Caverns National Park, NEPA (e.g. level of documentation, alternatives), mitigation, and the

Resource Management Plan revision. Responses to comment issue statements are provided in Appendix F of the EA.

V. Appeals

This decision may be appealed to the Interior Board of Land Appeals (IBLA), Office of the Secretary, in accordance with the regulations contained in 43 CFR Part 4. Any appeal must be filed within 30 days of this decision. Any notice of appeal must be filed with George MacDonell, Carlsbad Field Manager, at 620 East Greene Street, Carlsbad, NM 88220. The appellant shall serve a copy of the notice of appeal and any statement of reasons, written arguments, or briefs on each adverse party named in the decision, not later than 15 days after filing such document (see 43 CFR 4.413(a)). Failure to serve within the time required will subject the appeal to summary dismissal (see 43 CFR 4.413(b)). If a statement of reasons for the appeal is not included with the notice, it must be filed with the IBLA, Office of Hearings and Appeals, U. S. Department of the Interior, 801 North Quincy St., Suite 300, Arlington, VA 22203 within 30 days after the notice of appeal is filed with the IBLA, Office of Hearings and Appeals, U.S. Department of the Interior, 801 North Quincy St., Suite 300 Arlington, VA 22203 within 30 days after the notice of appeal is filed with George MacDonell, Carlsbad Field Manger.

Notwithstanding the provisions of 43 CFR 4.21(a)(1), filing a notice of appeal under 43 CFR Part 4 does not automatically suspend the effect of the decision. If you wish to file a petition for a stay of the effectiveness of this decision during the time that your appeal is being reviewed by the Board, the petition for a stay must accompany your notice of appeal.

A petition for a stay is required to show sufficient justification based on the following standards:

(1) The relative harm to the parties if the stay is granted or denied;

(2) The likelihood of the appellant's success on the merits;

(3) The likelihood of immediate and irreparable harm if the stay is not granted; and

(4) Whether the public interest favors granting the stay.

In the event a request for stay or an appeal is filed, the person/party requesting the stay or filing the appeal must serve a copy of the appeal on the Office of the Field Solicitor, 1100 Old Santa Fe Trail, Santa Fe, NM 87505.

George MacDonell
Field Manager

10/7/16
Date

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Pecos District
Carlsbad Field Office
620 East Greene Street
Carlsbad, NM 88220

Finding of No Significant Impact
Hayhurst Master Development Plan
NEPA No. DOI-BLM-NM-P020-2016-1434-EA

FINDING OF NO SIGNIFICANT IMPACT:

I have determined that the proposed action, as described in the EA will not have any significant impact, individually or cumulatively, on the quality of the human environment. Because there would not be any significant impact, an environmental impact statement is not required.

In making this determination, I considered the following factors:

1. The activities described in the proposed action do not include any significant beneficial or adverse impacts (40 CFR 1508.27(b)(1)). The EA includes a description of the expected environmental consequences of implementation of the Master Development Plan, including construction and operation of well pads; production, storage, and compression facilities; water disposal and recycling facilities; gathering pipelines for oil, gas, and produced water; pipelines for fresh, brackish, or recycled water to support hydraulic fracturing operations; and upgraded and new access roads.

   In order to ensure that the proponent's impacts are consistent with the operating parameters considered in the air quality analysis, Conditions of Approval (COA) will be applied to Applications for Permit to Drill requested under the Hayhurst Master Development Plan. These COAs are:

   - All project activities including equipment emissions shall meet or exceed all state and federal standards for air quality as regulated by the New Mexico Environment Department Air Quality Bureau and the U.S. Environmental Protection Agency.

   - The operator will implement a drill and completion rig schedule where Tier 4 (or equivalent) drill and completion rigs are phased in. The operator will not exceed four drill rigs at one time and will be 100% compliant with Tier 4 (or equivalent) standards in 2020.

   - During the drilling phase, the operator will emit NOx emissions of 262.95 tons per year (tpy) or less from nonroad (mobile sources) between Year 1 and Year 3 and 220.7 tpy or less from nonroad (mobile sources) for the remainder of the drilling phase.

   - The operator will emit 213.6 tpy or less of NOx emissions during production operations, as defined in the emission inventory analyzed in the Environmental Assessment. The operator will submit emissions and/or parameters with an Application for Permit to Drill or annual emissions inventory that show the NOx emissions are within the limits of the air quality analysis within the Environmental Assessment.

2. The activities included in the proposed action would not significantly affect public health or safety (40 CFR 1508.27(b)(2)).

3. The proposed activities would not significantly affect any unique characteristics (40 CFR 1508.27(b)(3)) of the geographic area such as prime and unique farmlands, caves, wild and scenic rivers, designated wilderness areas, wilderness study areas, or areas of critical concern.

4. The activities described in the proposed action do not involve effects on the human environment that are likely to be highly controversial (40 CFR 1508.27(b)(4)).

5. The activities described in the proposed action do not involve effects that are highly uncertain or involve unique or unknown risks (40 CFR 1508.27(b)(5)).

6. My decision to implement these activities does not establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration (40 CFR 1508.27(b)(6)).

7. The effects of the Master Development Plan including construction and operation of well pads; production, storage, and compression facilities; water disposal and recycling facilities; gathering pipelines for oil, gas, and produced water; pipelines for fresh, brackish, or recycled water to support hydraulic fracturing operations; and upgraded and new access roads would not be significant, individually or cumulatively, when considered with the effects of other actions (40 CFR 1508.27(b)(7)). The EA discloses that there are no other connected or cumulative actions that would cause significant cumulative impacts.

8. I have determined that the activities described in the proposed action will not adversely affect or cause loss or destruction of scientific, cultural, or historical resources, including those listed in or eligible for listing in the National Register of Historic Places (40 CFR 1508.27(b)(8)).

9. The proposed activities are not likely to adversely affect any endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act (40 CFR 1508.27(b)(9)).

10. The proposed activities will not knowingly threaten any violation of Federal, State, or local law or requirements imposed for the protection of the environment (40 CFR 1508.27(b)(10)).

APPROVED:

George MacDonell
Field Manager
Carlsbad Field Office

10/7/16
Date

HOLLAND&HART LLP

Jordan L. Kessler
Associate
Phone (505) 988-4421
Fax (505) 983-6043
jlkessler@hollandhart.com

June 10, 2016

VIA CERTIFIED MAIL
RETURN RECEIPT REQUESTED

TO AFFECTED PARTIES

Re: Application of Chevron U.S.A. Inc. for administrative approval of an unorthodox location, Sections 5 and 8, Township 26 South, Range 27 East, N.M.P.M., Eddy County, New Mexico.
HH SO 8 P2 No. 5H Well

Ladies and Gentlemen:

Enclosed is a copy of the above-referenced application which was filed with the New Mexico Oil Conservation Division on this date. Any objection to this application must be filed in writing within twenty days from this date with the applicant and the New Mexico Oil Conservation Division, 1220 South St. Francis Drive, Santa Fe, New Mexico, 87505. If no objection is received within this twenty-day period, this application may be approved administratively by the Division.

If you have any questions about this application, please contact the following:

Amber Tarr Delach
Chevron U.S.A. Inc.
(713) 372-9877
ATarr@chevron.com

Sincerely,

Jordan L. Kessler
ATTORNEY FOR CHEVRON U.S.A. INC.

HOLLAND&HART LLP

Jordan L. Kessler
Associate
Phone (505) 954-7286
Fax (505) 983-6043
JLKessler@hollandhart.com

June 10, 2016

VIA HAND DELIVERY

David Catanach
Oil Conservation Division
New Mexico Department of Energy,
Minerals and Natural Resources
1220 South Saint Francis Dr.
Santa Fe, New Mexico 87505

Re: Application of Chevron U.S.A. Inc. for administrative approval of an unorthodox location, Sections 5 and 8, Township 26 South, Range 27 East, N.M.P.M., Eddy County, New Mexico.
HH SO 8 P2 No. 5H Well

Dear Mr. Catanach:

Chevron U.S.A. Inc. ("Chevron") (OGRID 4323) seeks administrative approval of an unorthodox well location for its **HH SO 8 P2 No. 5H Well** to be completed within the Wolfcamp formation (WC-015 S262734P; Wolfcamp (98140)) underlying Sections 5 and 8.[1] This well will be drilled from a surface location 255 feet from the North line and 960 feet from the West line of Section 17. The upper most perforation will be located 330 feet from the South line and 330 feet from the West line of Section 8 and the lower most perforation will be located 330 feet from the North line and 330 feet from the West line of Section 5. Since this acreage is governed by the Division Rule 19.15.15.10.B which provides for wells in gas pools in Eddy County to be spaced on 320 acres and located no closer than 660 feet to the outer boundary of the spacing unit, the completed interval for this well will be unorthodox. Approval of the unorthodox completed interval will allow for efficient well spacing and prevent waste of a productive reservoir.

Exhibit A is the Well Location and Acreage Dedication Plat (Form C-102), which shows that the completed interval of the proposed **HH SO 8 P2 No. 5H Well** encroaches on the spacing and proration units to the North, Northwest, West, Southwest, and South.

Exhibit B is a land plat showing the proposed **HH SO 8 P2 No. 5H Well** in relation to adjoining spacing units.

[1] Chevron's development plan calls for six two-mile wells within Sections 5 and 8, to be drilled in the Wolfcamp formation from the same pad. Applications for administrative approval of unorthodox locations for all six wells have been simultaneously submitted to the Division.

ATS-16-785

BLM Carlsbad Field Office

Form 3160-3
(June 2015)

FORM APPROVED
OMB No. 1004-0137
Expires: January 31, 2018

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

APPLICATION FOR PERMIT TO DRILL OR REENTER

5. Lease Serial No.
NMNM118108

6. If Indian, Allotee or Tribe Name

1a. Type of work: ☑ DRILL ☐ REENTER

1b. Type of Well: ☑ Oil Well ☐ Gas Well ☐ Other

1c. Type of Completion: ☐ Hydraulic Fracturing ☑ Single Zone ☐ Multiple Zone

7. If Unit or CA Agreement, Name and No.

8. Lease Name and Well No.
HH SO 8 P2 10H

2. Name of Operator
CHEVRON USA INC

9. API Well No.
[redacted]

3a. Address	3b. Phone No. *(include area code)*	10. Field and Pool, or Exploratory
1616 W. BENDER BLVD HOBBS, NM 88240	575-263-0431	WILDCAT; WOLFCAMP

4. Location of Well *(Report location clearly and in accordance with any State requirements.*)*
At surface 280' FNL & 960' FWL
At proposed prod. zone 180' FSL & 996' FWL SEC 05 UNORTHODOX LOCATION

11. Sec., T. R. M. or Blk. and Survey or Area
SEC17, T26S, R27E, UL D (SHL)

14. Distance in miles and direction from nearest town or post office*	12. County or Parish	13. State
12.8 MILES FROM MALAGA, NEW MEXICO	EDDY	NM

15. Distance from proposed* location to nearest property or lease line, ft. (Also to nearest drig. unit line, if any)	16. No of acres in lease	17. Spacing Unit dedicated to this well
280' FSL	1920 ACRES	320 ACRES

18. Distance from proposed location* to nearest well, drilling, completed, applied for, on this lease, ft.	19. Proposed Depth	20. BLM/BIA Bond No. in file
4300 FT SKEEN 2 SW	TD 9628' MD 20,154	CA 0329

21. Elevations (Show whether DF, KDB, RT, GL, etc.)	22. Approximate date work will start*	23. Estimated duration
3245' GL	OCTOBER 2016	30 DAYS

24. Attachments

The following, completed in accordance with the requirements of Onshore Oil and Gas Order No. 1, and the Hydraulic Fracturing rule per 43 CFR 3162.3-3 (as applicable)

1. Well plat certified by a registered surveyor.
2. A Drilling Plan.
3. A Surface Use Plan (if the location is on National Forest System Lands, the SUPO must be filed with the appropriate Forest Service Office).
4. Bond to cover the operations unless covered by an existing bond on file (see Item 20 above).
5. Operator certification.
6. Such other site specific information and/or plans as may be requested by the BLM.

25. Signature	Name *(Printed/Typed)*	Date
Cindy Herrera-Murillo	CINDY HERRERA-MURILLO	02/11/2016

Title
PERMITTING SPECIALIST

Approved by *(Signature)*	Name *(Printed/Typed)*	Date
/s/ George MacDonell	/s/George MacDonell	10/11/16

Title	Office
FIELD MANAGER	CARLSBAD FIELD OFFICE

Application approval does not warrant or certify that the applicant holds legal or equitable title to those rights in the subject lease which would entitle the applicant to conduct operations thereon.
Conditions of approval, if any, are attached.

APPROVAL FOR TWO YEARS

Title 18 U.S.C. Section 1001 and Title 43 U.S.C. Section 1212, make it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious or fraudulent statements or representations as to any matter within its jurisdiction.

Carlsbad Controlled Water Basin

Witness Surface & Intermediate Casing

SEE ATTACHED FOR CONDITIONS OF APPROVAL

Approval Subject to General Requirements & Special Stipulations Attached

(Continued on page 2)

*(Instructions on page 2)

District I
1625 N French Dr., Hobbs, NM 88240
Phone (575) 393-6161 Fax (575) 393-0720
District II
811 S First St., Artesia, NM 88210
Phone: (575) 748-1283 Fax: (575) 748-9720
District III
1000 Rio Brazos Road, Aztec, NM 87410
Phone: (505) 334-6178 Fax: (505) 334-6170
District IV
1220 S St Francis Dr., Santa Fe, NM 87505
Phone: (505) 476-3460 Fax: (505) 476-3462

State of New Mexico
Energy, Minerals & Natural Resources Department
OIL CONSERVATION DIVISION
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-102
Revised August 1, 2011
Submit one copy to appropriate District Office

☐ AMENDED REPORT

WELL LOCATION AND ACREAGE DEDICATION PLAT

[1] API Number	[2] Pool Code	[3] Pool Name
		Wildcat;Wolfcamp

[4] Property Code	[5] Property Name	[6] Well Number
	HH SO 8 P2	6H

[7] OGRID No.	[8] Operator Name	[9] Elevation
4323	CHEVRON U.S.A. INC.	3245'

[10] Surface Location

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
D	17	26 SOUTH	27 EAST, N.M.P.M.		280'	NORTH	960'	WEST	EDDY

[11] Bottom Hole Location If Different From Surface

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
D	5	26 SOUTH	27 EAST, N.M.P.M.		180'	NORTH	996'	WEST	EDDY

[12] Dedicated Acres	[13] Joint or Infill	[14] Consolidation Code	[15] Order No.
320			

No allowable will be assigned to this completion until all interests have been consolidated or a non-standard unit has been approved by the division.

[16]

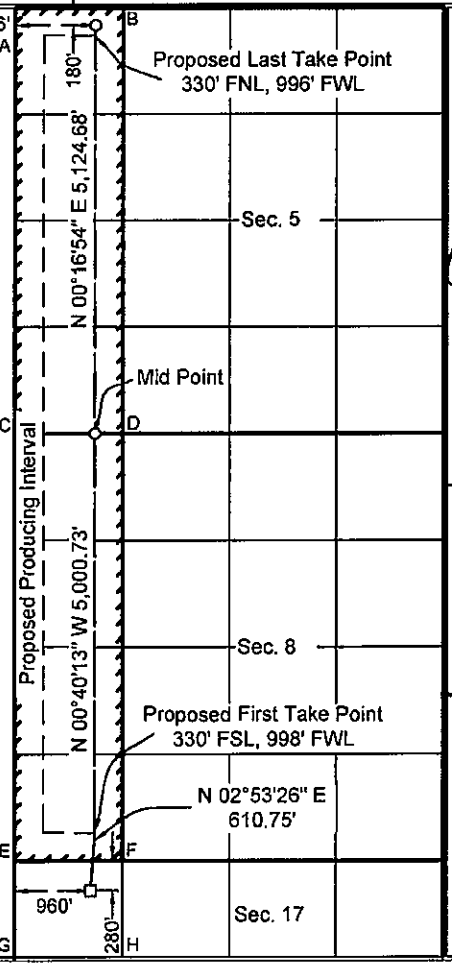
PROPOSED BOTTOM HOLE LOCATION		
X=	535,950	NAD 27
Y=	392,264	
LAT.	32.078396	
LONG.	104.217265	
X=	577,133	NAD83
Y=	392,321	
LAT.	32.078517	
LONG.	104.217760	

CORNER COORDINATES TABLE (NAD 27)

A - Y=392442.33, X=534954.83
B - Y=392444.24, X=536280.85
C - Y=387143.09, X=534935.36
D - Y=387137.83, X=536254.75
E - Y=381810.94, X=534988.20
F - Y=381808.02, X=536317.14
G - Y=380478.27, X=535007.69
H - Y=380475.74, X=536334.89

Mid Point
Y=387139.14, X=535924.76

HH SO 8 P2 6H WELL		
X=	535,952	NAD 27
Y=	381,529	
LAT.	32.048884	
LONG.	104.217294	
X=	557,136	NAD83
Y=	381,586	
LAT.	32.049006	
LONG.	104.217788	
ELEVATION +3245' NAVD 88		



[17] OPERATOR CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief, and that this organization either owns a working interest or unleased mineral interest in the land including the proposed bottom hole location or has a right to drill this well at this location pursuant to a contract with an owner of such a mineral or working interest, or to a voluntary pooling agreement or a compulsory pooling order heretofore entered by the division.

Cindy Herrera-Murillo 02/04/16
Signature Date

Cindy Herrera-Murillo
Printed Name

Cherreramurillo@chevron.com
E-mail Address

[18] SURVEYOR CERTIFICATION

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my belief.

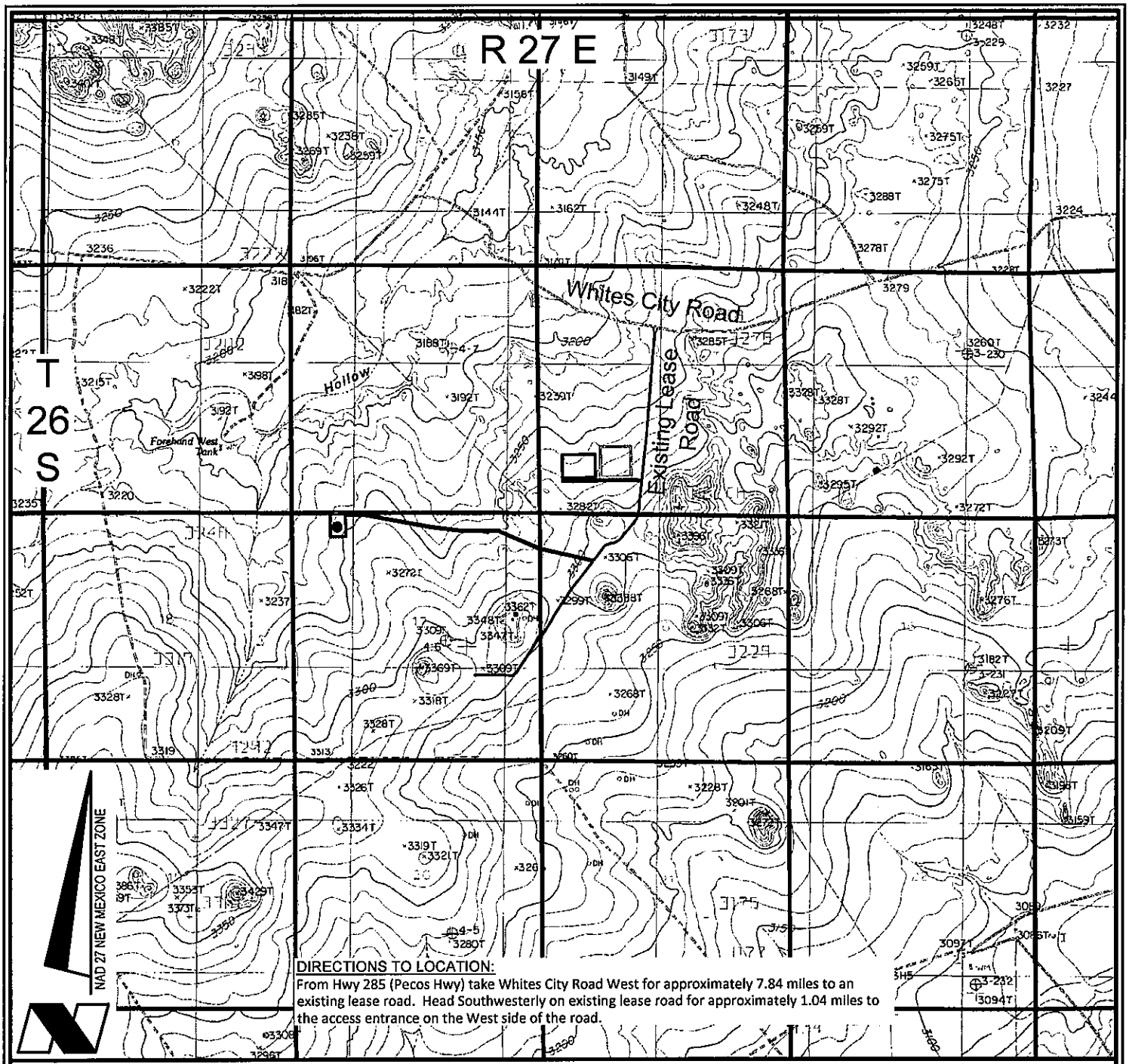
JAN 5, 2016
Date of Survey

Signature and Seal of Professional Surveyor

ROBERT L. LASTRAPES
NEW MEXICO
1-8-2016
23006
PROFESSIONAL SURVEYOR

23006
Certificate Number

EXHIBIT 1



DIRECTIONS TO LOCATION:
From Hwy 285 (Pecos Hwy) take Whites City Road West for approximately 7.84 miles to an existing lease road. Head Southwesterly on existing lease road for approximately 1.04 miles to the access entrance on the West side of the road.

VICINITY MAP

SCALE: 1" = 3000'
3000' 0 1500' 3000'

LEGEND

- Proposed Well
- Proposed Access Road
- Proposed Drillsite
- Existing Road
- Section Line
- Proposed Frac Pond
- Proposed Facility

CHEVRON U.S.A. INC.

HH SO 8 P2 NO. 6H WELL
LOCATED 280' FNL AND 960' FWL
SECTION 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

FENSTERMAKER
C.H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

DRAWN BY: MBD	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 01/07/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153439\DWG\HH SO 8 P2 6H_APD.dwg			

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

ROBERT L. LASTRAPES
NEW MEXICO
23006
1-19-2016
PROFESSIONAL SURVEYOR

Robert L. Lastrapes
Registration No.23006

R 27 E

NW PAD CORNER	NE PAD CORNER	HH SO 8 P2 NO. 6H WELL
X= 535,799 NAD 27	X= 536,129 NAD 27	X= 535,952 NAD 27
Y= 381,809	Y= 381,808	Y= 381,529
ELEVATION +3241' NAVD 88	ELEVATION +3247' NAVD 88	LAT. 32.048884
SW PAD CORNER	SE PAD CORNER	LONG. 104.217294
X= 535,805 NAD 27	X= 536,135 NAD 27	X= 577,136 NAD83
Y= 381,284	Y= 381,284	Y= 381,586
ELEVATION +3244' NAVD 88	ELEVATION +3256' NAVD 88	LAT. 32.049006
		LONG. 104.217788
		ELEVATION +3245' NAVD 88

T 26 S

Sec. 8

Bureau of Land Management

S 89°52'10" E 810.78'

Fnd. 2" Iron Pipe w/ Cap at the NW Corner of Section 17

280'
25'(Typ.)
52'
525'
150'
180'
245'
330'

HH SO 8 P2
No. 6H Well
280' FNL, 960' FWL

PROPOSED PAD
±3.98 Acres

CENTERLINE PROPOSED ACCESS ROAD (1)
24' X ±5,444.40'
±3.00 Acres
±329.96 Rods
(SEE PAGE 2)

Sec. 17

Bureau of Land Management

(Access Road 1) ± 4289.90', ±2.36 Acres, ±259.99 Rods

NAD 27 NEW MEXICO EAST ZONE

Scale: 1" = 300'

300' 0 150' 300'

FENSTERMAKER

C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED PADS, FRAC POND & ACCESS ROADS
HH SO 8 P2 NO. 6H WELL
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

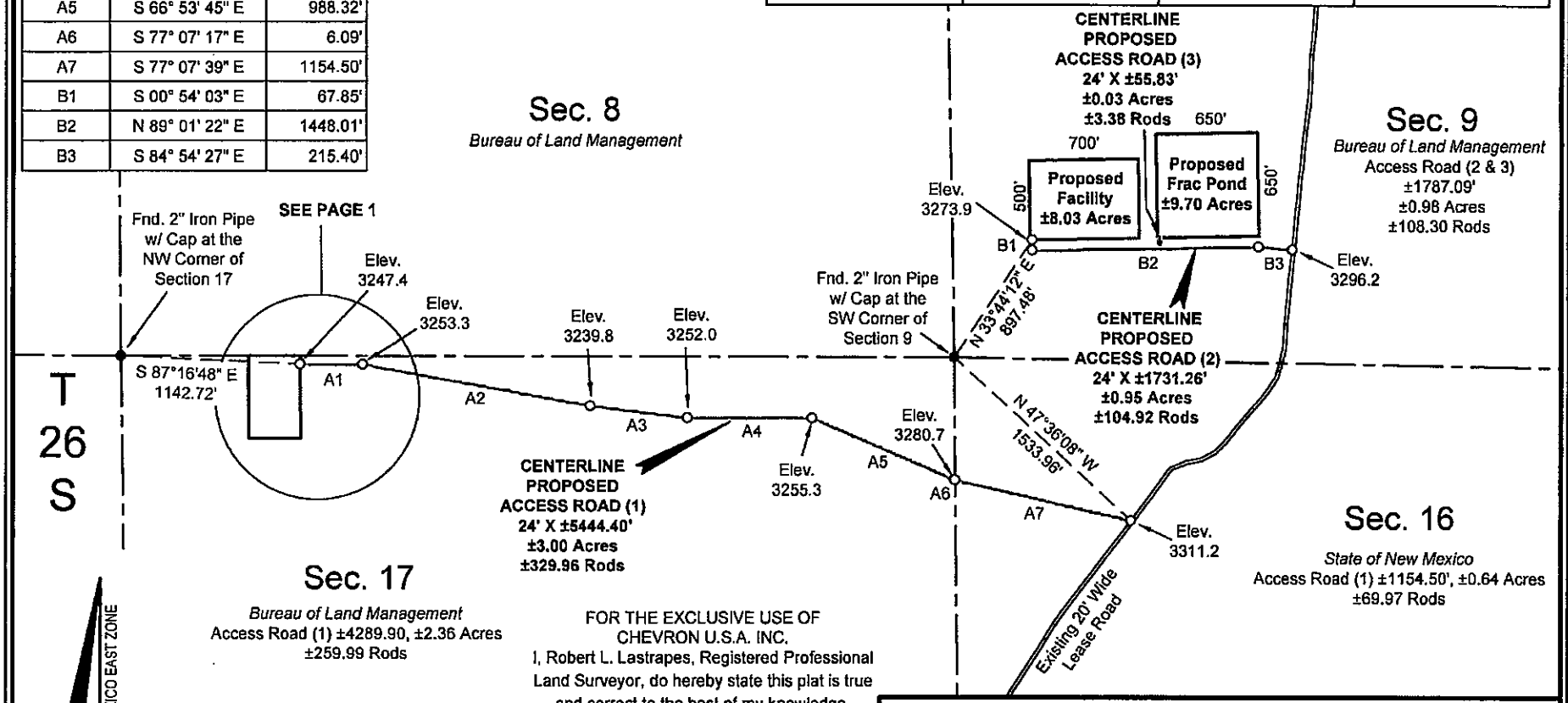
DRAWN BY: LJG	REVISIONS		
PROJ. MGR.: GDG	No. 1	DATE: 1/7/2016	REVISED BY: MBD
DATE: 12/22/2015	No. 2	DATE: 1/19/2016	REVISED BY: GDG
FILENAME: T:\2015\2153439\DWG\HH SO 8 P2 6H_SUP.dwg			

EXHIBITS 2&5

Centerline Proposed Access Roads		
COURSE	BEARING	DISTANCE
A1	S 89° 49' 39" E	398.61'
A2	S 79° 37' 12" E	1478.11'
A3	S 82° 59' 20" E	620.58'
A4	S 89° 50' 47" E	798.19'
A5	S 66° 53' 45" E	988.32'
A6	S 77° 07' 17" E	6.09'
A7	S 77° 07' 39" E	1154.50'
B1	S 00° 54' 03" E	67.85'
B2	N 89° 01' 22" E	1448.01'
B3	S 84° 54' 27" E	215.40'

R 27 E

NW FRAC POND CORNER	NE FRAC POND CORNER	NW FACILITY CORNER	NE FACILITY CORNER
X= 541,594 NAD 27	X= 542,244 NAD 27	X= 540,782 NAD 27	X= 541,482 NAD 27
Y= 383,209	Y= 383,220	Y= 383,045	Y= 383,057
ELEVATION +3264' NAVD 88	ELEVATION +3270' NAVD 88	ELEVATION +3263' NAVD 88	ELEVATION +3265' NAVD 88
SW FRAC POND CORNER	SE FRAC POND CORNER	SW FACILITY CORNER	SE FACILITY CORNER
X= 541,605 NAD 27	X= 542,255 NAD 27	X= 540,790 NAD 27	X= 541,490 NAD 27
Y= 382,559	Y= 382,570	Y= 382,545	Y= 382,557
ELEVATION +3278' NAVD 88	ELEVATION +3289' NAVD 88	ELEVATION +3274' NAVD 88	ELEVATION +3276' NAVD 88



NAD 27 NEW MEXICO EAST ZONE

Scale: 1" = 1000'

1000' 0 500' 1000'

FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

ROBERT L. LASTRAPES NEW MEXICO 23006 1-19-2016 PROFESSIONAL SURVEYOR

Robert L. Lastrapes
Registration No. 23006

FENSTERMAKER

C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED PADS, FRAC POND & ACCESS ROADS
HH SO 8 P2 NO. 6H WELL
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

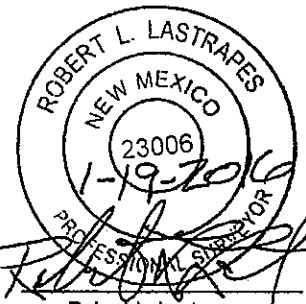
DRAWN BY: LJG	REVISIONS		
PROJ. MGR.: GDG	No. 1	DATE: 1/7/2016	REVISED BY: MBD
DATE: 12/22/2015	No. 2	DATE: 1/19/2016	REVISED BY: GDG
FILENAME: T:\2015\2153439\DWG\HH SO 8 P2 6H_SUP.dwg			

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:
Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

NOTE:
Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.



Robert L. Lastrapes
Registration No. 23006

FENSTERMAKER
C H Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

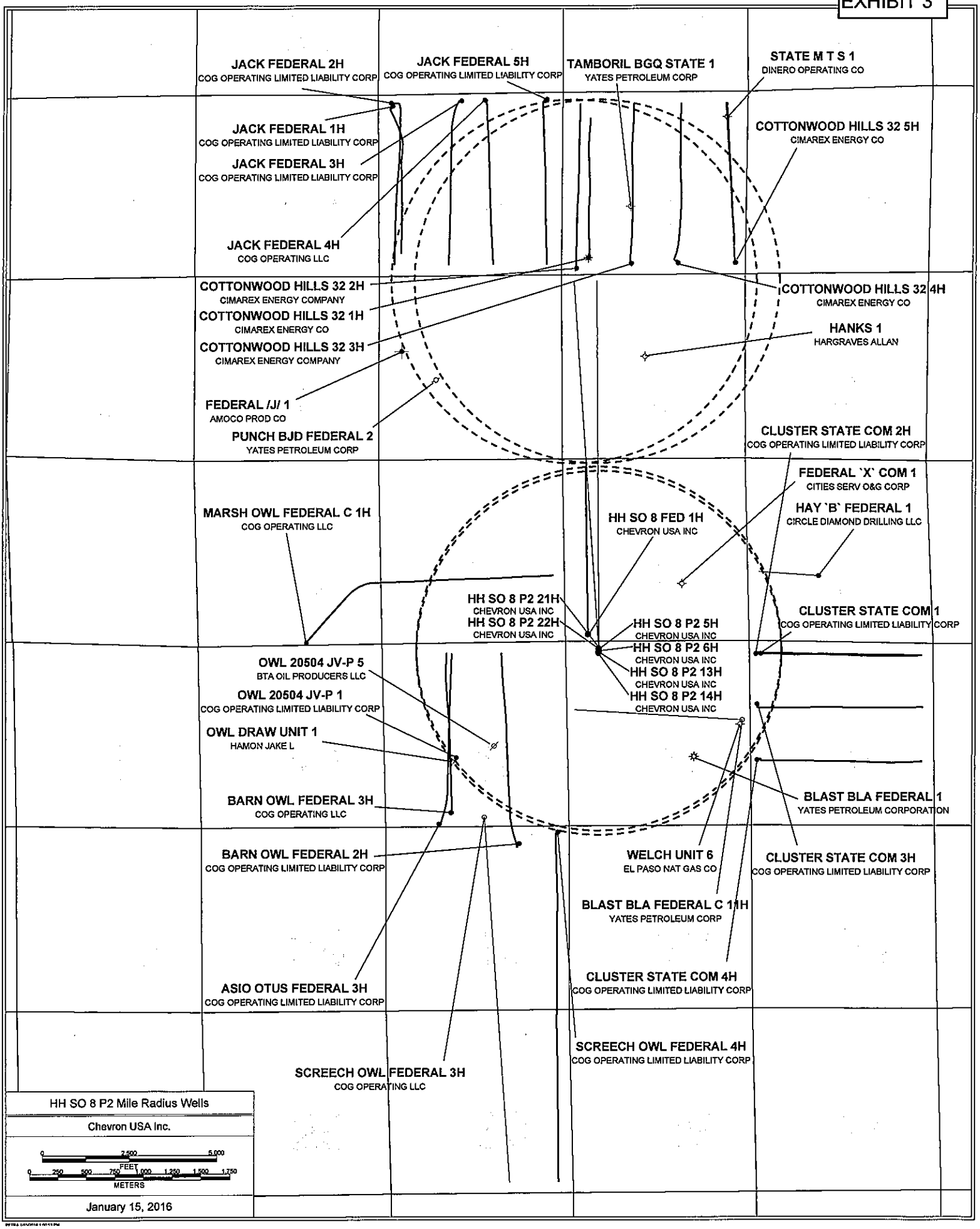
SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED PADS, FRAC POND & ACCESS ROADS
HH SO 8 P2 NO. 6H WELL
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: LJG	REVISIONS		
PROJ. MGR.: GDG	No. 1	DATE: 1/7/2016	REVISED BY: MBD
DATE: 12/22/2015	No. 2	DATE: 1/19/2016	REVISED BY: GDG
FILENAME: T:\2015\2153439\DWG\HH SO 8 P2 6H_SUP.dwg			

EXHIBIT 3


JACK FEDERAL 2H
COG OPERATING LIMITED LIABILITY CORP
JACK FEDERAL 5H
COG OPERATING LIMITED LIABILITY CORP
TAMBORIL BGQ STATE 1
YATES PETROLEUM CORP
STATE M T S 1
DINERO OPERATING CO
JACK FEDERAL 1H
COG OPERATING LIMITED LIABILITY CORP
JACK FEDERAL 3H
COG OPERATING LIMITED LIABILITY CORP
COTTONWOOD HILLS 32 5H
CIMAREX ENERGY CO
JACK FEDERAL 4H
COG OPERATING LLC
COTTONWOOD HILLS 32 2H
CIMAREX ENERGY COMPANY
COTTONWOOD HILLS 32 1H
CIMAREX ENERGY CO
COTTONWOOD HILLS 32 3H
CIMAREX ENERGY COMPANY
COTTONWOOD HILLS 32 4H
CIMAREX ENERGY CO
HANKS 1
HARGRAVES ALLAN
FEDERAL /J/ 1
AMOCO PROD CO
PUNCH BJD FEDERAL 2
YATES PETROLEUM CORP
CLUSTER STATE COM 2H
COG OPERATING LIMITED LIABILITY CORP
FEDERAL `X` COM 1
CITIES SERV O&G CORP
HAY `B` FEDERAL 1
CIRCLE DIAMOND DRILLING LLC
MARSH OWL FEDERAL C 1H
COG OPERATING LLC
HH SO 8 FED 1H
CHEVRON USA INC
HH SO 8 P2 21H
CHEVRON USA INC
HH SO 8 P2 22H
CHEVRON USA INC
HH SO 8 P2 5H
CHEVRON USA INC
HH SO 8 P2 6H
CHEVRON USA INC
HH SO 8 P2 13H
CHEVRON USA INC
HH SO 8 P2 14H
CHEVRON USA INC
CLUSTER STATE COM 1
COG OPERATING LIMITED LIABILITY CORP
OWL 20504 JV-P 5
BTA OIL PRODUCERS LLC
OWL 20504 JV-P 1
COG OPERATING LIMITED LIABILITY CORP
OWL DRAW UNIT 1
HAMON JAKE L
BARN OWL FEDERAL 3H
COG OPERATING LLC
BLAST BLA FEDERAL 1
YATES PETROLEUM CORPORATION
BARN OWL FEDERAL 2H
COG OPERATING LIMITED LIABILITY CORP
WELCH UNIT 6
EL PASO NAT GAS CO
CLUSTER STATE COM 3H
COG OPERATING LIMITED LIABILITY CORP
BLAST BLA FEDERAL C 1H
YATES PETROLEUM CORP
CLUSTER STATE COM 4H
COG OPERATING LIMITED LIABILITY CORP
ASIO OTUS FEDERAL 3H
COG OPERATING LIMITED LIABILITY CORP
SCREECH OWL FEDERAL 4H
COG OPERATING LIMITED LIABILITY CORP
SCREECH OWL FEDERAL 3H
COG OPERATING LLC
HH SO 8 P2 Mile Radius Wells
Chevron USA Inc.
0 2,500 5,000
FEET
0 250 500 750 1,000 1,250 1,500 1,750
METERS
January 15, 2016

1. **FORMATION TOPS**

The estimated tops of important geologic markers are as follows:

FORMATION	SUB-SEA TVD	KBTVD	MD
Castille		505	
Lamar		2395	
Bell		2310	
Cherry		3208	
Brushy		4450	
Bone Spring/Avalon		6299	
First Bone Spring Sand		6888	
First Bone Spring Shale		6914	
Second Bone Spring Sand		7621	
Harkey Sand		8123	
Third Bone Spring Sand		8617	
Wolfcamp A		9342	
Wolfcamp C		9628	
Lateral TVD Wolfcamp C		9628	20154.12'

2. **ESTIMATED DEPTH OF WATER, OIL, GAS & OTHER MINERAL BEARING FORMATIONS**

The estimated depths at which the top and bottom of the anticipated water, oil, gas, or other mineral bearing formations are expected to be encountered are as follows:

Substance	Formation	Depth
Deepest Expected Base of Fresh Water		450
Water	Castille	505
Water	Cherry Canyon	3208
Oil/Gas	Brushy Canyon	4450
Oil/Gas	Bone Spring Limestone	6888
Oil/Gas	First Bone Spring Shale	6914
Oil/Gas	Second Bone Spring Sand	7621
Oil/Gas	Harkey Sand	8123
Oil/Gas	Wolfcamp A	9342
Oil/Gas	Wolfcamp C	9628

All shows of fresh water and minerals will be reported and protected.

3. **BOP EQUIPMENT**
PLEASE REFERENCE MDP

10 M BOP after surface casing
Batch Drilling

4. **CASING PROGRAM**

Purpose	From	To	Hole Size	Csg Size	Weight	Grade	Thread	Condition
Surface	0'	450'	17-1/2"	13-3/8"	54.5 #	K-55	STC	New
Intermediate	0'	9,015'	12-1/4"	9-5/8"	40.0 #	L-80	TXP	New
Production	0'	20,154'	8-1/2"	5-1/2"	20.0 #	P-110	TXP	New

SF Calculations based on the following "Worst Case" casing design:

Surface Casing: 450'
Intermediate Casing: 9015'
Production Casing: 20154.12' MD/9,628' TVD (10,000' VS @ 89.7 deg inc)

Casing String	Min SF Burst	Min SF Collapse	Min SF Tension	Min SF Tri-Axial
Surface	1.82	5.11	3.97	2.31
Intermediate	1.45	1.32	1.78	1.84
Production	1.26	1.5	2.43	1.35

Min SF is the smallest of a group of safety factors that include the following considerations:

	Surf	Int	Prod
Burst Design			
Pressure Test- Surface, Int, Prod Csg P external: Water P internal: Test psi + next section heaviest mud in csg	X	X	X
Displace to Gas- Surf Csg P external: Water P internal: Dry Gas from Next Csg Point	X		
Frac at Shoe, Gas to Surf- Int Csg P external: Water P internal: Dry Gas, 15 ppg Frac Gradient		X	
Stimulation (Frac) Pressures- Prod Csg P external: Water P internal: Max inj pressure w/ heaviest injected fluid			X
Tubing leak- Prod Csg (packer at KOP) P external: Water P internal: Leak just below surf, 8.7 ppg packer fluid			X
Collapse Design			
Full Evacuation P external: Water gradient in cement, mud above TOC P internal: none	X	X	X
Cementing- Surf, Int, Prod Csg P external: Wet cement P internal: water	X	X	X
Tension Design			
100k lb overpull	X	X	X

5. **CEMENTING PROGRAM**

Slurry	Type	Cement Top	Cement Bottom	Weight (ppg)	Yield (sx/cu ft)	%Excess Open Hole	Sacks	Water gal/sk
Surface								
Tail	Class C	0'	450'	14.8	1.33	50	356	6.37
Intermediate								
Stage 2 Lead	50:50 Poz: Class C + Antifoam, Extender, Salt, Retarder	0'	1,100'	11.9	2.43	50	213	14.21
Stage 2 Tail	Class C + Antifoam, Retarder, Viscosifier	1,100'	2,100'	14.8	1.33	0	235	6.37
DV TOOL		2,100'						
Stage 1 Lead	50:50 Poz: Class H + Extender, Antifoam, Retarder, Salt, Viscosifier	2,100'	8,015'	11.9	2.43	100	1524	13.76
Stage 1 Tail	Class H + Retarder, Extender, Dispersant	8,015'	9,015'	15.6	1.21	50	389	5.54
Production								
Lead	50:50 Poz: Class H + Extender, Antifoam, Dispersant, , Retarder	7,015'	8,015'	14.5	1.21	100	430	5.54
Tail	Class H + Viscosifier, Antifoam, Dispersant, Fluid Loss, Retarder, Expanding Agent	8,015'	20,154'	15.6	1.2	50	3473	5.30

See COA

6. **MUD PROGRAM**

From	To	Type	Weight	F. Vis	Filtrate
0'	450'	Spud Mud	8.3 - 8.7	32 - 34	NC - NC
450'	9015'	OBM	9.0 - 9.5	50 -70	5.0 - 10
9015'	20,154'	OBM	10.0 - 13.5	50 -70	5.0 - 10

7. **TESTING, LOGGING, AND CORING**

TYPE	Logs	Interval	Timing	Vendor
Mudlogs	2 man mudlog	Int Csg to TD	Drillout of Int Csg	TBD
LWD	MWD Gamma	Int. and Prod. Hole	While Drilling	TBD

8. **ABNORMAL PRESSURES AND HYDROGEN SULFIDE**

PLEASE REFERENCE MDP

Schlumberger

#6H - Rev0

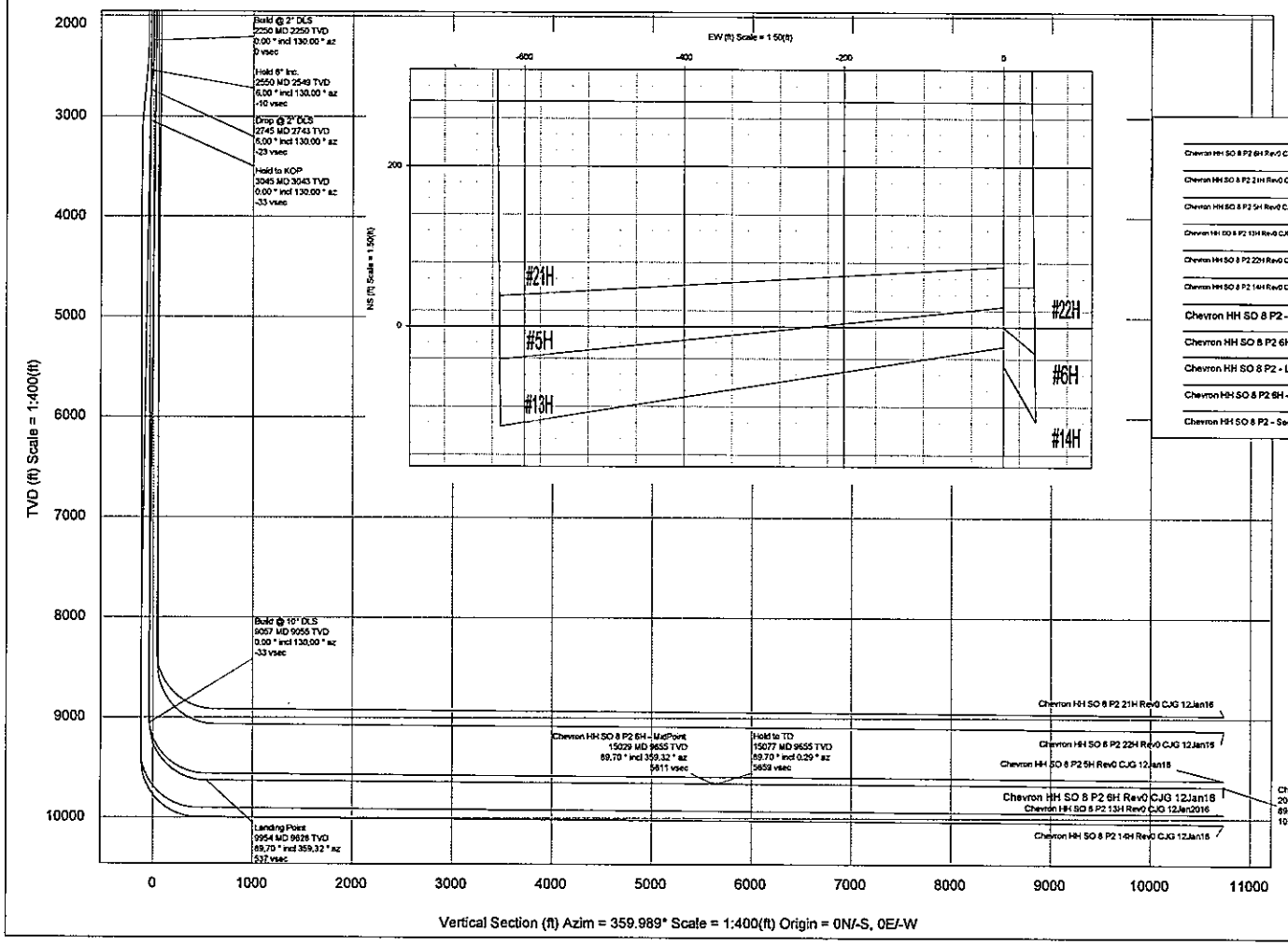
Chevron

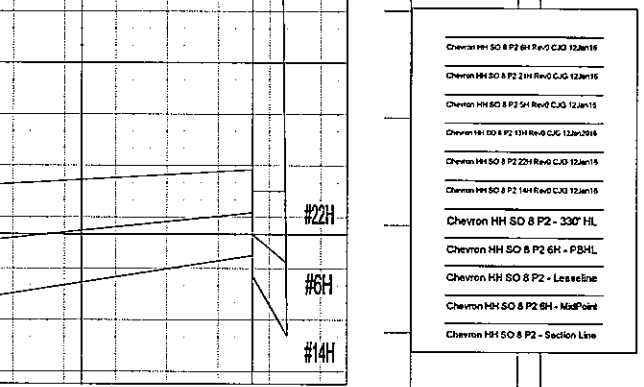
Borehole:	Well:	Field:	Structure:
Original Borehole	HH SO 8 P2 6H	NM Eddy County (NAD 27)	TBD

Gravity & Magnetic Parameters						Surface Location	NAD27 New Mexico State Plane, Eastern Zone, US Feet					Miscellaneous			
Model:	HDGM 2015	Dip:	59.774°	Date:	08-Jan-2016	Lat:	N 32 2 55.99	Northing:	381529.81US	Grid Conv:	0.0616°	Slot:	HH SO 8 P2 6H	TVD Ref:	RKB(3278ft above MSL)
MagDec:	7.555°	FS:	48138.077nT	Gravity FS:	998.431mgn (9.80665 Based)	Long:	W 104 13 2.28	Easting:	535952.51US	Scale Fact:	0.99991057	Plan:	Rev0 CJG 12Jan16		

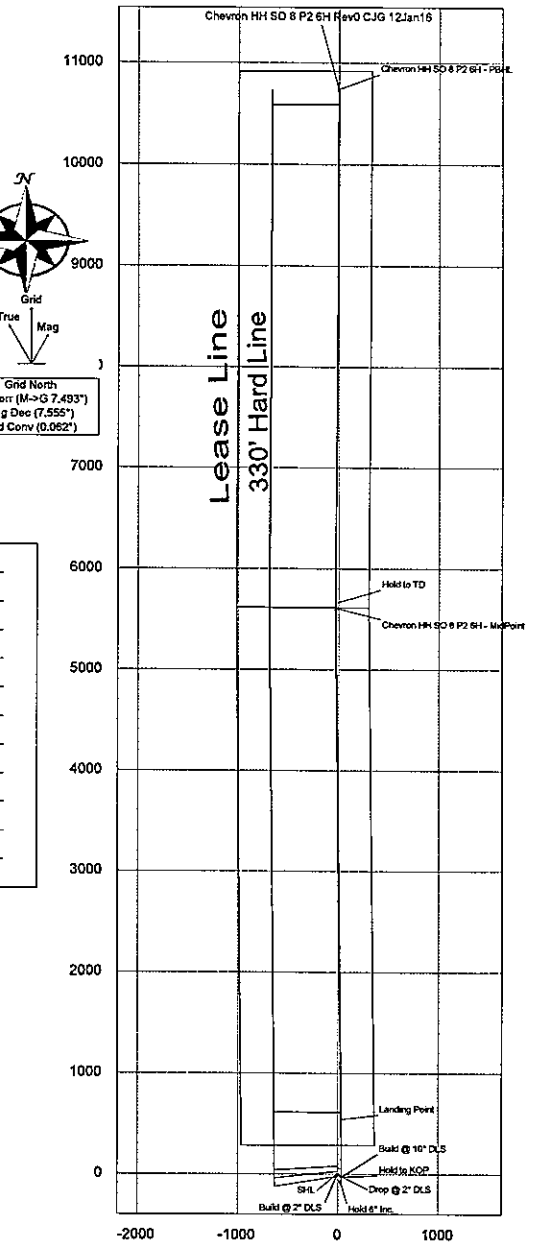
Critical Points

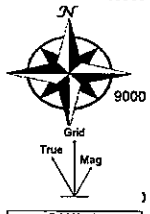
Critical Point	MD	INCL	AZIM	TVD	VSEC	N(+)/S(-)	E(+)/W(-)	DLS
SHL	0.00	0.00	130.00	0.00	0.00	0.00	0.00	
Build @ 2° DLS	2250.00	0.00	130.00	2250.00	0.00	0.00	0.00	0.00
Hold 6° Inc.	2550.00	6.00	130.00	2549.45	-10.09	-10.09	12.02	2.00
Drop @ 2° DLS	2745.00	6.00	130.00	2743.38	-23.19	-23.19	27.64	0.00
Hold to KOP	3045.00	0.00	130.00	3042.84	-33.28	-33.28	39.66	2.00
Build @ 10° DLS	9057.21	0.00	130.00	9055.05	-33.28	-33.28	39.66	0.00
Landing Point	9954.21	89.70	359.32	9628.00	536.63	536.64	32.90	10.00
Chevron HH SO 8 P2 6H - MidPoint	15028.65	89.70	359.32	9654.57	5610.66	5610.65	-27.24	0.00
Hold to TD	15076.95	89.70	0.29	9654.82	5658.95	5658.94	-27.41	2.00
Chevron HH SO 8 P2 6H - PBHL	20154.12	89.70	0.29	9681.40	10735.98	10735.98	-2.00	0.00





Chevron HH SO 8 P2 6H Rev0 CJG 12Jan16
Chevron HH SO 8 P2 21H Rev0 CJG 12Jan16
Chevron HH SO 8 P2 5H Rev0 CJG 12Jan16
Chevron HH SO 8 P2 13H Rev0 CJG 12Jan2016
Chevron HH SO 8 P2 22H Rev0 CJG 12Jan16
Chevron HH SO 8 P2 14H Rev0 CJG 12Jan16
Chevron HH SO 8 P2 - 330' HL
Chevron HH SO 8 P2 6H - PBHL
Chevron HH SO 8 P2 - Lease line
Chevron HH SO 8 P2 6H - MidPoint
Chevron HH SO 8 P2 - Section Line





Grid North
Tot Corr (M->G 7.493°)
Mag Dec (7.555°)
Grid Conv (0.062°)

CONTROLLED

Plan ref		Chevron HH SO 8 P2 6H Rev0 CJG 12Jan16
Drawing ref		
Copy number		sd 3
Date		13-Jan-2016
1	Originator	Colby Gannon
2	DEC Sign Off	
3	CC Sign Off	
4	Client	Chevron
Copy number		for

Schlumberger

Chevron

Chevron HH SO 8 P2 6H Rev0 CJG 12Jan16 Proposal Geodetic Report

(Non-Def Plan)

Report Date:	January 12, 2016 - 02:11 PM	**Survey / DLS Computation:**	Minimum Curvature / Lubinski
Client:	Chevron	**Vertical Section Azimuth:**	359.989 ° (Grid North)
Field:	NM Eddy County (NAD 27)	**Vertical Section Origin:**	0.000 ft, 0.000 ft
Structure / Slot:	Chevron HH SO 8 P2 Pad / Chevron HH SO 8 P2 6H	**TVD Reference Datum:**	RKB
Well:	HH SO 8 P2 6H	**TVD Reference Elevation:**	3278.000 ft above MSL
Borehole:	Original Borehole	**Seabed / Ground Elevation:**	3245.000 ft above MSL
UWI / API#:	Unknown / Unknown	**Magnetic Declination:**	7.555 °
Survey Name:	Chevron HH SO 8 P2 6H Rev0 CJG 12Jan16	**Total Gravity Field Strength:**	998.4306mgn (9.80665 Based)
Survey Date:	January 08, 2016	**Gravity Model:**	GARM
Tort / AHD / DDI / ERD Ratio:	102.666 ° / 10821.490 ft / 6.364 / 1.118	**Total Magnetic Field Strength:**	48139.077 nT
Coordinate Reference System:	NAD27 New Mexico State Plane, Eastern Zone, US Feet	**Magnetic Dip Angle:**	59.774 °
Location Lat / Long:	N 32° 2' 55.98615", W 104° 13' 2.26408"	**Declination Date:**	January 08, 2016
Location Grid N/E Y/X:	N 381529.000 ftUS, E 535952.000 ftUS	**Magnetic Declination Model:**	HDGM 2015
CRS Grid Convergence Angle:	0.0616 °	**North Reference:**	Grid North
Grid Scale Factor:	0.99991057	**Grid Convergence Used:**	0.0616 °
Version / Patch:	2.8.572.0	**Total Corr Mag North->Grid North:**	7.4939 °
		Local Coord Referenced To:	Well Head

Comments	MD (ft)	Incl (°)	Azim Grid (°)	TVD (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLS (°/100ft)	Northing (ftUS)	Easting (ftUS)	Latitude (N/S ° ' ")	Longitude (E/W ° ' ")
SHL	0.00	0.00	130.00	0.00	0.00	0.00	0.00	N/A	381529.00	535952.00	N 32 2 55.99	W 104 13 2.26
	100.00	0.00	130.00	100.00	0.00	0.00	0.00	0.00	381529.00	535952.00	N 32 2 55.99	W 104 13 2.26
	200.00	0.00	130.00	200.00	0.00	0.00	0.00	0.00	381529.00	535952.00	N 32 2 55.99	W 104 13 2.26
	300.00	0.00	130.00	300.00	0.00	0.00	0.00	0.00	381529.00	535952.00	N 32 2 55.99	W 104 13 2.26
	400.00	0.00	130.00	400.00	0.00	0.00	0.00	0.00	381529.00	535952.00	N 32 2 55.99	W 104 13 2.26
	500.00	0.00	130.00	500.00	0.00	0.00	0.00	0.00	381529.00	535952.00	N 32 2 55.99	W 104 13 2.26
	600.00	0.00	130.00	600.00	0.00	0.00	0.00	0.00	381529.00	535952.00	N 32 2 55.99	W 104 13 2.26
	700.00	0.00	130.00	700.00	0.00	0.00	0.00	0.00	381529.00	535952.00	N 32 2 55.99	W 104 13 2.26
	800.00	0.00	130.00	800.00	0.00	0.00	0.00	0.00	381529.00	535952.00	N 32 2 55.99	W 104 13 2.26
	900.00	0.00	130.00	900.00	0.00	0.00	0.00	0.00	381529.00	535952.00	N 32 2 55.99	W 104 13 2.26
	1000.00	0.00	130.00	1000.00	0.00	0.00	0.00	0.00	381529.00	535952.00	N 32 2 55.99	W 104 13 2.26
	1100.00	0.00	130.00	1100.00	0.00	0.00	0.00	0.00	381529.00	535952.00	N 32 2 55.99	W 104 13 2.26
	1200.00	0.00	130.00	1200.00	0.00	0.00	0.00	0.00	381529.00	535952.00	N 32 2 55.99	W 104 13 2.26
	1300.00	0.00	130.00	1300.00	0.00	0.00	0.00	0.00	381529.00	535952.00	N 32 2 55.99	W 104 13 2.26
	1400.00	0.00	130.00	1400.00	0.00	0.00	0.00	0.00	381529.00	535952.00	N 32 2 55.99	W 104 13 2.26
	1500.00	0.00	130.00	1500.00	0.00	0.00	0.00	0.00	381529.00	535952.00	N 32 2 55.99	W 104 13 2.26
	1600.00	0.00	130.00	1600.00	0.00	0.00	0.00	0.00	381529.00	535952.00	N 32 2 55.99	W 104 13 2.26
	1700.00	0.00	130.00	1700.00	0.00	0.00	0.00	0.00	381529.00	535952.00	N 32 2 55.99	W 104 13 2.26
	1800.00	0.00	130.00	1800.00	0.00	0.00	0.00	0.00	381529.00	535952.00	N 32 2 55.99	W 104 13 2.26
	1900.00	0.00	130.00	1900.00	0.00	0.00	0.00	0.00	381529.00	535952.00	N 32 2 55.99	W 104 13 2.26
	2000.00	0.00	130.00	2000.00	0.00	0.00	0.00	0.00	381529.00	535952.00	N 32 2 55.99	W 104 13 2.26
	2100.00	0.00	130.00	2100.00	0.00	0.00	0.00	0.00	381529.00	535952.00	N 32 2 55.99	W 104 13 2.26
	2200.00	0.00	130.00	2200.00	0.00	0.00	0.00	0.00	381529.00	535952.00	N 32 2 55.99	W 104 13 2.26
Build @ 2° DLS	2250.00	0.00	130.00	2250.00	0.00	0.00	0.00	0.00	381529.00	535952.00	N 32 2 55.99	W 104 13 2.26
	2300.00	1.00	130.00	2300.00	-0.28	-0.28	0.33	2.00	381528.72	535952.33	N 32 2 55.98	W 104 13 2.26
	2400.00	3.00	130.00	2399.93	-2.52	-2.52	3.01	2.00	381526.48	535955.01	N 32 2 55.96	W 104 13 2.23
	2500.00	5.00	130.00	2499.68	-7.01	-7.01	8.35	2.00	381521.99	535960.35	N 32 2 55.92	W 104 13 2.17
Hold 6° Inc.	2550.00	6.00	130.00	2549.45	-10.09	-10.09	12.02	2.00	381518.91	535964.02	N 32 2 55.89	W 104 13 2.12
	2600.00	6.00	130.00	2599.18	-13.45	-13.45	16.03	0.00	381515.55	535968.02	N 32 2 55.85	W 104 13 2.08
	2700.00	6.00	130.00	2698.63	-20.17	-20.17	24.03	0.00	381508.84	535976.03	N 32 2 55.79	W 104 13 1.99
Drop @ 2° DLS	2745.00	6.00	130.00	2743.38	-23.19	-23.19	27.64	0.00	381505.81	535979.63	N 32 2 55.76	W 104 13 1.94
	2800.00	4.90	130.00	2798.13	-26.55	-26.55	31.64	2.00	381502.46	535983.63	N 32 2 55.72	W 104 13 1.90
	2900.00	2.90	130.00	2897.90	-30.93	-30.92	36.85	2.00	381498.08	535988.84	N 32 2 55.68	W 104 13 1.84
	3000.00	0.90	130.00	2997.84	-33.06	-33.05	39.39	2.00	381495.95	535991.38	N 32 2 55.66	W 104 13 1.81
Hold to KOP	3045.00	0.00	130.00	3042.84	-33.28	-33.28	39.66	2.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	3100.00	0.00	130.00	3097.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	3200.00	0.00	130.00	3197.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	3300.00	0.00	130.00	3297.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	3400.00	0.00	130.00	3397.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	3500.00	0.00	130.00	3497.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	3600.00	0.00	130.00	3597.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	3700.00	0.00	130.00	3697.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	3800.00	0.00	130.00	3797.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	3900.00	0.00	130.00	3897.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	4000.00	0.00	130.00	3997.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	4100.00	0.00	130.00	4097.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	4200.00	0.00	130.00	4197.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	4300.00	0.00	130.00	4297.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	4400.00	0.00	130.00	4397.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	4500.00	0.00	130.00	4497.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	4600.00	0.00	130.00	4597.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	4700.00	0.00	130.00	4697.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	4800.00	0.00	130.00	4797.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	4900.00	0.00	130.00	4897.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	5000.00	0.00	130.00	4997.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	5100.00	0.00	130.00	5097.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	5200.00	0.00	130.00	5197.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	5300.00	0.00	130.00	5297.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	5400.00	0.00	130.00	5397.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	5500.00	0.00	130.00	5497.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	5600.00	0.00	130.00	5597.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	5700.00	0.00	130.00	5697.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	5800.00	0.00	130.00	5797.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	5900.00	0.00	130.00	5897.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80
	6000.00	0.00	130.00	5997.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13 1.80

Comments	MD (ft)	Incl (°)	Azim Grid (°)	TVD (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLS (°/100ft)	Northing (ftUS)	Easting (ftUS)	Latitude (N/S ° ' ")	Longitude (E/W ° ' ")	
	6100.00	0.00	130.00	6097.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	6200.00	0.00	130.00	6197.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	6300.00	0.00	130.00	6297.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	6400.00	0.00	130.00	6397.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	6500.00	0.00	130.00	6497.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	6600.00	0.00	130.00	6597.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	6700.00	0.00	130.00	6697.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	6800.00	0.00	130.00	6797.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	6900.00	0.00	130.00	6897.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	7000.00	0.00	130.00	6997.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	7100.00	0.00	130.00	7097.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	7200.00	0.00	130.00	7197.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	7300.00	0.00	130.00	7297.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	7400.00	0.00	130.00	7397.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	7500.00	0.00	130.00	7497.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	7600.00	0.00	130.00	7597.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	7700.00	0.00	130.00	7697.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	7800.00	0.00	130.00	7797.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	7900.00	0.00	130.00	7897.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	8000.00	0.00	130.00	7997.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	8100.00	0.00	130.00	8097.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	8200.00	0.00	130.00	8197.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	8300.00	0.00	130.00	8297.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	8400.00	0.00	130.00	8397.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	8500.00	0.00	130.00	8497.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	8600.00	0.00	130.00	8597.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	8700.00	0.00	130.00	8697.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	8800.00	0.00	130.00	8797.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	8900.00	0.00	130.00	8897.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	9000.00	0.00	130.00	8997.84	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
Build @ 10° DLS	9057.21	0.00	130.00	9055.05	-33.28	-33.28	39.66	0.00	381495.73	535991.65	N 32 2 55.66	W 104 13	1.80
	9100.00	4.28	359.32	9097.80	-31.69	-31.68	39.64	10.00	381497.32	535991.64	N 32 2 55.67	W 104 13	1.80
	9200.00	14.28	359.32	9196.36	-15.59	-15.58	39.45	10.00	381513.42	535991.44	N 32 2 55.83	W 104 13	1.81
	9300.00	24.28	359.32	9290.64	17.39	17.39	39.06	10.00	381546.39	535991.05	N 32 2 56.16	W 104 13	1.81
	9400.00	34.28	359.32	9377.75	66.23	66.23	38.48	10.00	381595.23	535990.48	N 32 2 56.64	W 104 13	1.82
	9500.00	44.28	359.32	9455.06	129.45	129.46	37.73	10.00	381658.45	535989.73	N 32 2 57.27	W 104 13	1.82
	9600.00	54.28	359.32	9520.21	205.14	205.15	36.83	10.00	381734.13	535988.83	N 32 2 58.02	W 104 13	1.83
	9700.00	64.28	359.32	9571.24	290.99	291.00	35.81	10.00	381819.97	535987.81	N 32 2 58.87	W 104 13	1.84
	9800.00	74.28	359.32	9606.57	384.40	384.40	34.71	10.00	381913.37	535986.70	N 32 2 59.79	W 104 13	1.86
	9900.00	84.28	359.32	9625.15	482.52	482.53	33.54	10.00	382011.48	535985.54	N 32 3 0.76	W 104 13	1.87
Landing Point	9954.21	89.70	359.32	9628.00	536.63	536.64	32.90	10.00	382065.59	535984.90	N 32 3 1.30	W 104 13	1.88
	10000.00	89.70	359.32	9628.24	582.42	582.42	32.36	0.00	382111.37	535984.36	N 32 3 1.75	W 104 13	1.88
	10100.00	89.70	359.32	9628.76	682.41	682.41	31.17	0.00	382211.35	535983.17	N 32 3 2.74	W 104 13	1.89
	10200.00	89.70	359.32	9629.29	782.40	782.41	29.99	0.00	382311.33	535981.99	N 32 3 3.73	W 104 13	1.91
	10300.00	89.70	359.32	9629.81	882.39	882.40	28.80	0.00	382411.32	535980.80	N 32 3 4.72	W 104 13	1.92
	10400.00	89.70	359.32	9630.33	982.38	982.39	27.62	0.00	382511.30	535979.62	N 32 3 5.71	W 104 13	1.93
	10500.00	89.70	359.32	9630.86	1082.38	1082.38	26.43	0.00	382611.28	535978.43	N 32 3 6.70	W 104 13	1.94
	10600.00	89.70	359.32	9631.38	1182.37	1182.37	25.25	0.00	382711.26	535977.25	N 32 3 7.69	W 104 13	1.96
	10700.00	89.70	359.32	9631.90	1282.36	1282.36	24.06	0.00	382811.25	535976.06	N 32 3 8.68	W 104 13	1.97
	10800.00	89.70	359.32	9632.43	1382.35	1382.36	22.88	0.00	382911.23	535974.88	N 32 3 9.67	W 104 13	1.98
	10900.00	89.70	359.32	9632.95	1482.34	1482.35	21.69	0.00	383011.21	535973.69	N 32 3 10.65	W 104 13	1.99
	11000.00	89.70	359.32	9633.48	1582.33	1582.34	20.51	0.00	383111.19	535972.51	N 32 3 11.64	W 104 13	2.01
	11100.00	89.70	359.32	9634.00	1682.33	1682.33	19.32	0.00	383211.18	535971.32	N 32 3 12.63	W 104 13	2.02
	11200.00	89.70	359.32	9634.52	1782.32	1782.32	18.14	0.00	383311.16	535970.14	N 32 3 13.62	W 104 13	2.03
	11300.00	89.70	359.32	9635.05	1882.31	1882.31	16.95	0.00	383411.14	535968.95	N 32 3 14.61	W 104 13	2.04
	11400.00	89.70	359.32	9635.57	1982.30	1982.30	15.77	0.00	383511.12	535967.77	N 32 3 15.60	W 104 13	2.06
	11500.00	89.70	359.32	9636.09	2082.29	2082.30	14.58	0.00	383611.11	535966.58	N 32 3 16.59	W 104 13	2.07
	11600.00	89.70	359.32	9636.62	2182.29	2182.29	13.40	0.00	383711.09	535965.39	N 32 3 17.58	W 104 13	2.08
	11700.00	89.70	359.32	9637.14	2282.28	2282.28	12.21	0.00	383811.07	535964.21	N 32 3 18.57	W 104 13	2.09
	11800.00	89.70	359.32	9637.66	2382.27	2382.27	11.03	0.00	383911.05	535963.02	N 32 3 19.56	W 104 13	2.11
	11900.00	89.70	359.32	9638.19	2482.26	2482.26	9.84	0.00	384011.04	535961.84	N 32 3 20.55	W 104 13	2.12
	12000.00	89.70	359.32	9638.71	2582.25	2582.25	8.65	0.00	384111.02	535960.65	N 32 3 21.54	W 104 13	2.13
	12100.00	89.70	359.32	9639.24	2682.24	2682.25	7.47	0.00	384211.00	535959.47	N 32 3 22.53	W 104 13	2.14
	12200.00	89.70	359.32	9639.76	2782.24	2782.24	6.28	0.00	384310.98	535958.28	N 32 3 23.52	W 104 13	2.16
	12300.00	89.70	359.32	9640.28	2882.23	2882.23	5.10	0.00	384410.97	535957.10	N 32 3 24.51	W 104 13	2.17
	12400.00	89.70	359.32	9640.81	2982.22	2982.22	3.91	0.00	384510.95	535955.91	N 32 3 25.50	W 104 13	2.18
	12500.00	89.70	359.32	9641.33	3082.21	3082.21	2.73	0.00	384610.93	535954.73	N 32 3 26.49	W 104 13	2.19
	12600.00	89.70	359.32	9641.85	3182.20	3182.20	1.54	0.00	384710.91	535953.54	N 32 3 27.48	W 104 13	2.21
	12700.00	89.70	359.32	9642.38	3282.20	3282.20	0.36	0.00	384810.90	535952.36	N 32 3 28.47	W 104 13	2.22
	12800.00	89.70	359.32	9642.90	3382.19	3382.19	-0.83	0.00	384910.88	535951.17	N 32 3 29.46	W 104 13	2.23
	12900.00	89.70	359.32	9643.42	3482.18	3482.18	-2.01	0.00	385010.86	535949.99	N 32 3 30.44	W 104 13	2.24
	13000.00	89.70	359.32	9643.95	3582.17	3582.17	-3.20	0.00	385110.84	535948.80	N 32 3 31.43	W 104 13	2.26
	13100.00	89.70	359.32	9644.47	3682.16	3682.16	-4.38	0.00	385210.83	535947.62	N 32 3 32.42	W 104 13	2.27
	13200.00	89.70	359.32	9645.00	3782.15	3782.15	-5.57	0.00	385310.81	535946.43	N 32 3 33.41	W 104 13	2.28
	13300.00	89.70	359.32	9645.52	3882.15	3882.15	-6.75	0.00	385410.79	535945.25	N 32 3 34.40	W 104 13	2.29
	13400.00	89.70	359.32	9646.04	3982.14	3982.14	-7.94	0.00	385510.77	535944.06	N 32 3 35.39	W 104 13	2.31
	13500.00	89.70	359.32	9646.57	4082.13	4082.13	-9.12	0.00	385610.76	535942.88	N 32 3 36.38	W 104 13	2.32
	13600.00	89.70	359.32	9647.09	4182.12	4182.12	-10.31	0.00	385710.74	535941.69	N 32 3 37.37	W 104 13	2.33
	13700.00	89.70	359.32	9647.61	4282.11	4282.11	-11.49	0.00	385810.72	535940.51	N 32 3 38.36	W 104 13	2.34
	13800.00	89.70	359.32	9648.14	4382.11	4382.10	-12.68	0.00	385910.70	535939.32	N 32 3 39.35	W 104 13	2.36
	13900.00	89.70	359.32	9648.66	4482.10	4482.09	-13.87	0.00	386010.69	535938.14	N 32 3 40.34	W 104 13	2.37
	14000.00	89.70	359.32	9649.18	4582.09	4582.09	-15.05	0.00	386110.67	535936.95	N 32 3 41.33	W 104 13	2.38
	14100.00	89.70	359.32	9649.71	4682.08	4682.08	-16.24	0.00	386210.65	535935.77	N 32 3 42.32	W 104 13	2.39
	14200.00	89.70	359.32	9650.23	4782.07	4782.07	-17.42	0.00	386310.63	535934.58	N 32 3 43.31	W 104 13	2.41
	14300.00	89.70	359.32	9650.75	4882.06	4882.06	-18.61	0.00	386410.62	535933.40	N 32 3 44.30	W 104 13	2.42
	14400.00	89.70	359.32	9651.28	4982.06	4982.05	-19.79	0.00	386510.60	535932.21	N 32 3 45.29	W 104 13	2.43
	14500.00	89.70	359.32	9651.80	5082.05	5082.04	-20.98	0.00	386610.58	535931.03	N 32 3 46.28	W 104 13	2.44
	14600.00	89.70	359.32	9652.33	5182.04	5182.04	-22.16	0.00	386710.56	535929.84	N 32 3 47.27	W 104 13	2.46

Comments	MD (ft)	Incl (°)	Azim Grid (°)	TVD (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLS (°/100ft)	Northing (ftUS)	Easting (ftUS)	Latitude (N/S ° ' ")	Longitude (E/W ° ' ")
	14700.00	89.70	359.32	9652.65	5282.03	5282.03	-23.35	0.00	385810.54	535928.66	N 32 3 48.26	W 104 13 2.47
	14800.00	89.70	359.32	9653.37	5382.02	5382.02	-24.53	0.00	385910.53	535927.47	N 32 3 49.25	W 104 13 2.48
	14900.00	89.70	359.32	9653.90	5482.02	5482.01	-25.72	0.00	387010.51	535926.28	N 32 3 50.23	W 104 13 2.49
	15000.00	89.70	359.32	9654.42	5582.01	5582.00	-26.90	0.00	387110.49	535925.10	N 32 3 51.22	W 104 13 2.51
Chevron HH SO 8 P2 6H - MidPoint	15028.65	89.70	359.32	9654.57	5610.66	5610.65	-27.24	0.00	387139.14	535924.76	N 32 3 51.51	W 104 13 2.51
Hold to TD	15076.95	89.70	0.29	9654.82	5658.95	5658.94	-27.41	2.00	387187.43	535924.59	N 32 3 51.99	W 104 13 2.51
	15100.00	89.70	0.29	9654.94	5682.00	5682.00	-27.29	0.00	387210.48	535924.71	N 32 3 52.21	W 104 13 2.51
	15200.00	89.70	0.29	9655.47	5782.00	5782.00	-26.79	0.00	387310.47	535925.21	N 32 3 53.20	W 104 13 2.50
	15300.00	89.70	0.29	9655.99	5882.00	5881.99	-26.28	0.00	387410.46	535925.71	N 32 3 54.19	W 104 13 2.50
	15400.00	89.70	0.29	9656.51	5981.99	5981.99	-25.78	0.00	387510.44	535926.21	N 32 3 55.18	W 104 13 2.49
	15500.00	89.70	0.29	9657.04	6081.99	6081.99	-25.29	0.00	387610.43	535926.71	N 32 3 56.17	W 104 13 2.48
	15600.00	89.70	0.29	9657.56	6181.99	6181.98	-24.79	0.00	387710.42	535927.21	N 32 3 57.16	W 104 13 2.47
	15700.00	89.70	0.29	9658.08	6281.99	6281.98	-24.29	0.00	387810.41	535927.71	N 32 3 58.15	W 104 13 2.47
	15800.00	89.70	0.29	9658.61	6381.98	6381.98	-23.79	0.00	387910.40	535928.21	N 32 3 59.14	W 104 13 2.46
	15900.00	89.70	0.29	9659.13	6481.98	6481.98	-23.29	0.00	388010.38	535928.71	N 32 4 0.13	W 104 13 2.45
	16000.00	89.70	0.29	9659.65	6581.98	6581.97	-22.79	0.00	388110.37	535929.21	N 32 4 1.12	W 104 13 2.45
	16100.00	89.70	0.29	9660.18	6681.98	6681.97	-22.29	0.00	388210.36	535929.71	N 32 4 2.11	W 104 13 2.44
	16200.00	89.70	0.29	9660.70	6781.97	6781.97	-21.79	0.00	388310.35	535930.21	N 32 4 3.10	W 104 13 2.43
	16300.00	89.70	0.29	9661.23	6881.97	6881.97	-21.29	0.00	388410.34	535930.71	N 32 4 4.09	W 104 13 2.43
	16400.00	89.70	0.29	9661.75	6981.97	6981.96	-20.79	0.00	388510.33	535931.22	N 32 4 5.08	W 104 13 2.42
	16500.00	89.70	0.29	9662.27	7081.97	7081.96	-20.29	0.00	388610.31	535931.72	N 32 4 6.07	W 104 13 2.41
	16600.00	89.70	0.29	9662.80	7181.96	7181.96	-19.79	0.00	388710.30	535932.22	N 32 4 7.06	W 104 13 2.40
	16700.00	89.70	0.29	9663.32	7281.96	7281.96	-19.29	0.00	388810.29	535932.72	N 32 4 8.05	W 104 13 2.40
	16800.00	89.70	0.29	9663.84	7381.96	7381.95	-18.79	0.00	388910.28	535933.22	N 32 4 9.04	W 104 13 2.39
	16900.00	89.70	0.29	9664.37	7481.95	7481.95	-18.28	0.00	389010.27	535933.72	N 32 4 10.03	W 104 13 2.38
	17000.00	89.70	0.29	9664.89	7581.95	7581.95	-17.78	0.00	389110.26	535934.22	N 32 4 11.02	W 104 13 2.38
	17100.00	89.70	0.29	9665.41	7681.95	7681.95	-17.28	0.00	389210.24	535934.72	N 32 4 12.00	W 104 13 2.37
	17200.00	89.70	0.29	9665.94	7781.95	7781.94	-16.78	0.00	389310.23	535935.22	N 32 4 12.99	W 104 13 2.36
	17300.00	89.70	0.29	9666.46	7881.94	7881.94	-16.28	0.00	389410.22	535935.72	N 32 4 13.98	W 104 13 2.35
	17400.00	89.70	0.29	9666.98	7981.94	7981.94	-15.78	0.00	389510.21	535936.22	N 32 4 14.97	W 104 13 2.35
	17500.00	89.70	0.29	9667.51	8081.94	8081.94	-15.28	0.00	389610.20	535936.72	N 32 4 15.96	W 104 13 2.34
	17600.00	89.70	0.29	9668.03	8181.94	8181.93	-14.78	0.00	389710.18	535937.22	N 32 4 16.95	W 104 13 2.33
	17700.00	89.70	0.29	9668.55	8281.93	8281.93	-14.28	0.00	389810.17	535937.72	N 32 4 17.94	W 104 13 2.33
	17800.00	89.70	0.29	9669.08	8381.93	8381.93	-13.78	0.00	389910.16	535938.22	N 32 4 18.93	W 104 13 2.32
	17900.00	89.70	0.29	9669.60	8481.93	8481.92	-13.28	0.00	390010.15	535938.72	N 32 4 19.92	W 104 13 2.31
	18000.00	89.70	0.29	9670.12	8581.92	8581.92	-12.78	0.00	390110.14	535939.22	N 32 4 20.91	W 104 13 2.31
	18100.00	89.70	0.29	9670.65	8681.92	8681.92	-12.28	0.00	390210.13	535939.72	N 32 4 21.90	W 104 13 2.30
	18200.00	89.70	0.29	9671.17	8781.92	8781.92	-11.78	0.00	390310.11	535940.22	N 32 4 22.89	W 104 13 2.29
	18300.00	89.70	0.29	9671.69	8881.92	8881.91	-11.28	0.00	390410.10	535940.72	N 32 4 23.88	W 104 13 2.28
	18400.00	89.70	0.29	9672.22	8981.91	8981.91	-10.78	0.00	390510.09	535941.22	N 32 4 24.87	W 104 13 2.28
	18500.00	89.70	0.29	9672.74	9081.91	9081.91	-10.28	0.00	390610.08	535941.72	N 32 4 25.86	W 104 13 2.27
	18600.00	89.70	0.29	9673.26	9181.91	9181.91	-9.78	0.00	390710.07	535942.22	N 32 4 26.85	W 104 13 2.26
	18700.00	89.70	0.29	9673.79	9281.91	9281.90	-9.28	0.00	390810.06	535942.72	N 32 4 27.84	W 104 13 2.26
	18800.00	89.70	0.29	9674.31	9381.90	9381.90	-8.78	0.00	390910.04	535943.22	N 32 4 28.83	W 104 13 2.25
	18900.00	89.70	0.29	9674.84	9481.90	9481.90	-8.28	0.00	391010.03	535943.72	N 32 4 29.82	W 104 13 2.24
	19000.00	89.70	0.29	9675.36	9581.90	9581.90	-7.78	0.00	391110.02	535944.22	N 32 4 30.81	W 104 13 2.23
	19100.00	89.70	0.29	9675.88	9681.89	9681.89	-7.28	0.00	391210.01	535944.73	N 32 4 31.80	W 104 13 2.23
	19200.00	89.70	0.29	9676.41	9781.89	9781.89	-6.77	0.00	391310.00	535945.23	N 32 4 32.79	W 104 13 2.22
	19300.00	89.70	0.29	9676.93	9881.89	9881.89	-6.27	0.00	391409.98	535945.73	N 32 4 33.77	W 104 13 2.21
	19400.00	89.70	0.29	9677.45	9981.89	9981.89	-5.77	0.00	391509.97	535946.23	N 32 4 34.76	W 104 13 2.21
	19500.00	89.70	0.29	9677.98	10081.88	10081.88	-5.27	0.00	391609.96	535946.73	N 32 4 35.75	W 104 13 2.20
	19600.00	89.70	0.29	9678.50	10181.88	10181.88	-4.77	0.00	391709.95	535947.23	N 32 4 36.74	W 104 13 2.19
	19700.00	89.70	0.29	9679.02	10281.88	10281.88	-4.27	0.00	391809.94	535947.73	N 32 4 37.73	W 104 13 2.19
	19800.00	89.70	0.29	9679.55	10381.88	10381.87	-3.77	0.00	391909.93	535948.23	N 32 4 38.72	W 104 13 2.18
	19900.00	89.70	0.29	9680.07	10481.87	10481.87	-3.27	0.00	392009.91	535948.73	N 32 4 39.71	W 104 13 2.17
	20000.00	89.70	0.29	9680.59	10581.87	10581.87	-2.77	0.00	392109.90	535949.23	N 32 4 40.70	W 104 13 2.16
	20100.00	89.70	0.29	9681.12	10681.87	10681.87	-2.27	0.00	392209.89	535949.73	N 32 4 41.69	W 104 13 2.16
Chevron HH SO 8 P2 6H - PBHL	20154.12	89.70	0.29	9681.40	10735.98	10735.98	-2.00	0.00	392264.00	535950.00	N 32 4 42.23	W 104 13 2.15

Survey Type: Non-Def Plan

Survey Error Model: ISCWSA Rev 0 *** 3-D 95.000% Confidence 2.7955 sigma

Survey Program:

Description	Part	MD From (ft)	MD To (ft)	EOU Freq (ft)	Hole Size (in)	Casing Diameter (in)	Survey Tool Type	Borehole / Survey
	1	0.000	33.000	1/100.000	30.000	30.000	SLB_MWD-STD-Depth Only	Original Borehole / Chevron HH SO 8 P2 6H Rev0 CJG 12Jan16
	1	33.000	20154.116	1/100.000	30.000	30.000	SLB_MWD-STD	Original Borehole / Chevron HH SO 8 P2 6H Rev0 CJG 12Jan16

Generic Hayhurst Development Pad Layout - Phase 1

H2S Monitor Locations
- Bop/Cellar
- Rig Floor
- Shaker Skid
- Bell Nipple

Flag Locations
- Sign-in Shack
- Rig Floor
- Dog House

10 Minute Escape Packs
- 1 at Pits
- 1 at Trip Tank
- 1 at Accumulator
- 4 at Rig Floor

45 Minute Escape Packs
- 2 at Briefing Area
- 2 at Alternate Briefing Area

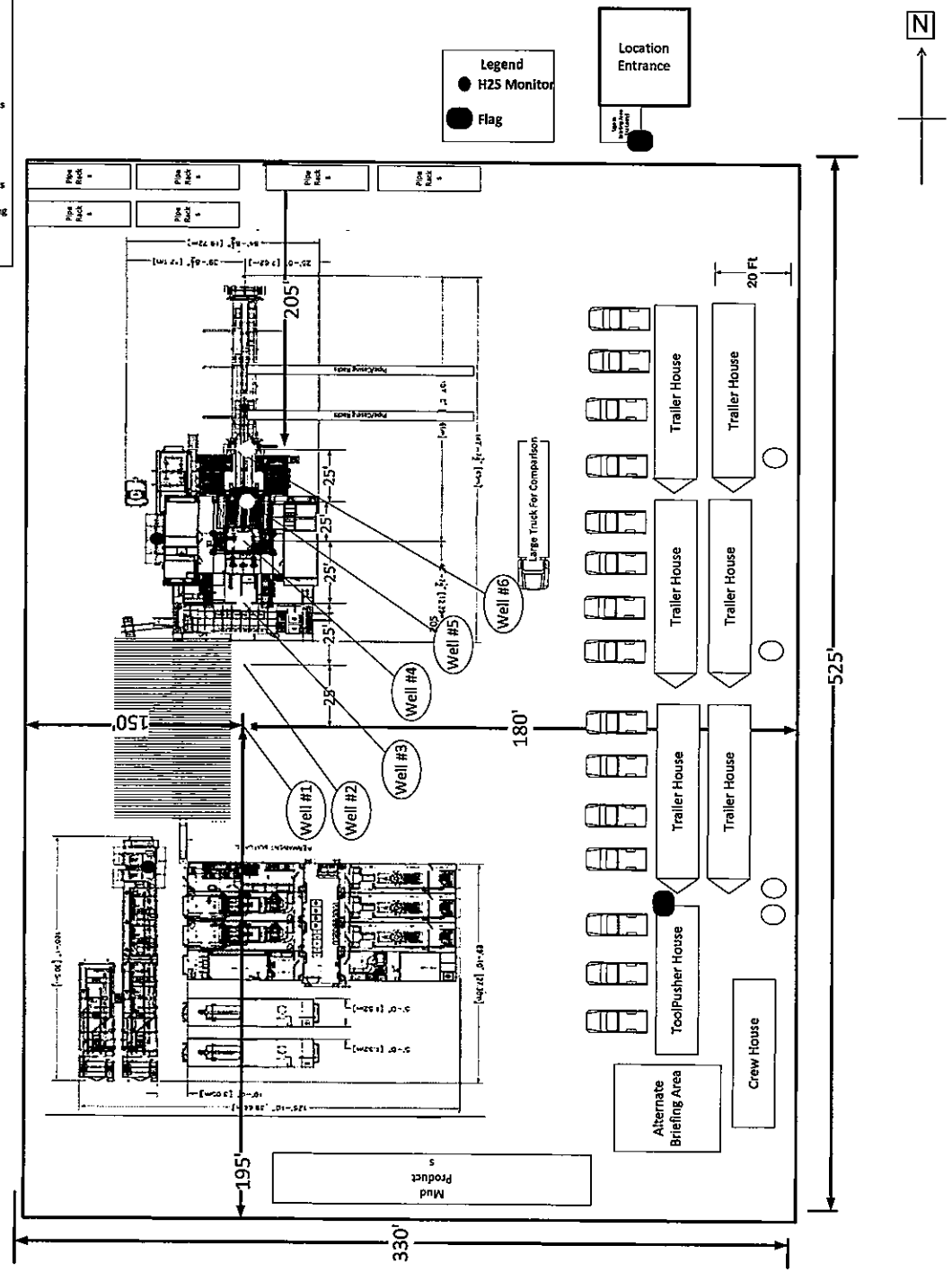
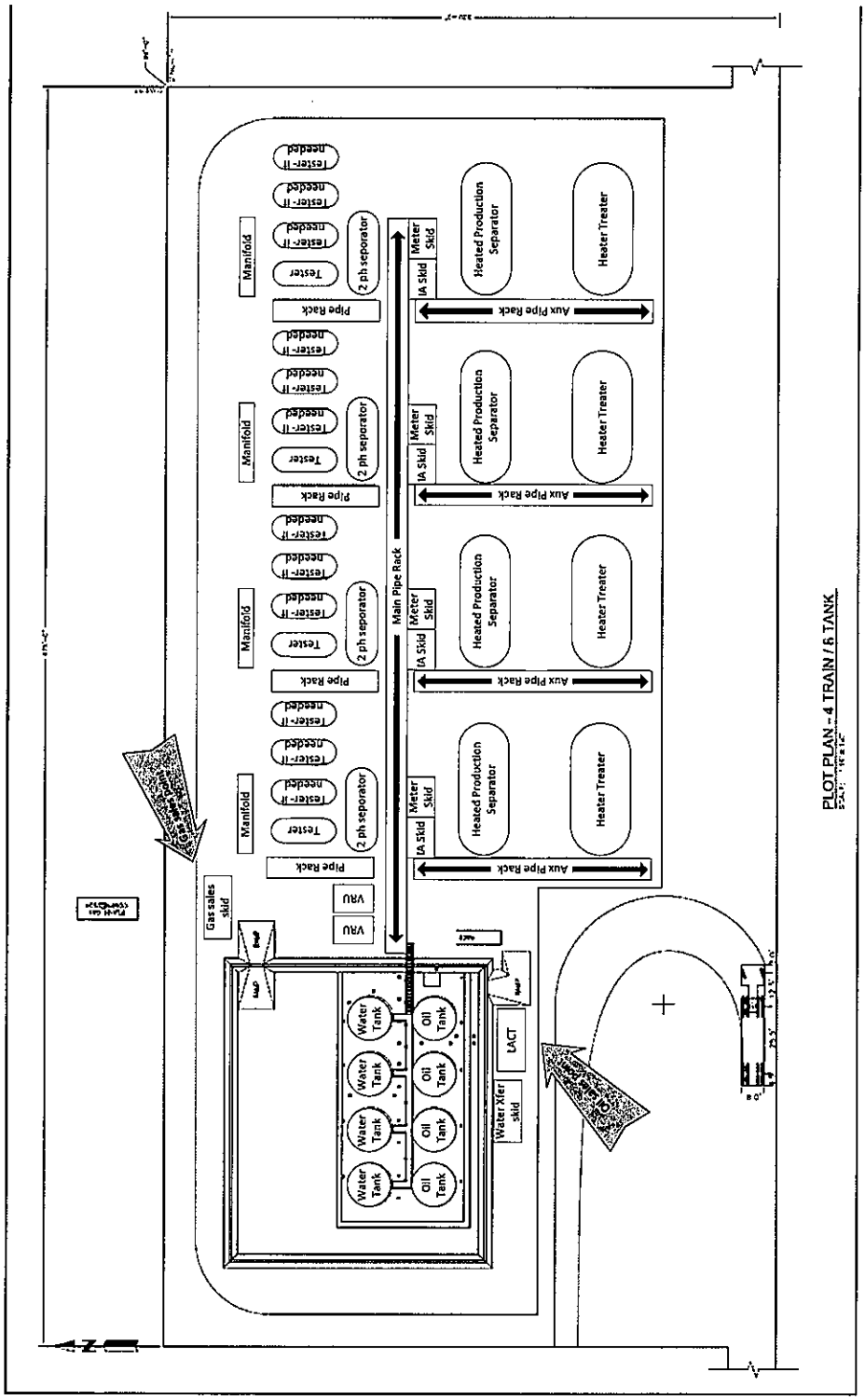


EXHIBIT 4


Main Pipe Rack
Aux Pipe Rack
Heated Production Separator
Heater Treater
IA Skid
Meter Skid
Manifold
Tester
2 ph separator
Pipe Rack
VRU
Gas sales skid
Water Tank
Oil Tank
LACT
Water Xfer skid
PLOT PLAN - 4 TRAIN / 6 TANK

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge

ROBERT L. LASTRAPES
NEW MEXICO
23006
1-8-2016
PROFESSIONAL SURVEYOR

Robert L. Lastrapes
Registration No. 23006

R 27 E

T 26 S

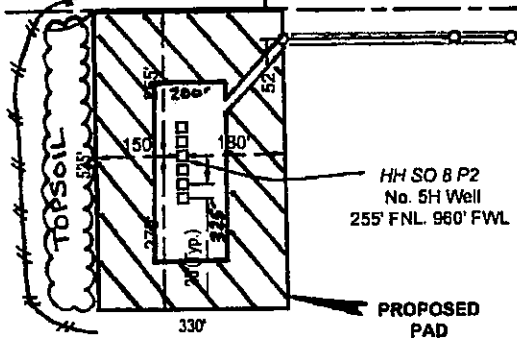
Sec. 8

Bureau of Land Management

EROSION CONTROL (STRAW WATTLES)

S 89°52'10" E 810.78'

Fnd. 2" Iron Pipe w/ Cap at the NW Corner of Section 17



HH SO 8 P2 No. 5H Well
255' FNL, 960' FWL

PROPOSED PAD
±3.98 Acres

CENTERLINE PROPOSED ACCESS ROAD (1)
24' X ±5,444.40'
±3.00 Acres
±329.96 Rods
(SEE PAGE 2)

Sec. 17

Bureau of Land Management

(Access Road 1) ± 4289.90': ±2.36 Acres ±259.99 Rods

NW PAD CORNER		NE PAD CORNER		HH SO 8 P2 NO. 5H WELL	
X=	535,799 NAD 27	X=	536,129 NAD 27	X=	535,952 NAD 27
Y=	381,809	Y=	381,808	Y=	381,554
ELEVATION +3241' NAVD 88		ELEVATION +3247' NAVD 88		LAT.	32.048953
SW PAD CORNER		SE PAD CORNER		LONG.	104.217295
X=	535,805 NAD 27	X=	536,135 NAD 27	X=	577,136 NAD83
Y=	381,284	Y=	381,284	Y=	381,611
ELEVATION +3244' NAVD 88		ELEVATION +3258' NAVD 88		LAT.	32.049075
				LONG.	104.217789
				ELEVATION +3245' NAVD 88	

NAD 27 NEW MEXICO EAST ZONE

Scale: 1" = 300'

300' 0 150' 300'

INTERIM RECLAMATION

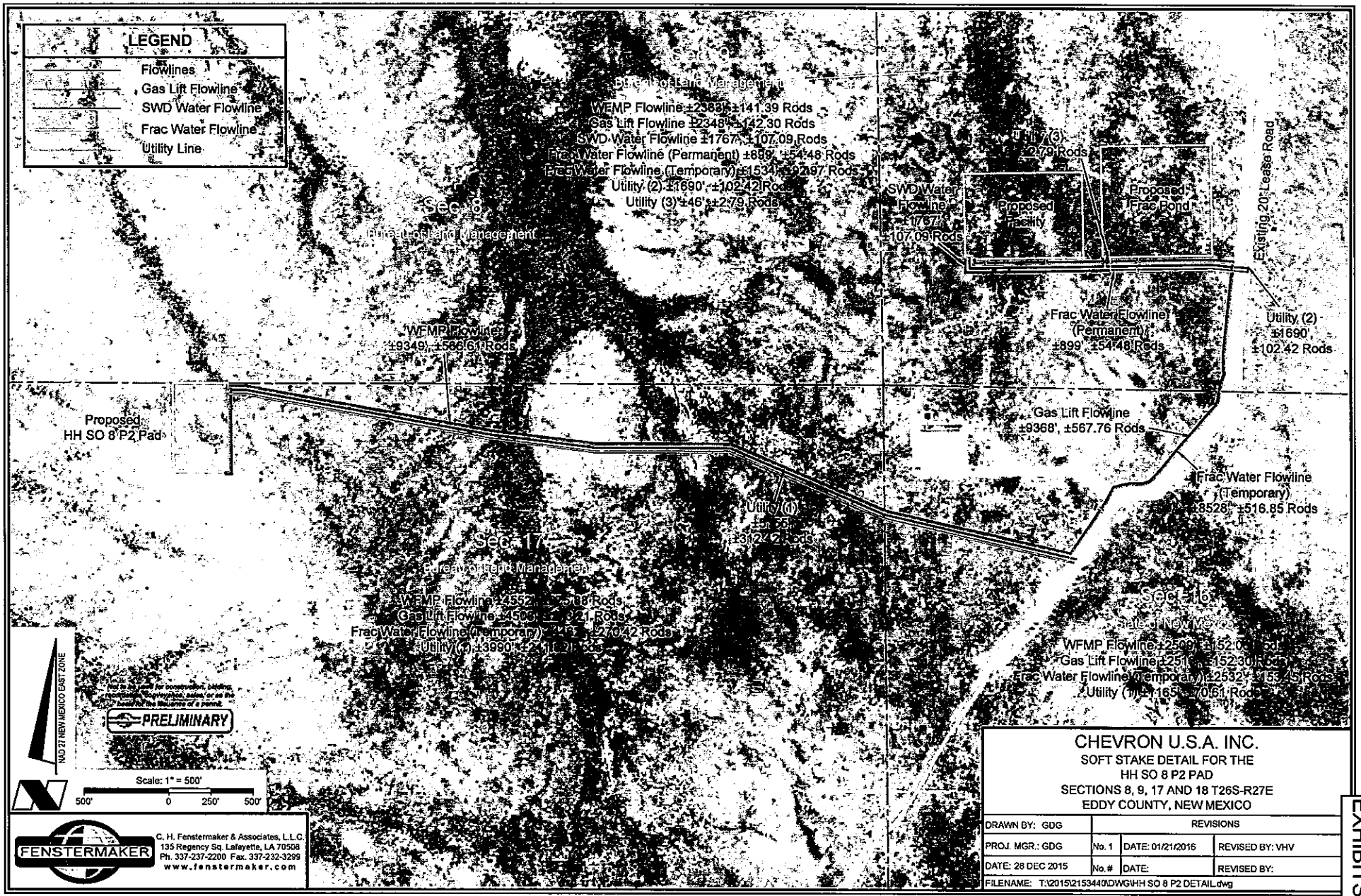
SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED PADS, FRAC POND & ACCESS ROADS
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: LJG	REVISIONS		
PROJ. MGR.: GDG	No. 1	DATE: 1/7/2016	REVISED BY: MBD
DATE: 12/22/2015	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153438\DWG\HH SO 8 P2 5H_SUP.dwg			

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com


LEGEND
Flowlines
Gas Lift Flowline
SWD Water Flowline
Frac Water Flowline
Utility Line
Sec. 9
Bureau of Land Management
WFMP Flowline ±2383', ±141.39 Rods
Gas Lift Flowline ±2348', ±142.30 Rods
SWD Water Flowline ±1767', ±107.09 Rods
Frac Water Flowline (Permanent) ±899', ±54.48 Rods
Frac Water Flowline (Temporary) ±1534', ±92.97 Rods
Utility (2) ±1690', ±102.42 Rods
Utility (3) ±46', ±2.79 Rods
Sec. 8
Bureau of Land Management
WFMP Flowline ±9349', ±566.61 Rods
Proposed HH SO 8 P2 Pad
SWD Water Flowline ±1767', ±107.09 Rods
Proposed Facility
Proposed Frac Pond
Existing 20' Lease Road
Frac Water Flowline (Permanent) ±899', ±54.48 Rods
Utility (2) ±1690', ±102.42 Rods
Gas Lift Flowline ±9368', ±567.76 Rods
Frac Water Flowline (Temporary) ±8528', ±516.85 Rods
Utility (1)
Sec. 17
Bureau of Land Management
Sec. 16
State of New Mexico
WFMP Flowline ±2509', ±152.06 Rods
Gas Lift Flowline ±2513', ±152.30 Rods
Frac Water Flowline (Temporary) ±2532', ±153.45 Rods
Utility (1) ±1165', ±70.61 Rods
NAD 27 NEW MEXICO EAST ZONE
PRELIMINARY
Scale: 1" = 500'
500' 0 250' 500'
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com
CHEVRON U.S.A. INC.
SOFT STAKE DETAIL FOR THE
HH SO 8 P2 PAD
SECTIONS 8, 9, 17 AND 18 T26S-R27E
EDDY COUNTY, NEW MEXICO
DRAWN BY: GDG
REVISIONS
PROJ. MGR.: GDG
No. 1
DATE: 01/21/2016
REVISED BY: VHV
DATE: 28 DEC 2015
No. #
DATE:
REVISED BY:
FILENAME: T:\2015\2153440\DWG\HH SO 8 P2 DETAIL.dwg

EXHIBITS 4&5

CHEVRON U.S.A. Inc
HH SO 8 P2 6H
NMNM 118108
SECTION 17, T26S-R27E (Off Lease SHL) SECTION 5, T26S, R27E
SHL 280' FNL & 960' FWL BHL 180' FNL & 996' FWL

APD Surface Use Plan of Operations

This Surface Use Plan of Operations has been designed to be reviewed in conjunction with Hayhurst Development Area (HDA) Master Development Plan

HDA Master Development Plan Reference Table
The contents referenced below apply to all HDA APD's

Existing Roads	Exhibit 1, MDP SUPO Page 1
Construction Materials	MDP SUPO Page 6
Methods for Handling Waste	MDP SUPO Page 6
Reclamation Objectives	MDP SUPO Page 6-8
Final Surface Reclamation	MDP SUPO Page 6-8

Driving Directions

- Driving Directions – From Malaga, New Mexico. The location is approximately 11.5 miles from the nearest town, which is Malaga, New Mexico. From Malaga, proceed South on Highway 285 approximately 11.5 miles and turn right (West) onto White City Rd and go approximately 7.5 miles on White City Road until the road reaches an intersection with a permanent sign reading "Chevron Access". Turn left onto this and travel 1 mile, then right and travel for another .5 miles to the well location.

New or Reconstructed Access Roads – (Exhibit 2, MDP SUPO Pg. 1)

- There will be 7172' of new road construction for this proposal.
- Ditches: See Exhibit 2 (To be submitted at later date)
- Culverts: See Exhibit 2 (To be submitted at later date)
- Road Cuts: See Exhibit 2 (To be submitted at later date)

Location of Existing Wells (Exhibit 3)

- 1-Mile radius map is attached

Location of Existing and/or Proposed Production Facilities (Exhibit 4, MDP SUP Pg. 2)

- Facilities: Proposed production facilities located in the SW corner of Sec. 9, T26S-R27E where oil and gas sales will take place.
    - The proposed facility and frac pond is in Sec. 9, T26S-R27E
    - Gas purchaser pipeline is in place at the tank battery.
    - Open top tanks or open containments will be netted.
    - Open vent exhaust stacks will be modified to prevent birds or bats from entering, discourage perching, roosting, and nesting.
    - Facilities will have a secondary containment 1.5 times the holding capacity of largest storage tank.
    - All above ground structures will be painted non-reflective shale green for blending with surrounding environment.
    - The permanent water disposal system will be determined prior to construction of any water transfer pipeline. Until permanent water takeaway is available, produced water will be hauled off location in trucks. **Notification will be provided to BLM upon site selection and survey – plats (including SWD well information) will be provided.**
- Pipelines: See Detail – Exhibit 5
    - Pipelines Include:
        - 9,349' of Flowlines carrying production (buried)
        - 9,368' Gas Lift Line carrying pressurized gas (buried)
        - 1,767' SWD Line carrying produced water (buried)
        - 899' Permanent Frac water line carrying fresh water (buried)
        - 8528' Temporary Water line carrying fresh water (surface)
    - A ROW will be applied for through the State and BLM.
    - All construction activity will be confined to the approved ROW.
    - Pipeline will run parallel to the road and will stay within approved ROW.
- Power lines\Utility lines: 6,891' of new power lines

Location and Types of Water Supply (Exhibit 5, MDP SUPO Pg. 5)

- Proposed pond in Section 9, T26S-R27E will be utilized for fresh water.
- Fresh water will be obtained from a private water source.

Construction Materials (MDP SUPO Pg. 6)

- Location-specific caliche sources will be provided in post-application supplement

CHEVRON U.S.A. Inc
HH SO 8 P2 6H
NMNM 118108
SECTION 17, T26S-R27E (Off Lease SHL) SECTION 5, T26S, R27E
SHL 280' FNL & 960' FWL BHL 180' FNL & 996' FWL

Well Site Layout (Exhibit 6)

- Surveyor Plat (Exhibit 6a)
  - Exterior well pad dimensions are 525' x 330'
  - Interior well pad dimensions from point of entry (well head) of the well are N-280', S-245', E-180', W-150'. Total disturbance area needed for construction of well pad will be approximately 4 acres
  - Topsoil placement is on the west where interim reclamation is planned to be completed upon completion of well and evaluation of best management practices.
  - Cut and fill: will be minimal.
- Rig Layout (Exhibit 6b)

Plans for Surface Reclamation (Exhibit 6, MDP SUPA Pg. 8)

Interim Reclamation Procedures

- Reclaimed pad size: 200' x 325'
- See Exhibit for reclaimed pad layout, topsoil location & erosion control features

Surface Ownership

- BLM Surface
  - Surface Tenant – Phillip Stell
- **Nearest Post Office:** Malaga Post Office; 11.4 Miles north

Other Information

- On-site performed by BLM NRS: Paul Murphy 11/4/2015
- Cultural report attached: **Yes** Participating Agreement attached: N/A

CHEVRON U.S.A. Inc
HH SO 8 P2 6H
NMNM 118108
SECTION 17, T26S-R27E (Off Lease SHL) SECTION 5, T26S, R27E
SHL 280' FNL & 960' FWL BHL 180' FNL & 996' FWL

Chevron Representatives

Primary point of contact:
Jennifer Van Curen
Jennifer.VanCuren@arcadis-us.com
M- 432-270-8753

Chevron Functional Contacts

Project Manager Name: Sean Cheben Address: 1400 Smith Street Houston, TX 77002 Phone: (432) 664-6809 Email: Sean.Cheben@chevron.com	**Drilling Engineer** Name: Roderick Milligan Address: 1400 Smith Street Houston, TX 77002 Phone: (281) 413-9794 Email: RoderickMilligan@chevron.com
Surface Land Representative Name: Kevin Dickerson Address: 15 Smith Road Midland Texas 79705 Phone: (432) 687-7104 Email: Kevin.Dickerson@chevron.com	**Facility Lead** Name: Tyler Weaver Address: 1400 Smith Street Houston, TX 77002 Phone: (281) 384-8934 Email: tyler.weaver@chevron.com
Geologist Name: Jeff Fabre Address: 1400 Smith Street Houston, TX 77002 Phone: (713) 372-0523 Email: JeffreyFabre@chevron.com	**Regulatory Specialist** Cindy Herrera-Murillo Address: 1616 W. Bender Blvd, Hobbs, NM 88240 Office: (575) 263-0431 Email: CHerreraMurillo@chevron.com

CHEVRON U.S.A. Inc
HH SO 8 P2 6H
NMNM 118108
SECTION 17, T26S-R27E (Off Lease SHL) SECTION 5, T26S, R27E
SHL 280' FNL & 960' FWL BHL 180' FNL & 996' FWL

EXHIBITS:

Exhibit 1 -- Existing Roads

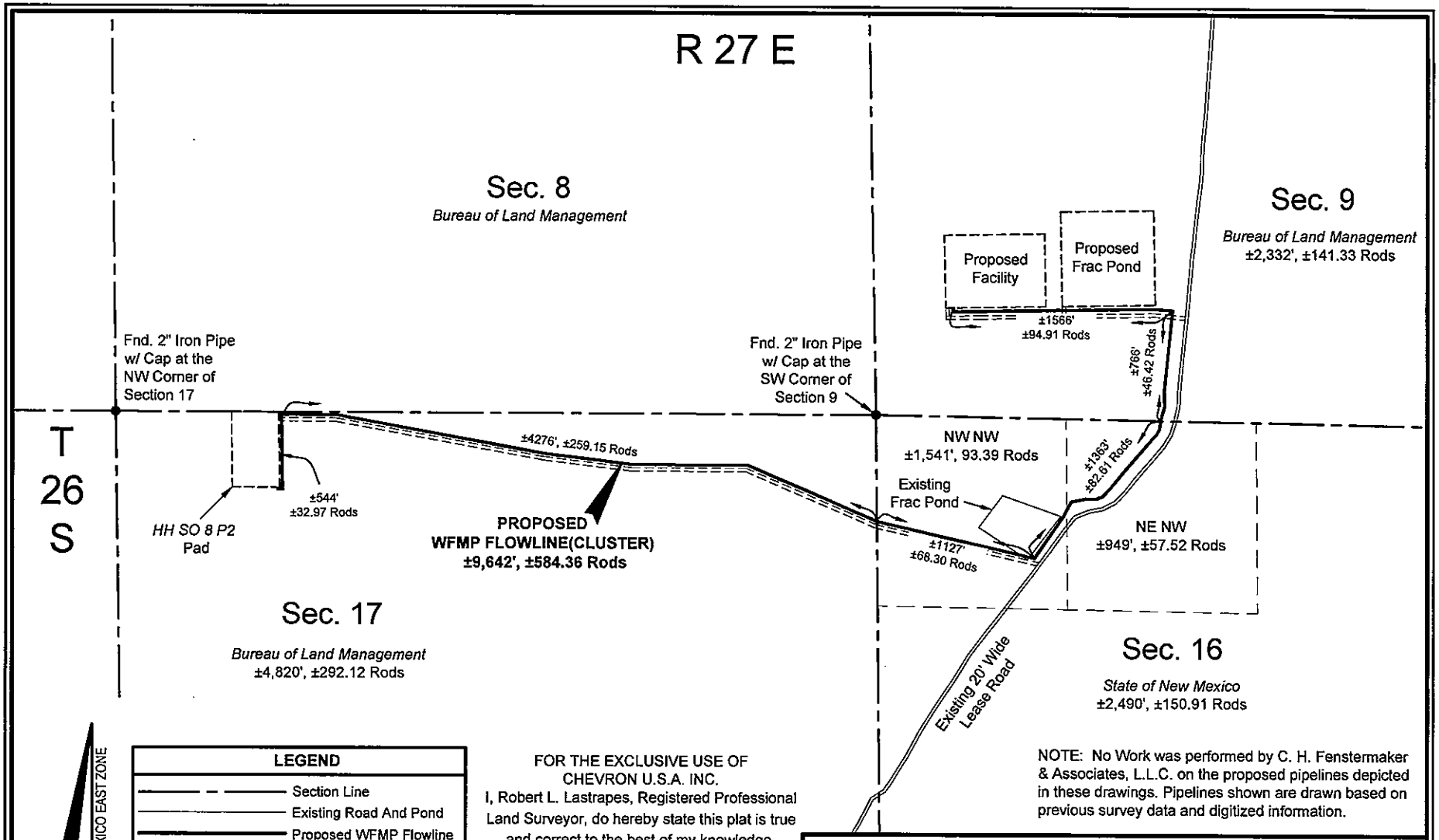
Exhibit 2 -- Survey Plat: New or Reconstructed Roads Map: if road is outside 600' x 600'.

Exhibit 3 -- 1-mile Radius Map

Exhibit 4 -- Location of Existing and/or Proposed Production Facilities (Tank Battery)

Exhibit 5 -- Survey Plat: Infrastructure: roads, pipelines, power lines, frac pond

Exhibit 6 -- Rig Layout: Well Site Layout Map / Diagram



FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

NOTE: No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED WFMP FLOWLINE(CLUSTER)
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\WFMP FL_SUP.dwg			

EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

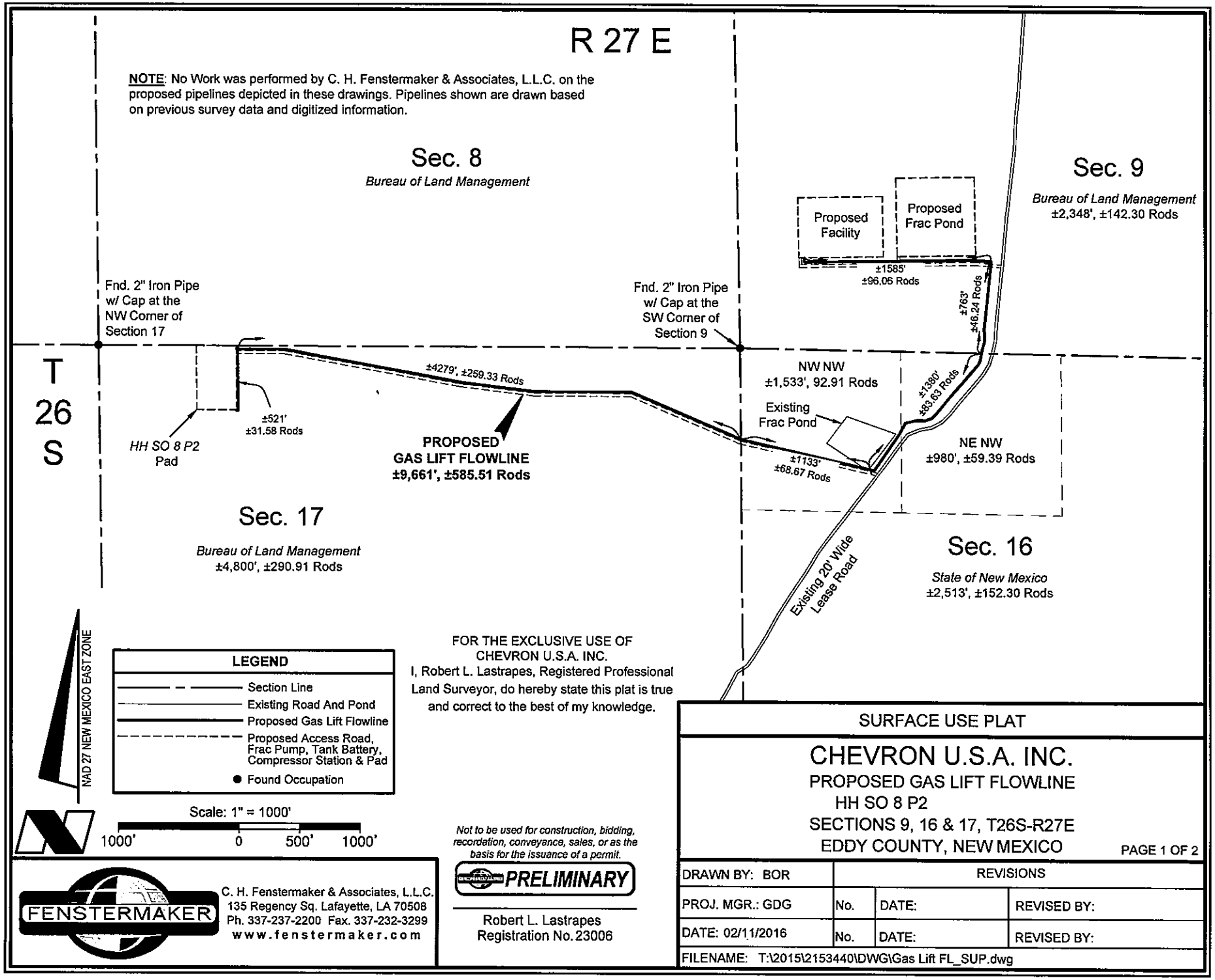
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED WFMP FLOWLINE(CLUSTER)
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\WFMP FL_SUP.dwg			


R 27 E
NOTE: No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.
Sec. 8
Bureau of Land Management
Sec. 9
Bureau of Land Management
±2,348', ±142.30 Rods
Proposed Facility
Proposed Frac Pond
±1585'
±96.06 Rods
±763'
±46.24 Rods
Fnd. 2" Iron Pipe w/ Cap at the NW Corner of Section 17
Fnd. 2" Iron Pipe w/ Cap at the SW Corner of Section 9
T 26 S
±4279', ±259.33 Rods
NW NW
±1,533', 92.91 Rods
±1380'
±83.63 Rods
Existing Frac Pond
±521'
±31.58 Rods
HH SO 8 P2 Pad
PROPOSED GAS LIFT FLOWLINE
±9,661', ±585.51 Rods
±1133'
±68.67 Rods
NE NW
±980', ±59.39 Rods
Sec. 17
Bureau of Land Management
±4,800', ±290.91 Rods
Sec. 16
State of New Mexico
±2,513', ±152.30 Rods
Existing 20' Wide Lease Road
NAD 27 NEW MEXICO EAST ZONE
LEGEND
Section Line
Existing Road And Pond
Proposed Gas Lift Flowline
Proposed Access Road, Frac Pump, Tank Battery, Compressor Station & Pad
Found Occupation
Scale: 1" = 1000'
1000' 0 500' 1000'
FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.
Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.
PRELIMINARY
Robert L. Lastrapes
Registration No. 23006
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com
SURFACE USE PLAT
CHEVRON U.S.A. INC.
PROPOSED GAS LIFT FLOWLINE
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO
PAGE 1 OF 2
DRAWN BY: BOR
PROJ. MGR.: GDG
DATE: 02/11/2016
REVISIONS
No. DATE: REVISED BY:
No. DATE: REVISED BY:
FILENAME: T:\2015\2153440\DWG\Gas Lift FL_SUP.dwg
EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No.23006

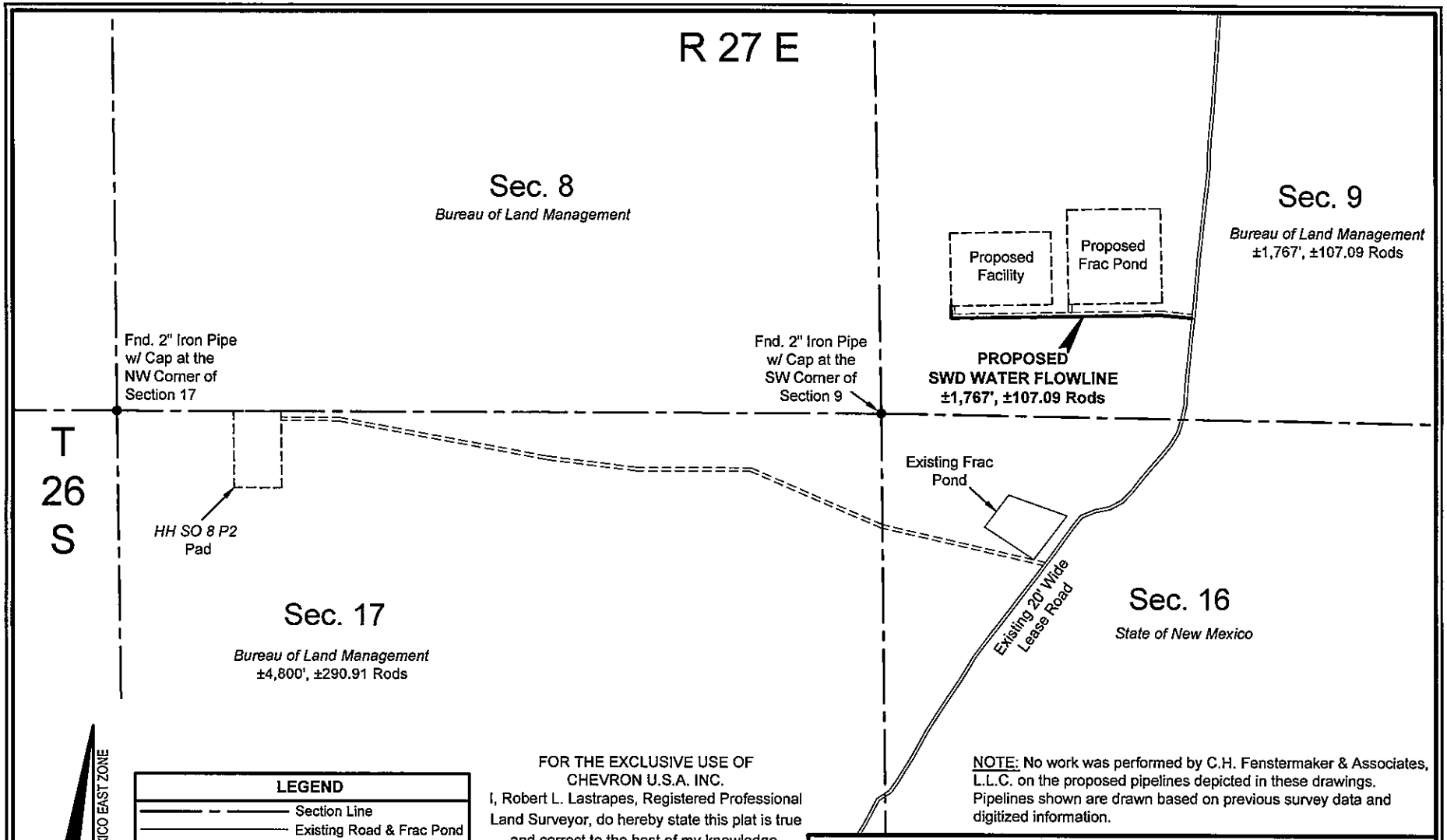
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED GAS LIFT FLOWLINE
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Gas Lift FL_SUP.dwg			



FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

NOTE: No work was performed by C.H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED SWD WATER FLOWLINE
HH SO 8 P2
SECTION 9, T26S-R27E
EDDY COUNTY, NEW MEXICO

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

DRAWN BY: VHV	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\SWD Water FL_SUP.dwg			

EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No.23006

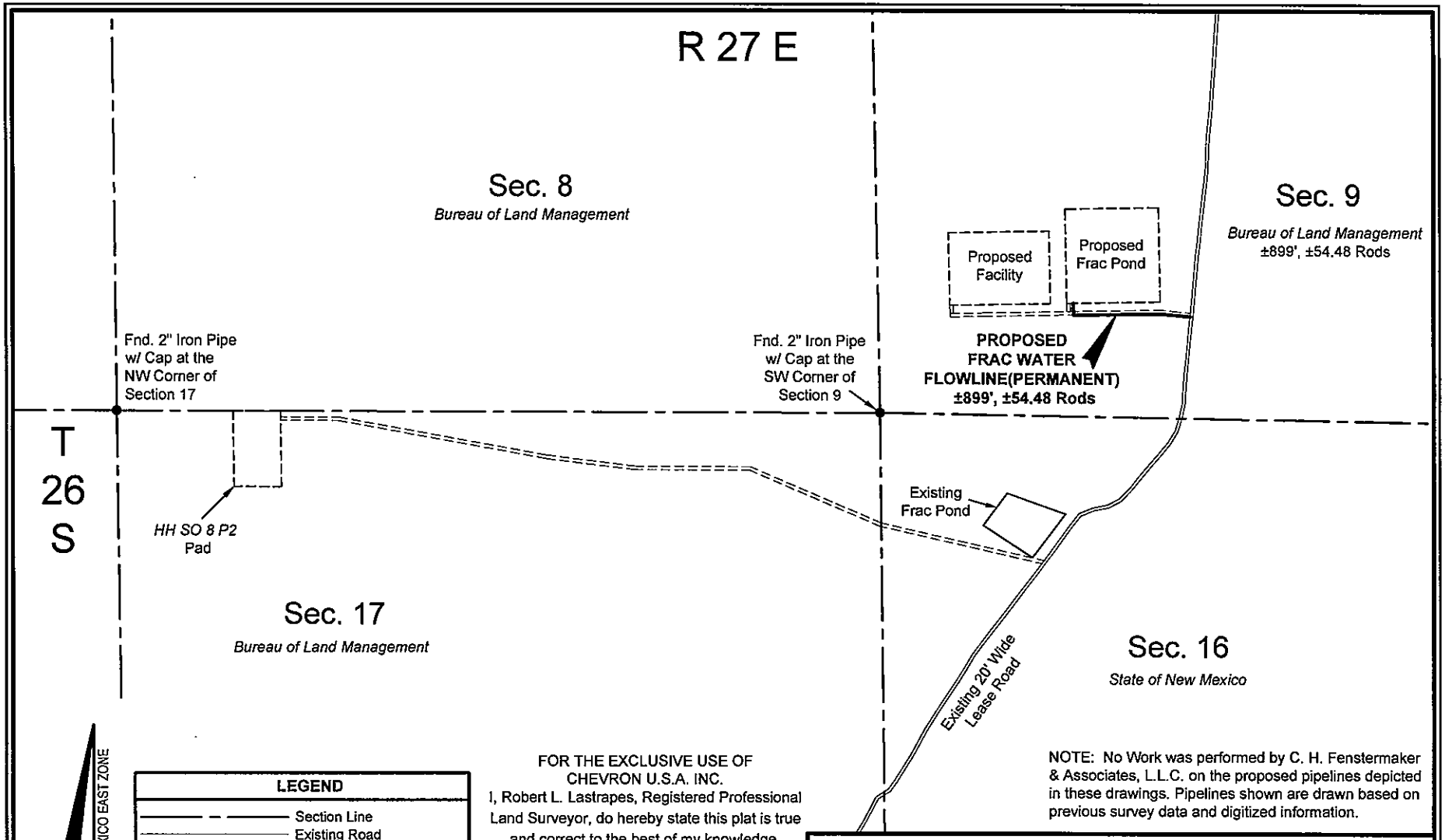
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED SWD WATER FLOWLINE
HH SO 8 P2
SECTION 9, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: VHV	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\SWD Water FL_SUP.dwg			



FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

NOTE: No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED FRAC WATER FLOWLINE(PERMANENT)
HH SO 8 P2
SECTION 9, T26S-R27E
EDDY COUNTY, NEW MEXICO

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Frac Water FL_Perm_SUP.dwg			

EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No.23006

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED FRAC WATER FLOWLINE(PERMANENT)
HH SO 8 P2
SECTION 9, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Frac Water FL_Perm_SUP.dwg			

R 27 E

NOTE: No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

Sec. 8
Bureau of Land Management

Sec. 9
Bureau of Land Management
±1,534', ±92.97 Rods

Proposed Facility

Proposed Frac Pond

±773'
±46.85 Rods

±761'
±46.12 Rods

Fnd. 2" Iron Pipe w/ Cap at the NW Corner of Section 17

Fnd. 2" Iron Pipe w/ Cap at the SW Corner of Section 9

T 26 S

±473', ±28.67 Rods

±473'
±28.67 Rods

HH SO 8 P2 Pad

PROPOSED FRAC WATER FLOWLINE(TEMPORARY) ±8,820', ±534.55 Rods

NW NW
±1,548', 93.82 Rods

±1423'
±86.24 Rods

Existing Frac Pond

NE NW
±984', ±59.64 Rods

±1109'
±67.21 Rods

Sec. 17
Bureau of Land Management
±4,754', ±288.12 Rods

Existing 20' Wide Lease Road

Sec. 16
State of New Mexico
±2,532', ±153.45 Rods

NAD 27 NEW MEXICO EAST ZONE

LEGEND

- Section Line
- Existing Road And Pond
- Proposed Frac Water Flowline(Temporary)
- Proposed Access Road, Frac Pump, Tank Battery, Compressor Station & Pad
- Found Occupation

Scale: 1" = 1000'

1000' 0 500' 1000'

FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED FRAC WATER FLOWLINE(TEMPORARY)
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Frac Water FL_Temp_SUP.dwg			

EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No.23006

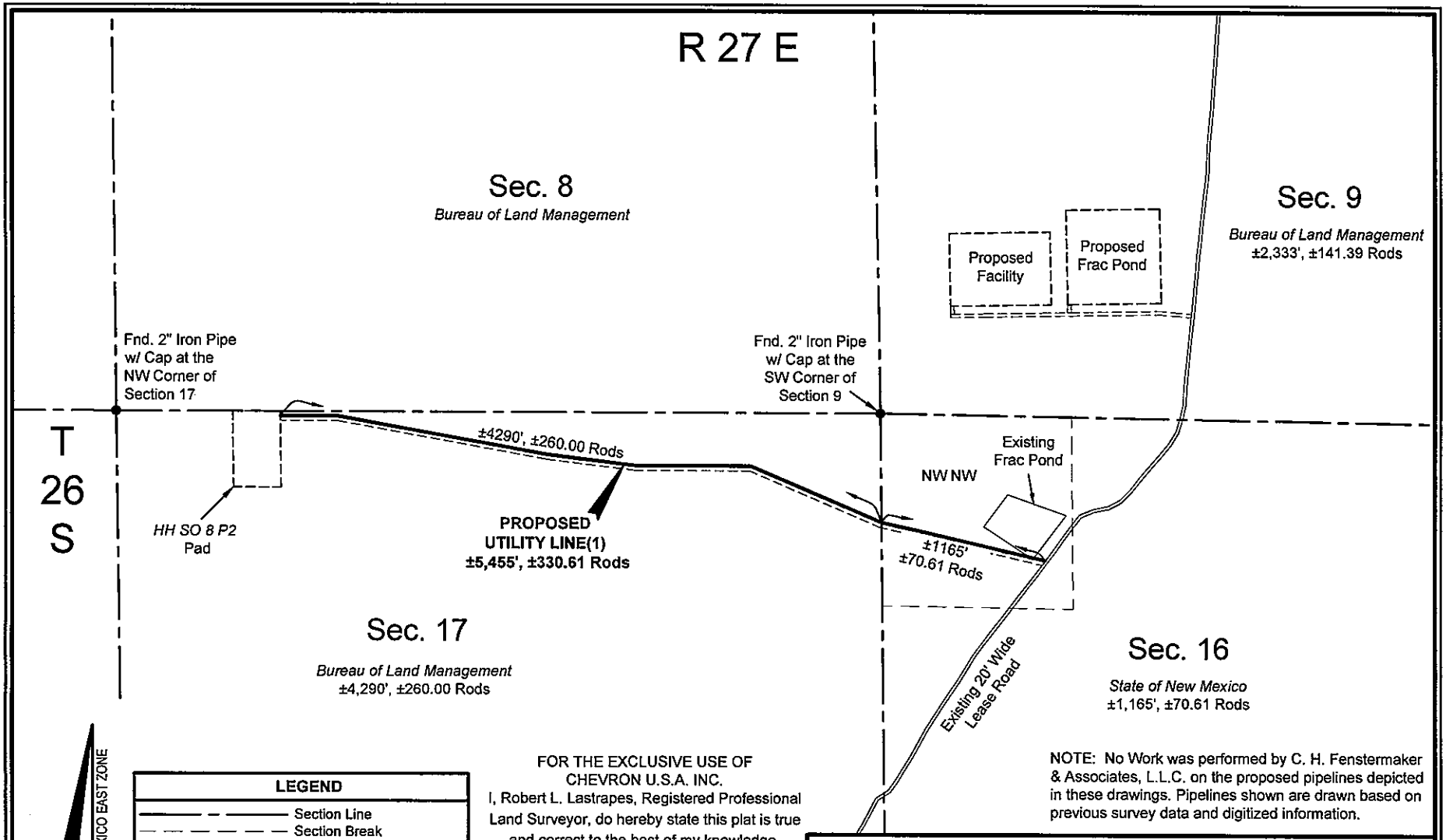
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED FRAC WATER FLOWLINE(TEMPORARY)
HH SO 8 P2
SECTIONS 9, 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Frac Water FL_Temp_SUP.dwg			



FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

NOTE: No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED UTILITY LINE(1)
HH SO 8 P2
SECTIONS 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Utility 1_SUP.dwg			

EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

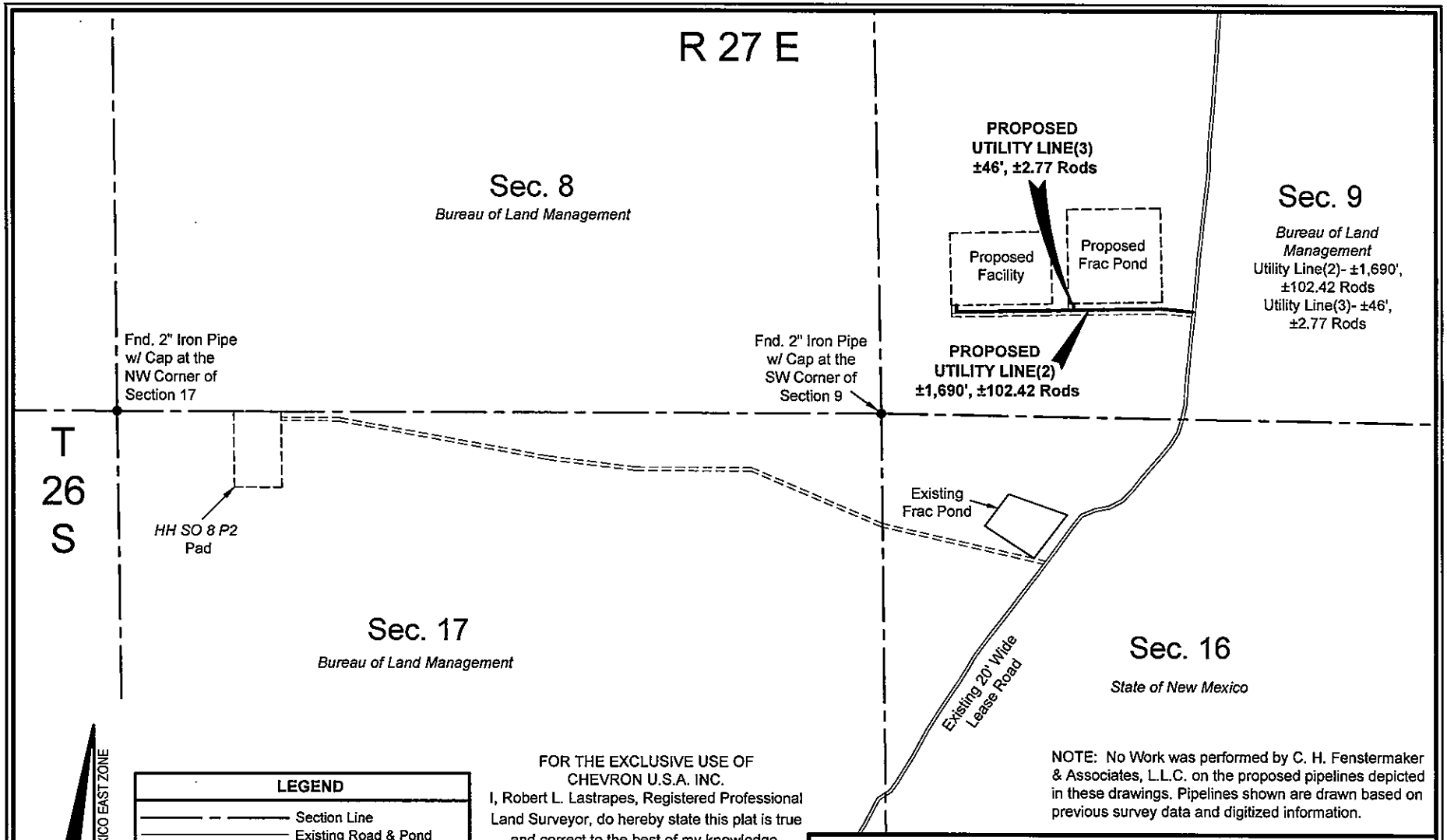
FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED UTILITY LINE(1)
HH SO 8 P2
SECTIONS 16 & 17, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Utility 1_SUP.dwg			



FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

NOTE: No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED UTILITY LINE(2 & 3)
HH SO 8 P2
SECTION 9, T26S-R27E
EDDY COUNTY, NEW MEXICO

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No.23006

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Utility 2 and 3_SUP.dwg			

EXHIBIT 5

DISCLAIMER: At this time, C.H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

NOTE:

1. Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

2. Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call. www.nmonecall.org

3. No Work was performed by C. H. Fenstermaker & Associates, L.L.C. on the proposed pipelines depicted in these drawings. Pipelines shown are drawn based on previous survey data and digitized information.

FOR THE EXCLUSIVE USE OF
CHEVRON U.S.A. INC.
I, Robert L. Lastrapes, Registered Professional Land Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

PRELIMINARY

Robert L. Lastrapes
Registration No. 23006

FENSTERMAKER
C. H. Fenstermaker & Associates, L.L.C.
135 Regency Sq. Lafayette, LA 70508
Ph. 337-237-2200 Fax. 337-232-3299
www.fenstermaker.com

SURFACE USE PLAT

CHEVRON U.S.A. INC.

PROPOSED UTILITY LINE(2 & 3)
HH SO 8 P2
SECTION 9, T26S-R27E
EDDY COUNTY, NEW MEXICO

DRAWN BY: BOR	REVISIONS		
PROJ. MGR.: GDG	No.	DATE:	REVISED BY:
DATE: 02/11/2016	No.	DATE:	REVISED BY:
FILENAME: T:\2015\2153440\DWG\Utility 2 and 3_SUP.dwg			

CERTIFICATION

I hereby certify that I, or someone under my direct supervision, have inspected the drill site and access route proposed herein; that I am familiar with the conditions which currently exist; that I have full knowledge of state and federal laws applicable to this operation; that the statements made in this APD package are, to the best of my knowledge, true and correct; and, that the work associated with the operations proposed will be performed in conformity with this APD package and the terms and conditions under which it is approved. I also certify that I, or the company I represent, am responsible for the operations conducted under this application. These statements are subject to the provisions of 18 U.S.C. 1001 for the filing of a false statement.

Executed this 19th day of JANUARY, 2016

Name: _____

Sean Cheben-Project Manager

Address: 1400 Smith Street

Houston, TX 77002

Room 40125

Office: 713-372-9382

Email: Sean.Cheben@CHEVRON.COM

PECOS DISTRICT
CONDITIONS OF APPROVAL

OPERATOR'S NAME:	**Chevron USA Inc.**
LEASE NO.:	**NMNM-118108**
WELL NAME & NO.:	**HH SO 8 P2 6H**
SURFACE HOLE FOOTAGE:	**0280' FNL & 0960' FWL**
BOTTOM HOLE FOOTAGE	**0180' FNL & 0996' FWL Sec. 05, T. 26 S., R 27 E.**
LOCATION:	**Section 17, T. 26 S., R 27 E., NMPM**
COUNTY:	**Eddy County, New Mexico**

TABLE OF CONTENTS

Standard Conditions of Approval (COA) apply to this APD. If any deviations to these standards exist or special COAs are required, the section with the deviation or requirement will be checked below.

- ☐ **General Provisions**
- ☐ **Permit Expiration**
- ☐ **Archaeology, Paleontology, and Historical Sites**
- ☐ **Noxious Weeds**
- ☒ **Special Requirements**
  - Cave/Karst
  - Raptor Nest
  - Avian Protection
  - VRM
  - Cultural
- ☐ **Construction**
  - Notification
  - Topsoil
  - Closed Loop System
  - Federal Mineral Material Pits
  - Well Pads
  - Roads
- ☐ **Road Section Diagram**
- ☒ **Drilling**
  - Cement Requirements
  - High Cave/Karst
  - Logging Requirements
  - Waste Material and Fluids
- ☒ **Production (Post Drilling)**
  - Well Structures & Facilities
  - Pipelines
  - Electric Lines
- ☐ **Interim Reclamation**
- ☐ **Final Abandonment & Reclamation**

I. GENERAL PROVISIONS

The approval of the Application For Permit To Drill (APD) is in compliance with all applicable laws and regulations: 43 Code of Federal Regulations 3160, the lease terms, Onshore Oil and Gas Orders, Notices To Lessees, New Mexico Oil Conservation Division (NMOCD) Rules, National Historical Preservation Act As Amended, and instructions and orders of the Authorized Officer. Any request for a variance shall be submitted to the Authorized Officer on Form 3160-5, Sundry Notices and Report on Wells.

II. PERMIT EXPIRATION

If the permit terminates prior to drilling and drilling cannot be commenced within 60 days after expiration, an operator is required to submit Form 3160-5, Sundry Notices and Reports on Wells, requesting surface reclamation requirements for any surface disturbance. However, if the operator will be able to initiate drilling within 60 days after the expiration of the permit, the operator must have set the conductor pipe in order to allow for an extension of 60 days beyond the expiration date of the APD. (Filing of a Sundry Notice is required for this 60 day extension.)

III. ARCHAEOLOGICAL, PALEONTOLOGY & HISTORICAL SITES

Any cultural and/or paleontological resource discovered by the operator or by any person working on the operator's behalf shall immediately report such findings to the Authorized Officer. The operator is fully accountable for the actions of their contractors and subcontractors. The operator shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery shall be made by the Authorized Officer to determine the appropriate actions that shall be required to prevent the loss of significant cultural or scientific values of the discovery. The operator shall be held responsible for the cost of the proper mitigation measures that the Authorized Officer assesses after consultation with the operator on the evaluation and decisions of the discovery. Any unauthorized collection or disturbance of cultural or paleontological resources may result in a shutdown order by the Authorized Officer.

IV. NOXIOUS WEEDS

The operator shall be held responsible if noxious weeds become established within the areas of operations. Weed control shall be required on the disturbed land where noxious weeds exist, which includes the roads, pads, associated pipeline corridor, and adjacent land affected by the establishment of weeds due to this action. The operator shall consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies.

V. SPECIAL REQUIREMENT(S)

Avian Protection

Power lines shall be constructed and designed in accordance to standards outlined in "Suggested Practices for Avian Protection on Power lines: The State of the Art in 2006" Edison Electric Institute, APLIC, and the California Energy Commission 2006. The holder shall assume the burden and expense of proving that pole designs not shown in the above publication deter raptor perching, roosting, and nesting. Such proof shall be provided by a raptor expert approved by the Authorized Officer. The BLM reserves the right to require modification or additions to all power line structures placed on this right-of-way, should they be necessary to ensure the safety of large perching birds. The holder without liability or expense shall make such modifications and/or additions to the United States.

Raptor Nest Mitigation

- A BLM Wildlife Biologist must be contacted by the operator prior to construction activities to determine if the raptor nest is active.
- Raptor nests on special, natural habitat features, such as trees, large brush, cliff faces and escarpments, will be protected by not allowing surface disturbance within up to 200 meters of nests or by delaying activity for up to 90 days, or a combination of both. Exceptions to this requirement for raptor nests will be considered if the nests expected to be disturbed are inactive, the proposed activity is of short duration (e.g. habitat enhancement projects, fences, pipelines), and will not result in continuing activity in proximity to the nest.
- Exhaust noise from pump jack engines must be muffled or otherwise controlled so as not to exceed 75 db measured at 30 ft. from the source of the noise.

Visual Resource Management (VRM)

- Above-ground structures including meter housing that are not subject to safety requirements are painted a flat non-reflective paint color, Shale Green from the BLM Standard Environmental Color Chart (CC-001: June 2008)
- Chevron would use minimal light necessary for site safety, security, and operations.
- Light should be directed downward or only where needed.
- Low-pressure sodium lamps, such as yellow LED lighting (3,000 Kelvin or less) or equivalent, would be used to reduce sky glow and wildlife impacts.
- Properly shielded and mounted light fixtures would be used to reduce sky glow from upward pointing light, as well as trespass from light falling outside of desired area of illumination. Full cutoff shielding would be used during production.

Cave and Karst

** Depending on location, additional Drilling, Casing, and Cementing procedures may be required by engineering to protect critical karst groundwater recharge areas.

Cave/Karst Surface Mitigation

The following stipulations will be applied to minimize impacts during construction, drilling and production.

Construction:
In the advent that any underground voids are opened up during construction activities, construction activities will be halted and the BLM will be notified immediately.

No Blasting:
No blasting will be utilized for pad construction. The pad will be constructed and leveled by adding the necessary fill and caliche.

Pad Berming:
The entire perimeter of the well pad will be bermed to prevent oil, salt, and other chemical contaminants from leaving the well pad.

- The compacted berm shall be constructed at a minimum of 12 inches high with impermeable mineral material (e.g. caliche).
- No water flow from the uphill side(s) of the pad shall be allowed to enter the well pad.
- The topsoil stockpile shall be located outside the bermed well pad.
- Topsoil, either from the well pad or surrounding area, shall not be used to construct the berm.
- No storm drains, tubing or openings shall be placed in the berm.
- If fluid collects within the bermed area, the fluid must be vacuumed into a safe container and disposed of properly at a state approved facility.
- The integrity of the berm shall be maintained around the surfaced pad throughout the life of the well and around the downsized pad after interim reclamation has been completed.
- Any access road entering the well pad shall be constructed so that the integrity of the berm height surrounding the well pad is not compromised. (Any access road crossing the berm cannot be lower than the berm height.)

Tank Battery Liners and Berms:
Tank battery locations and all facilities will be lined and bermed. A 20 mil permanent liner will be installed with a 4 oz. felt backing to prevent tears or punctures. Tank battery berms must be large enough to contain 1 ½ times the content of the largest tank.

Leak Detection System:
A method of detecting leaks is required. The method could incorporate gauges to measure loss, situating values and lines so they can be visually inspected, or installing

electronic sensors to alarm when a leak is present. Leak detection plan will be submitted to BLM for approval.

Automatic Shut-off Systems:
Automatic shut off, check values, or similar systems will be installed for pipelines and tanks to minimize the effects of catastrophic line failures used in production or drilling.

Cave/Karst Subsurface Mitigation

The following stipulations will be applied to protect cave/karst and ground water concerns:

Rotary Drilling with Fresh Water:
Fresh water will be used as a circulating medium in zones where caves or karst features are expected. SEE ALSO: Drilling COAs for this well.

Directional Drilling:
Kick off for directional drilling will occur at least 100 feet below the bottom of the cave occurrence zone. SEE ALSO: Drilling COAs for this well.

Lost Circulation:
ALL lost circulation zones from the surface to the base of the cave occurrence zone will be logged and reported in the drilling report.

Regardless of the type of drilling machinery used, if a void of four feet or more and circulation losses greater than 70 percent occur simultaneously while drilling in any cave-bearing zone, the BLM will be notified immediately by the operator. The BLM will assess the situation and work with the operator on corrective actions to resolve the problem.

Abandonment Cementing:
Upon well abandonment in high cave karst areas additional plugging conditions of approval may be required. The BLM will assess the situation and work with the operator to ensure proper plugging of the wellbore.

Pressure Testing:
Annual pressure monitoring will be performed by the operator on all casing annuli and reported in a sundry notice. If the test results indicated a casing failure has occurred, remedial action will be undertaken to correct the problem to the BLM's approval.

VI. CONSTRUCTION

A. NOTIFICATION

The BLM shall administer compliance and monitor construction of the access road and well pad. Notify the Carlsbad Field Office at (575) 234-5909 at least 3 working days prior to commencing construction of the access road and/or well pad.

When construction operations are being conducted on this well, the operator shall have the approved APD and Conditions of Approval (COA) on the well site and they shall be made available upon request by the Authorized Officer.

B. TOPSOIL

The operator shall strip the top portion of the soil (root zone) from the entire well pad area and stockpile the topsoil along the edge of the well pad as depicted in the APD. The root zone is typically six (6) inches in depth. All the stockpiled topsoil will be redistributed over the interim reclamation areas. Topsoil shall not be used for berming the pad or facilities. For final reclamation, the topsoil shall be spread over the entire pad area for seeding preparation.

Other subsoil (below six inches) stockpiles must be completely segregated from the topsoil stockpile. Large rocks or subsoil clods (not evident in the surrounding terrain) must be buried within the approved area for interim and final reclamation.

C. CLOSED LOOP SYSTEM

Tanks are required for drilling operations: No Pits.

The operator shall properly dispose of drilling contents at an authorized disposal site.

D. FEDERAL MINERAL MATERIALS PIT

Payment shall be made to the BLM prior to removal of any federal mineral materials. Call the Carlsbad Field Office at (575) 234-5972.

E. WELL PAD SURFACING

Surfacing of the well pad is not required.

If the operator elects to surface the well pad, the surfacing material may be required to be removed at the time of reclamation.The well pad shall be constructed in a manner which creates the smallest possible surface disturbance, consistent with safety and operational needs.

F. EXCLOSURE FENCING (CELLARS & PITS)

Exclosure Fencing
The operator will install and maintain exclosure fencing for all open well cellars to prevent access to public, livestock, and large forms of wildlife before and after drilling operations until the pit is free of fluids and the operator initiates backfilling. (For examples of exclosure fencing design, refer to BLM's Oil and Gas Gold Book, Exclosure Fence Illustrations, Figure 1, Page 18.)

G. ON LEASE ACCESS ROADS

Road Width
The access road shall have a driving surface that creates the smallest possible surface disturbance and does not exceed fourteen (14) feet in width. The maximum width of surface disturbance, when constructing the access road, shall not exceed twenty-five (25) feet.

Surfacing
Surfacing material is not required on the new access road driving surface. If the operator elects to surface the new access road or pad, the surfacing material may be required to be removed at the time of reclamation.

Where possible, no improvements should be made on the unsurfaced access road other than to remove vegetation as necessary, road irregularities, safety issues, or to fill low areas that may sustain standing water.

The Authorized Officer reserves the right to require surfacing of any portion of the access road at any time deemed necessary. Surfacing may be required in the event the road deteriorates, erodes, road traffic increases, or it is determined to be beneficial for future field development. The surfacing depth and type of material will be determined at the time of notification.

Crowning
Crowning shall be done on the access road driving surface. The road crown shall have a grade of approximately 2% (i.e., a 1" crown on a 14' wide road). The road shall conform to Figure 1; cross section and plans for typical road construction.

Ditching
Ditching shall be required on both sides of the road.

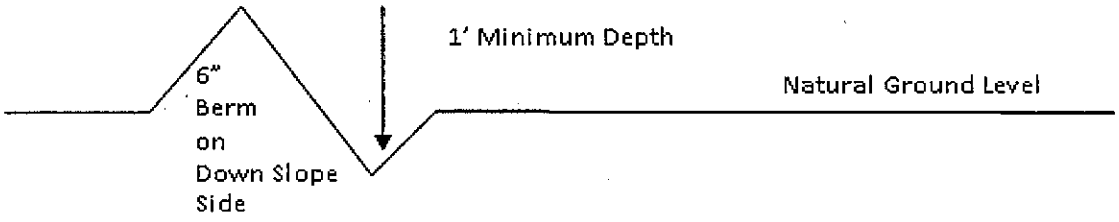
Turnouts
Vehicle turnouts shall be constructed on the road. Turnouts shall be intervisible with interval spacing distance less than 1000 feet. Turnouts shall conform to Figure 1; cross section and plans for typical road construction.

Drainage

Drainage control systems shall be constructed on the entire length of road (e.g. ditches, sidehill outsloping and insloping, lead-off ditches, culvert installation, and low water crossings).

A typical lead-off ditch has a minimum depth of 1 foot below and a berm of 6 inches above natural ground level. The berm shall be on the down-slope side of the lead-off ditch.

Cross Section of a Typical Lead-off Ditch



All lead-off ditches shall be graded to drain water with a 1 percent minimum to 3 percent maximum ditch slope. The spacing interval are variable for lead-off ditches and shall be determined according to the formula for spacing intervals of lead-off ditches, but may be amended depending upon existing soil types and centerline road slope (in %);

Formula for Spacing Interval of Lead-off Ditches

Example - On a 4% road slope that is 400 feet long, the water flow shall drain water into a lead-off ditch. Spacing interval shall be determined by the following formula:

400 foot road with 4% road slope: $\frac{400'}{4\%} + 100' = 200'$ lead-off ditch interval

Cattleguards

An appropriately sized cattleguard sufficient to carry out the project shall be installed and maintained at fence/road crossings. Any existing cattleguards on the access road route shall be repaired or replaced if they are damaged or have deteriorated beyond practical use. The operator shall be responsible for the condition of the existing cattleguards that are in place and are utilized during lease operations.

Fence Requirement

Where entry is granted across a fence line, the fence shall be braced and tied off on both sides of the passageway prior to cutting. The operator shall notify the private surface landowner or the grazing allotment holder prior to crossing any fences.

Public Access

Public access on this road shall not be restricted by the operator without specific written approval granted by the Authorized Officer.

Construction Steps

1. Salvage topsoil
2. Construct road
3. Redistribute topsoil
4. Revegetate slopes

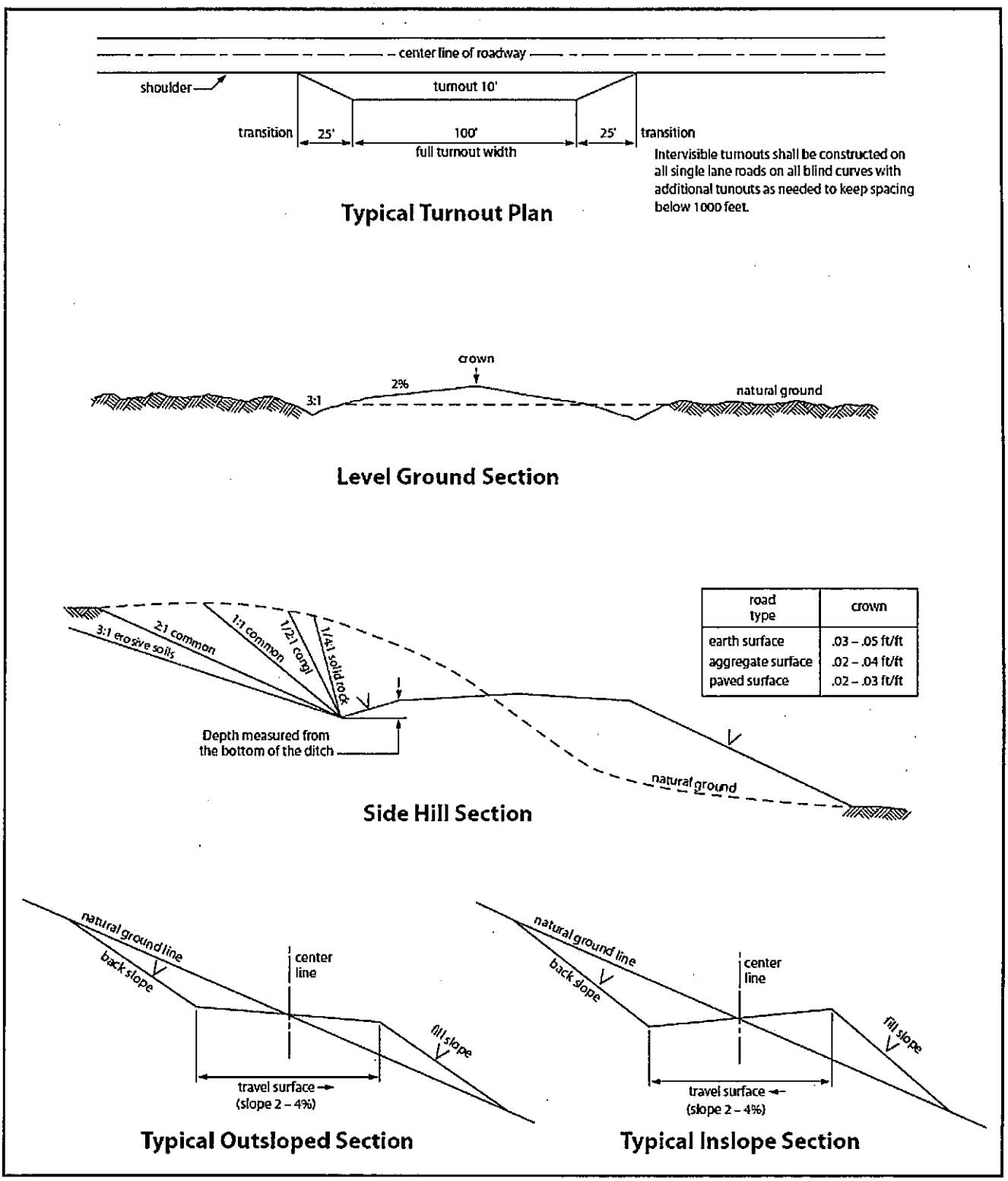


Figure 1. Cross-sections and plans for typical road sections representative of BLM resource or FS local and higher-class roads.

VII. DRILLING

A. DRILLING OPERATIONS REQUIREMENTS

The BLM is to be notified in advance for a representative to witness:

a. Spudding well (minimum of 24 hours)
b. Setting and/or Cementing of all casing strings (minimum of 4 hours)
c. BOPE tests (minimum of 4 hours)

☒ **Eddy County**
Call the Carlsbad Field Office, 620 East Greene St., Carlsbad, NM 88220, (575) 361-2822

1. **Hydrogen Sulfide (H2S) monitors shall be installed prior to drilling out the surface shoe. If H2S is detected in concentrations greater than 100 ppm, the Hydrogen Sulfide area shall meet Onshore Order 6 requirements, which includes equipment and personnel/public protection items. If Hydrogen Sulfide is encountered, provide measured values and formations to the BLM.**

2. Unless the production casing has been run and cemented or the well has been properly plugged, the drilling rig shall not be removed from over the hole without prior approval. **If the drilling rig is removed without approval – an Incident of Non-Compliance will be written and will be a "Major" violation.**

3. **The operator has proposed to drill multiple wells utilizing a skid/walking rig. Operator shall secure the wellbore on the current well, after installing and testing the wellhead, by installing a blind flange of like pressure rating to the wellhead and a pressure gauge that can be monitored while drilling is performed on the other wells.**

4. Floor controls are required for 3M or Greater systems. These controls will be on the rig floor, unobstructed, readily accessible to the driller and will be operational at all times during drilling and/or completion activities. Rig floor is defined as the area immediately around the rotary table; the area immediately above the substructure on which the draw works is located, this does not include the dog house or stairway area.

5. **The record of the drilling rate along with the GR/N well log run from TD to surface (horizontal well – vertical portion of hole) shall be submitted to the BLM office as well as all other logs run on the borehole 30 days from completion. If available, a digital copy of the logs is to be submitted in addition to the paper copies. The Rustler top and top and bottom of Salt are to be recorded on the Completion Report.**

B. CASING

Changes to the approved APD casing program need prior approval if the items substituted are of lesser grade or different casing size or are Non-API. The Operator can exchange the components of the proposal with that of superior strength (i.e. changing from J-55 to N-80, or from 36# to 40#). Changes to the

approved cement program need prior approval if the altered cement plan has less volume or strength or if the changes are substantial (i.e. Multistage tool, ECP, etc.). The initial wellhead installed on the well will remain on the well with spools used as needed.

Centralizers required on surface casing per Onshore Order 2.III.B.1.f.

Wait on cement (WOC) for Water Basin:
After cementing but before commencing any tests, the casing string shall stand cemented under pressure until both of the following conditions have been met: 1) cement reaches a minimum compressive strength of 500 psi at the shoe, 2) until cement has been in place at least 8 hours. WOC time will be recorded in the driller's log. See individual casing strings for details regarding lead cement slurry requirements.

Provide compressive strengths including hours to reach required 500 pounds compressive strength prior to cementing each casing string. Have well specific cement details onsite prior to pumping the cement for each casing string.

No pea gravel permitted for remedial or fall back remedial without prior authorization from the BLM engineer.

High Cave/Karst
Possibility of water flows in the Castillo and Salado.
Possibility of lost circulation in the Delaware.
Abnormal Pressures may be encountered when penetrating the 3rd Bone Spring Sandstone and all subsequent formations.

A MINIMUM OF TWO CASING STRINGS CEMENTED TO SURFACE IS REQUIRED IN HIGH CAVE/KARST AREAS. THE CEMENT MUST BE IN A SOLID SHEATH. THEREFORE, ONE INCH OPERATIONS ARE NOT SUFFICIENT TO PROTECT CAVE KARST RESOURCES. A CASING DESIGN THAT HAS A ONE INCH JOB PERFORMED DOES NOT COUNT AS A SOLID SHEATH. IF THE PRIMARY CEMENT JOB ON THE SURFACE CASING DOES NOT CIRCULATE, THEN THE NEXT TWO CASING STRINGS MUST BE CEMENTED TO SURFACE.

1. The **13-3/8** inch surface casing shall be set at approximately **450** feet (a minimum of 25 feet into the Rustler Anhydrite and above the salt) and cemented to the surface. **If salt is encountered, set casing at least 25 feet above the salt.**
    a. If cement does not circulate to the surface, the appropriate BLM office shall be notified and a temperature survey utilizing an electronic type temperature survey with surface log readout will be used or a cement bond log shall be run to verify the top of the cement. Temperature survey will be run a minimum of six hours after pumping cement and ideally between 8-10 hours after completing the cement job.

b. **Wait on cement (WOC) time for a primary cement job is to include the lead cement slurry.**
c. Wait on cement (WOC) time for a remedial job will be a minimum of 4 hours after bringing cement to surface or 500 pounds compressive strength, whichever is greater.
d. If cement falls back, remedial cementing will be done prior to drilling out that string.

Formation below the 13-3/8" shoe to be tested according to Onshore Order 2.III.B.1.i. Test to be done as a mud equivalency test using the mud weight necessary for the pore pressure of the formation below the shoe and the mud weight for the bottom of the hole. Report results to BLM office.

Intermediate casing shall be kept fluid filled while running into hole to meet BLM minimum collapse requirements.

2. The minimum required fill of cement behind the **9-5/8** inch intermediate casing is:

Operator has proposed DV tool at depth of 2100', but will adjust cement proportionately if moved. DV tool shall be set a minimum of 50' below previous shoe and a minimum of 200' above current shoe. Operator shall submit sundry if DV tool depth cannot be set in this range. If an ECP is used, it is to be set a minimum of 50' below the shoe to provide cement across the shoe. If it cannot be set below the shoe, a CBL shall be run to verify cement coverage.

a. First stage to DV tool:
☒ Cement to circulate. If cement does not circulate, contact the appropriate BLM office before proceeding with second stage cement job. Operator should have plans as to how they will achieve circulation on the next stage.
b. Second stage above DV tool:
☒ Cement to surface. If cement does not circulate see B.1.a, c-d above. **Wait on cement (WOC) time for a primary cement job is to include the lead cement slurry due to cave/karst. Excess calculates to 22% - Additional cement may be required.**

Formation below the 9-5/8" shoe to be tested according to Onshore Order 2.III.B.1.i. Test to be done as a mud equivalency test using the mud weight necessary for the pore pressure of the formation below the shoe (not the mud weight required to prevent dissolving the salt formation) and the mud weight for the bottom of the hole. Report results to BLM office.

Centralizers required on horizontal leg, must be type for horizontal service and a minimum of one every other joint.

3. The minimum required fill of cement behind the **5-1/2** inch production casing is:

☒ Cement as proposed by operator. Operator shall provide method of verification.

4. If hardband drill pipe is rotated inside casing, returns will be monitored for metal. If metal is found in samples, drill pipe will be pulled and rubber protectors which have a larger diameter than the tool joints of the drill pipe will be installed prior to continuing drilling operations.

C. PRESSURE CONTROL

1. All blowout preventer (BOP) and related equipment (BOPE) shall comply with well control requirements as described in Onshore Oil and Gas Order No. 2 and API 53.

2. Minimum working pressure of the blowout preventer (BOP) and related equipment (BOPE) required for drilling below the surface casing shoe shall be **10,000 (10M)** psi. **10M system requires an HCR valve, remote kill line and annular to match. The remote kill line is to be installed prior to testing the system and tested to stack pressure.** BOP/BOPE shall be tested after nipple up according to Onshore Order #2.

3. The appropriate BLM office shall be notified a minimum of 4 hours in advance for a representative to witness the tests.
   a. In a water basin, for all casing strings utilizing slips, these are to be set as soon as the crew and rig are ready and any fallback cement remediation has been done. The casing cut-off and BOP installation can be initiated four hours after installing the slips, which will be approximately six hours after bumping the plug. For those casing strings not using slips, the minimum wait time before cut-off is eight hours after bumping the plug. BOP/BOPE testing can begin after cut-off or once cement reaches 500 psi compressive strength (including lead when specified), whichever is greater. However, if the float does not hold, cut-off cannot be initiated until cement reaches 500 psi compressive strength (including lead when specified).
   b. The tests shall be done by an independent service company utilizing a test plug **not a cup or J-packer**.
   c. The test shall be run on a 5000 psi chart for a 2-3M BOP/BOP, on a 10000 psi chart for a 5M BOP/BOPE and on a 15000 psi chart for a 10M BOP/BOPE. If a linear chart is used, it shall be a one hour chart. A circular chart shall have a maximum 2 hour clock. If a twelve hour or twenty-four hour chart is used, tester shall make a notation that it is run with a two hour clock.
   d. The results of the test shall be reported to the appropriate BLM office.
   e. All tests are required to be recorded on a calibrated test chart. **A copy of the BOP/BOPE test chart and a copy of independent service company test will be submitted to the appropriate BLM office.**
   f. The BOP/BOPE test shall include a low pressure test from 250 to 300 psi. The test will be held for a minimum of 10 minutes if test is done with a test plug and 30 minutes without a test plug. This test shall be performed prior to the test at full stack pressure.

g. BOP/BOPE must be tested by an independent service company within 500 feet of the top of the **Wolfcamp** formation if the time between the setting of the intermediate casing and reaching this depth exceeds 20 days. This test does not exclude the test prior to drilling out the casing shoe as per Onshore Order No. 2.

D. DRILLING MUD

Mud system monitoring equipment, with derrick floor indicators and visual and audio alarms, shall be operating before drilling into the **Wolfcamp** formation, and shall be used until production casing is run and cemented.

E. DRILL STEM TEST

If drill stem tests are performed, Onshore Order 2.III.D shall be followed.

F. WASTE MATERIAL AND FLUIDS

All waste (i.e. drilling fluids, trash, salts, chemicals, sewage, gray water, etc.) created as a result of drilling operations and completion operations shall be safely contained and disposed of properly at a waste disposal facility. No waste material or fluid shall be disposed of on the well location or surrounding area.

Porto-johns and trash containers will be on-location during fracturing operations or any other crew-intensive operations.

JAM 072516

VIII. PRODUCTION (POST DRILLING)

A. WELL STRUCTURES & FACILITIES

Placement of Production Facilities

Production facilities should be placed on the well pad to allow for maximum interim recontouring and revegetation of the well location.

Exclosure Netting (Open-top Tanks)

Immediately following active drilling or completion operations, the operator will take actions necessary to prevent wildlife and livestock access, including avian wildlife, to all open-topped tanks that contain or have the potential to contain salinity sufficient to cause harm to wildlife or livestock, hydrocarbons, or Resource Conservation and Recovery Act of 1976-exempt hazardous substances. At a minimum, the operator will net, screen, or cover open-topped tanks to exclude wildlife and livestock and prevent mortality. If the operator uses netting, the operator will cover and secure the open portion of the tank to prevent wildlife entry. The operator will net, screen, or cover the tanks until the operator removes the tanks from the location or the tanks no longer contain substances that could be harmful to wildlife or livestock. Use a maximum netting mesh size of 1 ½ inches. The netting must not be in contact with fluids and must not have holes or gaps.

Chemical and Fuel Secondary Containment and Exclosure Screening
The operator will prevent all hazardous, poisonous, flammable, and toxic substances from coming into contact with soil and water. At a minimum, the operator will install and maintain an impervious secondary containment system for any tank or barrel containing hazardous, poisonous, flammable, or toxic substances sufficient to contain the contents of the tank or barrel and any drips, leaks, and anticipated precipitation. The operator will dispose of fluids within the containment system that do not meet applicable state or U. S. Environmental Protection Agency livestock water standards in accordance with state law; the operator must not drain the fluids to the soil or ground. The operator will design, construct, and maintain all secondary containment systems to prevent wildlife and livestock exposure to harmful substances. At a minimum, the operator will install effective wildlife and livestock exclosure systems such as fencing, netting, expanded metal mesh, lids, and grate covers. Use a maximum netting mesh size of 1 ½ inches.

Open-Vent Exhaust Stack Exclosures
The operator will construct, modify, equip, and maintain all open-vent exhaust stacks on production equipment to prevent birds and bats from entering, and to discourage perching, roosting, and nesting. (*Recommended exclosure structures on open-vent exhaust stacks are in the shape of a cone.*) Production equipment includes, but may not be limited to, tanks, heater-treaters, separators, dehydrators, flare stacks, in-line units, and compressor mufflers.

Containment Structures
Proposed production facilities such as storage tanks and other vessels will have a secondary containment structure that is constructed to hold the capacity of 1.5 times the largest tank, plus freeboard to account for precipitation, unless more stringent protective requirements are deemed necessary.

Painting Requirement
All above-ground structures including meter housing that are not subject to safety requirements shall be painted a flat non-reflective paint color, **Shale Green** from the BLM Standard Environmental Color Chart (CC-001: June 2008).

B. PIPELINES

BURIED PIPELINE STIPULATIONS

A copy of the application (Grant, APD, or Sundry Notice) and attachments, including conditions of approval, survey plat and/or map, will be on location during construction. BLM personnel may request to you a copy of your permit during construction to ensure compliance with all stipulations.

Holder agrees to comply with the following stipulations to the satisfaction of the Authorized Officer:

1. The Holder shall indemnify the United States against any liability for damage to life or property arising from the occupancy or use of public lands under this grant.

2. The Holder shall comply with all applicable Federal laws and regulations existing or hereafter enacted or promulgated. In any event, the holder shall comply with the Toxic Substances Control Act of 1976 as amended, 15 USC 2601 et seq. (1982) with regards to any toxic substances that are used, generated by or stored on the right-of-way or on facilities authorized under this right-of-way grant. (See 40 CFR Part 702-799 and especially, provisions on polychlorinated biphenyls, 40 CFR 761.1-761.193.) Additionally, any release of toxic substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act, section 102b. A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to the authorized officer concurrent with the filing of the reports to the involved Federal agency or State government.

3. The holder agrees to indemnify the United States against any liability arising from the release of any hazardous substance or hazardous waste (as these terms are defined in the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. 9601, et seq. or the Resource Conservation and Recovery Act, 42 U.S.C.6901, et seq.) on the Right-of-Way (unless the release or threatened release is wholly unrelated to the Right-of-Way holder's activity on the Right-of-Way), or resulting from the activity of the Right-of-Way holder on the Right-of-Way. This agreement applies without regard to whether a release is caused by the holder, its agent, or unrelated third parties.

4. If, during any phase of the construction, operation, maintenance, or termination of the pipeline, any oil or other pollutant should be discharged from the pipeline system, impacting Federal lands, the control and total removal, disposal, and cleaning up of such oil or other pollutant, wherever found, shall be the responsibility of holder, regardless of fault. Upon failure of holder to control, dispose of, or clean up such discharge on or affecting Federal lands, or to repair all damages resulting therefrom, on the Federal lands, the Authorized Officer may take such measures as he deems necessary to control and clean up the discharge and restore the area, including where appropriate, the aquatic environment and fish and wildlife habitats, at the full expense of the holder. Such action by the Authorized Officer shall not relieve holder of any responsibility as provided herein.

5. All construction and maintenance activity will be confined to the authorized right-of-way.

6. The pipeline will be buried with a minimum cover of **36** inches between the top of the pipe and ground level.

7. The maximum allowable disturbance for construction in this right-of-way will be **30** feet:

- Blading of vegetation within the right-of-way will be allowed: maximum width of blading operations will not exceed **20** feet. The trench is included in this area. (*Blading is defined as the complete removal of brush and ground vegetation.*)
- Clearing of brush species within the right-of-way will be allowed: maximum width of clearing operations will not exceed **30** feet. The trench and bladed area are included in this area. (*Clearing is defined as the removal of brush while*

leaving ground vegetation (grasses, weeds, etc.) intact. Clearing is best accomplished by holding the blade 4 to 6 inches above the ground surface.)

- The remaining area of the right-of-way (if any) shall only be disturbed by compressing the vegetation. (*Compressing can be caused by vehicle tires, placement of equipment, etc.*)

8. The holder shall stockpile an adequate amount of topsoil where blading is allowed. The topsoil to be stripped is approximately ___6___ inches in depth. The topsoil will be segregated from other spoil piles from trench construction. The topsoil will be evenly distributed over the bladed area for the preparation of seeding.

9. The holder shall minimize disturbance to existing fences and other improvements on public lands. The holder is required to promptly repair improvements to at least their former state. Functional use of these improvements will be maintained at all times. The holder will contact the owner of any improvements prior to disturbing them. When necessary to pass through a fence line, the fence shall be braced on both sides of the passageway prior to cutting of the fence. No permanent gates will be allowed unless approved by the Authorized Officer.

10. Vegetation, soil, and rocks left as a result of construction or maintenance activity will be randomly scattered on this right-of-way and will not be left in rows, piles, or berms, unless otherwise approved by the Authorized Officer. The entire right-of-way shall be recontoured to match the surrounding landscape. The backfilled soil shall be compacted and a 6 inch berm will be left over the ditch line to allow for settling back to grade.

11. In those areas where erosion control structures are required to stabilize soil conditions, the holder will install such structures as are suitable for the specific soil conditions being encountered and which are in accordance with sound resource management practices.

12. The holder will reseed all disturbed areas. Seeding will be done according to the Attached seeding requirements, using the following seed mix.

( ) seed mixture 1	( ) seed mixture 3
() seed mixture 2	(X) seed mixture 4
( ) seed mixture 2/LPC	( ) Aplomado Falcon Mixture

13. All above-ground structures not subject to safety requirements shall be painted by the holder to blend with the natural color of the landscape. The paint used shall be color which simulates "Standard Environmental Colors" – **Shale Green,** Munsell Soil Color No. 5Y 4/2.

14. The pipeline will be identified by signs at the point of origin and completion of the right-of-way and at all road crossings. At a minimum, signs will state the holder's name, BLM serial number, and the product being transported. All signs and information thereon will be posted in a permanent, conspicuous manner, and will be maintained in a legible condition for the life of the pipeline.

15. The holder shall not use the pipeline route as a road for purposes other than routine maintenance as determined necessary by the Authorized Officer in consultation with the holder before maintenance begins. The holder will take whatever steps are necessary to ensure that the pipeline route is not used as a roadway. As determined necessary during the life of the pipeline, the Authorized Officer may ask the holder to construct temporary deterrence structures.

16. Any cultural and/or paleontological resources (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the Authorized Officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery will be made by the Authorized Officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the Authorized Officer after consulting with the holder.

17. The operator shall be held responsible if noxious weeds become established within the areas of operations. Weed control shall be required on the disturbed land where noxious weeds exist, which includes associated roads, pipeline corridor and adjacent land affected by the establishment of weeds due to this action. The operator shall consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies.

18. Escape Ramps - The operator will construct and maintain pipeline/utility trenches [that are not otherwise fenced, screened, or netted] to prevent livestock, wildlife, and humans from becoming entrapped. At a minimum, the operator will construct and maintain escape ramps, ladders, or other methods of avian and terrestrial wildlife escape in the trenches according to the following criteria:

a. Any trench left open for eight (8) hours or less is not required to have escape ramps; however, before the trench is backfilled, the contractor/operator shall inspect the trench for wildlife, remove all trapped wildlife, and release them at least 100 yards from the trench.
b. For trenches left open for eight (8) hours or more, earthen escape ramps (built at no more than a 30 degree slope and spaced no more than 500 feet apart) shall be placed in the trench.

C. ELECTRIC LINES

STANDARD STIPULATIONS FOR OVERHEAD ELECTRIC DISTRIBUTION LINES

A copy of the grant and attachments, including stipulations, survey plat and/or map, will be on location during construction. BLM personnel may request to you a copy of your permit during construction to ensure compliance with all stipulations.

Holder agrees to comply with the following stipulations to the satisfaction of the Authorized Officer:

1. The holder shall indemnify the United States against any liability for damage to life or property arising from the occupancy or use of public lands under this grant.

2. The holder shall comply with all applicable Federal laws and regulations existing or hereafter enacted or promulgated. In any event, the holder shall comply with the Toxic Substances Control Act of 1976 as amended, 15 USC 2601 et seq. (1982) with regards to any toxic substances that are used, generated by or stored on the right-of-way or on facilities authorized under this right-of-way grant. (See 40 CFR, Part 702-799 and especially, provisions on polychlorinated biphenyls, 40 CFR 761.1-761.193.) Additionally, any release of toxic substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR, Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act, section 102b. A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to the authorized officer concurrent with the filing of the reports to the involved Federal agency or State government.

3. The holder agrees to indemnify the United States against any liability arising from the release of any hazardous substance or hazardous waste (as these terms are defined in the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. 9601, et seq. or the Resource Conservation and Recovery Act, 42 U.S.C. 6901, et seq.) on the Right-of-Way (unless the release or threatened release is wholly unrelated to the Right-of-Way holder's activity on the Right-of-Way), or resulting from the activity of the Right-of-Way holder on the Right-of-Way. This agreement applies without regard to whether a release is caused by the holder, its agent, or unrelated third parties.

4. There will be no clearing or blading of the right-of-way unless otherwise agreed to in writing by the Authorized Officer.

5. Power lines shall be constructed and designed in accordance to standards outlined in "Suggested Practices for Avian Protection on Power lines: The State of the Art in 2006" Edison Electric Institute, APLIC, and the California Energy Commission 2006 . The holder shall assume the burden and expense of proving that pole designs not shown in the above publication deter raptor perching, roosting, and nesting. Such proof shall be provided by a raptor expert approved by the Authorized Officer. The BLM reserves the right to require modification or additions to all powerline structures placed on this right-

of-way, should they be necessary to ensure the safety of large perching birds. Such modifications and/or additions shall be made by the holder without liability or expense to the United States.

Raptor deterrence will consist of but not limited to the following: triangle perch discouragers shall be placed on each side of the cross arms and a nonconductive perching deterrence shall be placed on all vertical poles that extend past the cross arms.

6. The holder shall minimize disturbance to existing fences and other improvements on public lands. The holder is required to promptly repair improvements to at least their former state. Functional use of these improvements will be maintained at all times. The holder will contact the owner of any improvements prior to disturbing them. When necessary to pass through a fence line, the fence shall be braced on both sides of the passageway prior to cutting the fence. No permanent gates will be allowed unless approved by the Authorized Officer.

7. The BLM serial number assigned to this authorization shall be posted in a permanent, conspicuous manner where the power line crosses roads and at all serviced facilities. Numbers will be at least two inches high and will be affixed to the pole nearest the road crossing and at the facilities served.

8. Upon cancellation, relinquishment, or expiration of this grant, the holder shall comply with those abandonment procedures as prescribed by the Authorized Officer.

9. All surface structures (poles, lines, transformers, etc.) shall be removed within 180 days of abandonment, relinquishment, or termination of use of the serviced facility or facilities or within 180 days of abandonment, relinquishment, cancellation, or expiration of this grant, whichever comes first. This will not apply where the power line extends service to an active, adjoining facility or facilities.

10. Any cultural and/or paleontological resource (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the Authorized Officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery will be made by the Authorized Officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the Authorized Officer after consulting with the holder.

11. Special Stipulations:
- For reclamation remove poles, lines, transformer, etc. and dispose of properly.
- Fill in any holes from the poles removed.

IX. INTERIM RECLAMATION

During the life of the development, all disturbed areas not needed for active support of production operations should undergo interim reclamation in order to minimize the environmental impacts of development on other resources and uses.

Within six (6) months of well completion, operators should work with BLM surface management specialists (Jim Amos: 575-234-5909) to devise the best strategies to reduce the size of the location. Interim reclamation should allow for remedial well operations, as well as safe and efficient removal of oil and gas.

During reclamation, the removal of caliche is important to increasing the success of revegetating the site. Removed caliche that is free of contaminants may be used for road repairs, fire walls or for building other roads and locations. In order to operate the well or complete workover operations, it may be necessary to drive, park and operate on restored interim vegetation within the previously disturbed area. Disturbing revegetated areas for production or workover operations will be allowed. If there is significant disturbance and loss of vegetation, the area will need to be revegetated. Communicate with the appropriate BLM office for any exceptions/exemptions if needed.

All disturbed areas after they have been satisfactorily prepared need to be reseeded with the seed mixture provided below.

Upon completion of interim reclamation, the operator shall submit a Sundry Notices and Reports on Wells, Subsequent Report of Reclamation (Form 3160-5).

X. FINAL ABANDONMENT & RECLAMATION

At final abandonment, well locations, production facilities, and access roads must undergo "final" reclamation so that the character and productivity of the land are restored.

Earthwork for final reclamation must be completed within six (6) months of well plugging. All pads, pits, facility locations and roads must be reclaimed to a satisfactory revegetated, safe, and stable condition, unless an agreement is made with the landowner or BLM to keep the road and/or pad intact.

After all disturbed areas have been satisfactorily prepared, these areas need to be revegetated with the seed mixture provided below. Seeding should be accomplished by drilling on the contour whenever practical or by other approved methods. Seeding may need to be repeated until revegetation is successful, as determined by the BLM.

Operators shall contact a BLM surface protection specialist prior to surface abandonment operations for site specific objectives (Jim Amos: 575-234-5909).

Mixture 4, for Gypsum Sites

The holder shall seed all the disturbed areas with the seed mixture listed below. The seed mixture shall be planted in the amounts specified in pounds of pure live seed (PLS)* per acre. There shall be no primary or secondary noxious weeds in the seed mixture. Seed will be tested and the viability testing of seed will be done in accordance with State law(s) and within nine (9) months prior to purchase. Commercial seed will be either certified or registered seed. The seed container will be tagged in accordance with State law(s) and available for inspection by the authorized officer.

Seed will be planted using a drill equipped with a depth regulator to ensure proper depth of planting where drilling is possible. The seed mixture will be evenly and uniformly planted over the disturbed area (smaller/heavier seeds have a tendency to drop the bottom of the drill and are planted first). The holder shall take appropriate measures to ensure this does not occur. Where drilling is not possible, seed will be broadcast and the area shall be raked or chained to cover the seed. When broadcasting the seed, the pounds per acre are to be doubled. The seeding will be repeated until a satisfactory stand is established as determined by the authorized officer. Evaluation of growth will not be made before completion of at least one full growing season after seeding.

Species to be planted in pounds of pure live seed* per acre:

Species	lb/acre
Alkli Sacaton (*Sporobolus airoides*)	1.5
DWS~ Four-wing saltbush (*Atriplex canescens*)	8.0

~DWS: DeWinged Seed

*Pounds of pure live seed:

Pounds of seed x percent purity x percent germination = pounds pure live seed

United States Department of the Interior
Bureau of Land Management
Carlsbad Field Office

Refer to: 3160-3

To: AFM, Lands & Minerals, CFO
From: Geologist, CFO
Subject: Geologic Review of Application for Permit to Drill

ORIGINAL

Operator: Chevron USA Inc

Well Name and Number: HH SO 8 P2-6H

Potash: No

Location: SHL:280'/N.& 960'/W. SEC017 T026S, R027E.(NWNW)

County Eddy **Lease Number:** NMNM118108 **APD Received:** 2-18-2016

Ground Level Elevation: 3245 **Surface Geology:** Psl-Salado Formation

TVD: 9628 **MD:** 20154 **BH Mud Weight:** 13.5

BHP: 6759 **MASP:** 4641

1. Geologic Marker Tops (from reports on surrounding wells):

Geologic Marker	WELCH #004 3001501153 T26S R27E Sec 20 990FNL 330FEL Elevation Depth	WELCH ABV FEDERAL #001 3001501159 T26S R27E Sec 21 660FNL 760FWL Elevation Depth	BLAST BLA FEDERAL #001 3001536136 T26S R27E Sec 17 1980FSL 1650FEL Elevation Depth	Cluster State Com 1H 3001537547 T26S R27E Sec 16 380FNL 330FWL Elevation Depth	**Proposed Well** HH SO 8 P2-6H T026S, R027E.(NWNWSEC017 280'/N.& 960'/W Unit Elevation Estimated Depth
Top of Salt	-	-	0	0	0
Castile	432	-	-	480	525
Lamar	2040	2028	2137	2140	2015
Bell Canyon	2100	2062	2178	2200	2065
Bone Spring Lime	-	5690	5720	5740	5615
1st BS Sand	-	6570	6682	6684	6565
2nd BS Sand	-	7330	7350	7382	7245
3rd BS Sand	-	8410	8510	8537	8385
Wolfcamp	-	8763	8857	8894	8745
Strawn	-	11210	11248	-	11125

2. Fresh Water Information

a. Fresh Water: 350

b. Fresh Water Remarks:

NEPA Log No: IT4RM-P020-2016-1711-EA

Reference Number: NMNM118108

Project Lead: Paul Murphy

Recd Date: 09-30-2016

Project Type:

Project Title: HH SO 8 P2 6H

Applicant: Chevron USA Inc

Routing Started: 10-04-2016

NEPA Checklist

Resource/Activity	Not Present	Not Impacted	**May be Impacted	Reviewer	COAs/Stips Req	Sign Off Date
Wastes, Hazardous or Solid	○	◉	○	Paul Murphy	☐	10-04-2016
Public Health and Safety	○	◉	○			
Enivronmental Justice	○	◉	○	Paul Murphy	☐	10-04-2016
General Topography/Surface Geology	○	◉	○			
Socio Economics	○	◉	○			
Lands/Realty, ROW	○	◉	○	Robert Gomez	☑	10-06-2016
Access/Transportation	○	◉	○			
Vegetation/Forestry	○	○	◉	Stephen Daly	☐	10-06-2016
Livestock Grazing	○	○	◉			
Invasive, Non-Native Species	○	○	◉			
Soils	○	○	◉	Stephen Daly	☐	10-06-2016
Air Quality	○	○	◉			
Floodplains	○	◉	○	Stephen Daly	☐	10-06-2016
Water Quality Surface/Ground	○	○	◉			
Watershed	○	○	◉			
Mineral Materials	○	○	◉	Paul Murphy	☐	10-04-2016
Potash	◉	○	○	Paul Murphy	☐	10-04-2016
Endangered Species	◉	○	○	Cassandra Brooks	☐	10-06-2016
Wetlands/Riparian Zones	◉	○	○			
Special Status Species	◉	○	○			
Wildlife Habitat	○	○	◉			
Karst Resources	○	○	◉	Stan Allison	☑	10-07-2016
ACECs	○	◉	○	Cassandra Brooks	☐	10-06-2016
Wild/Scenic Rivers	◉	○	○	Stan Allison	☐	10-07-2016
Wilderness	◉	○	○			
Outdoor Recreation	○	○	◉			
Visual Resources	○	○	◉			
Native American Religious Concerns	◉ Unknown			Stephanie Bergman	☐	10-07-2016
Cultural Resources	○	◉	○			
Paleontology	◉ Unknown					

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Pecos District
Carlsbad Field Office
620 East Greene Street
Carlsbad, NM 88220

Hayhurst Master Development Plan Environmental Assessment

NEPA No. DOI-BLM-NM-P020-2016-1434-EA

Conditions of Approval

In order to ensure that the proponent's impacts are consistent with the operating parameters considered in the air quality analysis, Conditions of Approval (COA) will be applied to Applications for Permit to Drill requested under the Hayhurst Master Development Plan. These COAs are:

- All project activities including equipment emissions shall meet or exceed all state and federal standards for air quality as regulated by the New Mexico Environment Department Air Quality Bureau and the U.S. Environmental Protection Agency.

- The operator will implement a drill and completion rig schedule where Tier 4 (or equivalent) drill and completion rigs are phased in. The operator will not exceed four drill rigs at one time and will be 100% compliant with Tier 4 (or equivalent) standards in 2020.

- During the drilling phase, the operator will emit NOx emissions of 262.95 tons per year (tpy) or less from nonroad (mobile sources) between Year 1 and Year 3 and 220.7 tpy or less from nonroad (mobile sources) for the remainder of the drilling phase.

- The operator will emit 213.6 tpy or less of NOx emissions during production operations, as defined in the emission inventory analyzed in the Environmental Assessment. The operator will submit emissions and/or parameters with an Application for Permit to Drill or annual emissions inventory that show the NOx emissions are within the limits of the air quality analysis within the Environmental Assessment.

PECOS DISTRICT
CONDITIONS OF APPROVAL

OPERATOR'S NAME:	**Chevron USA Inc.**
LEASE NO.:	**NMNM-118108**
WELL NAME & NO.:	**HH SO 8 P2 6H**
SURFACE HOLE FOOTAGE:	**0280' FNL & 0960' FWL**
BOTTOM HOLE FOOTAGE	**0180' FNL & 0996' FWL Sec. 05, T. 26 S., R 27 E.**
LOCATION:	**Section 17, T. 26 S., R 27 E., NMPM**
COUNTY:	**Eddy County, New Mexico**

TABLE OF CONTENTS

Standard Conditions of Approval (COA) apply to this APD. If any deviations to these standards exist or special COAs are required, the section with the deviation or requirement will be checked below.

☐ **General Provisions**
☐ **Permit Expiration**
☐ **Archaeology, Paleontology, and Historical Sites**
☐ **Noxious Weeds**
☒ **Special Requirements**
- Cave/Karst
- Raptor Nest
- Avian Protection
- VRM
- Cultural

☐ **Construction**
- Notification
- Topsoil
- Closed Loop System
- Federal Mineral Material Pits
- Well Pads
- Roads

☐ **Road Section Diagram**
☒ **Drilling**
- Cement Requirements
- High Cave/Karst
- Logging Requirements
- Waste Material and Fluids

☒ **Production (Post Drilling)**
- Well Structures & Facilities
- Pipelines
- Electric Lines

☐ **Interim Reclamation**
☐ **Final Abandonment & Reclamation**

I. GENERAL PROVISIONS

The approval of the Application For Permit To Drill (APD) is in compliance with all applicable laws and regulations: 43 Code of Federal Regulations 3160, the lease terms, Onshore Oil and Gas Orders, Notices To Lessees, New Mexico Oil Conservation Division (NMOCD) Rules, National Historical Preservation Act As Amended, and instructions and orders of the Authorized Officer. Any request for a variance shall be submitted to the Authorized Officer on Form 3160-5, Sundry Notices and Report on Wells.

II. PERMIT EXPIRATION

If the permit terminates prior to drilling and drilling cannot be commenced within 60 days after expiration, an operator is required to submit Form 3160-5, Sundry Notices and Reports on Wells, requesting surface reclamation requirements for any surface disturbance. However, if the operator will be able to initiate drilling within 60 days after the expiration of the permit, the operator must have set the conductor pipe in order to allow for an extension of 60 days beyond the expiration date of the APD. (Filing of a Sundry Notice is required for this 60 day extension.)

III. ARCHAEOLOGICAL, PALEONTOLOGY & HISTORICAL SITES

Any cultural and/or paleontological resource discovered by the operator or by any person working on the operator's behalf shall immediately report such findings to the Authorized Officer. The operator is fully accountable for the actions of their contractors and subcontractors. The operator shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery shall be made by the Authorized Officer to determine the appropriate actions that shall be required to prevent the loss of significant cultural or scientific values of the discovery. The operator shall be held responsible for the cost of the proper mitigation measures that the Authorized Officer assesses after consultation with the operator on the evaluation and decisions of the discovery. Any unauthorized collection or disturbance of cultural or paleontological resources may result in a shutdown order by the Authorized Officer.

IV. NOXIOUS WEEDS

The operator shall be held responsible if noxious weeds become established within the areas of operations. Weed control shall be required on the disturbed land where noxious weeds exist, which includes the roads, pads, associated pipeline corridor, and adjacent land affected by the establishment of weeds due to this action. The operator shall consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies.

V. SPECIAL REQUIREMENT(S)

Avian Protection

Power lines shall be constructed and designed in accordance to standards outlined in "Suggested Practices for Avian Protection on Power lines: The State of the Art in 2006" Edison Electric Institute, APLIC, and the California Energy Commission 2006. The holder shall assume the burden and expense of proving that pole designs not shown in the above publication deter raptor perching, roosting, and nesting. Such proof shall be provided by a raptor expert approved by the Authorized Officer. The BLM reserves the right to require modification or additions to all power line structures placed on this right-of-way, should they be necessary to ensure the safety of large perching birds. The holder without liability or expense shall make such modifications and/or additions to the United States.

Raptor Nest Mitigation

- A BLM Wildlife Biologist must be contacted by the operator prior to construction activities to determine if the raptor nest is active.
- Raptor nests on special, natural habitat features, such as trees, large brush, cliff faces and escarpments, will be protected by not allowing surface disturbance within up to 200 meters of nests or by delaying activity for up to 90 days, or a combination of both. Exceptions to this requirement for raptor nests will be considered if the nests expected to be disturbed are inactive, the proposed activity is of short duration (e.g. habitat enhancement projects, fences, pipelines), and will not result in continuing activity in proximity to the nest.
- Exhaust noise from pump jack engines must be muffled or otherwise controlled so as not to exceed 75 db measured at 30 ft. from the source of the noise.

Visual Resource Management (VRM)

- Above-ground structures including meter housing that are not subject to safety requirements are painted a flat non-reflective paint color, Shale Green from the BLM Standard Environmental Color Chart (CC-001: June 2008)
- Chevron would use minimal light necessary for site safety, security, and operations.
- Light should be directed downward or only where needed.
- Low-pressure sodium lamps, such as yellow LED lighting (3,000 Kelvin or less) or equivalent, would be used to reduce sky glow and wildlife impacts.
- Properly shielded and mounted light fixtures would be used to reduce sky glow from upward pointing light, as well as trespass from light falling outside of desired area of illumination. Full cutoff shielding would be used during production.

Cave and Karst

** Depending on location, additional Drilling, Casing, and Cementing procedures may be required by engineering to protect critical karst groundwater recharge areas.

Cave/Karst Surface Mitigation

The following stipulations will be applied to minimize impacts during construction, drilling and production.

Construction:
In the advent that any underground voids are opened up during construction activities, construction activities will be halted and the BLM will be notified immediately.

No Blasting:
No blasting will be utilized for pad construction. The pad will be constructed and leveled by adding the necessary fill and caliche.

Pad Berming:
The entire perimeter of the well pad will be bermed to prevent oil, salt, and other chemical contaminants from leaving the well pad.

- The compacted berm shall be constructed at a minimum of 12 inches high with impermeable mineral material (e.g. caliche).
- No water flow from the uphill side(s) of the pad shall be allowed to enter the well pad.
- The topsoil stockpile shall be located outside the bermed well pad.
- Topsoil, either from the well pad or surrounding area, shall not be used to construct the berm.
- No storm drains, tubing or openings shall be placed in the berm.
- If fluid collects within the bermed area, the fluid must be vacuumed into a safe container and disposed of properly at a state approved facility.
- The integrity of the berm shall be maintained around the surfaced pad throughout the life of the well and around the downsized pad after interim reclamation has been completed.
- Any access road entering the well pad shall be constructed so that the integrity of the berm height surrounding the well pad is not compromised. (Any access road crossing the berm cannot be lower than the berm height.)

Tank Battery Liners and Berms:
Tank battery locations and all facilities will be lined and bermed. A 20 mil permanent liner will be installed with a 4 oz. felt backing to prevent tears or punctures. Tank battery berms must be large enough to contain 1 ½ times the content of the largest tank.

Leak Detection System:
A method of detecting leaks is required. The method could incorporate gauges to measure loss, situating values and lines so they can be visually inspected, or installing

electronic sensors to alarm when a leak is present. Leak detection plan will be submitted to BLM for approval.

Automatic Shut-off Systems:
Automatic shut off, check values, or similar systems will be installed for pipelines and tanks to minimize the effects of catastrophic line failures used in production or drilling.

Cave/Karst Subsurface Mitigation

The following stipulations will be applied to protect cave/karst and ground water concerns:

Rotary Drilling with Fresh Water:
Fresh water will be used as a circulating medium in zones where caves or karst features are expected. SEE ALSO: Drilling COAs for this well.

Directional Drilling:
Kick off for directional drilling will occur at least 100 feet below the bottom of the cave occurrence zone. SEE ALSO: Drilling COAs for this well.

Lost Circulation:
ALL lost circulation zones from the surface to the base of the cave occurrence zone will be logged and reported in the drilling report.

Regardless of the type of drilling machinery used, if a void of four feet or more and circulation losses greater than 70 percent occur simultaneously while drilling in any cave-bearing zone, the BLM will be notified immediately by the operator. The BLM will assess the situation and work with the operator on corrective actions to resolve the problem.

Abandonment Cementing:
Upon well abandonment in high cave karst areas additional plugging conditions of approval may be required. The BLM will assess the situation and work with the operator to ensure proper plugging of the wellbore.

Pressure Testing:
Annual pressure monitoring will be performed by the operator on all casing annuli and reported in a sundry notice. If the test results indicated a casing failure has occurred, remedial action will be undertaken to correct the problem to the BLM's approval.

VI. CONSTRUCTION

A. NOTIFICATION

The BLM shall administer compliance and monitor construction of the access road and well pad. Notify the Carlsbad Field Office at (575) 234-5909 at least 3 working days prior to commencing construction of the access road and/or well pad.

When construction operations are being conducted on this well, the operator shall have the approved APD and Conditions of Approval (COA) on the well site and they shall be made available upon request by the Authorized Officer.

B. TOPSOIL

The operator shall strip the top portion of the soil (root zone) from the entire well pad area and stockpile the topsoil along the edge of the well pad as depicted in the APD. The root zone is typically six (6) inches in depth. All the stockpiled topsoil will be redistributed over the interim reclamation areas. Topsoil shall not be used for berming the pad or facilities. For final reclamation, the topsoil shall be spread over the entire pad area for seeding preparation.

Other subsoil (below six inches) stockpiles must be completely segregated from the topsoil stockpile. Large rocks or subsoil clods (not evident in the surrounding terrain) must be buried within the approved area for interim and final reclamation.

C. CLOSED LOOP SYSTEM

Tanks are required for drilling operations: No Pits.

The operator shall properly dispose of drilling contents at an authorized disposal site.

D. FEDERAL MINERAL MATERIALS PIT

Payment shall be made to the BLM prior to removal of any federal mineral materials. Call the Carlsbad Field Office at (575) 234-5972.

E. WELL PAD SURFACING

Surfacing of the well pad is not required.

If the operator elects to surface the well pad, the surfacing material may be required to be removed at the time of reclamation.The well pad shall be constructed in a manner which creates the smallest possible surface disturbance, consistent with safety and operational needs.

F. EXCLOSURE FENCING (CELLARS & PITS)

Exclosure Fencing
The operator will install and maintain exclosure fencing for all open well cellars to prevent access to public, livestock, and large forms of wildlife before and after drilling operations until the pit is free of fluids and the operator initiates backfilling. (For examples of exclosure fencing design, refer to BLM's Oil and Gas Gold Book, Exclosure Fence Illustrations, Figure 1, Page 18.)

G. ON LEASE ACCESS ROADS

Road Width
The access road shall have a driving surface that creates the smallest possible surface disturbance and does not exceed fourteen (14) feet in width. The maximum width of surface disturbance, when constructing the access road, shall not exceed twenty-five (25) feet.

Surfacing
Surfacing material is not required on the new access road driving surface. If the operator elects to surface the new access road or pad, the surfacing material may be required to be removed at the time of reclamation.

Where possible, no improvements should be made on the unsurfaced access road other than to remove vegetation as necessary, road irregularities, safety issues, or to fill low areas that may sustain standing water.

The Authorized Officer reserves the right to require surfacing of any portion of the access road at any time deemed necessary. Surfacing may be required in the event the road deteriorates, erodes, road traffic increases, or it is determined to be beneficial for future field development. The surfacing depth and type of material will be determined at the time of notification.

Crowning
Crowning shall be done on the access road driving surface. The road crown shall have a grade of approximately 2% (i.e., a 1" crown on a 14' wide road). The road shall conform to Figure 1; cross section and plans for typical road construction.

Ditching
Ditching shall be required on both sides of the road.

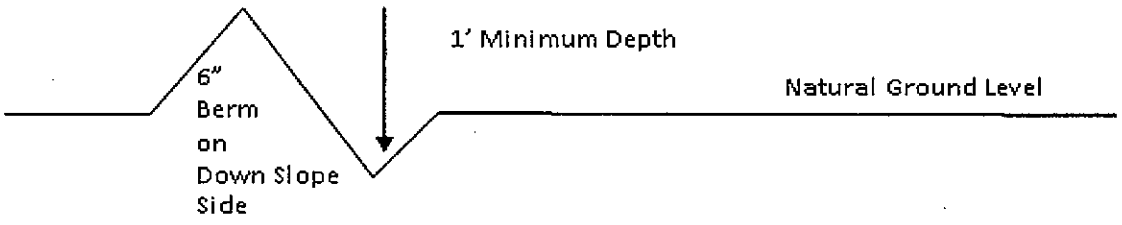
Turnouts
Vehicle turnouts shall be constructed on the road. Turnouts shall be intervisible with interval spacing distance less than 1000 feet. Turnouts shall conform to Figure 1; cross section and plans for typical road construction.

Drainage

Drainage control systems shall be constructed on the entire length of road (e.g. ditches, sidehill outsloping and insloping, lead-off ditches, culvert installation, and low water crossings).

A typical lead-off ditch has a minimum depth of 1 foot below and a berm of 6 inches above natural ground level. The berm shall be on the down-slope side of the lead-off ditch.

Cross Section of a Typical Lead-off Ditch



All lead-off ditches shall be graded to drain water with a 1 percent minimum to 3 percent maximum ditch slope. The spacing interval are variable for lead-off ditches and shall be determined according to the formula for spacing intervals of lead-off ditches, but may be amended depending upon existing soil types and centerline road slope (in %);

Formula for Spacing Interval of Lead-off Ditches

Example - On a 4% road slope that is 400 feet long, the water flow shall drain water into a lead-off ditch. Spacing interval shall be determined by the following formula:

400 foot road with 4% road slope: $\frac{400'}{4\%} + 100' = 200'$ lead-off ditch interval

Cattleguards

An appropriately sized cattleguard sufficient to carry out the project shall be installed and maintained at fence/road crossings. Any existing cattleguards on the access road route shall be repaired or replaced if they are damaged or have deteriorated beyond practical use. The operator shall be responsible for the condition of the existing cattleguards that are in place and are utilized during lease operations.

Fence Requirement

Where entry is granted across a fence line, the fence shall be braced and tied off on both sides of the passageway prior to cutting. The operator shall notify the private surface landowner or the grazing allotment holder prior to crossing any fences.

Public Access

Public access on this road shall not be restricted by the operator without specific written approval granted by the Authorized Officer.

Construction Steps

1. Salvage topsoil
2. Construct road
3. Redistribute topsoil
4. Revegetate slopes

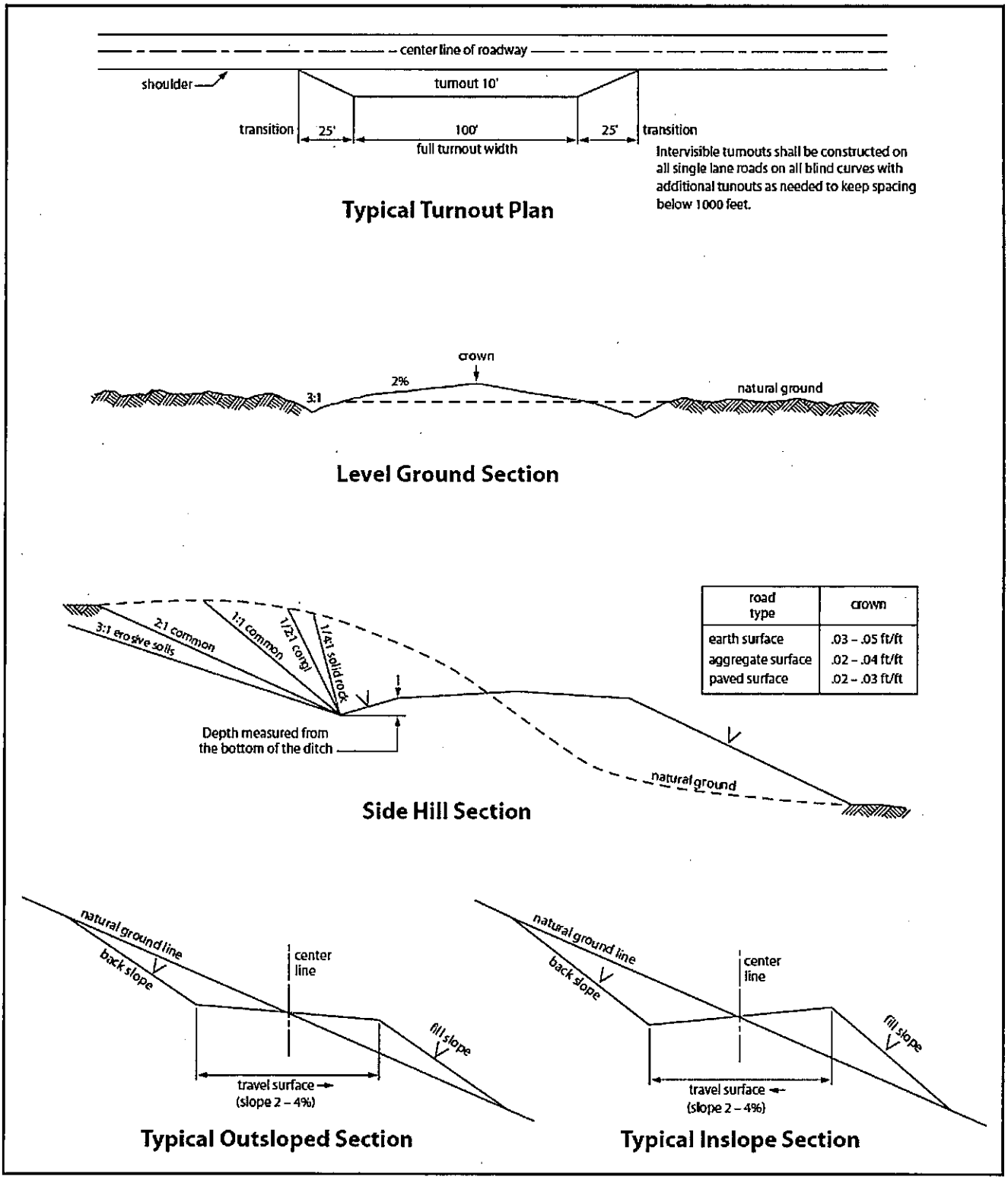


Figure 1. Cross-sections and plans for typical road sections representative of BLM resource or FS local and higher-class roads.

VII. DRILLING

A. DRILLING OPERATIONS REQUIREMENTS

The BLM is to be notified in advance for a representative to witness:

a. Spudding well (minimum of 24 hours)
b. Setting and/or Cementing of all casing strings (minimum of 4 hours)
c. BOPE tests (minimum of 4 hours)

☒ **Eddy County**
Call the Carlsbad Field Office, 620 East Greene St., Carlsbad, NM 88220, (575) 361-2822

1. **Hydrogen Sulfide (H2S) monitors shall be installed prior to drilling out the surface shoe. If H2S is detected in concentrations greater than 100 ppm, the Hydrogen Sulfide area shall meet Onshore Order 6 requirements, which includes equipment and personnel/public protection items. If Hydrogen Sulfide is encountered, provide measured values and formations to the BLM.**

2. Unless the production casing has been run and cemented or the well has been properly plugged, the drilling rig shall not be removed from over the hole without prior approval. **If the drilling rig is removed without approval – an Incident of Non-Compliance will be written and will be a "Major" violation.**

3. **The operator has proposed to drill multiple wells utilizing a skid/walking rig. Operator shall secure the wellbore on the current well, after installing and testing the wellhead, by installing a blind flange of like pressure rating to the wellhead and a pressure gauge that can be monitored while drilling is performed on the other wells.**

4. Floor controls are required for 3M or Greater systems. These controls will be on the rig floor, unobstructed, readily accessible to the driller and will be operational at all times during drilling and/or completion activities. Rig floor is defined as the area immediately around the rotary table; the area immediately above the substructure on which the draw works is located, this does not include the dog house or stairway area.

5. **The record of the drilling rate along with the GR/N well log run from TD to surface (horizontal well – vertical portion of hole) shall be submitted to the BLM office as well as all other logs run on the borehole 30 days from completion. If available, a digital copy of the logs is to be submitted in addition to the paper copies. The Rustler top and top and bottom of Salt are to be recorded on the Completion Report.**

B. CASING

Changes to the approved APD casing program need prior approval if the items substituted are of lesser grade or different casing size or are Non-API. The Operator can exchange the components of the proposal with that of superior strength (i.e. changing from J-55 to N-80, or from 36# to 40#). Changes to the approved cement program need prior approval if the altered cement plan has less volume or strength or if the changes are substantial (i.e. Multistage tool, ECP, etc.). The initial wellhead installed on the well will remain on the well with spools used as needed.

Centralizers required on surface casing per Onshore Order 2.III.B.1.f.

Wait on cement (WOC) for Water Basin:
After cementing but before commencing any tests, the casing string shall stand cemented under pressure until both of the following conditions have been met: 1) cement reaches a minimum compressive strength of 500 psi at the shoe, 2) until cement has been in place at least 8 hours. WOC time will be recorded in the driller's log. See individual casing strings for details regarding lead cement slurry requirements.

Provide compressive strengths including hours to reach required 500 pounds compressive strength prior to cementing each casing string. Have well specific cement details onsite prior to pumping the cement for each casing string.

No pea gravel permitted for remedial or fall back remedial without prior authorization from the BLM engineer.

High Cave/Karst
Possibility of water flows in the Castillo and Salado.
Possibility of lost circulation in the Delaware.
Abnormal Pressures may be encountered when penetrating the 3rd Bone Spring Sandstone and all subsequent formations.

A MINIMUM OF TWO CASING STRINGS CEMENTED TO SURFACE IS REQUIRED IN HIGH CAVE/KARST AREAS. THE CEMENT MUST BE IN A SOLID SHEATH. THEREFORE, ONE INCH OPERATIONS ARE NOT SUFFICIENT TO PROTECT CAVE KARST RESOURCES. A CASING DESIGN THAT HAS A ONE INCH JOB PERFORMED DOES NOT COUNT AS A SOLID SHEATH. IF THE PRIMARY CEMENT JOB ON THE SURFACE CASING DOES NOT CIRCULATE, THEN THE NEXT TWO CASING STRINGS MUST BE CEMENTED TO SURFACE.

1. The **13-3/8** inch surface casing shall be set at approximately **450** feet (a minimum of 25 feet into the Rustler Anhydrite and above the salt) and cemented to the surface. **If salt is encountered, set casing at least 25 feet above the salt.**

    a. If cement does not circulate to the surface, the appropriate BLM office shall be notified and a temperature survey utilizing an electronic type temperature survey with surface log readout will be used or a cement bond log shall be run to verify the top of the cement. Temperature survey will be run a minimum of six hours after pumping cement and ideally between 8-10 hours after completing the cement job.

    b. Wait on cement (WOC) time for a primary cement job is to include the lead cement slurry.

    c. Wait on cement (WOC) time for a remedial job will be a minimum of 4 hours after bringing cement to surface or 500 pounds compressive strength, whichever is greater.

    d. If cement falls back, remedial cementing will be done prior to drilling out that string.

Formation below the 13-3/8" shoe to be tested according to Onshore Order 2.III.B.1.i. Test to be done as a mud equivalency test using the mud weight necessary for the pore pressure of the formation below the shoe and the mud weight for the bottom of the hole. Report results to BLM office.

Intermediate casing shall be kept fluid filled while running into hole to meet BLM minimum collapse requirements.

2. The minimum required fill of cement behind the **9-5/8** inch intermediate casing is:

Operator has proposed DV tool at depth of 2100', but will adjust cement proportionately if moved. DV tool shall be set a minimum of 50' below previous shoe and a minimum of 200' above current shoe. Operator shall submit sundry if DV tool depth cannot be set in this range. If an ECP is used, it is to be set a minimum of 50' below the shoe to provide cement across the shoe. If it cannot be set below the shoe, a CBL shall be run to verify cement coverage.

a. First stage to DV tool:

☒ Cement to circulate. If cement does not circulate, contact the appropriate BLM office before proceeding with second stage cement job. Operator should have plans as to how they will achieve circulation on the next stage.

b. Second stage above DV tool:

☒ Cement to surface. If cement does not circulate see B.1.a, c-d above. **Wait on cement (WOC) time for a primary cement job is to include the lead cement slurry due to cave/karst. Excess calculates to 22% - Additional cement may be required.**

Formation below the 9-5/8" shoe to be tested according to Onshore Order 2.III.B.1.i. Test to be done as a mud equivalency test using the mud weight necessary for the pore pressure of the formation below the shoe (not the mud weight required to prevent dissolving the salt formation) and the mud weight for the bottom of the hole. Report results to BLM office.

Centralizers required on horizontal leg, must be type for horizontal service and a minimum of one every other joint.

3. The minimum required fill of cement behind the **5-1/2** inch production casing is:

   ☒ Cement as proposed by operator. Operator shall provide method of verification.

4. If hardband drill pipe is rotated inside casing, returns will be monitored for metal. If metal is found in samples, drill pipe will be pulled and rubber protectors which have a larger diameter than the tool joints of the drill pipe will be installed prior to continuing drilling operations.

C. PRESSURE CONTROL

1. All blowout preventer (BOP) and related equipment (BOPE) shall comply with well control requirements as described in Onshore Oil and Gas Order No. 2 and API 53.

2. Minimum working pressure of the blowout preventer (BOP) and related equipment (BOPE) required for drilling below the surface casing shoe shall be **10,000 (10M)** psi. **10M system requires an HCR valve, remote kill line and annular to match. The remote kill line is to be installed prior to testing the system and tested to stack pressure.** BOP/BOPE shall be tested after nipple up according to Onshore Order #2.

3. The appropriate BLM office shall be notified a minimum of 4 hours in advance for a representative to witness the tests.

   a. In a water basin, for all casing strings utilizing slips, these are to be set as soon as the crew and rig are ready and any fallback cement remediation has been done. The casing cut-off and BOP installation can be initiated four hours after installing the slips, which will be approximately six hours after bumping the plug. For those casing strings not using slips, the minimum wait time before cut-off is eight hours after bumping the plug. BOP/BOPE testing can begin after cut-off or once cement reaches 500 psi compressive strength (including lead when specified), whichever is greater. However, if the float does not hold, cut-off cannot be initiated until cement reaches 500 psi compressive strength (including lead when specified).

   b. The tests shall be done by an independent service company utilizing a test plug **not a cup or J-packer.**

   c. The test shall be run on a 5000 psi chart for a 2-3M BOP/BOP, on a 10000 psi chart for a 5M BOP/BOPE and on a 15000 psi chart for a 10M BOP/BOPE. If a linear chart is used, it shall be a one hour chart. A circular chart shall have a maximum 2 hour clock. If a twelve hour or twenty-four hour chart is used, tester shall make a notation that it is run with a two hour clock.

   d. The results of the test shall be reported to the appropriate BLM office.

   e. All tests are required to be recorded on a calibrated test chart. **A copy of the BOP/BOPE test chart and a copy of independent service company test will be submitted to the appropriate BLM office.**

   f. The BOP/BOPE test shall include a low pressure test from 250 to 300 psi. The test will be held for a minimum of 10 minutes if test is done with a test plug and 30 minutes without a test plug. This test shall be performed prior to the test at full stack pressure.

   g. BOP/BOPE must be tested by an independent service company within 500 feet of the top of the **Wolfcamp** formation if the time between the setting of the intermediate casing and reaching this depth exceeds 20 days. This test does not exclude the test prior to drilling out the casing shoe as per Onshore Order No. 2.

D. DRILLING MUD

Mud system monitoring equipment, with derrick floor indicators and visual and audio alarms, shall be operating before drilling into the **Wolfcamp** formation, and shall be used until production casing is run and cemented.

E. DRILL STEM TEST

If drill stem tests are performed, Onshore Order 2.III.D shall be followed.

F. WASTE MATERIAL AND FLUIDS

All waste (i.e. drilling fluids, trash, salts, chemicals, sewage, gray water, etc.) created as a result of drilling operations and completion operations shall be safely contained and disposed of properly at a waste disposal facility. No waste material or fluid shall be disposed of on the well location or surrounding area.

Porto-johns and trash containers will be on-location during fracturing operations or any other crew-intensive operations.

JAM 072516

VIII. PRODUCTION (POST DRILLING)

A. WELL STRUCTURES & FACILITIES

Placement of Production Facilities
Production facilities should be placed on the well pad to allow for maximum interim recontouring and revegetation of the well location.

Exclosure Netting (Open-top Tanks)
Immediately following active drilling or completion operations, the operator will take actions necessary to prevent wildlife and livestock access, including avian wildlife, to all open-topped tanks that contain or have the potential to contain salinity sufficient to cause harm to wildlife or livestock, hydrocarbons, or Resource Conservation and Recovery Act of 1976-exempt hazardous substances. At a minimum, the operator will net, screen, or cover open-topped tanks to exclude wildlife and livestock and prevent mortality. If the operator uses netting, the operator will cover and secure the open portion of the tank to prevent wildlife entry. The operator will net, screen, or cover the tanks until the operator removes the tanks from the location or the tanks no longer contain substances that could be harmful to wildlife or livestock. Use a maximum netting mesh size of 1 ½ inches. The netting must not be in contact with fluids and must not have holes or gaps.

Chemical and Fuel Secondary Containment and Exclosure Screening
The operator will prevent all hazardous, poisonous, flammable, and toxic substances from coming into contact with soil and water. At a minimum, the operator will install and maintain an impervious secondary containment system for any tank or barrel containing hazardous, poisonous, flammable, or toxic substances sufficient to contain the contents of the tank or barrel and any drips, leaks, and anticipated precipitation. The operator will dispose of fluids within the containment system that do not meet applicable state or U. S. Environmental Protection Agency livestock water standards in accordance with state law; the operator must not drain the fluids to the soil or ground. The operator will design, construct, and maintain all secondary containment systems to prevent wildlife and livestock exposure to harmful substances. At a minimum, the operator will install effective wildlife and livestock exclosure systems such as fencing, netting, expanded metal mesh, lids, and grate covers. Use a maximum netting mesh size of 1 ½ inches.

Open-Vent Exhaust Stack Exclosures
The operator will construct, modify, equip, and maintain all open-vent exhaust stacks on production equipment to prevent birds and bats from entering, and to discourage perching, roosting, and nesting. (*Recommended exclosure structures on open-vent exhaust stacks are in the shape of a cone.*) Production equipment includes, but may not be limited to, tanks, heater-treaters, separators, dehydrators, flare stacks, in-line units, and compressor mufflers.

Containment Structures
Proposed production facilities such as storage tanks and other vessels will have a secondary containment structure that is constructed to hold the capacity of 1.5 times the

largest tank, plus freeboard to account for precipitation, unless more stringent protective requirements are deemed necessary.

Painting Requirement
All above-ground structures including meter housing that are not subject to safety requirements shall be painted a flat non-reflective paint color, **Shale Green** from the BLM Standard Environmental Color Chart (CC-001: June 2008).

B. PIPELINES

BURIED PIPELINE STIPULATIONS

A copy of the application (Grant, APD, or Sundry Notice) and attachments, including conditions of approval, survey plat and/or map, will be on location during construction. BLM personnel may request to you a copy of your permit during construction to ensure compliance with all stipulations.

Holder agrees to comply with the following stipulations to the satisfaction of the Authorized Officer:

1. The Holder shall indemnify the United States against any liability for damage to life or property arising from the occupancy or use of public lands under this grant.

2. The Holder shall comply with all applicable Federal laws and regulations existing or hereafter enacted or promulgated. In any event, the holder shall comply with the Toxic Substances Control Act of 1976 as amended, 15 USC 2601 et seq. (1982) with regards to any toxic substances that are used, generated by or stored on the right-of-way or on facilities authorized under this right-of-way grant. (See 40 CFR Part 702-799 and especially, provisions on polychlorinated biphenyls, 40 CFR 761.1-761.193.) Additionally, any release of toxic substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act, section 102b. A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to the authorized officer concurrent with the filing of the reports to the involved Federal agency or State government.

3. The holder agrees to indemnify the United States against any liability arising from the release of any hazardous substance or hazardous waste (as these terms are defined in the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. 9601, et seq. or the Resource Conservation and Recovery Act, 42 U.S.C.6901, et seq.) on the Right-of-Way (unless the release or threatened release is wholly unrelated to the Right-of-Way holder's activity on the Right-of-Way), or resulting from the activity of the Right-of-Way holder on the Right-of-Way. This agreement applies without regard to whether a release is caused by the holder, its agent, or unrelated third parties.

4. If, during any phase of the construction, operation, maintenance, or termination of the pipeline, any oil or other pollutant should be discharged from the pipeline system, impacting Federal lands, the control and total removal, disposal, and cleaning up of such oil or other pollutant, wherever found, shall be the responsibility of holder, regardless of fault. Upon failure of holder to control, dispose of, or clean up such discharge on or affecting Federal lands, or to repair all damages resulting therefrom, on the Federal lands, the Authorized Officer may take such measures as he deems necessary to control and clean up the discharge and restore the area, including where appropriate, the aquatic environment and fish and wildlife habitats, at the full expense of the holder. Such action by the Authorized Officer shall not relieve holder of any responsibility as provided herein.

5. All construction and maintenance activity will be confined to the authorized right-of-way.

6. The pipeline will be buried with a minimum cover of **36** inches between the top of the pipe and ground level.

7. The maximum allowable disturbance for construction in this right-of-way will be **30** feet:

- Blading of vegetation within the right-of-way will be allowed: maximum width of blading operations will not exceed **20** feet. The trench is included in this area. (*Blading is defined as the complete removal of brush and ground vegetation.*)

- Clearing of brush species within the right-of-way will be allowed: maximum width of clearing operations will not exceed **30** feet. The trench and bladed area are included in this area. (*Clearing is defined as the removal of brush while leaving ground vegetation (grasses, weeds, etc.) intact. Clearing is best accomplished by holding the blade 4 to 6 inches above the ground surface.*)

- The remaining area of the right-of-way (if any) shall only be disturbed by compressing the vegetation. (*Compressing can be caused by vehicle tires, placement of equipment, etc.*)

8. The holder shall stockpile an adequate amount of topsoil where blading is allowed. The topsoil to be stripped is approximately 6 inches in depth. The topsoil will be segregated from other spoil piles from trench construction. The topsoil will be evenly distributed over the bladed area for the preparation of seeding.

9. The holder shall minimize disturbance to existing fences and other improvements on public lands. The holder is required to promptly repair improvements to at least their former state. Functional use of these improvements will be maintained at all times. The holder will contact the owner of any improvements prior to disturbing them. When necessary to pass through a fence line, the fence shall be braced on both sides of the passageway prior to cutting of the fence. No permanent gates will be allowed unless approved by the Authorized Officer.

10. Vegetation, soil, and rocks left as a result of construction or maintenance activity will be randomly scattered on this right-of-way and will not be left in rows, piles, or berms, unless otherwise approved by the Authorized Officer. The entire right-of-way shall be recontoured to match the surrounding landscape. The backfilled soil shall be compacted and a 6 inch berm will be left over the ditch line to allow for settling back to grade.

11. In those areas where erosion control structures are required to stabilize soil conditions, the holder will install such structures as are suitable for the specific soil conditions being encountered and which are in accordance with sound resource management practices.

12. The holder will reseed all disturbed areas. Seeding will be done according to the attached seeding requirements, using the following seed mix.

( ) seed mixture 1 ( ) seed mixture 3

() seed mixture 2 (X) seed mixture 4

( ) seed mixture 2/LPC ( ) Aplomado Falcon Mixture

13. All above-ground structures not subject to safety requirements shall be painted by the holder to blend with the natural color of the landscape. The paint used shall be color which simulates "Standard Environmental Colors" – **Shale Green**, Munsell Soil Color No. 5Y 4/2.

14. The pipeline will be identified by signs at the point of origin and completion of the right-of-way and at all road crossings. At a minimum, signs will state the holder's name, BLM serial number, and the product being transported. All signs and information thereon will be posted in a permanent, conspicuous manner, and will be maintained in a legible condition for the life of the pipeline.

15. The holder shall not use the pipeline route as a road for purposes other than routine maintenance as determined necessary by the Authorized Officer in consultation with the holder before maintenance begins. The holder will take whatever steps are necessary to

ensure that the pipeline route is not used as a roadway. As determined necessary during the life of the pipeline, the Authorized Officer may ask the holder to construct temporary deterrence structures.

16. Any cultural and/or paleontological resources (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the Authorized Officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery will be made by the Authorized Officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the Authorized Officer after consulting with the holder.

17. The operator shall be held responsible if noxious weeds become established within the areas of operations. Weed control shall be required on the disturbed land where noxious weeds exist, which includes associated roads, pipeline corridor and adjacent land affected by the establishment of weeds due to this action. The operator shall consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies.

18. Escape Ramps - The operator will construct and maintain pipeline/utility trenches [that are not otherwise fenced, screened, or netted] to prevent livestock, wildlife, and humans from becoming entrapped. At a minimum, the operator will construct and maintain escape ramps, ladders, or other methods of avian and terrestrial wildlife escape in the trenches according to the following criteria:

a. Any trench left open for eight (8) hours or less is not required to have escape ramps; however, before the trench is backfilled, the contractor/operator shall inspect the trench for wildlife, remove all trapped wildlife, and release them at least 100 yards from the trench.
b. For trenches left open for eight (8) hours or more, earthen escape ramps (built at no more than a 30 degree slope and spaced no more than 500 feet apart) shall be placed in the trench.

C. ELECTRIC LINES

STANDARD STIPULATIONS FOR OVERHEAD ELECTRIC DISTRIBUTION LINES

A copy of the grant and attachments, including stipulations, survey plat and/or map, will be on location during construction. BLM personnel may request to you a copy of your permit during construction to ensure compliance with all stipulations.

Holder agrees to comply with the following stipulations to the satisfaction of the Authorized Officer:

1. The holder shall indemnify the United States against any liability for damage to life or property arising from the occupancy or use of public lands under this grant.

2. The holder shall comply with all applicable Federal laws and regulations existing or hereafter enacted or promulgated. In any event, the holder shall comply with the Toxic Substances Control Act of 1976 as amended, 15 USC 2601 et seq. (1982) with regards to any toxic substances that are used, generated by or stored on the right-of-way or on facilities authorized under this right-of-way grant. (See 40 CFR, Part 702-799 and especially, provisions on polychlorinated biphenyls, 40 CFR 761.1-761.193.) Additionally, any release of toxic substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR, Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act, section 102b. A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to the authorized officer concurrent with the filing of the reports to the involved Federal agency or State government.

3. The holder agrees to indemnify the United States against any liability arising from the release of any hazardous substance or hazardous waste (as these terms are defined in the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. 9601, et seq. or the Resource Conservation and Recovery Act, 42 U.S.C. 6901, et seq.) on the Right-of-Way (unless the release or threatened release is wholly unrelated to the Right-of-Way holder's activity on the Right-of-Way), or resulting from the activity of the Right-of-Way holder on the Right-of-Way. This agreement applies without regard to whether a release is caused by the holder, its agent, or unrelated third parties.

4. There will be no clearing or blading of the right-of-way unless otherwise agreed to in writing by the Authorized Officer.

5. Power lines shall be constructed and designed in accordance to standards outlined in "Suggested Practices for Avian Protection on Power lines: The State of the Art in 2006" Edison Electric Institute, APLIC, and the California Energy Commission 2006 . The holder shall assume the burden and expense of proving that pole designs not shown in the above publication deter raptor perching, roosting, and nesting. Such proof shall be provided by a raptor expert approved by the Authorized Officer. The BLM reserves the right to require modification or additions to all powerline structures placed on this right-of-way, should they be necessary to ensure the safety of large perching birds. Such modifications and/or additions shall be made by the holder without liability or expense to the United States.

Raptor deterrence will consist of but not limited to the following: triangle perch discouragers shall be placed on each side of the cross arms and a nonconductive perching deterrence shall be placed on all vertical poles that extend past the cross arms.

6. The holder shall minimize disturbance to existing fences and other improvements on

public lands. The holder is required to promptly repair improvements to at least their former state. Functional use of these improvements will be maintained at all times. The holder will contact the owner of any improvements prior to disturbing them. When necessary to pass through a fence line, the fence shall be braced on both sides of the passageway prior to cutting the fence. No permanent gates will be allowed unless approved by the Authorized Officer.

7. The BLM serial number assigned to this authorization shall be posted in a permanent, conspicuous manner where the power line crosses roads and at all serviced facilities. Numbers will be at least two inches high and will be affixed to the pole nearest the road crossing and at the facilities served.

8. Upon cancellation, relinquishment, or expiration of this grant, the holder shall comply with those abandonment procedures as prescribed by the Authorized Officer.

9. All surface structures (poles, lines, transformers, etc.) shall be removed within 180 days of abandonment, relinquishment, or termination of use of the serviced facility or facilities or within 180 days of abandonment, relinquishment, cancellation, or expiration of this grant, whichever comes first. This will not apply where the power line extends service to an active, adjoining facility or facilities.

10. Any cultural and/or paleontological resource (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the Authorized Officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery will be made by the Authorized Officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the Authorized Officer after consulting with the holder.

11. Special Stipulations:
- For reclamation remove poles, lines, transformer, etc. and dispose of properly.
- Fill in any holes from the poles removed.

IX. INTERIM RECLAMATION

During the life of the development, all disturbed areas not needed for active support of production operations should undergo interim reclamation in order to minimize the environmental impacts of development on other resources and uses.

Within six (6) months of well completion, operators should work with BLM surface management specialists (Jim Amos: 575-234-5909) to devise the best strategies to reduce the size of the location. Interim reclamation should allow for remedial well operations, as well as safe and efficient removal of oil and gas.

During reclamation, the removal of caliche is important to increasing the success of revegetating the site. Removed caliche that is free of contaminants may be used for road repairs, fire walls or for building other roads and locations. In order to operate the well or complete workover operations, it may be necessary to drive, park and operate on restored interim vegetation within the previously disturbed area. Disturbing revegetated areas for production or workover operations will be allowed. If there is significant disturbance and loss of vegetation, the area will need to be revegetated. Communicate with the appropriate BLM office for any exceptions/exemptions if needed.

All disturbed areas after they have been satisfactorily prepared need to be reseeded with the seed mixture provided below.

Upon completion of interim reclamation, the operator shall submit a Sundry Notices and Reports on Wells, Subsequent Report of Reclamation (Form 3160-5).

X. FINAL ABANDONMENT & RECLAMATION

At final abandonment, well locations, production facilities, and access roads must undergo "final" reclamation so that the character and productivity of the land are restored.

Earthwork for final reclamation must be completed within six (6) months of well plugging. All pads, pits, facility locations and roads must be reclaimed to a satisfactory revegetated, safe, and stable condition, unless an agreement is made with the landowner or BLM to keep the road and/or pad intact.

After all disturbed areas have been satisfactorily prepared, these areas need to be revegetated with the seed mixture provided below. Seeding should be accomplished by drilling on the contour whenever practical or by other approved methods. Seeding may need to be repeated until revegetation is successful, as determined by the BLM.

Operators shall contact a BLM surface protection specialist prior to surface abandonment operations for site specific objectives (Jim Amos: 575-234-5909).

Mixture 4, for Gypsum Sites

The holder shall seed all the disturbed areas with the seed mixture listed below. The seed mixture shall be planted in the amounts specified in pounds of pure live seed (PLS)* per acre. There shall be no primary or secondary noxious weeds in the seed mixture. Seed will be tested and the viability testing of seed will be done in accordance with State law(s) and within nine (9) months prior to purchase. Commercial seed will be either certified or registered seed. The seed container will be tagged in accordance with State law(s) and available for inspection by the authorized officer.

Seed will be planted using a drill equipped with a depth regulator to ensure proper depth of planting where drilling is possible. The seed mixture will be evenly and uniformly planted over the disturbed area (smaller/heavier seeds have a tendency to drop the bottom of the drill and are planted first). The holder shall take appropriate measures to ensure this does not occur. Where drilling is not possible, seed will be broadcast and the area shall be raked or chained to cover the seed. When broadcasting the seed, the pounds per acre are to be doubled. The seeding will be repeated until a satisfactory stand is established as determined by the authorized officer. Evaluation of growth will not be made before completion of at least one full growing season after seeding.

Species to be planted in pounds of pure live seed* per acre:

Species	lb/acre
Alkli Sacaton (*Sporobolus airoides*)	1.5
DWS~ Four-wing saltbush (*Atriplex canescens*)	8.0

~DWS: DeWinged Seed

*Pounds of pure live seed:

Pounds of seed **x** percent purity **x** percent germination = pounds pure live seed

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Pecos District
Carlsbad Field Office
620 East Greene Street
Carlsbad, NM 88220

DECISION RECORD

for the

Hayhurst Master Development Plan Environmental Assessment

NEPA No. DOI-BLM-NM-P020-2016-1434-EA

I. Decision

I have decided to select the proposed action for implementation as described in the September 2016, Hayhurst Master Development Plan Environmental Assessment (EA). Based on my review of the EA and project record, I have concluded that the proposed action was analyzed in sufficient detail to allow me to make an informed decision. I have selected this alternative because the proposed treatments will allow reasonable access to oil and gas development.

II. Finding of No Significant Impact

I have reviewed the direct, indirect and cumulative effects of the proposed activities documented in the EA for the DOI-BLM-NM-P020-2016-1434-EA. I have also reviewed the project record for this analysis. The effects of the proposed action are disclosed in the Environmental Consequences sections of the EA. I have determined that the proposed action as described in the EA will not significantly affect the quality of the human environment. Accordingly, I have determined that the preparation of an Environmental Impact Statement is not necessary.

III. Other Alternatives Considered

No reasonable action alternative was substantially different in design or effects from the proposed action for this project. Therefore no other alternative was considered or analyzed.

IV. Public Involvement

The Carlsbad Field Office (CFO) publishes a NEPA log for public inspection. This log contains a list of proposed and approved actions in the field office. The log is located in the lobby of the CFO as well as on the BLM New Mexico website (http://www.blm.gov/nm/st/en/prog/planning/nepa_logs.html). The BLM also has an ePlanning website (https://eplanning.blm.gov/epl-front-office/eplanning/lup/lup_register.do) that allows the public to review and comment online on BLM NEPA and planning projects. Hard copies of the draft EA were also available at the BLM CFO as well as the BLM Santa Fe and Albuquerque Offices. The draft EA was be made available for a 30-day public review and comment period.

BLM CFO received a total of nine comment letters on the EA. Comments were categorized into issue statements that primarily focused on air resources, vegetation, wildlife, karst, night skies, visual resources, Areas of Critical Environmental Concern, Lands with Wilderness Characteristics, impacts to Carlsbad Caverns National Park, NEPA (e.g. level of documentation, alternatives), mitigation, and the

Resource Management Plan revision. Responses to comment issue statements are provided in Appendix F of the EA.

V. Appeals

This decision may be appealed to the Interior Board of Land Appeals (IBLA), Office of the Secretary, in accordance with the regulations contained in 43 CFR Part 4. Any appeal must be filed within 30 days of this decision. Any notice of appeal must be filed with George MacDonell, Carlsbad Field Manager, at 620 East Greene Street, Carlsbad, NM 88220. The appellant shall serve a copy of the notice of appeal and any statement of reasons, written arguments, or briefs on each adverse party named in the decision, not later than 15 days after filing such document (see 43 CFR 4.413(a)). Failure to serve within the time required will subject the appeal to summary dismissal (see 43 CFR 4.413(b)). If a statement of reasons for the appeal is not included with the notice, it must be filed with the IBLA, Office of Hearings and Appeals, U. S. Department of the Interior, 801 North Quincy St., Suite 300, Arlington, VA 22203 within 30 days after the notice of appeal is filed with the IBLA, Office of Hearings and Appeals, U.S. Department of the Interior, 801 North Quincy St., Suite 300 Arlington, VA 22203 within 30 days after the notice of appeal is filed with George MacDonell, Carlsbad Field Manger.

Notwithstanding the provisions of 43 CFR 4.21(a)(1), filing a notice of appeal under 43 CFR Part 4 does not automatically suspend the effect of the decision. If you wish to file a petition for a stay of the effectiveness of this decision during the time that your appeal is being reviewed by the Board, the petition for a stay must accompany your notice of appeal.

A petition for a stay is required to show sufficient justification based on the following standards:

(1) The relative harm to the parties if the stay is granted or denied;

(2) The likelihood of the appellant's success on the merits;

(3) The likelihood of immediate and irreparable harm if the stay is not granted; and

(4) Whether the public interest favors granting the stay.

In the event a request for stay or an appeal is filed, the person/party requesting the stay or filing the appeal must serve a copy of the appeal on the Office of the Field Solicitor, 1100 Old Santa Fe Trail, Santa Fe, NM 87505.

George MacDonell
Field Manager

10/7/16
Date

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Pecos District
Carlsbad Field Office
620 East Greene Street
Carlsbad, NM 88220

Finding of No Significant Impact
Hayhurst Master Development Plan

NEPA No. DOI-BLM-NM-P020-2016-1434-EA

FINDING OF NO SIGNIFICANT IMPACT:

I have determined that the proposed action, as described in the EA will not have any significant impact, individually or cumulatively, on the quality of the human environment. Because there would not be any significant impact, an environmental impact statement is not required.

In making this determination, I considered the following factors:

1. The activities described in the proposed action do not include any significant beneficial or adverse impacts (40 CFR 1508.27(b)(1)). The EA includes a description of the expected environmental consequences of implementation of the Master Development Plan, including construction and operation of well pads; production, storage, and compression facilities; water disposal and recycling facilities; gathering pipelines for oil, gas, and produced water; pipelines for fresh, brackish, or recycled water to support hydraulic fracturing operations; and upgraded and new access roads.

   In order to ensure that the proponent's impacts are consistent with the operating parameters considered in the air quality analysis, Conditions of Approval (COA) will be applied to Applications for Permit to Drill requested under the Hayhurst Master Development Plan. These COAs are:

   - All project activities including equipment emissions shall meet or exceed all state and federal standards for air quality as regulated by the New Mexico Environment Department Air Quality Bureau and the U.S. Environmental Protection Agency.

   - The operator will implement a drill and completion rig schedule where Tier 4 (or equivalent) drill and completion rigs are phased in. The operator will not exceed four drill rigs at one time and will be 100% compliant with Tier 4 (or equivalent) standards in 2020.

   - During the drilling phase, the operator will emit NOx emissions of 262.95 tons per year (tpy) or less from nonroad (mobile sources) between Year 1 and Year 3 and 220.7 tpy or less from nonroad (mobile sources) for the remainder of the drilling phase.

   - The operator will emit 213.6 tpy or less of NOx emissions during production operations, as defined in the emission inventory analyzed in the Environmental Assessment. The operator will submit emissions and/or parameters with an Application for Permit to Drill or annual emissions inventory that show the NOx emissions are within the limits of the air quality analysis within the Environmental Assessment.

2. The activities included in the proposed action would not significantly affect public health or safety (40 CFR 1508.27(b)(2)).

3. The proposed activities would not significantly affect any unique characteristics (40 CFR 1508.27(b)(3)) of the geographic area such as prime and unique farmlands, caves, wild and scenic rivers, designated wilderness areas, wilderness study areas, or areas of critical concern.

4. The activities described in the proposed action do not involve effects on the human environment that are likely to be highly controversial (40 CFR 1508.27(b)(4)).

5. The activities described in the proposed action do not involve effects that are highly uncertain or involve unique or unknown risks (40 CFR 1508.27(b)(5)).

6. My decision to implement these activities does not establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration (40 CFR 1508.27(b)(6)).

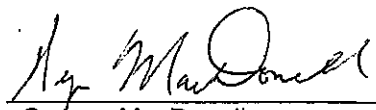
7. The effects of the Master Development Plan including construction and operation of well pads; production, storage, and compression facilities; water disposal and recycling facilities; gathering pipelines for oil, gas, and produced water; pipelines for fresh, brackish, or recycled water to support hydraulic fracturing operations; and upgraded and new access roads would not be significant, individually or cumulatively, when considered with the effects of other actions (40 CFR 1508.27(b)(7)). The EA discloses that there are no other connected or cumulative actions that would cause significant cumulative impacts.

8. I have determined that the activities described in the proposed action will not adversely affect or cause loss or destruction of scientific, cultural, or historical resources, including those listed in or eligible for listing in the National Register of Historic Places (40 CFR 1508.27(b)(8)).

9. The proposed activities are not likely to adversely affect any endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act (40 CFR 1508.27(b)(9)).

10. The proposed activities will not knowingly threaten any violation of Federal, State, or local law or requirements imposed for the protection of the environment (40 CFR 1508.27(b)(10)).

APPROVED:



George MacDonell
Field Manager
Carlsbad Field Office

10/7/16
Date

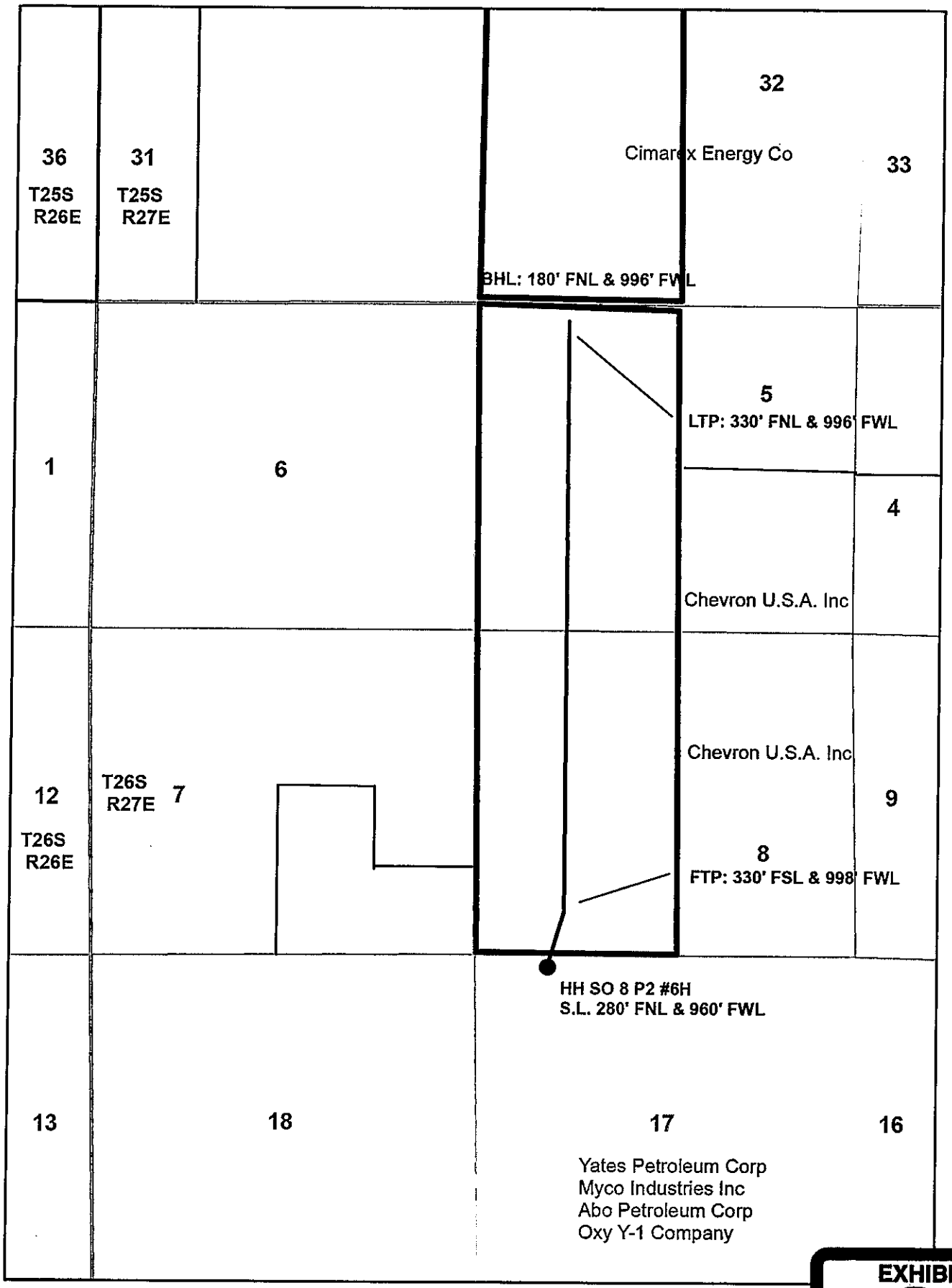

36
T25S
R26E
31
T25S
R27E
32
Cimarex Energy Co
33
BHL: 180' FNL & 996' FWL
5
LTP: 330' FNL & 996' FWL
1
6
4
Chevron U.S.A. Inc
Chevron U.S.A. Inc
12
T26S
R26E
T26S
R27E
7
9
8
FTP: 330' FSL & 998' FWL
HH SO 8 P2 #6H
S.L. 280' FNL & 960' FWL
13
18
17
16
Yates Petroleum Corp
Myco Industries Inc
Abo Petroleum Corp
Oxy Y-1 Company

EXHIBIT
B

DATE IN	SUSPENSE	ENGINEER	LOGGED IN	TYPE	APP NO.

ABOVE THIS LINE FOR DIVISION USE ONLY

NEW MEXICO OIL CONSERVATION DIVISION
- Engineering Bureau -
1220 South St. Francis Drive, Santa Fe, NM 87505

ADMINISTRATIVE APPLICATION CHECKLIST

THIS CHECKLIST IS MANDATORY FOR ALL ADMINISTRATIVE APPLICATIONS FOR EXCEPTIONS TO DIVISION RULES AND REGULATIONS WHICH REQUIRE PROCESSING AT THE DIVISION LEVEL IN SANTA FE

Application Acronyms:

[NSL-Non-Standard Location] [NSP-Non-Standard Proration Unit] [SD-Simultaneous Dedication]
[DHC-Downhole Commingling] [CTB-Lease Commingling] [PLC-Pool/Lease Commingling]
[PC-Pool Commingling] [OLS - Off-Lease Storage] [OLM-Off-Lease Measurement]
[WFX-Waterflood Expansion] [PMX-Pressure Maintenance Expansion]
[SWD-Salt Water Disposal] [IPI-Injection Pressure Increase]
[EOR-Qualified Enhanced Oil Recovery Certification] [PPR-Positive Production Response]

[1] **TYPE OF APPLICATION** - Check Those Which Apply for [A]

[A] Location - Spacing Unit - Simultaneous Dedication
☑ NSL ☐ NSP ☐ SD

Check One Only for [B] or [C]

[B] Commingling - Storage - Measurement
☐ DHC ☐ CTB ☐ PLC ☐ PC ☐ OLS ☐ OLM

[C] Injection - Disposal - Pressure Increase - Enhanced Oil Recovery
☐ WFX ☐ PMX ☐ SWD ☐ IPI ☐ EOR ☐ PPR

[D] Other: Specify _____

[2] **NOTIFICATION REQUIRED TO:** - Check Those Which Apply, or Does Not Apply

[A] ☑ Working, Royalty or Overriding Royalty Interest Owners

[B] ☑ Offset Operators, Leaseholders or Surface Owner

[C] ☐ Application is One Which Requires Published Legal Notice

[D] ☑ Notification and/or Concurrent Approval by BLM or SLO
U.S. Bureau of Land Management - Commissioner of Public Lands, State Land Office

[E] ☑ For all of the above, Proof of Notification or Publication is Attached, and/or,

[F] ☐ Waivers are Attached

[3] **SUBMIT ACCURATE AND COMPLETE INFORMATION REQUIRED TO PROCESS THE TYPE OF APPLICATION INDICATED ABOVE.**

[4] **CERTIFICATION:** I hereby certify that the information submitted with this application for administrative approval is **accurate** and **complete** to the best of my knowledge. I also understand that **no action** will be taken on this application until the required information and notifications are submitted to the Division.

Note: Statement must be completed by an individual with managerial and/or supervisory capacity.

Jordan L. Kessler		Attorney	6/10/16
Print or Type Name	Signature	Title	Date

jlkessler@hollandhart.com
e-mail Address

From: Layton, Cody
To: judy@nmwild.org; joelle@nmwild.org; nada_culver@tws.org
Subject: Chevron MDP information and confusion with documents.
Date: Friday, December 16, 2016 4:15:20 PM
Attachments: Chevron Hayhurst MDP Final EA 20161007.pdf
HH Field Survey Report_FINAL_112015.pdf

Good Afternoon all,

I attempted earlier this morning to send you all the documents in a zipped drive. It appears for some reason you all were not able to receive them so I will send them one at a time in the hopes you can receive all the pertinent information. Let me know if you would like me to send an disk with the information all together. Additional e-mails to follow.

Cody R. Layton

Bureau of Land Management

Assistant Field Manager Lands and Minerals

Carlsbad Field Office

620 E. Greene St.

Carlsbad, NM 88220

Office: (575) 234-5959

Fax: (575) 234-5927

clayton@blm.gov

United States Department of the Interior
Bureau of Land Management

Environmental Assessment DOI-BLM-NM-P020-2016-1434-EA

Chevron U.S.A., Inc.
Hayhurst Master Development Plan

U.S. Department of the Interior
Bureau of Land Management
Pecos District
Carlsbad Field Office
620 East Greene Street
Carlsbad, NM 88220
Phone: (575) 234-5972
FAX: (575) 885-9264

September 2016

BLM

Carlsbad Field Office

Confidentiality Policy
Any comments, including names and street addresses of respondents, you submit may be made available for public review. Individual respondents may request confidentiality. If you wish to withhold your name or street address from public review or from disclosure under the Freedom of Information Act, you must state this prominently at the beginning of your written comment. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, will be made available for public inspection in their entirety.

TABLE OF CONTENTS

1. Purpose and Need for Action 1-1
   1.1. Background 1-1
   1.2. Purpose and Need for Action 1-5
   1.3. Decision to be Made 1-5
   1.4. Conformance with Applicable Land Use Plan(s) 1-5
   1.5. Relationship to Statutes, Regulations or Other Plans 1-6
   1.6. Scope of Analysis 1-7
   1.7. Scoping, Public Involvement, and Issues 1-8
2. Proposed Action and Alternative(s) 2-1
   2.1. Proposed Action 2-1
   2.2. No Action 2-32
   2.3. Alternatives Considered but Eliminated from Detailed Study 2-33
3. Affected Environment and Environmental Consequences 3-1
   3.1. Cumulative Impacts Assessment 3-1
   3.2. Air Resources 3-6
   3.3. Soils 3-22
   3.4. Caves and Karst 3-27
   3.5. Watershed 3-33
   3.6. Floodplains, Wetlands, and Riparian Areas 3-40
   3.7. Vegetation 3-41
   3.8. Noxious Weeds and Invasive Plants 3-43
   3.9. Wildlife 3-44
   3.10. Special Status Species, including Threatened and Endangered Species 3-51
   3.11. Range 3-59
   3.12. Cultural and Historical Resources 3-65
   3.13. Paleontology 3-67
   3.14. Visual Resource Management 3-68
   3.15. Special Land Designations 3-75
   3.16. Wastes – Hazardous and Solid 3-79
4. Supporting Information 4-1
   4.1. Consultation/Coordination 4-1
   4.2. List of Preparers and Reviewers 4-1
   4.3. References 4-2

Tables

Table 1.7-1 Biological Species Not Expected in EA Area of Analysis 1-9
Table 2.1-1 Proposed Action Estimated Surface Disturbance – MDP 2-7
Table 2.1-2 Proposed Action Surface Disturbances – APDs 2-7
Table 2.1-3 Proposed Action Estimated Surface Disturbance by Landowner 2-8
Table 2.1-4 Right-of-Way Configuration and Services in Each Trench 2-10
Table 2.1-5 Pipeline Detailed Information 2-13
Table 2.1-6 Potential Target Zones in the HDA 2-14
Table 2.1-7 Proposed Pad Size for Production-Related Surface Facilities 2-19
Table 2.1-8 Proposed Central Tank Battery Locations 2-19
Table 2.1-9 Proposed Salt Water Disposal Locations 2-20
Table 2.1-10 Proposed Permanent Containment Pond Locations 2-20
Table 2.1-11 Proposed Gas Compressor Station Locations 2-21
Table 2.1-12 Water Sources for Drilling and Completion 2-23
Table 2.1-13 Vendors Potentially Supplying Local Groundwater 2-23
Table 2.1-14 Approved Drilling Waste Disposal Sites 2-25
Table 2.1-15 Estimated Daily Peak Construction and Operations Workforces 2-25
Table 3.1-1 Estimated Cumulative Actions 3-5
Table 3.1-2 Estimated Future Oil and Gas Development 3-6
Table 3.2-1 Climate Normals for Carlsbad, 1981-2010 3-7
Table 3.2-2 Design Concentrations of Criteria Pollutants in the HDA Airshed 3-7
Table 3.2-3 National Ambient Air Quality Standards 3-11
Table 3.2-4 Class I and Sensitive Class II Areas of Concern for Air Quality Impact Analysis 3-12
Table 3.2-5 PSD Increments for Class I and Class II Areas 3-15
Table 3.2-6 Summary of Maximum Annual Emissions of Criteria and Hazardous Air Pollutants from the Proposed Action (in tons per year)[1] 3-15
Table 3.2-7 Comparison of Drilling and Completion Emissions from the Proposed Action to ARTSD 3-16
Table 3.2-8 Summary of 1-hr NO_2 Ambient Air Quality Impacts Near the Project Area[3] 3-16
Table 3.2-9 CALPUFF Modeled Results for Nitrogen Deposition in Class I Areas from the Proposed Action 3-16
Table 3.2-10 CALPUFF Modeled Results for Impacts to Visibility in Class I Areas from the Proposed Action 3-17
Table 3.2-11 Comparison of Maximum Annual Emissions of Criteria and Hazardous Air Pollutants from the Proposed Action to ARTSD (in tons per year)[1] 3-18
Table 3.2-12 CFO Oil and Gas RMP Reasonably Foreseeable Development and Proposed Action Well Counts and Emissions Comparison 3-19
Table 3.2-13 Comparison of Applicant Committed Environmental Protection Measures and New Regulations for Air Quality to “On the Books” Management Actions in the ARTSD for CFO RMP Revision 3-19
Table 3.3-1 Soil Map Units 3-25
Table 3.9-1 Wildlife Species with Potential or Known to Occur in the Analysis Area[1] 3-45
Table 3.9-2 Avian Species with Potential or Known to Occur in the Analysis Area 3-46
Table 3.10-1 USFWS T&E and BLM Sensitive Species Listed for Eddy County[1] and CFO 3-51
Table 3.10-2 State T&E Species Listed for Eddy County, New Mexico[1,2] 3-54
Table 3.11-1 Grazing Allotments, Range Improvements, and Range Study Plots within Analysis Area 3-59

Figures

Figure 1.1-1 Project Vicinity Map 1-3
Figure 2.1-1 Proposed Action Project Area and Surface Ownership 2-3
Figure 2.1-2 Proposed Action Overview 2-4
Figure 2.1-3 Proposed Action Well Pad HH SO 8 P2 Overview 2-5
Figure 2.1-4 Proposed Action Well Pad HH SO 10 P3 Overview 2-6
Figure 2.1-5 Example ROW Trench Configuration 2-11
Figure 2.1-6 Well Casing and Cement Schematic 2-17
Figure 3.1-1 Cumulative Impacts Area 3-3
Figure 3.2-1 Carlsbad, NM Windrose, 2014 3-9
Figure 3.2-2 Hobbs, NM Windrose, 2014 3-10
Figure 3.2-3 Class I and Sensitive Class II Areas of Concern Map 3-13
Figure 3.3-1 Soil Resources 3-23
Figure 3.4-1 Caves, Karst, and Subsurface Hydrology 3-29
Figure 3.4-2 Cave and Karst Features 3-30
Figure 3.5-1 Watershed, Floodplains, Wetlands, and Riparian Areas 3-35
Figure 3.11-1 Range Resources 3-61
Figure 3.14-1 Visual Resource Management Classes 3-69
Figure 3.15-1 Special Land Designations 3-77

Appendices

Appendix A Applications for Permit to Drill
Appendix B Master Development Plan (Surface Use Plan of Operation, Drilling Plan)
Appendix C Well Pad Typical (Drilling and Production)
Appendix D Hydraulic Fracturing Process
Appendix E Vascular Plant List
Appendix F Response to Comments

Acronyms and Abbreviations

°F	degrees Fahrenheit
ACEC	Area of Critical Environmental Concern
APD	Application for Permit to Drill
APLIC	Avian Power Line Interaction Committee
AQRV	air quality related value
ARTSD	Air Resources Technical Support Document
AUM	Animal Unit Month
BACT	Best Available Control Technology
bbl	barrel (unit of measurement equal to 42 gallons)
BISON-M	Biota Information System of New Mexico
BLM	Bureau of Land Management
BMP	best management practice
BOP	blowout preventer
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFO	Carlsbad Field Office
CFR	Code of Federal Regulations
Chevron	Chevron U.S.A., Inc.
CIA	Cumulative Impact Area
CO	carbon monoxide
COA	Conditions of Approval
CTB	central tank battery
DNA	Determination of NEPA Adequacy
EA	Environmental Assessment
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FLM	Federal Land Manager
FONSI	Finding of No Significant Impact
GHG	greenhouse gas
GIS	geographic information system
IM	Instruction Memorandum
HAP	hazardous air pollutant
HDA	Hayhurst Development Area
HDPE	high-density polyethylene
HP	high pressure
HUC	hydrologic unit code

kV	kilovolt
LACT	Lease Automated Custody Transfer
LDAR	leak detection and repair
LP	low pressure
MACT	Maximum Achievable Control Technology
MDP	Master Development Plan
mg/L	milligram per liter
mph	miles per hour
MSDS	Material Safety Data Sheet
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act (of 1990)
NATA	National Air Toxics Assessment
NEPA	National Environmental Policy Act of 1970
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act of 1966
NMAC	New Mexico Administrative Code
NMBGMR	New Mexico Bureau of Geology and Mineral Resources
NMDA	New Mexico Department of Agriculture
NMDGF	New Mexico Department of Game and Fish
NMED	New Mexico Environment Department
NMED/NMAQB	New Mexico Environment Department/Air Quality Bureau
NMOCD	New Mexico Oil Conservation Division
NMSO	New Mexico State Office
NMOSE	New Mexico Office of the State Engineer
NMPIF	New Mexico Partners in Flight
NMRPTC	New Mexico Rare Plant Technical Council
NMSA	New Mexico State Act
NNSR	Nonattainment New Source Review
NO_2	nitrogen dioxide
NHPA	National Historic Preservation Act
NP	National Park
NPS	National Park Service
NRHP	National Register of Historic Places
NSPS	New Source Performance Standards
NSR	New Source Review
O_3	ozone
OSHA	Occupational Safety and Health Act
PCBs	polychlorinated biphenyls
Pecos Valley WUO	Pecos Valley Water Users Organization

PFYC	Potential Fossil Yield Classification
ppb	parts per billion
ppm	parts per million
Project Area	MDP Project Area
PSD	Prevention of Significant Deterioration
psi	pounds per square inch
psig	pounds per square inch gauge
RCRA	Resource Conservation and Recovery Act of 1976
RFD	reasonable foreseeable development
RMP	Resource Management Plan
ROW	right-of-way
SAAQS	State Ambient Air Quality Standards
SCADA	supervisory control and data acquisition
SHPO	State Historic Preservation Office
SLO	State Land Office
SMA	Special Management Area
SO_2	sulfur dioxide
SPCC	Spill Prevention, Control, and Countermeasures
SUPO	Surface Use Plans of Operations
SWD	Salt Water Disposal
T&E	threatened and endangered
TCEQ	Texas Commission on Environmental Quality
TCP	traditional cultural property
TDS	total dissolved solids
TRRC	Texas Railroad Commission
USC	United States Code
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
VRM	Visual Resource Management
VRU	vapor recovery unit
WCA	Wildlife Conservation Act
WEG	wind erodibility group
$\mu g/m^3$	micrograms per cubic meter

1. PURPOSE AND NEED FOR ACTION

1.1. Background

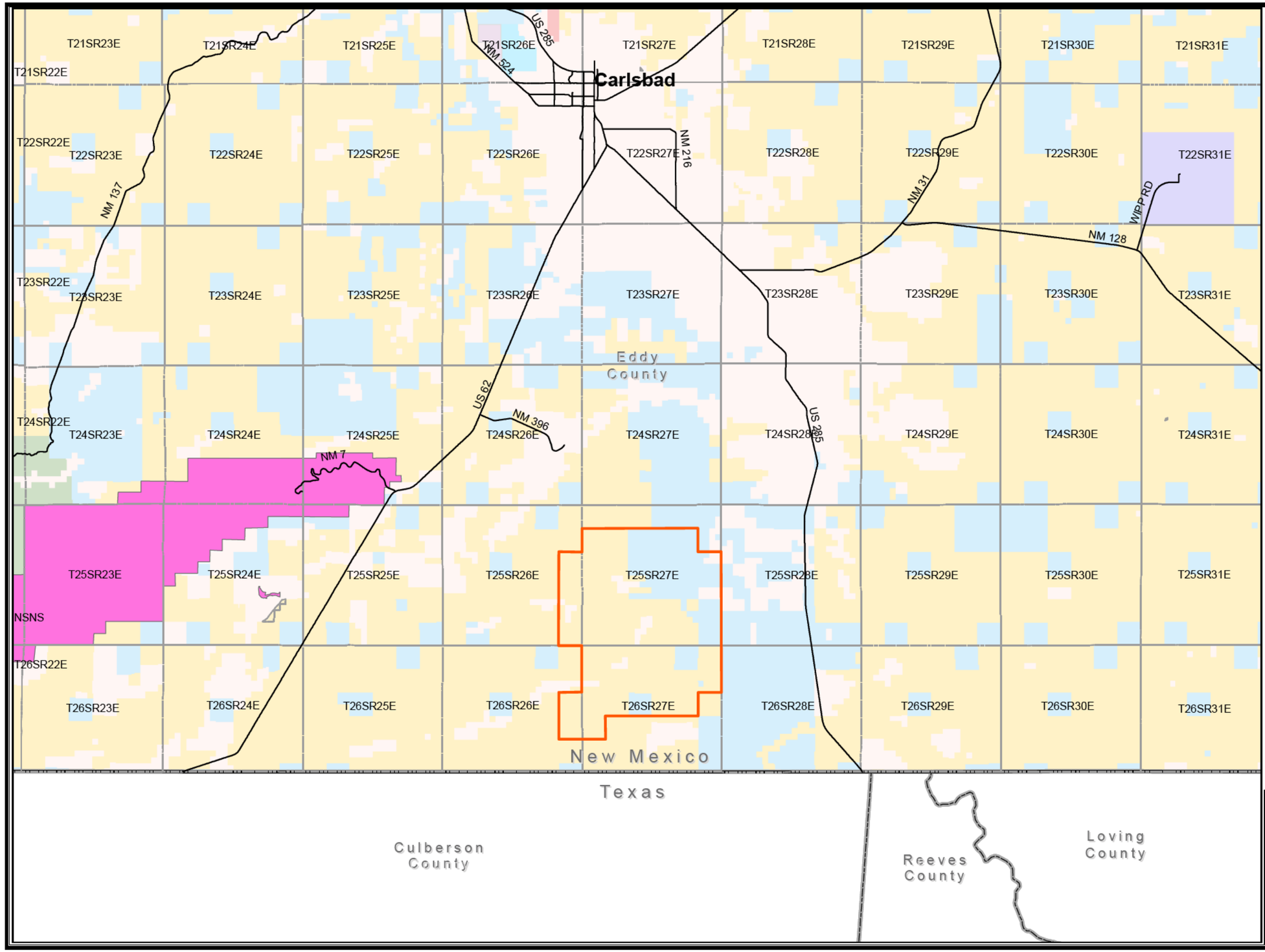
Chevron U.S.A., Inc. (Chevron) has submitted a proposed Master Development Plan (MDP) to the Bureau of Land Management (BLM) Carlsbad Field Office (CFO) for oil and natural gas exploration and development within the Hayhurst Development Area (HDA), located in Eddy County, New Mexico (**Figure** 1.1-1). An MDP provides information common to multiple planned wells, including drilling plans, Surface Use Plans of Operations (SUPOs), and plans for future production. MDPs also include information on associated facilities (e.g., roads, pipelines, utility corridors, and compressor stations). Instead of treating the development of multiple wells as a series of individual actions, the BLM encourages the use of multi-well development plans to more effectively manage federal lease development (BLM Instruction Memorandum [IM] 2005-247).

Chevron's proposed MDP includes development within an approximate 8,866-acre area on lands primarily administered by the BLM CFO, but also includes state-owned and private lands. If the proposed MDP is approved, Chevron would develop up to 436 oil and gas wells on 109 well pads. The proposed MDP also addresses all necessary infrastructure such as roads, pipelines, and facilities.

Twelve Applications for Permit to Drill (APDs) have been submitted with the proposed MDP. Information about these and other wells planned for future submission, including surface hole location, is provided in **Appendix A**.

Preparing Office:
Pecos District, Carlsbad Field Office
620 East Greene Street
Carlsbad, NM 88220

This page intentionally left blank.



LEGEND

- Hayhurst Development Area
- Major Roads

Surface Ownership

- Bureau of Land Management
- Bureau of Reclamation
- Dept. of Defense
- Dept. of Energy
- Forest Service
- Private
- State
- State Park
- Carlsbad Caverns National Park
- Township Boundary
- County Boundary
- State Boundary

Source:
BLM 2016
Analysis of the Management Situation
for the Bureau of Land Management
Carlsbad Field Office
May 2014

NORTH

5 2.5 0 5 Miles

CHEVRON HAYHURST MDP EA

FIGURE 1.1-1
Project Vicinity Map

ANALYSIS AREA: Eddy County, New Mexico

Date: 6/6/2016 | Prepared By: BW

Z:\GIS\PROJECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment Final\Figure1.1-1_ProjectVicinity.mxd

This page intentionally left blank.

1.2. Purpose and Need for Action

The BLM's purpose of this action is to consider the proponent's (Chevron's) request for an MDP to develop federal fluid minerals within the Hayhurst Development Area, while also considering the BLM's multiple-use mission.

The need for the action is established by the BLM's responsibility under the Mineral Leasing Act of 1920 as amended, the Mining and Minerals Policy Act of 1970, the Federal Land Policy and Management Act of 1976, and the Federal Onshore Oil and Gas Leasing Reform Act of 1987 to allow reasonable access to develop a federal oil and gas lease. To increase the orderly development of oil and natural gas resources consistent with the Energy Policy Acts of 2001 and 2005, which emphasize the development of domestic oil and gas reserves for supply and economic stability, and to better facilitate the planning of infrastructure, the BLM is considering the proposed MDP. The MDP takes into account field development as a whole rather than as individual actions.

The proposed action is needed to facilitate efficient and effective development of the oil and gas resources in the defined area through the use of an MDP. Accordingly, the MDP provides an effective planning process to identify infrastructure and resource needs for a larger area of development; whereas individual wells may result in more duplication of infrastructure and thus more development and related impacts.

1.3. Decision to be Made

The BLM will decide whether to approve the MDP, and if so, under what terms and conditions.

Approval of the MDP would also serve as approval of the 12 APDs submitted with the MDP. A Notice of Staking was filed for each of the 12 APDs, and the BLM conducted onsite inspections for each APD on December 8, 2015. Actions not included in the 12 APDs would require additional authorizations from the BLM (Section 1.6). Any decisions made in the Decision Record will provide a blueprint for future anticipated actions.

1.4. Conformance with Applicable Land Use Plan(s)

The 1988 Carlsbad Resource Management Plan (RMP), as amended by the 1997 Carlsbad Approved RMP Amendment, has been reviewed, and it has been determined that the proposed action conforms with the land use plan terms and conditions as required by Title 43 of the Code of Federal Regulations (CFR), Section 1610.5. The BLM is revising its RMP for the CFO. The existing RMP decisions will remain in effect during the RMP revision process until the revision is completed and approved. Any future actions associated with the MDP would need to comply with the approved RMP.

Name of Plan: 1997 Carlsbad Approved Resource Management Plan Amendment

Date Approved: October 1997

Decision: [Page 4] "Approximately 3,907,700 acres (95 percent of the oil and gas mineral estate) will be open to leasing and development under the BLM's standard terms and conditions, the Surface Use and Occupancy Requirements (Appendix 1), the Roswell District Conditions of Approval (Appendix 2), and the Practices for Oil and Gas Drilling and Operations in Cave and Karst Areas (Appendix 3)." The proposed action lies within the 95 percent of oil and gas mineral estate open to development and complies with the Surface Use and Occupancy Requirements.

Name of Plan: 2008 Special Status Species Approved Resource Management Plan Amendment

Date Approved: April 2008

Decision: [Page 7] "The BLM will continue to require oil and gas lessees to conduct operations in a manner that will minimize adverse impacts to resources, land uses, and other uses. To that end, the BLM

will continue to apply reasonable mitigation measures to all oil and gas activities." The proposed action will utilize best management practices (BMPs) when developing leases in Lesser Prairie-Chicken and Sand Dune Lizard Habitat. Special mitigation measures will be included into the Pecos District Conditions of Approval.

1.5. Relationship to Statutes, Regulations or Other Plans

This Environmental Assessment (EA) has been prepared in accordance with the National Environmental Policy Act of 1970 (NEPA) and is in compliance with all applicable subsequent regulations and laws, including the Council on Environmental Quality (CEQ) regulations (40 CFR 1500-1508) and the BLM NEPA Handbook, H-1790-1 (BLM 2008a). The proposed action would also comply with federal, state, and local laws and regulations. The following is a list of federal statutes that apply to the proposed action:

- **National Historic Preservation Act of 1966, as amended (16 United States Code [USC] 470)** - Preserves historical and archaeological sites.
- **Archaeological and Historic Preservation Act of 1974 (16 USC 469)** - Provides for the preservation of historical and archaeological data (including relics and specimens) that might otherwise be irreparably lost or destroyed as the result of (1) flooding, the building of access roads, the erection of workmen's communities, the relocation of railroads and highways, and other alterations of the terrain caused by the construction of a dam by any agency of the United States, or by any private person or corporation holding a license issued by any such agency or (2) any alteration of the terrain caused as a result of any federal construction project or federally licensed activity or program.
- **Archaeological Resources Protection Act of 1979, as amended (16 USC 470 et seq.)** - Secures, for the present and future benefit of the American people, the protection of archaeological resources and sites that are on public lands and Indian lands, and fosters increased cooperation and exchange of information among governmental authorities, the professional archaeological community, and private individuals.
- **National American Graves Protection and Repatriation Act of 1990 (25 USC 301)** - Provides a process for museums and federal agencies to return certain Native American cultural items such as human remains, funerary objects, sacred objects, or objects of cultural patrimony to lineal descendants and culturally affiliated Indian tribes and Native Hawaiian organizations, and includes provisions for unclaimed and culturally unidentifiable Native American cultural items, intentional and inadvertent discovery of Native American cultural items on federal and tribal lands, and penalties for noncompliance and illegal trafficking.
- **Clean Air Act of 1970, as amended (42 USC 7401 et seq.)** - Defines the U.S. Environmental Protection Agency's (EPA's) responsibilities for protecting and improving the nation's air quality and the stratospheric ozone layer.
- **Clean Water Act of 1977, as amended (30 USC 1251)** - Establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters.
- **Endangered Species Act of 1973 (16 USC 1531 et seq.)** - Protects critically imperiled species from extinction as a consequence of economic growth and development untempered by adequate concern and conservation.
- **Migratory Bird Treaty Act of 1918 (16 USC 703-712)** - Implements the convention for the protection of migratory birds.
- **Federal Cave Resources Protection Act of 1988 (16 USC 4301 et seq.)** - Protects significant caves on federal lands by identifying their location, regulating their use, requiring permits for removal of their resources, and prohibiting destructive acts.

The following are regulatory exemptions for petroleum industry operations that are relevant to the proposed action:

- **Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA or Superfund), Sections 101(14) and (33)**, exclude petroleum from the definitions of "hazardous substances" and "pollutant or contaminant." Petroleum derivatives to which this exclusion applies include crude oil or any fraction thereof (if the fraction is not specifically listed or designated a hazardous substance by other listed acts), natural gas, natural gas liquids, liquefied natural gas, and synthetic gas usable for fuel.
- According to the **Resource Conservation and Recovery Act of 1976 (RCRA)**, drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil, natural gas, or geothermal energy are exempt by regulatory definition. The term "other wastes associated" is specifically included to designate waste materials "intrinsically derived from primary field operations associated with the exploration, development, or production of crude oil, natural gas or geothermal energy" (Bohannon 2009). This definition includes hydrocarbon-bearing soil in and around related facilities; drill cuttings; and materials (such as hydrocarbons, water, sand, and emulsion) produced from a well in conjunction with crude oil, natural gas, or geothermal energy; and the accumulated material (such as hydrocarbons, water, sand, and emulsion) from production separators, fluid treating vessels, storage vessels, and production impoundments.
- The 2005 Energy Policy Act exempts fracturing wastes and fluids, such as flowback, from regulation under the **Safe Drinking Water Act of 1974** and the **Clean Water Act of 1972.**

State of New Mexico regulations would also apply to the Project. When handling, storing, and disposing of produced water and fracturing fluids, Chevron would comply with Title 19, Chapter 15, Part 34 of the State of New Mexico's Energy, Minerals and Natural Resources Department, Oil Conservation Commission. Releases or spills by Chevron would be handled in accordance with Title 19, Chapter 15, Part 29 of the State of New Mexico's Energy, Minerals and Natural Resources Department, Oil Conservation Commission.

Air quality standards in New Mexico (with the exception of Bernalillo County) are under the jurisdiction of the New Mexico Environment Department/Air Quality Bureau (NMED/NMAQB). The Environmental Improvement Act, New Mexico State Act (NMSA) 1978, and the Air Quality Control Act, NMSA 1978, dictate state air quality standards. Also, 40 CFR 60 "Standards of Performance for New Stationary Sources" is administered by the NMED/NMAQB. Other relevant air quality regulations include 40 CFR Subpart OOOO, Standards of Performance for Crude Oil and Natural Gas Production; Regulation #40 CFR part 52 EPA-R06-OAR-2011-0079; FRI-9932-51-Region 6, control of Volatile Organic Compound emissions from degassing of storage tanks, transport vessels and marine vessels. The BLM New Mexico State Office (NMSO) also published the following relevant document, *Air Resources Technical Report for Oil and Gas Development in New Mexico, Texas and Oklahoma* (BLM 2016a).

Additionally, Chevron would comply with all applicable federal, state, and local laws and regulations; obtain the necessary permits for drilling, construction, completion, and operation; and certify that Surface Use Agreements have been reached with the private landowners, where required.

1.6. Scope of Analysis

As stated previously, 12 APDs were submitted with the MDP. Therefore, approval of the MDP also indicates approval of the 12 APDs. Site-specific design information is known for the 12 APDs but is not known for the remainder of the MDP. Therefore, two approaches were taken for the analysis. The scope of the analysis was conducted at a site-specific level for the actions contained in the 12 APDs and at a programmatic level for all other actions in the MDP. For the programmatic analysis, this EA considers the impacts associated with potential development of all actions included in the MDP and provides an analytical framework to which subsequent analyses of site-specific decisions may be tiered. In this manner, the BLM is able to analyze future potential energy development.

All phases of oil and gas field development are included in the scope of the analysis, including siting, construction, drilling, completion, interim reclamation, production and maintenance, final wellbore

abandonment, and final reclamation. At the programmatic analysis level, the information for the well pad locations, road alignments, pipeline routes, and other facilities is approximate. The technologies described herein are representative of those most likely to be deployed over the life of the project. While actual production years may vary for individual wells, for the purpose of this analysis, it is assumed that the life of the project, through the end of production and final reclamation, is 45 years.

The environmental consequences sections provide the decision maker with the information necessary to compare and contrast the predicted effects of the proposed action and alternatives and make a reasoned and informed decision regarding which alternative or combination of actions should be selected in the Decision Record.

Requirements for Future NEPA Analysis

Components of the Hayhurst MDP EA alternatives are programmatic in nature (with the exception of the 12 APDs submitted with the MDP), meaning that the well pad and well locations, pipeline routes, and other facility placements are conceptually illustrated for the purposes of assessing impacts of proposed development within the HDA. The exact locations of wells, roads, pipelines, and other facilities would be determined when those wells and facilities are proposed for drilling or construction (e.g., when the BLM receives an APD or Right-of-Way [ROW] application for review). Siting of these locations would be subject to design features, BMPs, mitigation measures, and Conditions of Approval (COAs) adopted in the Decision Record for this EA. Implementation of the MDP would be phased over time.

Approval of the MDP would allow this EA to function as a higher level of analysis to which analysis of subsequent federal actions (e.g., approval of APDs) proposed for the HDA would be tiered. Approval of these actions would require additional NEPA analysis, such as a tiered EA, a Determination of NEPA Adequacy (DNA), or a Categorical Exclusion. Categorical Exclusions that may apply to some future development activities include those provided in Section 390 of the Energy Policy Act of 2005, 42 USC 15942(b). Phases of development would be subject to the appropriate NEPA-level and Field Office-required documentation, review, approval, and inspections. The BLM would apply appropriate mitigation measures, design features, and BMPs to all permitted actions in accordance with federal and state oil and gas regulations, the 1997 Carlsbad RMP (as amended), or the future revised Carlsbad RMP.

1.7. Scoping, Public Involvement, and Issues

The CFO publishes a NEPA log for public review. This log contains a list of proposed actions under review and actions approved by the field office. The log is located in the lobby of the CFO as well as on the BLM New Mexico website (http://www.blm.gov/nm/st/en/prog/planning/nepa_logs.html). The BLM also has an ePlanning website (https://eplanning.blm.gov/epl-front-office/eplanning/lup/lup_register.do) that allows the public to review and comment online on BLM NEPA and planning projects. Hard copies of the draft EA were also available at the BLM CFO as well as the BLM Santa Fe and Albuquerque Offices. The draft EA was made available for a 30-day public review and comment period.

The CFO uses geographic information systems (GISs) to identify resources that may be affected by the proposed action. The proposed action was reviewed by CFO resource specialists to identify any issues associated with the project. The programmatic nature of the proposed action was discussed and reviewed with resource specialists during this process. Some adjustments to the proposed action were made based on identification of issues by resource specialists and subsequent discussion with Chevron. These adjustments are reflected in this EA as revised design features or other modified components of the proposed action that differ slightly from the proposed action submitted by Chevron to the BLM. The issues that were raised include:

- How would air quality be impacted by the proposed action?
- How would climate change be impacted by the proposed action?
- How would range management be impacted by the proposed action?
- How would soils be impacted by the proposed action?

- How would vegetation be impacted by the proposed action?
- How would wildlife habitat be impacted by the proposed action?
- How would special status species be impacted by the proposed action?
- How would visual resources be impacted by the proposed action?
- Could noxious weeds be introduced to the project area as a result of the proposed action?
- How would cultural resources be impacted by the proposed action?
- How would paleontological resources be impacted by the proposed action?
- How would karst resources be impacted by the proposed action?
- How would watershed resources (including surface and groundwater) be impacted by the proposed action?

As determined by CFO resource specialists, no issues associated with the following were identified and are not evaluated further in this EA:

- Wilderness Study Areas (not present in EA area of analysis)
- Wilderness Areas (not present in EA area of analysis)
- Wild and Scenic Rivers (not present in EA area of analysis)
- Socioeconomics or environmental justice

Additionally, multiple protected biological species (e.g., threatened, endangered, BLM special status species) are listed in state and federal databases as occurring within Eddy County, New Mexico (Biota Information System of New Mexico [BISON-M] 2016; New Mexico Rare Plant Technical Council [NMRPTC] 1999a,b,c,d; U.S. Fish and Wildlife Service [USFWS] 2016b). Based on the absence of suitable habitat, the species listed in Table 1.7-1 are not expected to occur within the EA area of analysis.

Table 1.7-1 Biological Species Not Expected in EA Area of Analysis

Common Name	Scientific Name	Listing Status[1]
Arid land ribbonsnake	*Thamnophis proximus*	ST
Bald Eagle	*Haliaeetus leucocephalus*	ST
Bell's vireo	*Vireo bellii*	ST
Bigscale logperch	*Percina macrolepida*	ST
Black tern	*Chlidonias niger surinamensis*	NMSO
Blue sucker	*Cycleptus elongatus*	NMSO, SE
Broad-billed hummingbird	*Cynanthus latirostris*	ST
Brown pelican	*Pelecanus occidentalis*	SE
Common blackhawk	*Buteogallus anthracinus*	ST
Dunes sagebrush lizard	*Sceloporus arenicolus*	NMSO, SE
Gray redhorse	*Moxostoma congestum*	SE
Greenthroat darter	*Etheostoma lepidum*	ST
Gypsum wild-buckwheat	*Eriogonum gypsophilum*	FT, SE
Headwater chub	*Ictalurus lupus*	NMSO
Kuenzler's hedgehog cactus	*Echinocereus fendleri var. kuenzleri*	FE, SE
Least tern	*Sterna antillarum*	FE, SE
Lee's pincushion cactus	*Coryphantha sneedii var. leei*	FT
Lesser prairie-chicken	*Tympanuchus pallidicinctus*	FT[2], NMSO
Lucifer hummingbird	*Calothorax lucifer*	ST
Mexican spotted owl	*Strix occidentalis lucida*	FT
Mexican tetra	*Astyanax mexicanus*	ST
Neotropic cormoranat	*Phalacrocorax brasilianus*	ST

Table 1.7-1 Biological Species Not Expected in EA Area of Analysis

Common Name	Scientific Name	Listing Status[1]
New Mexico meadow jumping mouse	*Zapus hudsonius luteus*	NMSO
Northern aplomado falcon	*Falco femoralis septentrionalis*	EXPE/NE[3]
Northern beardless-tyrannulet	*Camptostoma imberbe*	ST
Northern goshawk	*Accipiter gentilis*	NMSO
Ovate vertigo snail	*Vertigo ovata*	ST
Pecos bluntnose shiner	*Notropis simus pecosensis*	FT, SE
Pecos gambusia	*Gambusia nobilis*	FE, SE
Pecos River muskrat	*Ondatra zibethicus ripensis*	NMSO
Pecos springsnail	*Pyrgulopsis pecosensis*	NMSO, ST
Peppered chub	*Macrhybopsis tetranema*	NMSO
Piping plover	*Charadrius melodus*	FT, ST
Plain-bellied water snake	*Nerodia erythrogaster*	SE
Rio Grande shiner	*Notropis jemezanus*	NMSO
Sacramento Mountain salamander	*Aneides hardii*	NMSO
Scheer's pincushion cactus	*Coryphantha scheeri var. scheeri*	SE
Shining coralroot	*Hexalectris nitida*	SE
Sneed pincushion cactus	*Coryphantha sneedii var. sneedii*	FE and SE
Southwestern willow flycatcher	*Empidonax traillii extimus*	FE, SE
Texas hornshell	*Popenaias popei*	C, SE[4]
Tharp's bluestar	*Amsonia tharpii*	SE
Thick-billed kingbird	*Tyrannus crassirostris*	SE
Western river cooter	*Pseudemys gorzugi*	ST
Wright's marsh thistle	*Cirsium wrightii*	C and SE
Yellow-billed cuckoo	*Coccyzus americanus*	FT

Notes:
Sources: BISON-M 2016; NMRPTC 1999a,b,c,d; USFWS 2016b

1 C = Candidate for Federal Listing; FE = Federally Endangered; FT = Federally Threatened; EXPE/NE = Experimental Population, Non-Essential; NMSO = BLM CFO Sensitive Species; SE = State Endangered; ST = State Threatened.

2 The USFWS listed the lesser prairie-chicken as threatened on May 12, 2014; however, on September 1, 2015, a U.S. district judge in Texas vacated the USFWS's listing decision. The listing status is still in the courts; therefore, currently (at the time of writing this EA), the lesser prairie-chicken is not protected under the Endangered Species Act.

3 Experimental populations are members of a listed species that are geographically separated from other populations of the same species. Experimental, non-essential populations are treated as threatened species on public lands under the Endangered Species Act for the purposes of Section 9 (Proh bited Acts).

4 Baseline field surveys did not identify suitable habitat for Texas hornshell (Arcadis U.S., Inc. 2016).

The EA was made available for public comment for 30 days on the BLM eplanning website, as well as via hard copies at the BLM CFO and BLM Santa Fe and Albuquerque Offices. BLM CFO received a total of nine comment letters on the EA. Comments were categorized into issue statements that primarily focused on air resources, vegetation, wildlife, karst, night skies, visual resources, Areas of Critical Environmental Concern (ACECs), Lands with Wilderness Characteristics, impacts to Carlsbad Caverns National Park, NEPA (e.g. level of documentation, alternatives), mitigation, and the RMP revision. Responses to comment issue statements is provided in **Appendix F**.

2. PROPOSED ACTION AND ALTERNATIVE(S)

2.1. Proposed Action

Under the proposed action, Chevron would construct, drill, complete, operate, plug, and abandon up to 436 horizontal oil and gas wells and five water disposal wells. Approval of the proposed action would also approve the 12 APDs submitted with the MDP (**Appendix A**). Approval of these 12 APDs would authorize the construction of two well pads and related infrastructure, including access roads, and water storage ponds. This section describes features that are common to all components of the MDP first, followed by site-specific descriptions of components included in the 12 APDs. APDs for the remaining 424 wells would be submitted at a later time.

The oil and gas wells would be drilled on a maximum of 109 new well pads (**Appendix B**). As described below, the MDP also includes the construction and operation of production, storage, and compression facilities; water disposal and recycling facilities; gathering pipelines for oil, gas, and produced water; pipelines for fresh, brackish, or recycled water to support hydraulic fracturing operations; and upgraded and new access roads.

A SUPO and Drilling Use Plan for the MDP have been submitted to the CFO as part of the proposed action (**Appendix B**). These plans contain planning elements common to all wells and facilities included in the MDP. Each APD would reference the SUPO and Drilling Use Plan to the extent practicable and would contain site-specific information as necessary in APD-specific SUPO and Drilling Plans (e.g., drilling and casing programs, reclamation seed mixes).

The proposed action would occur on a combination of BLM-administered, state-owned, and private lands (**Figure 2.1-1**). One hundred of the well pads would be located on BLM-administered surface lands, and wells drilled from these pads would produce federal minerals for which Chevron has existing leases (**Figure 2.1-2**). Nine well pads would be located on surface lands owned by the State of New Mexico (state lands) and would partially produce both federal and state leases. The numbers of well pads proposed assume development of four wells per pad. As technology improves, Chevron may increase the number of wells per pad and likewise decrease the total number of pads, while drilling the same number of wells. In the event that more wells are drilled on each pad, the configuration and size of individual pads may differ; however, surface disturbances would not increase beyond a total of 1,808 acres. This EA analyzes the predicted impacts associated with a maximum of 109 well pads and associated development.

Exact locations for the majority of proposed well pads, roads, and other facilities have not been determined through APD or ROW procurement processes. Therefore, Chevron's proposed action presents probable locations for these project components. The following description of the proposed action, descriptions of the affected environment, and analysis of environmental consequences are based on these probable locations, with more specific information for those locations specified in the 12 APDs submitted with the MDP. As stated in Section 1.6, future proposed actions that tier to the proposed MDP would require additional documentation of NEPA compliance. The "MDP Project Area (Project Area)" illustrated on **Figure 2.1-1**, **Figure 2.1-2**, and others provides the area within which Chevron would potentially shift locations of well pads, roads, and other facilities.

Chevron would obtain and comply with all appropriate federal, state, county, municipal, and local permits, including all necessary environmental clearances and permits before commencing any work.

Submitted APDs

Figure 2.1-3 and **Figure 2.1-4** illustrate the locations and layouts of facilities associated with the 12 submitted APDs. The 12 wells included in the submitted APDs would be drilled on a total of two well pads (six wells per pad). Because each of the six wells on each pad would share the same well pad, access road, and other infrastructure, discussion of the submitted APDs is combined into two groups. APD

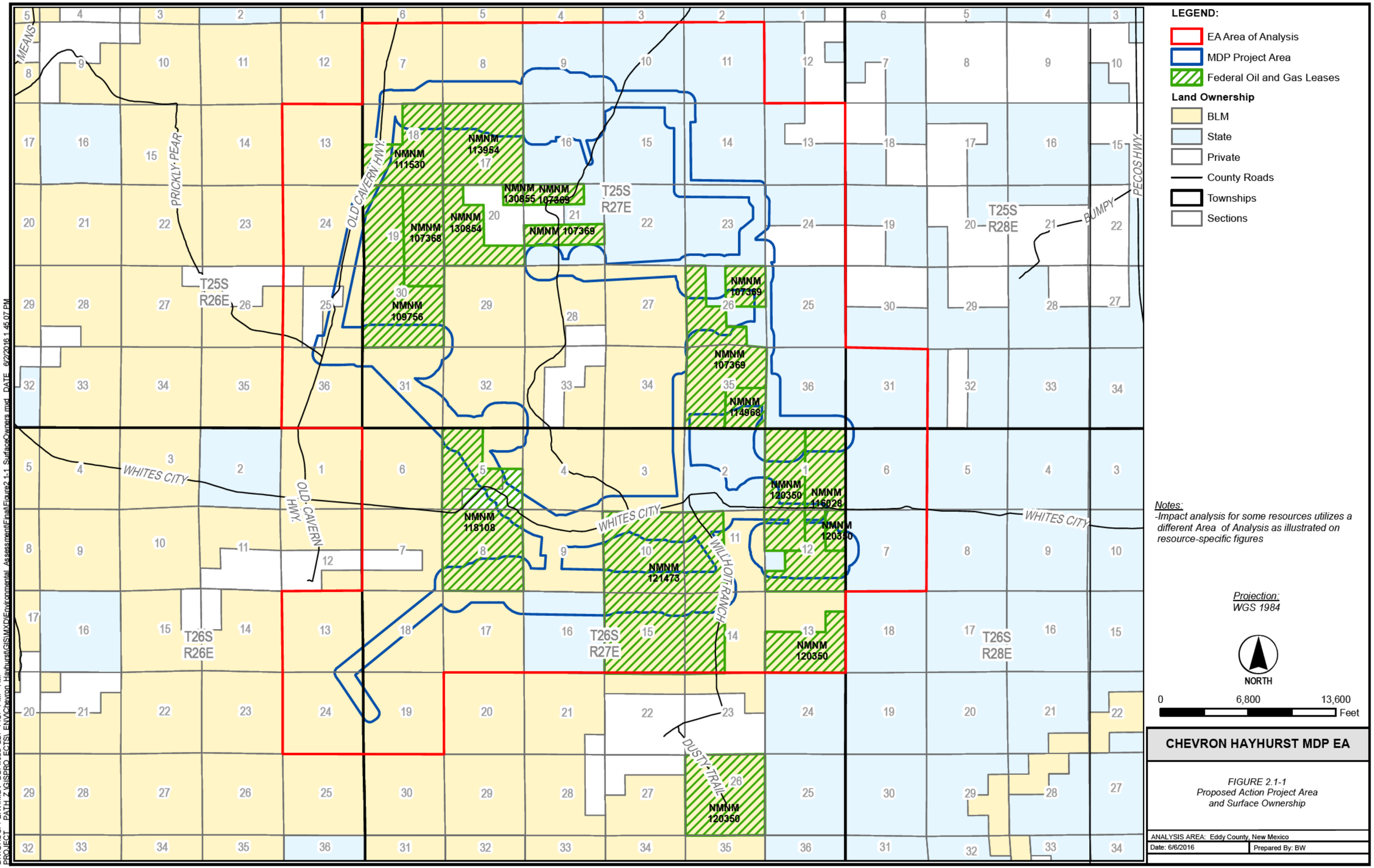
Group 1 includes all wells to be drilled on well pad HH SO 8 P2, plus associated facilities and infrastructure. APD Group 2 includes all wells to be drilled on well pad HH SO 10 P3, plus associated facilities and infrastructure. This approach is intended to simplify descriptions of the proposed APDs, as well as facilitate disclosure of potential environmental impacts. These two well pads would contain more than four wells in order to test the feasibility of increasing the numbers of wells on future pads and reducing the total number of pads.

Surface Requirements

Table 2.1-1 provides estimates of short-term (less than 18 months) and long-term (up to 45 years, assuming well production into the 2050s) disturbance for each wellfield component. **Table 2.1-2** summarizes disturbances for the 12 submitted APDs. A total of 1,808 acres of short-term surface disturbance would occur, of which approximately 1,437 acres would be on BLM-administered lands, 365 acres on state lands, and 6 acres on private lands (**Table 2.1-3**). All proposed surface disturbances on private lands would occur on a single parcel in Township 26 South (T26S), Range 27 East (R27E), Section 5. Interim reclamation would decrease project-wide long-term disturbances to an approximate total of 806 acres.

At the programmatic level of analysis for MDP features where an APD has not been submitted, estimating surface requirements for construction of project facilities requires some assumptions. The assumptions used in this analysis are conservative in order to provide a worst-case scenario for potential environmental impacts while leaving some operational flexibility. For example, the dimensions of well pads needed for operations are expected to average 475 feet by 330 feet; however, the required surface disturbance during construction may be larger to account for areas of cut or fill and storage of topsoil and spoil. To account for additional construction surface requirements for cut, fill, and topsoil or spoil storage, each non-linear feature (e.g., well pads, tank batteries, water containment ponds) was estimated to have additional surface disturbances extending 55 feet in all directions (**Table 2.1-3**). Areas where the 55-foot buffer for surface disturbances overlapped between neighboring features were double-counted to account for disturbances that could occur due to relocating the feature in the future.

Estimating surface disturbances for linear features (e.g., roads, pipelines, utility lines) also requires similar assumptions. The actual configuration of linear disturbance corridors (e.g., ROWs) would vary according to the number and types of components within the corridor. For example, the number of flowlines within a particular portion of a corridor may range from one to a few dozen. Therefore, although a typical ROW width of 106 feet is anticipated for most areas, the actual width and configuration may vary from that shown in **Table 2.1-4**. This analysis assumes that all linear disturbances would occur within a 654-acre area that encompasses all proposed roads, pipelines, flowlines, and utility lines as conceptually envisioned. This area includes approximately 0.7 miles of existing road that would be upgraded in T25S, R27E, Section 16 that was not included in the proposed MDP as submitted to the BLM. Within the 654-acre linear disturbance area, disturbances from each type of linear feature were estimated based on the total length and estimated width of disturbance for each feature type. As described above, surface requirements for each linear feature type would be larger than the trench or road width. Some areas between linear features may be disturbed multiple times (e.g., if utility construction follows pipeline reclamation) but are not double-counted.



CHEVRON HAYHURST MDP EA

FIGURE 2.1-1
Proposed Action Project Area and Surface Ownership

ANALYSIS AREA: Eddy County, New Mexico

Date: 6/6/2016 | Prepared By: BW

DIV/GROUP: ENV/MDV DB: webb LD: PIC: PM: TM:
PROJECT PATH Z:\GISPRO_ECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment\Final\Figure2.1-1_SurfaceOwners.mxd DATE 6/2/2016 1:45:07 PM

T24S R26E
T24S R27E
T24S R28E
T25S R26E
T25S R27E
T25S R28E
T26S R26E
T26S R27E
T26S R28E
MEANS
OLD CAVERN HWY.
PRICKLY PEAR
ROADRUNNER
BUMPY
PECOS HWY.
GYPSUM
WHITES CITY
OLD CAVERN HWY.
GYPSUM HILLAHUNTY
WILLIAMS RANCH
DUSTY TRAIL
APD Group 2 Area
See Figure 2.1-4
APD Group 1 Area
See Figure 2.1-3

LEGEND:

- EA Area of Analysis
- MDP Project Area

Land Ownership

- BLM
- State
- Private
- County Roads
- Major Lease Roads
- Townships
- Major Access Road and Pipeline/Flowline Corridors
- Pipeline and Maintenance Road (Two-Track) Corridor

MDP Features

- Central Tank Batteries
- Compression Station
- Frac Ponds
- Man Camp
- Salt Water Disposal Wells and Facilities
- Sub Station
- Water Tank Farm
- Well Pad

APD Features

- Well Pad
- Tank Battery
- Frac Pond
- Compression Station

Notes:
-Impact analysis for some resources utilizes a different Area of Analysis as illustrated on resource-specific figures
-ROWs included in APDs are not depicted. See Figures 2.1-3 and 2.1-4 for more details

Projection:
WGS 1984

NORTH

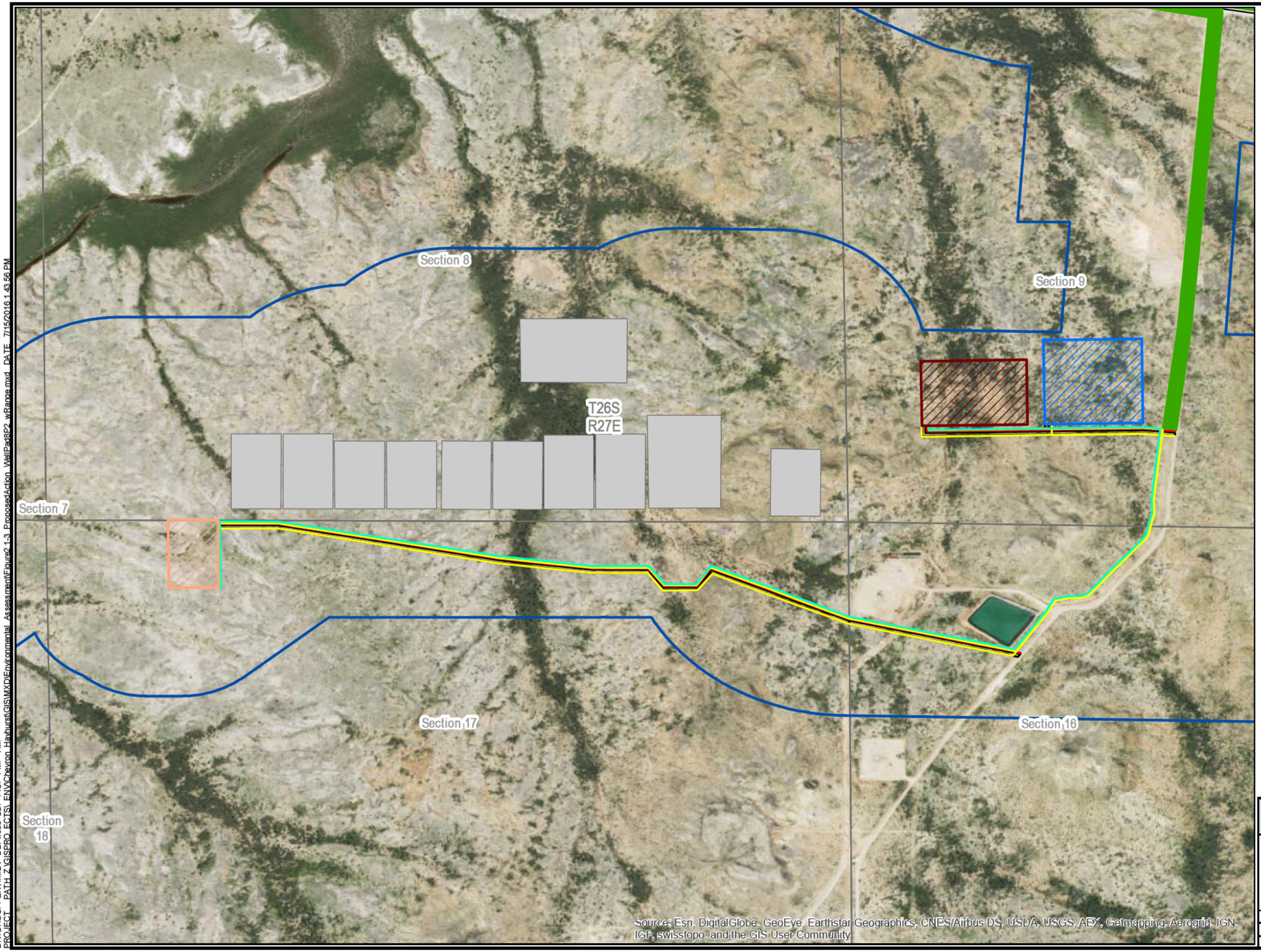
0 6,800 13,600 Feet

CHEVRON HAYHURST MDP EA

FIGURE 2.1-2
Proposed Action Overview

ANALYSIS AREA: Eddy County, New Mexico
Date: 6/6/2016 | Prepared By: BW

DIV/GROUP: ENV/MDV DB: webb LD: PIC: PM: TM:
PROJECT: PATH: Z:\GIS\PROJECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment\Final\Figure2.1-2_ProposedAction.mxd DATE: 6/6/2016 3:05:49 PM



LEGEND:

- MDP Project Area
- MDP Features - See Figure 2.1-2
- County Roads
- Sections
- Major Access Road and Pipeline/Flowline Corridors

APD Features

- Frac Pond
- Tank Battery
- Well Pad
- Flowline
- Pipeline
- Powerline
- Road

Notes:
- MDP Features final locations pending APD submittal to BLM.
- Facility sizes shown are for working area only and do not include extra space for cut and fill, or topsoil/spoil storage.

Projection:
WGS 1984

NORTH

0 750 1,500 Feet

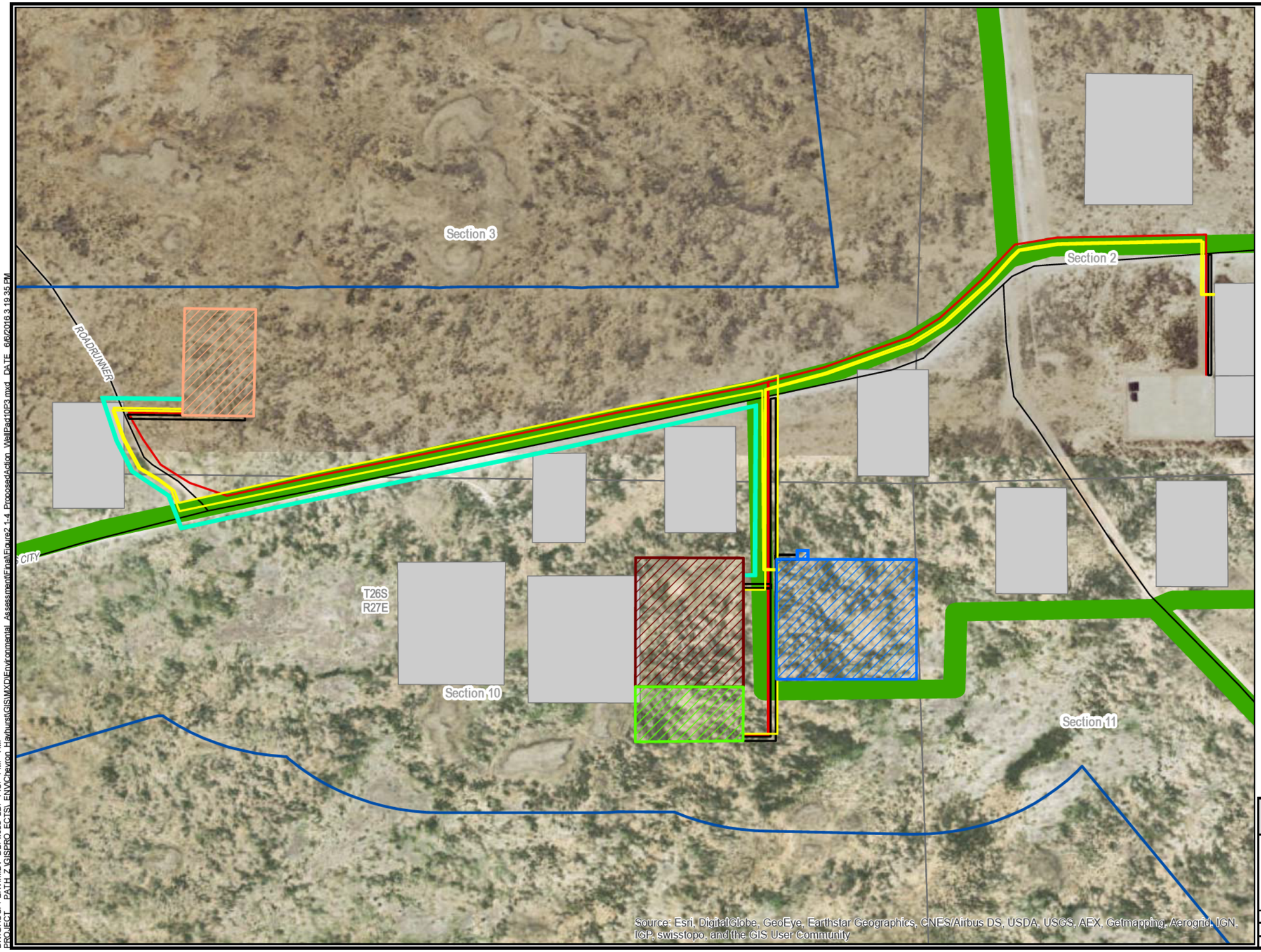
CHEVRON HAYHURST

FIGURE 2.1-3
Proposed Action
Well Pad HH SO 8 P2 Overview

ANALYSIS AREA: Eddy County, New Mexico

Date: 7/20/2016 | Prepared By: BW

DIV/GROUP: ENV/MDV DB: webb LD: PIC: PM: TM:
PROJECT PATH Z:\GIS\PRO_ECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment\Figure2.1-3_ProposedAction_WellPad8P2_wRange.mxd DATE 7/15/2016 1:43:56 PM



LEGEND:

- MDP Project Area
- MDP Features - See Figure 2.1-2
- County Roads
- Sections
- Major Access Road and Pipeline/Flowline Cooridors

APD Features

- Well Pad
- Tank Battery
- Frac Pond
- Compression Station
- Flowline
- Pipeline
- Powerline
- Road

Notes:
- MDP Features final locations pending APD submittal to BLM.
- Facility sizes shown are for working area only and do not include extra space for cut and fill, or topsoil/spoil storage.

Projection:
WGS 1984

NORTH

0 525 1,050 Feet

CHEVRON HAYHURST

FIGURE 2.1-4
Proposed Action
Well Pad HH SO 10 P3 Overview

ANALYSIS AREA: Eddy County, New Mexico

Date: 6/6/2016 | Prepared By: BW

DIV/GROUP: ENV/MDV DB: webb LD: PIC: PM: TM:
PROJECT PATH: Z:\GIS\PRO_ECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment\Final\Figure2.1-4_ProposedAction_WellPad10P3.mxd DATE: 6/6/2016 3:19:35 PM

Table 2.1-1 Proposed Action Estimated Surface Disturbance – MDP

Project Component[1,2,3]	Length (miles)	Width (feet)[4]	Quantity	Buried or Surface-Laid	Short-term Disturbance (acres)	Long-term Disturbance (acres)
Well Pads	---	--	109	---	723	163[5]
Tank Battery Pads	---	--	16	---	184	184
Compressor Station Pads	---	--	7	---	74	74
Salt Water Disposal Pads[6]	---	--	5	---	82	44
Containment Ponds	---	--	4	---	53	53
Water Storage Facilities	---	--	2	---	23	23
Electrical Substation	---	--	1	---	11	11
Central Housing Facilities	---	--	2	---	4	4
Linear Features						
Roads[7]	51	28	---	---	226	226
Roads – Maintenance and Inspection Only[8]	4	10	---	---	6	6
Flowlines[9,10]	223	4	---	Buried	140	0
Gas Pipelines[11,12]	100	6	---	Buried	94	5
Oil Gathering Pipelines	25	4	---	Buried	15	1
Water Pipelines[13]	43	8	---	Buried	54	3
Powerlines	38	20	---	Overhead	118	6
				Total	**1,808**	**806**

Notes:
1 Actual permitted disturbances for specific features will be refined during the APD or ROW review process.
2 All non-linear features assume that an additional 55 feet in all directions would be required to account for topsoil and spoil storage, cut and fill areas, and other site-specific needs.
3 All linear disturbances are anticipated to occur within an approximately 654-acre area as illustrated in **Appendix B**. Disturbances for linear feature type are estimated based on total length and average width within this 654-acre area. Actual disturbances will depend on specific ROW configuration (e.g., number of flowlines and other features).
4 Includes trench, driving surface, and roadside ditch width only. Actual width will be greater to account for topsoil and spoil stockpiles, safety offset, etc. Increased width is reflected in disturbance acreage estimates. Widths are estimated based on a weighted average of line lengths and widths presented in **Table 2.1-4**.
5 Long-term disturbance assumes all well pads reduced to 200 x 325 feet during interim reclamation.
6 Includes both salt water disposal facilities and salt water disposal well pads.
7 Roads include resource roads and well pad/surface facility access roads. Disturbances potentially required to upgrade or maintain existing roads are included.
8 Includes two-track road in northeastern corner of HDA (**Figure 2.1-2**).
9 Flowlines transport produced fluid from all target formations to the first collection point.
10 Flowline construction disturbance would be 100% reclaimed immediately following installation.
11 Gas pipelines include gas lift, high-pressure gathering, and low-pressure gathering lines. The 6-foot width is an estimated average for all gas lift (4-foot trench), high-pressure gathering (8-foot trench), and low-pressure gathering (4-foot trench) lines.
12 Pipeline and powerline disturbance would be 95% reclaimed immediately following installation. Locations of permanent risers for isolation valves and tie-ins would not be reclaimed until final reclamation
13 Water pipelines include hydraulic fracturing water and salt water disposal flowlines.

Table 2.1-2 Proposed Action Surface Disturbances – APDs

Project Component	Length (feet) or Initial Dimensions (feet)	Short-term Disturbance (acres)	Long-term Disturbance (acres)
APD Group 1			
Well Pad	600 x 400[1]	5.5	1.5
Roads	7,325	0[2]	4.7[2]
Flowlines (Temporary Surface)	8,622	0[3]	0[3]
Pipelines (Permanent Buried)	9,492[4]	22.6[5]	1.1[6]
Tank Battery Pad	550 x 750[1]	9.5	9.5
Containment Pond	760 x 760[1]	13.3	13.3
Powerlines	7,285	0[7]	0[5,6]
	Total	**50.9**	**30.1**

Table 2.1-2 Proposed Action Surface Disturbances – APDs

Project Component	Length (feet) or Initial Dimensions (feet)	Short-term Disturbance (acres)	Long-term Disturbance (acres)
APD Group 2			
Well Pad	600 x 375[1]	5.2	1.5
Roads	2,658	0[2]	1.7[2]
Flowlines (Temporary Surface)	4,823	0[3]	0[3]
Pipelines (Permanent Buried)	8,440[4]	21.3[5]	1.1[6]
Combined Tank Battery and Compressor Station Pad	1,100 x 600[1]	15.2	15.2
Containment Pond	760 x 760[1]	13.3	13.3
Powerlines	8,642	0[7]	0[5,6]
	Total	**55.0**	**32.8**
	Grand Total	**105.9**	**62.9**

Notes:
1 Includes areas for topsoil and spoil storage and areas of cut and fill.
2 Assumes 28-foot road width (including ditches) for long-term disturbance. All roads would be constructed parallel to pipelines and flowlines. Short-term road disturbances are included in calculations for Pipelines (Permanent Buried).
3 Flowline construction disturbance would be 100% reclaimed immediately following installation. In this table, short-term flowline construction disturbances are included in calculations for Pipelines (Permanent Buried).
4 Maximum length – does not equal combined length of individual flowlines. APD Group 2 includes salt water disposal flowlines to a future salt water disposal facility in T26S, R27E, Section 2 SW1/4. Surface Use Plats for salt water disposal and salt water disposal access road have not been submitted to the BLM at this time.
5 Assumes 106-foot-width, including flowlines, powerlines, and access roads.
6 Pipeline and powerline disturbance would be 95% reclaimed immediately following installation.
7 Disturbances are included in calculations for Pipelines (Permanent Buried). APD Group 2 includes salt water disposal utility lines.

Table 2.1-3 Proposed Action Estimated Surface Disturbance by Landowner

Landowner/ Management Agency	Short-term Disturbance (acres)	Long-term Disturbance (acres)
MDP		
Federal (BLM)	1,437	623
State of New Mexico	365	178
Private[1]	6	6
APD Groups 1 and 2 (combined)		
Federal (BLM)	95.3	62.4
State of New Mexico	10.6	0.5
Private	0	0
Total	**1,808[2]**	**806[2]**

Notes:
1 All disturbances on private lands would be from road or ROW construction.
2 All APD Group 1 and Group 2 disturbances are included in MDP disturbances and are not additive.

Construction

This section describes the proposed construction of well pads, access roads, gathering pipelines, and powerlines. Facilities associated with oil and gas production (e.g., tank batteries, compressor stations, salt water disposal facilities, and water storage and recycling facilities), the electrical substation, and central housing facilities are described in the "Production – Operation and Maintenance" or "Workforce" sections below. For each APD, construction, maintenance, restoration, and reclamation would be conducted in accordance with the MDP SUPO unless otherwise specified in the APD-specific SUPO, as described below.

Well Pads

Chevron is proposing to construct 109 production well pads. The well pad construction schedule has yet to be determined, but Chevron expects to construct between three and seven pads annually. The working surface (drilling and completion operations area) of the well pads would average 475 feet by 330 feet (3.6 acres) and would be surfaced with caliche. Including cut and fill slopes and topsoil storage, average surface disturbance per pad would be approximately 6.6 acres. Construction of the 109 well pads would result in an estimated 723 acres of short-term surface disturbance. Following interim reclamation (reduction of the pad size as areas unnecessary for long-term production are reshaped and revegetated), a working area of approximately 1.3 acres per well pad would remain disturbed throughout the long-term production phase of the wells. Following interim reclamation, total long-term disturbance for all well pads is estimated to be 163 acres. As stated above, Chevron may increase the number of wells per pad and likewise decrease the total number of well pads. If more than four wells are drilled on a pad, the size of the pad may need to be increased; however, the total short-term and long-term surface disturbances for well pads would not exceed 723 and 163 acres, respectively. Typical drawings of the proposed well pads during drilling and production are included in **Appendix C**.

Each proposed production well pad would accommodate approximately four wells, and would be constructed from native soil and rock materials present at the site or mined from approved caliche pits. Pads would be constructed by clearing vegetation, salvaging and storing topsoil, and leveling the drilling area using cut-and-fill techniques where appropriate. Topsoil would be placed adjacent to the pad where interim reclamation is planned to be conducted following well completion. Chevron would conduct interim reclamation within six months after well completion. If an approved APD is planned to be drilled from a location in which interim reclamation has yet to be initiated, Chevron would request an extension through Sundry Notice – Notice of Intent to delay interim reclamation until either six months following the approved APD's well completion or the APD expires, whichever occurs first.

Access Roads – Existing

Chevron proposes to use approximately 4.9 miles of existing county roads and 11.8 miles of existing lease roads for access within the HDA during construction, drilling, and completion operations. Road maintenance and upgrades on BLM-administered surface would comply with Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development (also known as the BLM Gold Book; BLM 2007). Maintenance and upgrades for existing roads are included in estimates of surface disturbances. All roads would be surfaced with caliche, crushed gravel, or river rock during construction. Chevron would restrict activities to permitted roads, facilities, and established or approved sites. Chevron would follow posted speed limits.

Chevron would improve or maintain existing roads in a condition the same as or better than before operations begin. All existing roads would be used in their present condition with the exception of minor maintenance as needed. All existing structures on the entire access route such as cattle guards, other range improvement projects, culverts, etc. would be properly repaired or replaced if they are damaged or have deteriorated beyond practical use due to Chevron's activities. Chevron would abate and, where reasonably possible, prevent fugitive dust as needed, whether created by vehicular traffic, equipment operations, or wind events. BLM written approval would be acquired before application of surfactants, binding agents, or other dust suppression chemicals on roadways.

Access Roads – New

Prior to construction, ROWs would be applied for through the BLM and all construction activity would be confined to the approved ROW. Chevron would run all ROWs parallel to existing disturbances wherever possible. Proposed ROWs would include new access roads, pipelines, and powerlines. The typical ROW configuration is provided in **Table 2.1-4** and shown on **Figure 2.1-5**. The third-party oil gathering pipeline is provided to estimate disturbances; however, Chevron would not be applying for this ROW. BLM CFO Realty would evaluate the third-party ROW application and may tier its analysis to this EA.

Table 2.1-4 Right-of-Way Configuration and Services in Each Trench

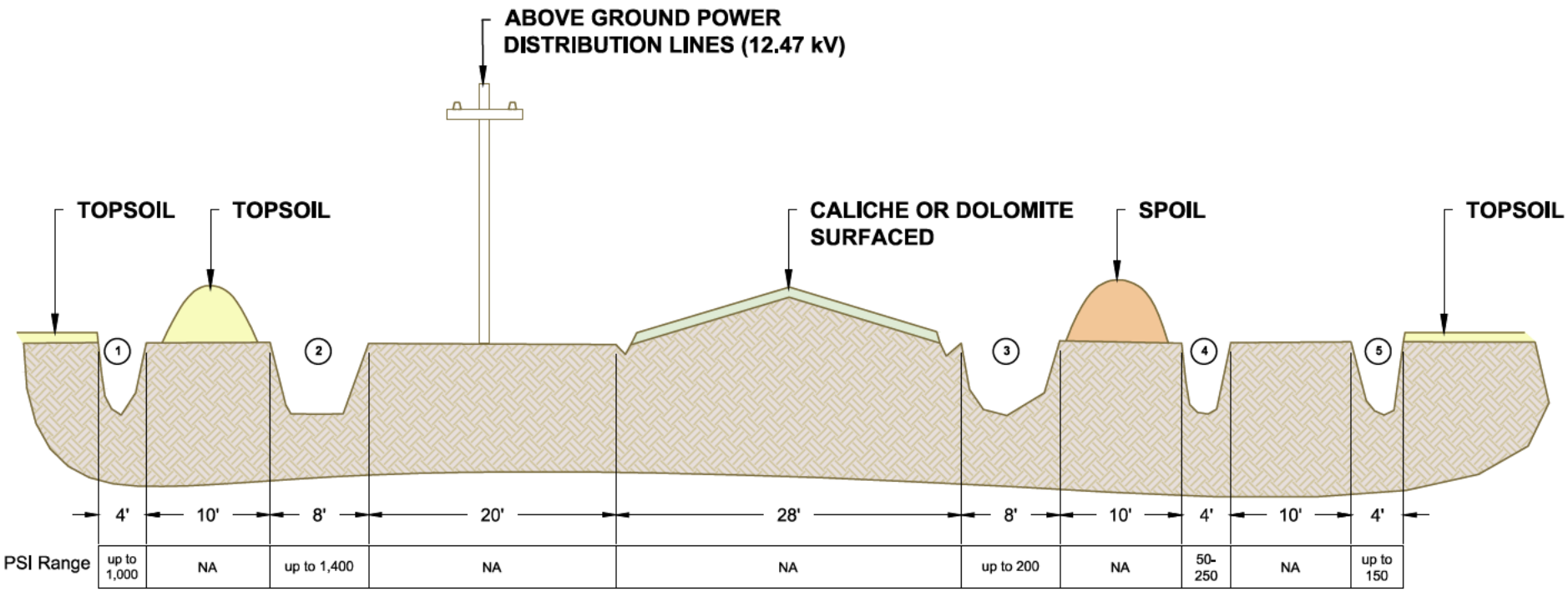
Trench ID	ROW Component	Service Description	ROW Width (feet)
1	Gas Lift Pipeline	Lift-gas distribution	4
		Safety Offset	10
2	High-Pressure Gas Pipeline	Gas gathering at up to 1,400 pounds per square inch gauge (psig), dual lines in some cases	8
		Aboveground (overhead) distribution powerlines (12.47 kilovolts)	20
		Two-lane access road with ditches	28
3	Water Pipelines	Distribution pipelines for hydraulic fracturing water and gathering pipelines for produced water	8
		Safety Offset	10
4	Low-Pressure Gas Pipeline	Gas gathering at 50 to 250 psig	4
		Safety Offset	10
5	Oil Pipeline	Third-party oil gathering pipeline	4
		Total Width	**106**

Chevron proposes approximately 16 miles of new resource roads under the proposed action. New resource roads up to 24 feet wide (28 feet including ditches) would be constructed at the same time as the well pads and facilities they are intended to serve. Road construction, maintenance, and upgrades on BLM-administered surface, state, and private surface estate would comply with the BLM Gold Book (BLM 2007). All roads would be surfaced with caliche or river rock during construction. Reclamation of new access roads is not proposed and Chevron estimates a short- and long-term disturbance of approximately 45 acres for new roads.

New access roads would be constructed as crowned and ditched roads and would be graveled as needed for drilling. If requested by the surface tenant, upgrading of this portion of the road would be kept to a minimum. In accordance with BLM standards, drainage control would be ensured over the entire road through the use of drainage dips, in-slipping and ditches, natural rolling topography, ditch turnouts, armored crossings, or culverts. Site-specific road design would consider grades, soils, and local hydrology. Culverts, low water crossings, and cattle guards would be installed as needed. Where culverts or drainage crossings are required, they would be designed for a 100-year, 24-hour storm event without development of a static head at the pipe inlet.

The following design specifications would be observed while constructing all access roads:

- No additional construction easement would be required outside the total ROW (see “Flowlines and Gathering Pipelines” subsection below).
- No turnouts are anticipated to be constructed due to the 24-foot road width; if a turnout is deemed necessary, it would be approved on a case-by-case basis.
- If the road gradient exceeds 8 percent over a 300-foot length, a site-specific engineering design would be submitted to the CFO for approval prior to construction.
- A cross slope of 2 percent would be used to allow water to drain from the crown.
- Major cuts-and-fills would use a 2:1 horizontal to vertical slope initially, and would be modified to a 3:1 slope when the road is completed.
- Six inches of base material, leadoff ditching, low water crossings, culverts, and water bars would be installed where needed to control erosion.



Notes:
1. Topsoil and Spoil pile locations would vary according to timing of component construction.
2. Working space location and width would vary according to timing and component being constructed.
3. Dolomite to be used in areas of gypsum soils.

Trench ID	ROW Component	Service Description	ROW Width (feet)
1	Gas Lift Pipeline	Lift-gas distribution	4
Safety Offset			10
2	High-Pressure Gas Pipeline	Gas gathering at up to 1,400 psig, dual lines in some cases	8
Aboveground distribution powerlines (12.47 kV			20
Two-lane access road, including drainage ditches			28
3	Water Pipelines	Distribution pipelines for hydraulic fracturing water and gathering pipelines for produced water	8
Safety Offset			10
4	Low-Pressure Gas Pipeline	Gas gathering at 50-250 psig	4
Safety Offset			10
5	Oil Pipeline	Third party oil gathering pipeline	4
		Total Width	106

CHEVRON HAYHURST MDP EA

FIGURE 2.1-5
Example ROW Trench Configuration

ANALYSIS AREA: Eddy County, New Mexico

Date: 5/18/2016 | Prepared By: BAR

CITY:ROSEVILLE DIV/GROUP:ENVCAD DB:ENVCAD PM:(Reqd)
G:\ENVCAD\Roseville-CA\ACT\B0048783\0000\0004A\B0048783,0000 ROW Trench.dwg LAYOUT: 2.1-X SAVED: 5/25/2016 10:19 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: LTR LAND PLOTSTYLETABLE: ARCADIS.CTB
PLOTTED: 6/2/2016 9:18 AM BY: ROBITAILLE, BEVERLY

This page intentionally left blank.

While not a BLM CFO requirement for resource roads, Chevron may elect to windrow, segregate, and store topsoil along the road for later spreading across the disturbed ROW corridor. If so, topsoil would be promptly seeded to control erosion, prevent weed establishment, and maintain soil microbial activity. In areas of high wind or water erosion, staked soil retention blankets would be used in combination with seeding to prevent topsoil erosion. Retention blankets would be a straw/coconut blend (or similar) and would be covered on the top and bottom with 100 percent fiber netting to reduce entanglement of small animals. Retention blanket stakes or anchors would be constructed of wood or other non-hazardous materials, not steel. All disturbed areas would be seeded by broadcast or drill-and-crimp during interim reclamation. Ground conditions would determine the seeding method used.

Flowlines and Gathering Pipelines

Proposed flowlines and gathering pipelines will be constructed immediately adjacent to roads. A flowline transports produced fluids and gases from the well head to the first collection point, and the gathering pipelines transport fluids and gases that have been separated at a collection point to another facility. Some new pipelines and flowlines would be installed adjacent to approximately 16.7 miles of existing improved roads (no upgrading needed) or adjacent to existing roads planned for upgrading. The remainder of pipelines and flowlines would be constructed adjacent to new roads or within an existing utility line corridor in the northeast portion of T25S R27E. For pipelines within the existing utility line corridor, no roads would be constructed or upgraded and the pipeline ROW would be used for inspection and maintenance access. Chevron proposes to reclaim approximately 95 percent of surface disturbances required for pipeline construction (**Table 2.1-1**). As a result, Chevron estimates a short-term disturbance of 163 acres for pipelines and a long-term disturbance of 9 acres. These estimates include pipelines for the transport of water for drilling and hydraulic fracturing operations.

All flowlines and gathering pipelines would be buried – none would be surface-laid. Flowline and pipeline trenches would be excavated mechanically; pipe segments would then be welded together and tested, lowered into the trench, and covered with excavated material. Topsoil would be salvaged and windrowed separately from the underlying subsoil and stored alongside the road until the trench is backfilled. All pipelines would be buried to a minimum depth of 36 inches from surface to top of pipe. Temporary water lines for hydraulic fracturing water would be installed on the ground surface, and located where practical within areas of previous surface disturbance.

The pipelines would be installed in separated trenches for each service (i.e., type of pipeline). **Table 2.1-4** shows the configuration of services in each trench, and **Table 2.1-5** provides detailed information about each pipeline required for drilling, completions, and production operations. Buried flowlines would also be constructed and reclaimed immediately following construction. Total short-term disturbance from flowline construction is estimated to be 140 acres.

Table 2.1-5 Pipeline Detailed Information

Pipeline Service	Nominal Size (inches)	Length (miles)	Pressure (psig)	Material of Construction	ROW Width (feet)
Gas Lift	4	26.2	1,100	Flexpipe	4
HP Gas Gathering[1]	12	14.7	1,400	Steel	8
Hydraulic Fracturing Water[2]	12	14.3	200	HDPE	8
Produced Water	12	17.8	150	HDPE	4
LP Gas Gathering	24	22.9	150	Steel	4
Oil Gathering[3]	12	22.9	150	Steel	4

Notes:
1 HP gas gathering ROW would include some third-party pipelines.
2 Hydraulic fracturing water includes all water to be used for hydraulic fracturing, which may be fresh, brackish, or recycled.
3 Oil gathering pipeline would be managed by a third-party.

Abbreviations:
psig = pounds per square inch gauge; HDPE = high-density polyethylene; HP = high pressure; LP = low pressure

Each pipeline and flowline would be pressure tested with freshwater to ensure integrity. All hydrostatic test (hydrotest) water would be purchased from local owners of water rights or sourced by Chevron and would be transported to the testing location by truck. After testing, the water would be disposed of in a produced-water injection facility where it would either be injected into a disposal well or be recycled for hydraulic fracturing operations. Cathodic protection will be used for metallic gathering pipelines. Flowlines will be made of nonmetallic material and would not require cathodic protection.

Powerlines

All powerlines would be overhead (none would be buried) and would be constructed to Avian Power Line Interaction Committee (APLIC) standards. The electrical distribution system would operate at 12.47 kilovolts (kV) with an average span of 250 feet between poles. Chevron estimates that 788 power poles would be required for a total of 37.3 miles of powerline. Chevron estimates a short-term disturbance of 118 acres for powerline construction and a long-term disturbance of 6 acres. Powerlines would be located within the same ROW as roads and pipelines as shown in **Table 2.1-4**. Chevron may post the powerline height at each road crossing.

Caliche Sources

Caliche would be required for surfacing of well pads, access roads, and some surface facilities. An existing BLM-approved caliche pit in T26S, R27E, Section 9, SWNE and SENE (Lease Number: NMNM91806) has been identified as the most likely source of caliche for the project. Disturbances associated with use of the existing caliche pit were assessed during permitting of the caliche pit and are not considered disturbances associated with the proposed action (EA-NM-067-3-1312). If additional caliche source areas are needed, Chevron would include the caliche pit in future APDs. Each APD will identify the caliche sources for that well and associated facilities. Potential future caliche pit locations have been identified in T24S R27E, Section 7 NESE (approximately 5 miles north of the HDA) and in T26S R27E, Section 17 SENE (within the HDA). Chevron will make payment to the BLM prior to removing any federal mineral materials.

Drilling and Completion

Up to 436 horizontal oil and gas wells and five vertical water disposal wells would be drilled under this proposed action. Fewer wells could be drilled than are proposed due to geologic conditions, market uncertainties, or other technological considerations. Chevron's drilling operations would be conducted in compliance with all Federal Onshore Oil and Gas Orders, as well as with all other applicable laws, rules, and regulations. As required by 43 CFR 3162.6, well signs would be installed for each well and would include the surface hole lease number, bottom hole lease number, and communitization agreement number. The seven potential target zones for the 436 total wells along with the target zone for the five water disposal wells are detailed in **Table 2.1-6**. As geology is more fully developed, Chevron may increase or decrease the number of target zones as it deems advisable.

Table 2.1-6 Potential Target Zones in the HDA

Target Zone	Approximate Depth Range[1] (feet)	Approximate Thickness Range (feet)
First Bone Spring	6,513 – 6,888	130 – 190
Second Bone Spring	7,492 – 7,621	1,080 – 1,250
Harkey Sand	7,771 – 8,123	55 – 115
Third Bone Spring Sand	8,050 – 8,617	810 – 850
Wolfcamp A	8,400 – 9,014	130 – 190
Wolfcamp C	9,459 – 9,870	130 - 145
Wolfcamp D	9,570 – 9,992	270 – 300
Disposal Zone (Devonian)	14,100 – 15,300	1,000 – 1,200

Notes:
1 Approximate depth to top of target reservoir below ground surface.

Up to four drilling rigs may be simultaneously deployed in the HDA. Drilling rigs with onsite diesel generators would maintain 4,500-foot spacing from other drilling rigs with onsite diesel generators to minimize the impact on air quality.

Drilling Plan

The Hayhurst MDP contains a 10-point drilling plan that would apply to all oil and gas wells drilled under the proposed action. Each APD would tier to this drilling plan and provide additional information specific to each well. A well is expected to require 24 to 60 days to drill and an additional 34 to 47 days to complete, depending on the targeted reservoir.

For all wells, surface casing would be run to a minimum depth of 100 feet below freshwater aquifers. The surface hole would be cased with steel casing and would be cemented in place from ground level to the depth specified in each well's approved APD. Prior to drilling below the surface casing, a Blowout Preventer (BOP) would be installed on the surface casing and both the BOP and surface casing would be tested for pressure integrity. The BOP and related equipment would meet the requirements of Federal Onshore Oil and Gas Order No. 2 and the BLM would be notified in advance of all pressure tests. Intermediate casing would also be set and cemented as specified in each well's approved APD. BOPs with a minimum system pressure rating of 10,000 pounds per square inch (psi) would be installed for the intermediate liner string for wells completed in the Wolfcamp Formation and for salt water disposal (SWD) wells.

Figure 2.1-6 provides a schematic example of the proposed casing and cementing program.[1] As stated above, the bottom of the surface casing would be placed at least 100 feet below the lowest occurrence of freshwater aquifers (e.g., Rustler Formation on diagram). Progressively smaller-diameter intermediate and production casing would be installed at greater depths. Production tubing, which transports hydrocarbons and produced water to the surface, is located in the center of the casing string. The annular space between the outside of the casing and the rock formations is filled with cement. For surface and intermediate casing, the cement extends from the bottom of the casing to the ground surface. For the production casing, cement extends from the bottom of the casing to above the base of the intermediate casing. The specific depth of each type of casing and amount of cement will vary from well to well.

Specific directional plans for each well would be included with a well's APD. Downhole operations would be completed with tools to facilitate proper direction and path of the well bore. Some wells may require a pilot hole to facilitate drilling the horizontal section of the well; these would be specified in a well's APD.

After drilling each hole section to its final depth, logging tools would be run into the well to evaluate the potential hydrocarbon resource. Once the evaluation is complete, steel production casing would be run and cemented into place in accordance with the well design as approved by the BLM. The proposed casing and cementing program would be designed to protect and isolate all usable water zones, potential productive zones, lost circulation zones, abnormally pressured zones, and any prospectively valuable deposits of minerals. BLM approval is required prior to the use of any isolating medium other than cement.

Upon cementing production casing in place, the drilling rig would be removed and replaced by a completion rig. Well completion primarily consists of hydraulic fracturing operations to stimulate a well's lateral section. Completion operations would be conducted according to "green completion" guidelines per 40 CFR 60, subpart OOOOa. A general description of the hydraulic fracturing process is included **Appendix D** (BLM 2015).

---

[1] The main purpose of cementing casing is to prevent fluid loss in production zones or aquifers and to prevent contamination of freshwater zones. The process of installing steel casing (a series of pipes that are screwed together end to end), which is then encased in cement, isolates and cushions the wel bore and casing from surrounding geologic formations and aquifers. The amount of each type of casing, depth to which they are installed, and cementing program are reviewed by the BLM prior to APD approval.

Production – Operation and Maintenance

This section describes components of the proposed action that would be required for the operation and maintenance of producing oil and gas wells. This includes facilities such as central tank batteries (CTBs), produced fluid (oil, gas, water) management, compression, work-overs, and completion. Production equipment at well pads is also described. Chevron anticipates drilling until 2033 and that production could continue until the late 2050s; however, this is dependent on funding and drill rig availability

All wells would be produced by gas lift and would not initially require a pumping unit or rotaflex. Gas lift would be accomplished by transporting produced natural gas to a centralized compressor station, where the gas would be dehydrated and compressed. The gas would then be transported via gas lift pipeline to each well pad where a valve and meter skid would control the amount of gas that is sent into the wellbore.

All permanent aboveground structures that would remain longer than six months would be painted a non-reflective BLM Standard Environmental Color, such as Shale Green. The exception would be that the Occupational Safety and Health Act (OSHA) Rules and Regulations would be complied with where special safety colors are required.

All production facilities with the potential to leak or spill oil-produced water, glycol, or other fluids that might be a hazard to public health or safety would be placed within secondary containment structures in accordance with Spill Prevention, Control, and Countermeasures (SPCC) guidelines. Secondary containment structures would consist of earthen containment berms. Secondary containment would be sized to contain a minimum of 150 percent of the storage capacity of the largest tank within the berm. All loading lines would be placed outside the containment berm with the valve protected by a drip bucket.

Well Pads

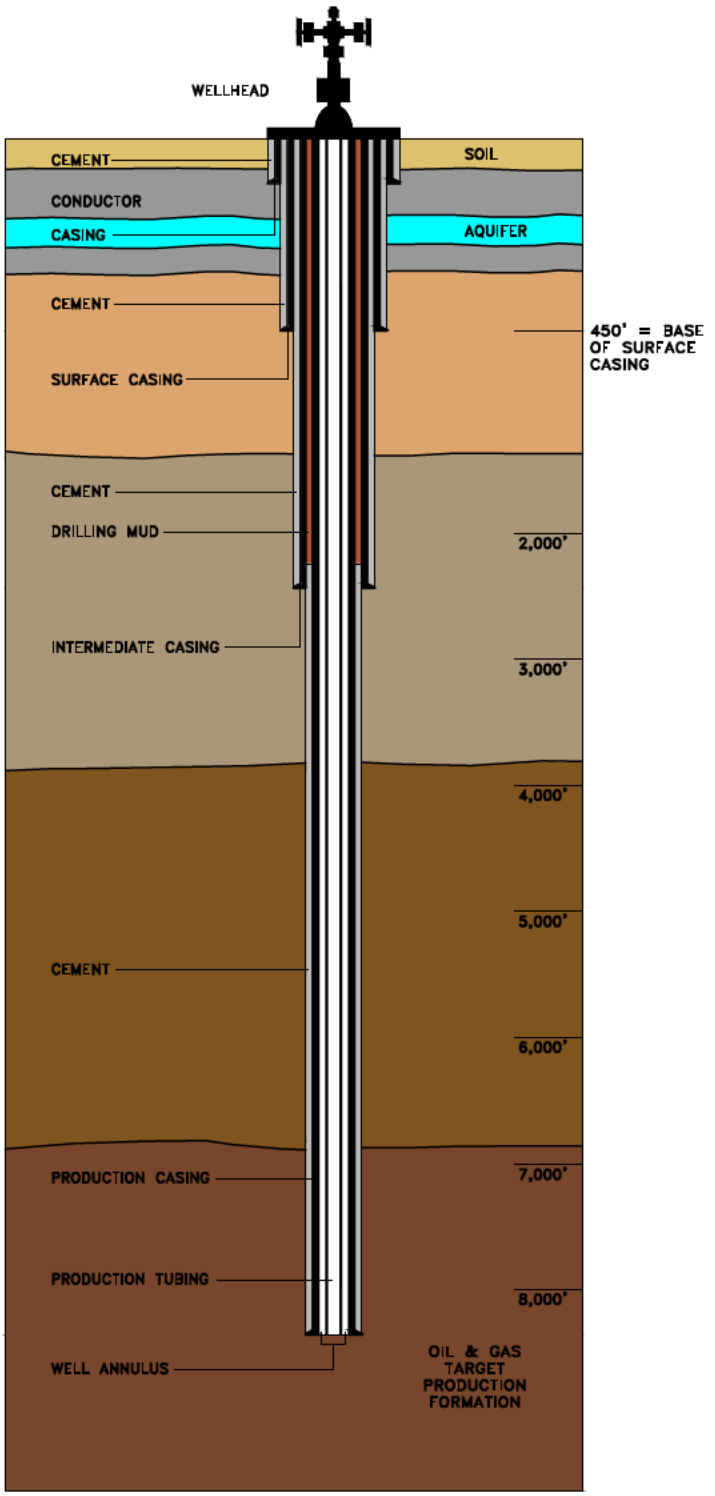
Surface facilities at each well pad location would consist of wellheads, gas lift metering units, and chemical injection equipment. Chemical injection equipment would be used to pump chemicals into flowlines to prevent freezing (e.g., methanol), or to pump chemicals into wellbores for operational purposes (e.g., scale inhibitor, paraffin inhibitor). Temporary equipment, such as sand separators and pressure let-down skids, may be installed during the first six to twelve months of production. No other equipment, including gas handling equipment, would be permanently installed on a well pad until after drilling and completion operations have finished. Telemetry and supervisory control and data acquisition (SCADA) equipment would be used to remotely monitor oil and gas wells and would reduce traffic to and from the well locations in order to minimize impacts on air quality, wildlife, and plants. A pumper truck would periodically visit the pads based upon information gathered from telemetry equipment. The approximate life of a well pad is anticipated to be 30 years.

Existing Facilities

Within the boundary of the HDA, Chevron currently operates two oil and gas facilities on BLM-administered surface lands and two facilities on state surface lands. These facilities would not be used as part of the proposed action as they are not designed for the scale of production envisioned in the MDP. Chevron would decommission these existing facilities as new facilities become operational, pending the approval of commingling agreements. The surface disturbance from the existing facilities would then be remediated or re-purposed.

Proposed Surface Facilities

Table 2.1-7 provides the expected number and pad size for each of the proposed surface facility types described below (with the exception of well pads, which are described above). Locations of these facilities, as proposed in the MDP, are shown on **Figure 2.1-2**. As for well pads, the locations of these facilities as proposed in APDs may move slightly, but would stay within the “MDP Project Area” shown on **Figure 2.1-2**.



NOT TO SCALE

NOTES:

1. Not to scale.
2. Actual depth of casing will depend on well geologic characteristics.
3. Deeper wells may have additional production casing segments of other sizes.
4. Wellhead type shown is for illistration purposes only.
5. Figure modified from ProPublica (https://www.propublica.org/artical/anatomy-of-a-gas-well-426).

CHEVRON HAYHURST

FIGURE 2.1-6
WELL CASING AND CEMENT SCHEMATIC

ANALYSIS AREA: Eddy County, New Mexico

Date: 7/8/2016 | Prepared By: RTS

G:\ENVCAD\COLUMBUS-OH\ACT\B0048783 - CHEVRON HAYHURST\0000\0004\WELLHEAD DETAIL.DWG

This page intentionally left blank.

Table 2.1-7 Proposed Pad Size for Production-Related Surface Facilities

Facility Type	Total Number	Pad Dimensions (feet x feet)[1]	Pad Size (acres)
Centralized Tank Battery	16	500 x 700	8
Compressor Station	7	500 x 700	8
Salt Water Disposal Facility	5	500 x 700	8
Containment Pond	4	710 x 710	12
Water Storage	2	500 x 700	8
Electrical Substation	1	500 x 650	7

Notes:
1 Facility dimensions are for working area only. For the purposes of estimating surface disturbances, each pad was buffered by an additional 55 feet to account for topsoil and spoil storage, cut and fill areas, and other site-specific needs.

Central Tank Batteries

Chevron expects all wells drilled in the HDA to produce oil, water, and gas. Produced oil, water, and gas would flow via buried flowlines from the wells to one of 16 proposed CTB facilities, where oil, water, and gas are separated and treated to meet sales specifications. **Table 2.1-8** and **Figure 2.1-2** detail the location of each CTB. All CTBs would have adequate oil and water tankage to minimize the risk of spills and to provide adequate time for field personnel to respond to production variations. Each CTB facility would have approximately three oil tanks and approximately six to eight water tanks. More oil and water tanks may be required based on site-specific production needs. All tanks located at a CTB would have a capacity of 750 barrels (bbl) and would be installed inside lined berms in accordance with SPCC guidelines. Secondary containment would be sized to contain a minimum of 150 percent of the storage capacity of the largest tank within each berm.

Table 2.1-8 Proposed Central Tank Battery Locations

ID	Township	Range	Section	Quarter-Quarter Section
1	26S	27E	10	NENE
2	25S	27E	9	SWSE
3	26S	27E	9	SWSW
4	25S	27E	35	NWSW
5	25S	27E	17	SENE
6	26S	27E	12	SWNW
7	25S	27E	35	NWSW
8	25S	27E	31	NWNE
9	26S	27E	12	SWNW
10	26S	27E	10	NWNE
11	26S	27E	12	SWNE
12	26S	27E	10	SESE
13	26S	27E	8	SWSE
14	25S	27E	35	NESW
15	25S	27E	16	SWNW
16	25S	27E	31	NWNE

Vapor recovery units (VRUs) would be installed to capture flash gases produced from tanks storing both oil and water. Chevron would install appropriate redundancy in VRU capacity to ensure 99 percent recovery of vapors. VRUs would typically consist of a switch that detects pressure and triggers a compressor, and a scrubber that traps and separates liquids and gas and feeds them to their respective pipelines. Leak detection and repair (LDAR) programs would be implemented at the facilities to minimize the quantity of fugitive emissions from valves and flanges. All production equipment with a chimney, vent, or stack would be fitted with a device, such as an excluder cone or equivalent, to prevent birds from

entering the chimney. Open top tanks or open containments (e.g., containment pans less than 5 bbl in capacity used at chemical tanks) will be netted.

Produced Water

Produced water would be pumped via pipeline to centralized SWD and treating facilities, where it would either be injected into a disposal well via electric pumps or be treated to remove oil, solids, and some dissolved metals for reuse in hydraulic fracturing operations. Once treated, this water would be stored in permanent containment ponds (i.e., "frac ponds"), each sized to hold approximately 770,000 bbl of water. When operational, treatment capacity of the system is anticipated to provide the required volume of water for drilling and completion activities (except freshwater for drilling in karst zones) for all proposed wells. The proposed locations of SWD and containment facilities are detailed in **Table 2.1-9** and **Table 2.1-10**, respectively, and are illustrated on **Figure 2.1-2**.

Table 2.1-9 Proposed Salt Water Disposal Locations

ID	Township	Range	Section	Quarter-Quarter Section
1	26S	27E	2	SESW
2	25S	27E	16	SENW
3	25S	27E	26	SESE
4	26S	27E	12	NWSE
5	26S	27E	2	SESE

Table 2.1-10 Proposed Permanent Containment Pond Locations

ID	Township	Range	Section	Quarter-Quarter Section
1	26S	27E	10	NENE
2	26S	27E	9	SESW
3	25S	27E	18	NENE
4	25S	27E	26	SESE

Notes:
All permanent containment facilities would have a capacity of 770,000 bbl.

Prior to completion of the permanent water recycling system, the containment ponds would be used to store water from other sources. Containment ponds would be designed as "multiwell fluid management pits" in compliance with New Mexico Administrative Code (NMAC) Section 19.15.34 and would include the following design features:

- Berms: Berms shall be sloped at 3:1 both internally and externally. Berm tops would have at least 12 feet of working area and be capable of supporting light vehicle traffic. Berm height, thickness, and depth would be determined based on site-specific information and included in each APD and ROW application (SF-299).
- Liners: Ponds shall be double-lined and have a method of leak detection, typically trenched high-density polyethylene (HDPE) pipe, between liners. An 8-ounce geotextile fabric shall be used to line the soil prior to installation of a secondary (bottom) liner. Primary liner of 60-mil smooth HDPE and secondary liner of 60-mil smooth HDPE shall be installed. Minimum 200-mil geonet shall be installed between the primary and secondary liner to maintain an interstitial space.
- Fencing: Ponds shall have 8-foot game fencing installed around the perimeter, outside of the bottom berm. The fence bottom shall be keyed-in around the perimeter of the pond site and include the use of 2-foot silt fencing to prevent access of smaller animals.
- Wildlife Protection: Typical bird deterrent options include molded decoy owls and noise-making streamers. Wildlife protection measures, including those for migratory birds, shall be monitored at least monthly to ensure deterrents are effective. Additional bird deterrent options include sound-

activated devices that mimic predatory calls. These deterrents would be monitored on a periodic basis and enhanced as necessary to ensure effectiveness.

Until the permanent HDA water disposal and recycling system is available, produced water would be hauled off location in trucks for disposal at a state-approved facility. Chevron may construct up to two water storage facilities if produced water volumes meet or exceed forecasts. Each facility would utilize site-fabricated tanks larger than 3,000 bbl and would minimize the number of 750 bbl water tanks that would need to be installed at each CTB. The water storage facilities would each be approximately 8 acres in size (16 acres total) and would be located in T26S, R27E, Section 2 NWSW and T25S, R27E, Section 17 NE1/4.

Gas and Gas Compression

Gas would be piped to one of seven compressor stations, where it would be compressed to 1,200 pounds per square inch gauge (psig), dehydrated to meet sales specifications and to reduce the risk of methane hydrate formation, and sold into a third-party gas pipeline system. The location of each compressor station is detailed in **Table 2.1-11** and illustrated on **Figure 2.1-2**. If gas-driven engines are used for compression, all engines would be designed to meet Tier 4 emissions standards. Chevron may elect to use electrically-driven compression rather than gas-driven compression. The surface disturbance for an electrical substation (which involves slightly higher surface impact) is included in the proposed action (**Table 2.1-1**). If constructed, the electrical substation would be located in T25S, R27E, Section 17 NE1/4. Prior to sales, some of the gas would be diverted for use in artificial lift operations at each wellhead. Lift gas would be metered in accordance with the Federal Onshore Oil and Gas Order No. 5 prior to injection into each well's production tubing to ensure accurate production royalty accounting.

Table 2.1-11 Proposed Gas Compressor Station Locations

ID	Township	Range	Section	Quarter-Quarter Section
1	26S	27E	10	SENE
2	25S	27E	16	SENW
3	26S	27E	8	NENE
4	25S	27E	35	NWSE
5	25S	27E	17	SWNE
6	26S	27E	12	SWNE
7	25S	27E	31	NWNE

Oil

Oil would be sold via Lease Automated Custody Transfer (LACT) to a third-party oil pipeline system, although oil may be trucked during upset conditions or periods of pipeline curtailment.

Work-overs or Recompletions

Periodically, the work-over or recompletion of wells might be required to ensure that efficient production is maintained. Work-overs can include repairs to wellbore equipment (casing, tubing, valves, rods, or pumps), a wellhead, or production facilities. Cleaning or swabbing the wellbore may also be necessary for efficient production. Repairs would usually be completed during daylight. The frequency of this work cannot be accurately predicted because the need for work-overs varies from well to well. Recompletion of horizontal hydraulically-fractured wells is not anticipated.

Plugging, Abandonment, and Reclamation

New non-producing wells would be plugged, abandoned, and reclaimed within 90 days of well completion, weather permitting. Upon abandonment, each borehole would be plugged, capped, and its related surface equipment removed. Subsurface pipelines would be purged and plugged at specific intervals. A Sundry Notice would be submitted by Chevron to the BLM proposing the engineering,

technical, and/or environmental aspects of final plugging and abandonment. This notice would include final reclamation procedures and mitigation measures, and BLM standards for plugging would be followed.

Interim Reclamation

The objectives of interim reclamation, which reestablishes vegetation, ecological function, and other natural resource values during the productive life of a well pad, are to restore vegetative cover and a portion of the landform sufficient to maintain healthy, biologically active topsoil; to control erosion and sediment transport; and to minimize loss of habitat, forage, and visual resources throughout the project life. Chevron would complete interim reclamation of a well pad within six months following the completion of the last well on the pad. Following interim reclamation, Chevron would submit the required Sundry Notice-Sundry Report (Form 3160-5) to the CFO, informing the BLM that reclamation occurred. The following best practices will be followed during interim reclamation and discussion with the BLM CFO during the APD process:

- Within six months after a well pad has been placed on production, Chevron would implement the best strategies to reduce the size of the location that were discussed with contact BLM Surface Management Specialists during the APD submittal.
- Within 30 days of completion of the last well on a pad, the well location and surrounding areas would be cleared of, and maintained free of, all materials, trash, and equipment not required for production. A plan would be submitted, with the APD, showing where interim reclamation would be completed in order to allow for safe operations and protection of the environment outside of the drilled well, and would follow BMPs found in the BLM Gold Book (BLM 2007).
- In areas planned for interim reclamation, all surfacing material (e.g., caliche) would be removed and recycled to repair or build roads and well pads.
- The areas planned for interim reclamation would then be recontoured to the original contour if feasible, or if not feasible, to an interim contour that blends with the surrounding topography as much as possible. Where applicable, the fill material of the well pad would be backfilled into the cut to bring the area back to the original contour. The interim cut and fill slopes prior to re-seeding would not be steeper than a 3:1 ratio, unless the adjacent native topography is steeper. Note: constructed slopes may be much steeper during drilling, but would be recontoured to the above ratios during interim reclamation.
- Topsoil would be evenly respread and revegetated over the entire disturbed area not needed for all-weather operations, including cuts and fills. To seed the area, a BLM-approved seed mixture, free of noxious weeds, would be used.
- Erosion controls would be used on the disturbed areas to control erosion, runoff, and siltation of the surrounding area.
- Interim reclamation would be monitored periodically to ensure that vegetation has reestablished.

Final Reclamation

The long-term objective of final reclamation is to return the land, following authorized use, to a condition approximating that which existed prior to disturbance. This includes reclaiming of the landform, natural vegetative community, hydrologic systems, visual resources, and wildlife habitats.

A well pad that no longer has a producing well would undergo final reclamation within six months following plugging and abandonment of the final well on that pad. Buried pipelines would be purged and abandoned in place and not removed, and any remaining surface disturbance associated with pipelines would be reclaimed to final reclamation standards at the time of installation. Following abandonment of the final well, all associated overhead powerlines and access roads no longer required for operations and maintenance would be removed and reclaimed as required by the BLM.

Prior to final reclamation of a well pad, Chevron would submit a Sundry Notice – Notice of Intent detailing the reclamation plan (including the appropriate seed mixture to be used) and follow any Conditions of Approval added to the plan.

Prior to re-contouring and re-seeding the well pad, Chevron would complete the following:

- All equipment, facilities, and trash would be removed from the location.
- All surfacing material would be removed and returned to the original mineral pit or recycled to repair or build roads and well pads.
- Each borehole would be plugged, capped, and its related surface equipment removed.
- Subsurface pipelines would be purged and plugged at specific intervals.
- Dry hole markers would be installed subsurface, to prevent their use as perching sites by raptors.

Re-contouring for final reclamation would consist of returning the pad, material storage piles, cut and fill slopes, and stormwater control features to natural contours that blend with adjacent undisturbed areas, as specified in the final reclamation plan or final reclamation plat approved by the BLM. Requirements for seedbed preparation, soil amendments, seed, seeding procedures, mulching, erosion control fencing, security, and monitoring would be as specified for interim reclamation.

Water Supply and Management

Chevron expects that a variety of water sources would need to be utilized over the life of the project for drilling, completion, dust control, and hydrostatic testing. A number of potential water sources are outlined in **Table 2.1-12** and **Table 2.1-13**. Chevron may include additional water sources in subsequent APDs and would be analyzed through a separate NEPA analysis. The MDP does not propose completion of any new water wells. Any such wells would be applied for and evaluated separately under NEPA. Water obtained from the sources below would be obtained from existing, permitted water wells.

Table 2.1-12 Water Sources for Drilling and Completion

Source	Location[1]	Quality (mg/L TDS)	Transport Method
Local groundwater	Within 15 miles of HDA	Zero – 5,000	Pipeline or Truck
Recycled produced water	Within HDA	150,000 – 210,000	Pipeline

Notes:
1 Locations of potential water wells to be used under the proposed action are included in MDP Appendix B.
Abbreviations: mg/L = milligrams per liter; TDS – total dissolved solids

Table 2.1-13 Vendors Potentially Supplying Local Groundwater

Vendor	Mailing Address
Gregory Rockhouse Ranch, Inc.	1108 West Pierce Street, Carlsbad, NM 88220
MMX Excavating, Inc.	2373 Pecos Highway, Carlsbad, NM 8820
Wolfcamp Water Partners	4800 Bryan Irvin Court, Fort Worth, TX 76107
XRI Blue	415 West Wall Street #130, Midland, TX 79701

Notes:
1 Actual location of water source is not reflected in mailing address; water would not be transported from Fort Worth or Midland, TX.

Drilling and completion of each well are estimated to require 90,000 to 380,000 bbl of water. Of this, up to 7,000 bbl of freshwater per well may also be needed for karst zone drilling requirements (i.e., a maximum total of approximately 3,050,000 bbl). Chevron estimates that 2,000,000 bbl of freshwater would be required to construct all pads and roads under the proposed action. An additional 1,700,000 bbl of freshwater would be required for dust control during construction and operations and 70,000 bbl of

freshwater would be required to hydrotest all pipelines and flowlines. Once all wells are in the production phase, freshwater would only be used for dust control.

The remainder of drilling and completion water would be brackish, produced, or recycled. Chevron expects that all non-fresh drilling and completion water for oil and gas wells would be supplied by the project water recycling system. Drilling and completion water for the initial SWD well would be obtained from local groundwater sources. The water recycling system would be operational prior to drilling the first oil and gas wells. Chevron expects to recycle produced water from currently producing wells within the HDA and to utilize the recycled water for drilling and completion operations for the initial wells in APD Groups 1 and 2. Recycled produced flowback water from these initial wells would then be used to drill and complete subsequent wells. As operations expand to additional well pads, additional recycling units would be constructed adjacent to proposed containment ponds locations (**Figure 2.1-2** and **Table 2.1-10**).

During the well drilling and completion process, water would be transported to each well location by temporary 10-inch-diameter, expanding surface-laid pipelines installed along the edge of the access roads or cross country. Chevron would secure all necessary ROWs prior to laying of temporary surface lines. All temporary surface lines would be removed within 30 days following last use.

Waste Management

Wastes associated with the proposed action may include produced water, garbage, sewage, drill cuttings, water recycling wastes, and other waste materials associated with drilling and completion. The following measures are proposed regarding handling waste, including those for hazardous materials management:

- Chevron would use a closed loop drilling system (constructed, maintained, and operated in accordance with rules and regulations of the New Mexico Oil Conservation Division [NMOCD] [Pit Rule 19.15.17 NMAC]) to capture drill cuttings and to recycle drilling mud. Drill cuttings, drilling fluids, and produced oil and water would be stored in steel tanks, trucked to an NMOCD-approved disposal site (**Table 2.1-14**), and disposed of properly. Additional disposal sites may be included in subsequent APDs.
- Produced water would be transported via truck outside of the HDA for disposal at a state-approved facility, or would be transported via pipeline to SWD facilities, where it would either be injected into a disposal well or be treated to remove oil, solids, and some dissolved metals for reuse in hydraulic fracturing operations.
- Garbage, trash, and other waste materials would be collected in portable, self-contained, and fully enclosed trash cages during drilling and completion. Upon completion of operations, or as needed, the accumulated trash would be disposed of at a state-approved facility. No trash would be burned or buried on location.
- Immediately after the removal of the drilling rig, all debris and other waste materials not contained in the trash cage would be cleaned up and removed from the well location.
- Self-contained chemical toilets would be provided for human waste. Upon completion of operations, or as needed, the toilet holding tanks would be pumped and the contents thereof disposed of in the nearest approved sewage disposal facility.
- Hazardous materials would be handled in the following manner:
  - Project-related activities involving hazardous materials would be conducted in a manner that minimizes environmental impacts. A file would be maintained containing current Material Safety Data Sheets (MSDSs) for all chemicals, compounds, and/or substances used in the course of construction, drilling, completion, production, and reclamation.
  - Spills of any potentially hazardous substance would be reported immediately to the BLM and other responsible parties. Spills would be mitigated immediately. Appropriate measures for

cleanup would be implemented, and spilled material removed and transported to an approved disposal site according to the SPCC plan. Any release of toxic substance (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR, Part 117 would be reported per CERCLA Section 102b. Spills or leakages of oil, gas, produced water, toxic liquids, or other materials would be reported in accordance with 43 CFR 3162.5-1(c). Copies of any report to any federal agency or state government as a result of a reportable release/spill of any toxic substances would be furnished to the BLM, concurrently with the filing of the repots to any federal agency or state government.

Table 2.1-14 Approved Drilling Waste Disposal Sites

Nearest City	Disposal Facility	Address
Carlsbad	R360 – Halfway	6601 Hobbs Highway, Carlsbad, NM
Eunice	Sundance Services	5 miles east of Eunice, NM, on Highway 18 and Wallach Lane
Seminole, TX	Permian Disposal	587 US Highway 385 South, Seminole, TX

Schedule

The schedule of construction for the proposed action has yet to be determined. However, activity is expected to begin within six months of obtaining all BLM and other federal, state, and local approvals. Chevron expects to construct between three and seven pads annually and to drill and complete between 12 and 28 wells annually, but could be more. Chevron may delay activity and control the pace of its operations according to lease obligations and market conditions.

Workforce, Access, and Traffic

Chevron estimates that 18 workers (nine per shift) would be required per drilling rig, which would drill 24 hours per day and seven days per week. Chevron also estimates that a peak of 70 workers (35 per shift) would be required per pad during completion operations, which would occur 24 hours per day and seven days per week. Additional personnel would be required for facility construction, pipeline construction, commissioning, and operations. **Table 2.1-15** provides an estimate of peak construction and operations workforces. Personnel may be housed at temporary, centralized housing facilities or at the drilling location (T26S, R27E, Section 2 SWSE). If constructed, the centralized housing facilities would be removed and reclaimed following drilling and completion of the final well, or earlier.

Table 2.1-15 Estimated Daily Peak Construction and Operations Workforces

Workforce Category	Number of Workers at Peak
Construction	
Well pad construction	4
Well drilling	72[1]
Well completion	70[2]
Interim reclamation	2
Road/pipeline/facility construction	20
Construction Total	**168**
Operations	
Commissioning	6
Production operations and maintenance	8
Compression operations and maintenance	10
Operations Total	**24**

Notes:
1 Assumes a maximum of four rigs operating at one time.
2 Assumes one completions spread – may temporarily increase to two spreads if required by logistics.

All access into the HDA would be via White City Road (CR 724). This county road can be accessed from Pecos Highway (NM 285) either from Carlsbad, New Mexico from the north or Pecos, Texas from the south.

Substantial traffic is not expected as part of the proposed action. Light vehicles for construction and operations are expected to travel to and from the HDA regularly from Carlsbad, Eunice, or Jal, New Mexico or Pecos, Texas, or other towns. Heavy vehicles (e.g., drilling rigs, hydraulic fracturing spreads, cranes, and facility equipment delivery trucks) would travel to and from the HDA sporadically during mobilization and demobilization. Heavy vehicle traffic would be routed away from the Village of Loving, New Mexico so as to avoid the school zone near the Loving Municipal Schools campus on Pecos Highway (NM 285).

Design Features

Design features are those specific means, measures, or practices that make up the proposed action. Additional design features may be added as needed, particularly after APD submittal and onsite review. Regulations, standard operating procedures, stipulations, operator-committed measures, and BMPs are usually considered design features. For example, if the proposed action sites a reserve pit for drilling fluids away from areas of shallow groundwater, this is a design feature, not mitigation. Design features are incorporated into the proposed action to reduce or avoid adverse effects.

Because the formulation of alternatives and the impact analysis is often an iterative process, additional means, measures, or practices can be identified through the impact analysis process. If any means, measures, or practices are not incorporated into the proposed action, they are considered mitigation measures. Mitigation measures, if needed, are listed at the end of each environmental consequence section in Chapter 3 of this EA. Mitigation measures are added only if the design features do not reduce or avoid adverse effects to protected resources.

Some of the more relevant design features and environmental protection measures that would reduce or eliminate adverse effects after the initial formulation of alternatives are discussed below. If deviation from these design features is necessary, Chevron would include a request for deviation as part of the APD associated with the deviation. Additional design features identified for the 12 APDs submitted with the MDP are described individually for each APD.

Archaeological, Paleontological, and Historical Sites

- In the event that prehistoric or historic archaeological material or bones are uncovered during construction or earth-disturbing activities, Chevron shall cease work immediately, protect the remains from further disturbance, and notify the appropriate land owner. On BLM land, if skeletal remains or associated funerary objects are found, Chevron shall immediately cease activities in the area of discovery, protect the remains, and notify the BLM pursuant to 43 CFR Section 10.5 (e) within 24 hours of discovery. The BLM will determine the nature and extent of the remains and determine appropriate treatment of the remains in consultation with tribes under the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA). Construction will resume only after clearance is provided by the BLM.
- If bones are found on State Trust Land, Chevron shall immediately notify local law enforcement and the Office of the Medical Investigator pursuant to 18-6-11.2C (Cultural Properties Act NMSA 1978). In accordance with 18-6-11.2C and/or 36 CFR 800 et seq. implementing Section 106 of the National Historic Preservation Act of 1966 (NHPA) as amended (54 USC 306108 et seq.), and the NAGPRA (25 USC, 3001, et seq.), Chevron shall notify the State Historic Preservation Office (SHPO) or the State Archaeologist immediately. The New Mexico State Land Office (SLO) and the SHPO will determine the necessary steps to evaluate significance and document, protect, or remove the material or remains, in compliance with the law. Construction will resume only after clearance is provided by the SLO and the SHPO.

- If the inadvertent discovery is composed of archaeological material not associated with skeletal remains, Chevron shall cease work immediately, protect the find, and notify the relevant land management agency or owner pursuant to the Antiquities Act of 1906 (34 Statute 225; 16 USC 431-433). Construction will resume only after clearance is provided by the land management agency.
- Indirect impacts will be controlled by limiting access to cultural resources, educating employees about the significance of cultural resources, and implementing a strict management policy restricting the casual collection of artifacts from the project area. All construction and monitoring personnel will be briefed on protective measures implemented for cultural resources and the importance of resource preservation.

Chemical and Fuel Secondary Containment and Exclosure Screening

- Chevron shall install and maintain an impervious secondary containment system for any tank or barrel containing hazardous, poisonous, flammable, or toxic substances sufficient to contain the contents of the tank or barrel and any drips, leaks, and anticipated precipitation.
- Chevron would dispose of fluids within the containment system in accordance with state law, and will not drain the fluids to soil or ground.
- Chevron would design, construct, and maintain all secondary containment systems to prevent wildlife and livestock exposure to harmful substances by installing effective exclosure systems such as fencing, netting, expanded metal mesh, lids, and grate covers (using a maximum netting mesh size of 1.5 inches).

Communitization Agreement

- Communitization agreements would be required for some wells. When required, Chevron shall submit the communitization agreement to the CFO when the APD is submitted.

Construction Notification

- Chevron shall notify the CFO at least three days prior to commencing construction of an access road or pad, and shall have the approved MDP, APD, and Conditions of Approval onsite and shall make them available upon request by the Authorized Officer.

Dark Skies

- Chevron would install lighting on fixed equipment and surface facilities in a way that minimizes light pollution and protects visual resources while ensuring adequate light for safe and reliable production operations.

Enclosure Fencing

- Chevron shall install and maintain enclosure fencing for all open well cellars before and after drilling operations until the pit is free of fluids and backfilling has been initiated.

Flaring

- Chevron would not flare produced or recycled gas except for instances where flaring is necessary to protect operating personnel or to ensure the safe operation of surface facilities.

Karst

- A 200-meter avoidance buffer will initially be placed around karst features. In cases where the 200-meter karst feature avoidance buffer is not reasonably achievable, karst features may be avoided by a lesser distance if deemed appropriate in consultation with BLM Karst Specialists.
- During construction, Chevron would halt all activities and immediately notify the BLM in the event that any underground voids are encountered.
- During construction, Chevron would not use blasting as a construction method.

- During construction, Chevron would berm all pads to minimize the effects of any spilled contaminant.
- While drilling, Chevron would use a closed mud system using steel tanks with all fluids and cuttings hauled off.
- While drilling, Chevron would use freshwater where cave or karst features are expected to prevent contamination of freshwater aquifers.
- While drilling, Chevron would only directional drill after at least 100 feet below the cave occurrence zone.
- While drilling, Chevron would log and report all lost circulation zones in the drilling report.
- During production operations, Chevron would install automatic shutdown systems, check valves, or similar systems on pipelines and tanks to minimize the effects of line failures.
- During production operations, Chevron would perform annual pressure monitoring on well casing and would undertake remedial action if any casing failures are identified.

Netting of Open-Topped Tanks.

- Chevron shall net, screen, or cover open-topped tanks until the tanks are removed or until the tanks no longer contain the substances that could be harmful to wildlife or livestock. If netting is used, Chevron would cover and secure the open portion of the tank to prevent wildlife entry. A maximum netting size of 1.5 inches would be used, and the netting would not be in contact with fluids and would not have holes or gaps.

Noise Control

- Chevron would install exhaust mufflers on fixed equipment so as not to exceed 75 decibels measured at 30 feet from the source of the noise.

Noxious Weeds

- Chevron would use appropriate weed control methods (per the Authorized Officer) on disturbed land where noxious weeds exist, including roads, pads, associated pipeline corridors, and adjacent lands affected by the establishment of weeds due to Chevron's action.

Open-Vent Exhaust Stack Exclosures

- Chevron would construct, modify, equip, and maintain all open-vent exhaust stacks on production equipment to prevent birds and bats from entering, and to discourage perching, roosting, and nesting. Exclosure systems would be in the shape of a cone.

Painting Requirement

- Chevron would paint all aboveground structures that are not subject to safety requirements a flat non-reflective paint color, Shale Green from the BLM Standard Environmental Color Chart (CC-001: June 2008). Exceptions would apply where special safety colors are required by OSHA.

Range Features, including Fences and Cattle Guards

- Chevron would avoid or pay to relocate structures that provide water to livestock, such as windmills, pipelines, drinking troughs, and earthen reservoirs.
- Where entry is granted across a fence line, Chevron would brace the fence and tie off on both sides of the passageway with H-braces prior to cutting. A wire gate or appropriately sized cattle guard would be installed in the fence opening during infrastructure installation to prevent livestock from crossing the fence and would remain in place during construction inactivity.

- Chevron would repair or replace new or existing cattle guards on the route if they are damaged or have deteriorated beyond practical use. Once the work is completed or the road is abandoned, Chevron would restore the fence to its prior condition, or better.
- Chevron would notify the private surface landowner or the grazing allotment holder prior to crossing any fences or livestock water pipelines.

Topsoil

- Chevron would strip the top portion of the soil (root zone – typically 6 inches in depth) from the entire ROW, road, or pad area and stockpile the topsoil, where possible, along the uphill edge of the ROW, road, or pad as depicted in the MDP SUPO. Other subsoil would be completely segregated from the topsoil stockpile. Stockpiled topsoil would be redistributed over the interim reclamation areas. Topsoil would not be used for berming the pad or facilities. For final reclamation, topsoil would be spread over the entire pad area for seeding preparation. Large rocks or subsoil clods shall be buried within the approved area for interim reclamation or scattered to match surrounding baseline surface texture.
- Blading would not be conducted in areas of gypsum soils.

Watershed

- Chevron would berm the entire well pad to prevent oil, salt, and other chemical contaminants from leaving the well pad. No water flow from the uphill side of the pad would be allowed to enter the well pad.

Well Pad Surfacing

- Chevron would surface roads and well pads with caliche, crushed gravel, or river rock which would be removed at the time of reclamation. Well pads would be constructed in a manner that creates the smallest possible surface disturbance, consistent with safety and operational needs.

Wildlife

- Chevron would protect raptor nests on special, natural habitat features – such as trees, large brush, cliff faces, and escarpments – by not allowing surface disturbance within up to 200 meters of active nests or by delaying activity for up to 90 days, or a combination of both.
- Prior to initiating construction activities, Chevron or the BLM would perform a wildlife survey to identify raptor nests in the proximity and to determine if the raptor nests are active. Chevron would contact a BLM Wildlife Biologist if any raptor nests within 200 meters of the construction site are active.
- Chevron would only consider construction within 200 meters of a raptor nest if the nest is inactive, the proposed activity is of short duration (e.g., habitat enhancement projects, fences, pipelines), and if construction would not result in continuing activity in proximity to the nest.

APD Group 1

Six APDs submitted with the MDP are for wells that would be drilled from the HH SO 8 P2 well pad. These wells and associated infrastructure would share the same well pad, access road, CTB, and containment pond (**Figure 2.1-3**). Total surface disturbances for APD Group 1 are estimated to be 50.9 acres (45.0 on BLM-administered surface; 5.9 on state surface). Following interim reclamation, long-term disturbances would be 30.1 acres (29.8 on BLM-administered surface; 0.3 on state surface). Surface disturbances for APD Group 1 are summarized in **Table 2.1-2**. These disturbances are included in the MDP estimates summarized in **Table 2.1-1** and are not additive to those totals. The well pad, tank battery, and containment pond would be located on BLM-administered surface. Access roads, pipelines, flowlines, and powerlines would be constructed on a combination of BLM and state lands. An existing well pad, containment pond, and tank battery are present in T26S, R27E, Section 16. The existing lease road for that pad would be utilized for APD Group 1.

Proposed Well Pad

To drill the proposed wells with a closed loop system, a 525-foot by 330-foot surfaced well pad would be needed, with additional surface requirements for topsoil and spoil storage and areas of cut and fill. Because six wells would be drilled from this well pad, surface dimensions are greater than for four well pads described previously in this section. Chevron would construct the well pad in accordance with the MDP SUPO. After the sixth well is drilled and completed on the well pad, the proposed well pad would be downsized to a 200-foot by 325-foot surfaced pad. All areas not needed for production would be reclaimed in accordance with the interim reclamation components of the MDP SUPO.

Proposed Access Roads

Chevron proposes to construct an access road for the well pad and separate access roads for the CTB and water containment pond. The well pad access road would connect an existing lease road with the northeast corner of the well pad. The well pad access road would be 5,538 feet long (4,384 feet on BLM surface; 1,154 feet on state surface) and would require approximately 3.6 acres of surface disturbance for construction, including roadside ditches (approximately 2.8 acres on BLM surface; 0.8 acres on state surface). Combined, the CTB and containment pond access roads would be 1,787 feet long (all BLM surface) and would require approximately 1.1 acres of surface disturbance for construction. All access roads would use waterbars, lead-off ditches, and low-water crossings for water control and would not require the installation of culverts.

Proposed Electrical Lines

Chevron proposes to construct a total of 7,285 feet of electrical utility lines parallel to the access roads. The electrical lines would connect with an existing four-wire electrical line at the existing lease road in T26S, R27E, Section 16, NWNW. The electrical lines would be constructed within the same disturbance corridor as the flowlines and pipelines. Surface disturbance calculations incorporate all components within the corridor and assume that the entire corridor would be disturbed (**Table 2.1-4**).

Proposed Flowlines and Pipelines

Chevron proposes to construct multiple flowlines and pipelines as summarized in **Table 2.1-5**. As described for the MDP, these would be constructed within a shared corridor, with safety offsets between lines. Proposed pipelines include a produced fluids flowline cluster (high-pressure gas, low-pressure gas, oil, water), gas lift flowline, SWD water flowline, and frac water flowline. The maximum combined length of buried flowlines and pipelines would be approximately 9,492 feet (6,960 feet on BLM-administered surface; 2,532 feet on state surface). Total disturbance for the pipelines would be 22.6 acres (16.7 acres on BLM-administered surface; 5.9 acres on state surface). The final permanent water recycling and disposal system described for the MDP would be determined prior to constructing water transfer pipelines. Until that determination has been made, produced water would be hauled off location in trucks. The gas purchaser pipeline is already in place at the existing tank battery.

Proposed Central Tank Battery

The CTB for APD Group 1 would be located in T26S, R27E, Section 9, SW1/4 approximately 0.9 miles east of the proposed well pad location. The CTB would be 550 feet by 750 feet (including areas for topsoil and spoil storage and areas of cut and fill) and would occupy approximately 9.5 acres of BLM-administered surface. The CTB would be designed and constructed as described for the MDP.

Proposed Water Containment Pond

One containment pond for water to be used in hydraulic fracturing operations would be located in T26S, R27E, Section 9, SW1/4 approximately 1.0 mile east of the proposed well pad location. The pond would require a construction footprint of 760 feet by 760 feet and occupy approximately 13.3 acres of BLM-administered surface. The containment pond would initially be used to hold freshwater brought to the site

by truck and would be used to store recycled water after the water recycling system has been constructed and associated water transfer pipelines (see above) have been constructed.

APD Group 2

Six APDs submitted with the MDP are for wells that would be drilled from the HH SO 10 P3 well pad. These wells and associated infrastructure would share the same well pad, access road, CTB, compressor station, and containment pond (**Figure 2.1-4**). Total surface disturbances for APD Group 2 are estimated to be 55.0 acres (50.3 acres on BLM-administered surface; 4.7 acres on state surface). Following interim reclamation, long-term disturbances would be 32.8 acres (32.6 acres on BLM-administered surface; 0.2 acres on state surface). Surface disturbances for APD Group 2 are summarized in **Table 2.1-2**. These disturbances are included in the MDP estimates summarized in **Table 2.1-1** and are not additive to those totals. The well pad, tank battery, and containment pond would be located on BLM-administered surface. Access roads, pipelines, flowlines, and powerlines would be constructed on a combination of BLM and state lands.

Proposed Well Pad

To drill the proposed wells with a closed loop system, a 580-foot by 330-foot surfaced well pad would be needed, with additional surface requirements for topsoil and spoil storage and areas of cut and fill. Because six wells would be drilled from this well pad, surface dimensions are greater than for four well pads described previously in this section. Chevron would construct the well pad in accordance with the MDP SUPO. After the sixth well is drilled and completed on the well pad, the proposed well pad would be downsized to a 200-foot by 325-foot surfaced pad. All areas not needed for production would be reclaimed in accordance with the interim reclamation components of the MDP SUPO.

Proposed Access Roads

Chevron would need to construct an access road for the well pad as well as separate access roads for the CTB, compressor station, and water containment pond. The well pad access road would connect the existing Roadrunner Road with the southern boundary of the well pad. The well pad access road would be 542 feet long (all BLM surface) and would require approximately 0.3 acres of surface disturbance for construction. The other access roads would intersect with Whites City Road. Combined, the CTB, compressor station, and containment pond access roads would be 2,116 feet long (all BLM surface) and would require approximately 1.2 acres of surface disturbance for construction. All access roads would use waterbars, lead-off ditches, and low-water crossings for water control and would not require the installation of culverts.

Proposed Electrical Lines

Chevron would need to construct a total of 8,642 feet of electrical utility lines parallel to the access roads. The electrical lines would connect with an existing four-wire electrical line at Whites City Road. The electrical lines would be constructed within the same ROW as the flowlines and pipelines and would not represent additional surface disturbance (**Table 2.1-4**).

Proposed Flowlines and Pipelines

Chevron would need to construct multiple flowlines and pipelines as summarized in **Table 2.1-5**. As described for the MDP, these would be constructed within a shared corridor, with safety offsets between lines. Proposed pipelines include a produced fluids flowline cluster (high-pressure gas, low-pressure gas, oil, water), gas lift flowline, SWD water flowline, and frac water flowline. The maximum combined length of buried flowlines and pipelines would be approximately 8,440 feet (6,504 feet on BLM-administered surface; 1,936 feet on state surface). Total disturbance for the pipelines would be 19.8 acres (15.3 acres on BLM-administered surface; 4.7 acres on state surface). The final permanent water recycling and disposal system described for the MDP (including location of SWD facilities connected to APD Group 2) would be determined prior to constructing water transfer pipelines. Until that determination has been

made, produced water would be hauled off location in trucks. The gas purchaser pipeline is already in place at the existing tank battery.

Proposed Central Tank Battery

The CTB for APD Group 2 would be located in T26S, R27E, Section 10, NW1/4, approximately 0.3 miles southeast of the proposed well pad location. Surface requirements for a combined CTB and compressor station pad would be 1,100 feet by 600 feet (including areas for topsoil and spoil storage and areas of cut and fill) and would occupy approximately 8.0 acres of BLM-administered surface. The CTB would be designed and constructed as described for the MDP.

Proposed Compressor Station

The compressor station for APD Group 2 would be located immediately south of the proposed CTB pad. The compressor station would occupy approximately 3.4 acres of the combined CTB and compressor station pad, all of which would be located on BLM-administered surface. The compressor station would be designed and constructed as described for the MDP. Once necessary pipelines are constructed, this compressor station would also serve APD Group 1.

Proposed Water Containment Pond

One containment pond for water to be used in hydraulic fracturing operations would be located in T26S, R27E, Section 10, NW1/4, approximately 0.5 miles southeast of the proposed well pad location. The pond would require a construction footprint of 760 feet by 760 feet and occupy approximately 13.3 acres of BLM-administered surface. The containment pond would initially be used to hold freshwater brought to the site by truck and would be used to store recycled water after the water recycling system has been constructed and associated water transfer pipelines (see above) have been constructed.

2.2. No Action

The BLM NEPA Handbook (H-1790-1; BLM 2008a) states that for EAs for externally initiated proposed actions, the no action alternative generally means that the proposed activity would not take place. This option is provided in 43 CFR 3162.3-1 (h) (2). This alternative would deny the approval of the proposed MDP. Under the no action alternative, the coordinated exploration of the HDA area proposed by Chevron would not be authorized by the BLM. The BLM would consider APDs and other authorizations within the HDA on a case-by-case basis outside the scope of this EA. Similar design features would likely be incorporated on a case-by-case basis and the same mitigation measures would be required. However, approval of wells on a case-by-case basis may result in separate infrastructure being constructed for individual wells, which would increase surface disturbance and lead to greater effects to the environment and resources.

Under the no action alternative, the proposed action would not be completed; no new oil and gas wells would be constructed, drilled, completed, operated, plugged, or abandoned and no access roads or other infrastructure would be constructed or upgraded. Therefore, there would be no new impacts to natural or cultural resources. The no action alternative would result in the continuation of the current land and resources uses in the project area and is used as the baseline for comparison of environmental effects of the analyzed alternatives.

2.3. Alternatives Considered but Eliminated from Detailed Study

All areas of proposed surface disturbance for the proposed action were inspected to ensure that potential impacts to natural and cultural resources would be minimized through the implementation of mitigation measures. These measures for all resources potentially impacted are described in Section 3 of this EA. Therefore, no additional alternatives other than those listed above and below have been considered for this project.

One alternative was considered, but eliminated from further consideration. This alternative would not approve road construction along 4,200 feet of existing disturbance in T25S, R27, Section 26. Chevron proposes this road to connect the northern portion of the HDA (T25S, R27E, Sections 16-20 and 30) with leases to the south. Use of the proposed road would reduce routine operational traffic passing through southern portions of the HDA, including along Whites City Road and portions of Roadrunner Road. The proposed road would be constructed in an area that is currently disturbed from an existing overhead powerline and buried water line. No significant natural or cultural resource constraints were identified in the proposed area during baseline surveys (Arcadis 2016a). Overall, the alternative is substantially similar to the proposed action and would have similar effects as the proposed action. Therefore, this alternative was not carried forward for analysis.

This page intentionally left blank.

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section describes the affected environment and the environmental consequences. The affected environment varies for each resource. Both the nature of the resource and components of the proposed action define this variation. The project area shown on **Figure 2.1-1** and many of the figures in Section 3 encompass the proposed action. The project area is larger than the proposed action. In addition, individual resource sections in this document may discuss an analysis area that is larger than the project area. The analysis area defined for a given resource consists of areas of potential direct disturbance in the project area as well as adjacent areas of indirect effects. For some resources, such as geology, soils, and vegetation, the affected area is the physical location and immediate vicinity of the areas that the proposed action would disturb. For other resources, such as air resources, the affected environment is larger (e.g., airshed).

Environmental effects are described in terms of context (site-specific, local, or regional effects), duration (short- or long-term), and intensity (negligible, minor, moderate, or major).

Duration of effects is defined as:

- Short-term - Short-term effects are defined as those effects that would not last longer than the life of the proposed action, including initial reclamation.
- Long-term - Long-term effects are effects that would remain following completion of the proposed action.

The thresholds of change for the intensity of an impact are defined as:

- Negligible - the impact is at the lowest levels of detection.
- Minor - the impact is slight, but detectable.
- Moderate - the impact is readily apparent.
- Major - the impact is a severe or adverse impact or of exceptional benefit.

With the exception of the 12 APDs filed with the MDP, due to the uncertainty of the number of wells per pad and alignments for roads and pipelines, the disturbance areas used in the environmental effects discussion are estimates only and were developed based on the assumption that the disturbance area would need to be large enough to reasonably accommodate future permitted construction or realignments. Actual and specific well pad size, pipeline width, or road width will be determined in future APDs or ROW applications and analyzed in subsequent NEPA actions, such as a DNA.

During the analysis process, the interdisciplinary team considered several resources and supplemental authorities. The interdisciplinary team determined that the resources discussed below would be affected by the proposed action. Projects requiring approval from the BLM, such as MDPs, can be denied when the BLM determines that adverse effects to resources (direct or indirect) cannot be mitigated to reach a Finding of No Significant Impact (FONSI).

3.1. Cumulative Impacts Assessment

This section describes the cumulative impacts of the proposed action described in Section 2. Cumulative impacts are the combined effect of past projects, specific planned projects, and other reasonably foreseeable future actions within the Cumulative Impact Area (CIA) to which oil and gas exploration and development may add incremental impacts. This includes all actions, not just oil and gas actions that may occur in the area, including foreseeable non-federal actions.

All resources are expected to sustain some level of cumulative impacts over time; however, these impacts fluctuate with the gradual abandonment and reclamation of wells. As new wells are being drilled, others are being abandoned and reclaimed. As the oil field plays out, the cumulative impacts will lessen as more areas are reclaimed and less are developed.

The combination of all land use practices across a landscape has the potential to change the visual character, disrupt natural water flow and infiltration, disturb cultural sites, cause minor increases in greenhouse gas emissions, fragment wildlife habitat, and contaminate groundwater. However, the likelihood of these impacts occurring is minimized through standard mitigation measures, special Conditions of Approval, and ongoing monitoring studies.

Cumulative Impacts Area

The CIA boundary is the area of analysis for cumulative impacts. The CIA is reasonably sized to prevent dilution of the cumulative impacts over large areas. Guidance from the CEQ was used to identify geographic boundaries (CEQ 1997).

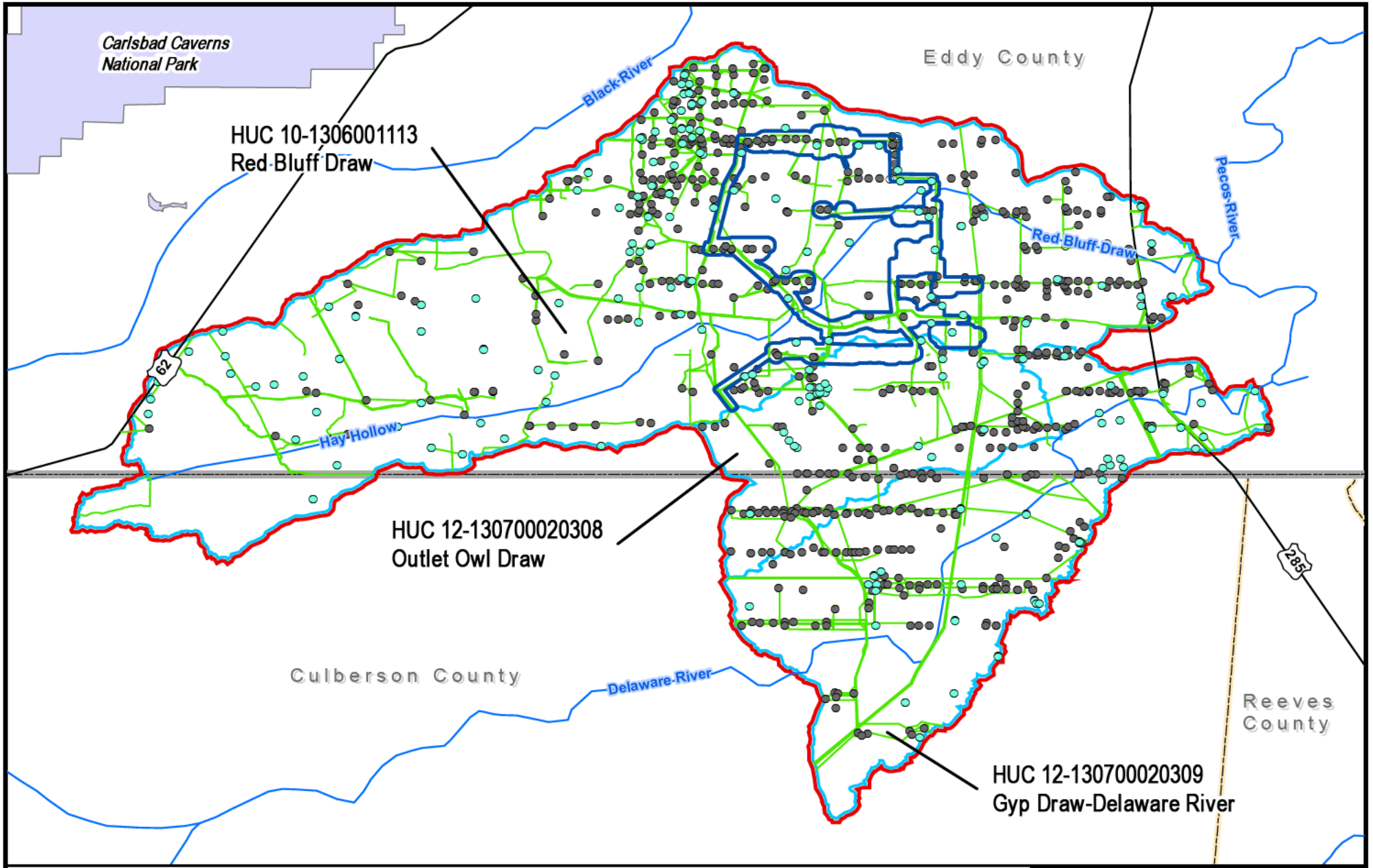
The CIA for this project has been defined as the combined Red Bluff Draw watershed (10-digit hydrologic unit code [HUC-10] 1306001113) and the 12-digit (HUC-12) Outlet Owl Draw (130700020308) and Gyp Draw-Delaware River (130700020309) sub-watersheds (**Figure 3.1-1**). Variations to this CIA for the various resources are described in the applicable individual resource sections below. This CIA was selected, and is appropriate for the assessed resources, because it would be the area potentially impacted by the proposed activities during the project and before the area would be reclaimed. This area is particularly suited for resources impacted by surface disturbances (e.g., soil, water, vegetation), because, as surface disturbances occur and water flows continue downstream, localized impacts become more and more diluted, and eventually reach a point where they become non-measurable. Watersheds provide a discrete boundary within which cumulative impacts can be quantified and analyzed. The CIA comprises approximately 259 square miles (about 165,927 acres), including 82,816 acres of BLM-administered surface.

Past, Present, and Reasonably Foreseeable Future Actions

Past, present, and reasonably foreseeable future actions in the CIA include oil and gas exploration and development, utility construction, mineral (non-hydrocarbon) exploration and extraction, livestock grazing, recreation, and off-road travel. Oil and gas exploration and development are the most prevalent activities within the CIA and are expected to continue to be over the life of the proposed action. Therefore, this analysis focuses on oil and gas industry-related actions. Quantifying cumulative impacts of livestock grazing, recreation, and off-road travel is not practicable; therefore, cumulative impacts resulting from these actions are discussed qualitatively. Estimated surface disturbances within the CIA are summarized in **Table 3.1-1**. Total surface disturbances from past, present, and reasonably foreseeable future actions are estimated to affect approximately 8,342 acres within the CIA, or approximately 5 percent of the CIA.

Within the CIA, approximately 848 oil and gas-related wells (including injection and disposal sites) have been permitted (NMOCD 2016; Texas Railroad Commission [TRRC] 2016). This evaluation assumes that all wells were drilled on single-well pads (a conservative assumption) and that 50 percent of the wells drilled in the CIA were vertical wells, and 50 percent horizontal (based on review of NMOCD data). Using per-well surface disturbance estimates presented in the reasonable foreseeable development (RFD) (1.67 acres for vertical well pads; 2.0 acres for horizontal well pads), approximately 1,919 acres are estimated to have been disturbed within the CIA.

CFO and TRRC data indicate that approximately 900 miles of ROWs, pipelines, and powerlines were previously constructed within the CIA. ROWs within the CIA typically include an access road as well as one or more pipeline/flowline and/or powerlines. Each linear component is assumed to have an average initial disturbance width of 30 feet. Total construction disturbance for existing linear features is estimated to be approximately 3,300 acres. Because the amount of access roads compared to pipelines and utility lines has not been determined, an estimate of reclaimed areas is not calculated.



DIV/GROUP: ENV/IMDV DB: webb LD: PIC: PM: TM:
PROJECT: PATH: Z:\GIS\PROJECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment\Final\Figure3.1-1_CumulativeImpacts.mxd DATE: 6/6/2016 10:30:17 PM

LEGEND:

- MDP Project Area
- National Hydrographic Dataset
- Cumulative Impacts Area
- Rivers
- Major Roads
- State Boundary
- County Boundary
- Past or Currently Permitted Oil and Gas Well Locations
- Past or Currently Permitted Well Locations (plugged/abandoned/cancelled/dry hole)
- Past or Currently Permitted Pipelines and ROWs
- Carlsbad Caverns National Park

Notes:
-The Cumulative Impact Area for some resources may differ as described in the EA text.

Projection:
WGS 1984

NORTH

0 3.75 7.5 Miles

CHEVRON HAYHURST MDP EA

FIGURE 3.1-1
Cumulative Impacts Area

ANALYSIS AREA: Eddy County, New Mexico
Date: 7/5/2016 | Prepared By: BW

This page intentionally left blank.

Table 3.1-1 Estimated Cumulative Actions

	Number or Miles	Estimated Size (acres) or Width (feet)	Estimated Disturbance (acres)
Past and Present Activities			
Oil and Gas Wells (NMOCD)	650	2 acres (horizontal); 1.67 acres (vertical)[1]	1,193
Oil and Gas Wells (TRRC)	198		363
ROWs (CFO)	702	30	2,554
Utility Lines (CFO)	100	30	364
Pipelines (TRRC)	107	30	389
Reasonably Foreseeable Future Activities (Oil and Gas)			
Oil and Gas Wells (CFO APDs)	65	NA[2]	217
Oil and Gas Wells (RFD)	573[3]	2 acres (horizontal); 1.67 acres (vertical)[4]	1,108
Oil and Gas Flowlines (CFO APDs)	20	30	71
Oil and Gas Pipelines (CFO APDs)	13	30	46
Roads (CFO APDs)	24	30	88
Utility Lines (CFO APDs)	6	30	23
ROWs (CFO Realty)	NA	NA	767
Xcel Energy Transmission Lines and Substations			74
Proposed Action			
Components except Oil and Gas Wells[5]	**Table 2.1-1**		1,085
		Total	**8,342**

Notes:
1 Assumes existing oil and gas wells are 50% vertical and 50% horizontal.
2 Disturbances for future wells within the CFO based on well pad and associated facility sizes included in APDs.
3 Through 2034 – see **Table 3.1-2**.
4 Assumes future oil and gas wells are 20% vertical and 80% horizontal.
5 Assumes proposed action wells are included in reasonably foreseeable future action totals.

In 2012 and 2014, the BLM New Mexico State Office published an RFD scenario for hydrocarbon production in southeast New Mexico for the next 20 years (i.e, through 2034) (BLM 2012 and 2014b). The RFD included a comprehensive review of existing and emerging hydrocarbon plays. The wells drilled under the proposed action would be included in the RFD. New oil and gas wells are estimated to be drilled at a rate of 800 per year within the RFD analysis area; however, the CIA encompasses only a fraction (approximately 2 percent) of the RFD analysis area. To determine the potential future oil and gas activity within the CIA, the BLM reviewed the distribution of oil and gas plays identified in the RFD. According to the RFD, the Bone Spring play within the CIA has high development potential, and portions of the Delaware Mountain Group play have high to low potential (BLM 2012 and 2014b). Other plays within the CIA (e.g., Morrow) have lower development potential and were not specifically factored into estimates of future development. The RFD only assessed lands in New Mexico; therefore, based on the presence of similar geologic conditions in Texas, the Bone Spring and Delaware Mountain Group play boundaries were extended to the south. **Table 3.1-2** summarizes the extent of these plays within the CIA and numbers of wells estimated to be drilled through 2034.

Electrical transmission infrastructure construction is considered a reasonably foreseeable future action. Xcel Energy plans to construct a 115 kV transmission line between the proposed China Draw and Yeso Hills substations. Both substations and the entire transmission line would be within the CIA. Construction of the substations is assumed to require approximately 20 acres of total surface disturbances (10 acres for each substation). Approximately 11.1 miles of this transmission line would be within the CIA. Based on a likely ROW construction width of 30 feet, approximately 40 acres of temporary surface disturbance are expected to occur. Reclamation would likely occur immediately following construction. The proposed in-service date for this transmission line is June 1, 2018 (Xcel Energy 2016a).

Table 3.1-2 Estimated Future Oil and Gas Development

Play Name and Development Potential	Extent within CIA (miles^2)	New Wells per Section	Estimated New Wells
Bone Spring (High)	65	4	260
Delaware Mountain Group (High)	12	4	48
Delaware Mountain Group (Medium)	55	2	110
Delaware Mountain Group (Low)	118	1	118
All Other Areas (Lowest)	74	0.5	37
		Total	**573**

Notes:
Bone Spring play overlaps with portions of the Delaware Mountain Group play. All areas of overlap assume both plays would be developed.
Assumption of four wells per section for high potential plays from the BLM (2014b).
One section equals one square mile.

Xcel Energy also plans to construct a 345 kV transmission line between the proposed China Draw substation and a proposed North Loving substation along US Highway 285 approximately 9 miles south of Carlsbad. Approximately 3.9 miles of this transmission line would be within the CIA. The North Loving substation would be outside the CIA. Based on a ROW width of 30 feet, approximately 14 acres of temporary surface disturbance are expected to occur. Reclamation would likely occur immediately following construction. The proposed in-service date for this transmission line is June 1, 2018 (Xcel Energy 2016b).

3.2. Air Resources

Affected Environment

The proposed action would occur within the boundaries of the BLM CFO. Air resources within the CFO are managed according to the CFO's revised RMP. As such, much of the information referenced in this section is incorporated from the Air Resources Technical Support Document (ARTSD) prepared in support of the RMP (URS Group, Inc. 2013). The ARTSD summarizes the technical information related to air resources and climate change associated with oil and gas development and the methodology and assumptions used for analysis. As described below, the two components of air resources are climate and air quality.

The area of analysis for air resources is the Permian Basin; this basin's airshed covers southeastern New Mexico and the northern panhandle of Texas. Air quality within the HDA has the potential to be affected by emissions from the construction and operation of oil and gas facilities, pipelines, and other infrastructure. Regional air quality also is affected by natural events such as windstorms and wildfires. These natural events generally are short lived, lasting from several hours to perhaps several days. The effects during these events may impact human health and the environment, and generally are considered part of the natural and physical environment. This section describes the existing air quality resources of the region and the applicable air regulations that would apply to the HDA.

Climate

The area of analysis is located in a semiarid climate regime typified by dry windy conditions, limited rainfall, hot summers, and mild winters. Summertime maximum temperatures are generally in the 90s (all temperatures are in degrees Fahrenheit [˚F]) with occasional temperatures over 110˚F. Winter minimum temperatures are generally between the 20s and 30s with extremes remaining above zero. Precipitation is mainly in the form of summer thunderstorms associated with the Southwest Monsoon, although occasional Pacific storms occur south into New Mexico during the winter. **Table 3.2-1** shows climate normals for 1981 through 2010 for the Carlsbad Monitoring Station (NOAA [National Oceanic and Atmospheric Administration 2011]).

Table 3.2-1 Climate Normals for Carlsbad, 1981-2010

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Temperature (°F)	42.6	47.2	54.0	62.4	71.5	79.3	81.2	79.9	73.2	62.9	51.5	42.8
Average Maximum Temperature (°F)	57.5	62.7	70.2	78.5	86.9	94.4	94.6	93.1	87.0	78.1	67.1	57.5
Average Minimum Temperature (°F)	27.6	31.7	37.9	46.2	56.0	64.3	67.7	66.6	59.4	47.7	35.8	28.0
Average Precipitation (inches)	0.47	0.54	0.51	0.64	1.17	1.53	2.01	1.83	2.11	1.16	0.81	0.63

Source: NOAA 2011

Prevailing winds are from the southeast with speeds varying from 0 to 20 miles per hour (mph), rarely exceeding 31 mph (Cedar Lake 2016). **Figure 3.2-1** and **Figure 3.2-2** show the distribution of magnitude and direction of local winds for 2014 from the Cavern City Airport in Carlsbad, New Mexico and the Lea County Regional Airport in Hobbs, New Mexico, respectively (NCDC [National Climatic Data Center 2014]).

Existing Air Quality

Air quality in a given location is defined by pollutant concentrations in the atmosphere and is generally expressed in units of parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$). The existing air quality in the proposed development area is considered to be acceptable for human health and the environment since it is in attainment of the National Ambient Air Quality Standards (NAAQS) and State AAQS (SAAQS) or has insufficient data to establish compliance. The EPA Green Book web page (EPA 2015) reports that the Permian Basin is in attainment for all NAAQS as defined by the Clean Air Act (CAA).

The CFO recently installed monitors in the HDA airshed, including in Carlsbad, Carlsbad Caverns National Park, and Hobbs (URS Group, Inc. 2013), to monitor ambient concentrations of criteria air pollutants. Monitored design values for ozone (O_3), nitrogen dioxide (NO_2), particulate matter with aerodynamic diameter less than 10 microns and 2.5 microns (PM_{10} and $PM_{2.5}$, respectively), carbon monoxide (CO), and sulfur dioxide (SO_2) are shown in varied units in **Table 3.2-2**. Design values are the concentrations of air pollution at a specific monitoring site represented in the averaging period that can be compared to the NAAQS. Monitoring is not conducted for lead and CO in southeastern New Mexico; however, concentrations of these pollutants are expected to be low in rural areas and are therefore not monitored. CO is monitored, however, in Texas. The New Mexico Environment Department (NMED) discontinued monitoring for SO_2 in Eddy County due to very low monitored concentrations. Design values for PM_{10} in southeastern New Mexico are not available due to incomplete data collection.

Table 3.2-2 Design Concentrations of Criteria Pollutants in the HDA Airshed

Pollutant	Averaging Period	Location	Design Value (units vary)					NAAQS
			2008	2011	2012	2013	2014	
O_3	8-hour	Hobbs	0.067 ppm[1]	0.061 ppm	--	--	0.065	0.070 ppm[4]
		Carlsbad	0.067 ppm[1]	0.069 ppm	--	--	--	
NO_2	Annual	Hobbs	--	6 ppb	--	--	--	53 ppb
		Carlsbad	--	3 ppb	--	--	2.8 ppb[2]	
	1-hour	Carlsbad	--	42 ppb	18.4 ppb[3]	18.4 ppb[3]	18.4 ppb[3]	100 ppb[5]
$PM_{2.5}$	Annual	Hobbs	--		7.8 $\mu g/m^3$[6]	7.8 $\mu g/m^3$[6]	7.8 $\mu g/m^3$[6]	12 $\mu g/m^3$
	24-hour	Hobbs	--	21.9 $\mu g/m^3$[7]	21.9 $\mu g/m^3$[7]	21.9 $\mu g/m^3$[7]	--	35 $\mu g/m^3$
PM_{10}[8]	24-hour	--	--	--	--	--	--	150 $\mu g/m^3$
CO	8-hour	El Paso, TX	--	--	1.5 ppm[9]	1.5 ppm[9]	1.5 ppm[9]	9 ppm
	1-hour	El Paso, TX	--	--	2.1 ppm[9]	2.1 ppm[9]	2.1 ppm[9]	35 ppm
SO_2	Annual	El Paso, TX	--	--	0.0006 ppm[9]	0.0006 ppm[9]	0.0006 ppm[9]	0.03 ppm
	24-hour	El Paso, TX	--	--	0.0017 ppm[10]	0.0017 ppm[10]	0.0017 ppm[10]	0.14 ppm

Table 3.2-2 Design Concentrations of Criteria Pollutants in the HDA Airshed

Pollutant	Averaging Period	Location	Design Value (units vary)					NAAQS
			2008	2011	2012	2013	2014	
	3-hour	El Paso, TX	--	--	0.0065 ppm(10)	0.0065 ppm(10)	0.0065 ppm(10)	0.5 ppm
	1-hour	El Paso, TX	--	--	4.7 ppb(11)	4.7 ppb(11)	4.7 ppb(11)	75 ppb

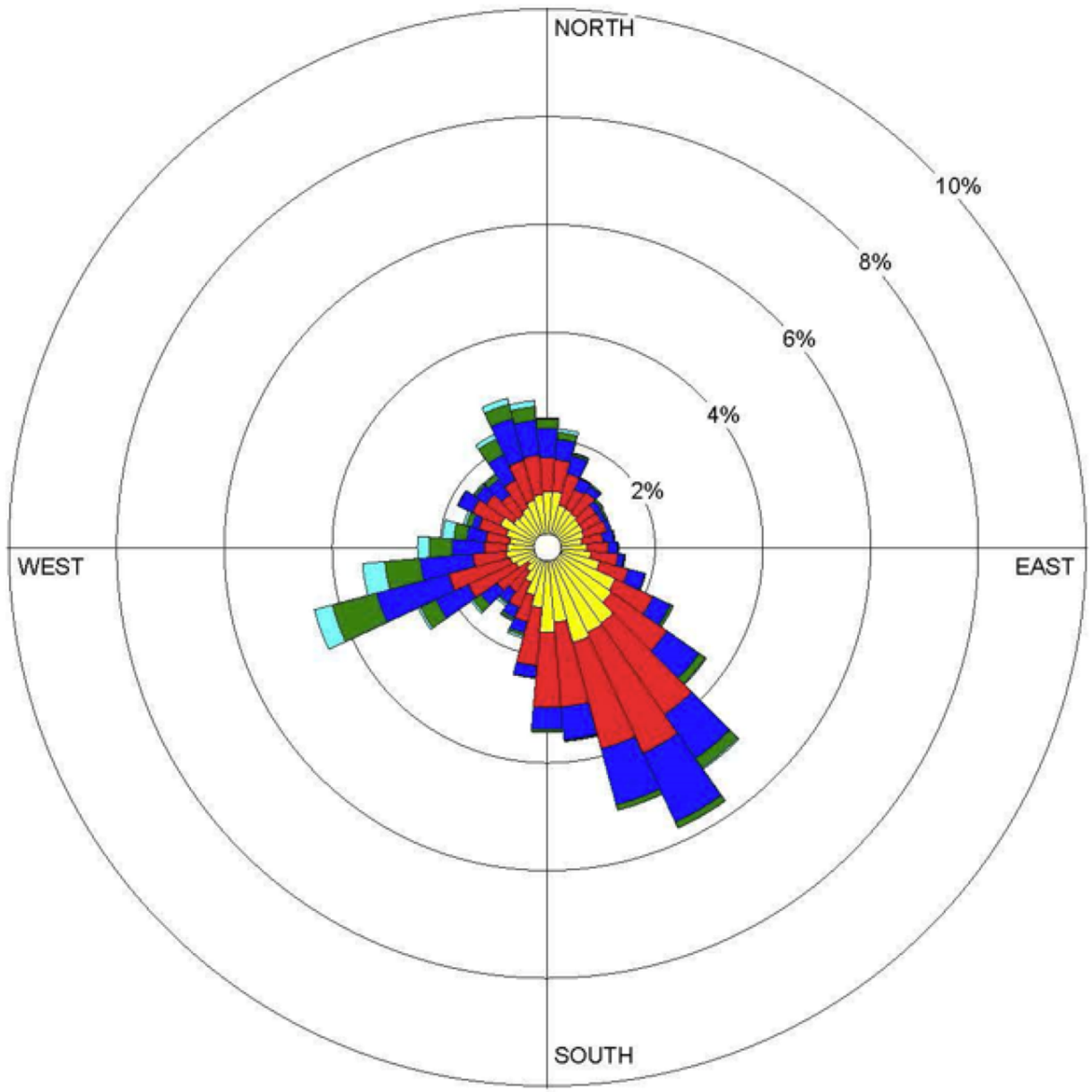
Notes:
1 Annual fourth-highest daily maximum 8-hour concentration (URS Group, Inc. 2013, Table 4-7)
2 Highest annual value from the most recent year monitored (2014) (1 part per billion [ppb] = 1.88 µg/m^3) (NMED 2014a).
3 Three-year average of 98th percentile of 1-hour maximum used (2012-2014) (1 ppb = 1.88 µg/m^3) (NMED 2014a).
4 Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years.
5 98th percentile, averaged over 3 years.
6 Average of annual values from 3 years of data set (2012-2014) (NMED 2014a).
7 Three-year average of 98th percentile of 24-hour maximum used (2011-2013) (NMED 2014a).
8 No PM_{10} data are available as there are no PM_{10} monitors within the HDA airshed.
9 Highest annual value over 3 years (2012-2014) (TCEQ 2014).
10 Highest annual value of the 3-hour maximum over three years (2012-2014) (TCEQ 2014).
11 Three-year average of 99th percentile of 1-hour maximum used (2012-2014) (TCEQ 2014).

The EPA conducts a periodic National Air Toxics Assessment (NATA) to quantify hazardous air pollutant (HAP) impacts by county and to identify areas where HAP emissions result in high health risks and therefore further emissions reduction strategies are necessary. A review of the 2011 NATA results shows that cancer, neurological, and respiratory risks in Eddy and Lea Counties are generally increasing compared to statewide and national levels (EPA 2011).

Regulatory Framework and Standards of Significance

The CAA of 1970 (42 USC 7401 et seq.) as amended in 1977 and 1990 is the basic federal statute governing air pollution. Provisions of the CAA of 1970 that potentially are relevant to the HDA are listed and discussed below:

- **NAAQS** – These standards set limits to protect public health (primary standards) and public welfare (secondary standards). Details on the NAAQS are described in the following section.
- **New Source Review (NSR)** – This program protects air quality by reviewing newly constructed or modified stationary sources to ensure that adequate controls, emission limits, and operational practices to prevent a violation of the NAAQS or other standard are in place. This program is administered by the state of New Mexico, tribal authorities, or the EPA through approved implementation plans.
- **Prevention of Significant Deterioration (PSD)** – This program serves to protect public health and welfare, and preserve, protect, and enhance air quality in areas currently compliant with the NAAQS. PSD does not prevent sources from increasing emissions, but provides a review process for large stationary sources to ensure that Best Available Control Technology (BACT) is applied and the project will not contribute to a violation of the NAAQS or degrade ambient air quality above established baselines. Special protection is given to Class I areas, which are defined as areas of special national or regional natural, scenic, recreational, or historic value. Class I areas are protected by Federal Land Managers (FLMs) by management of air quality related values (AQRVs) such as visibility and acid deposition. FLMs review the issuance of a PSD permit for any impacts that exceed guideline thresholds.
- **Nonattainment New Source Review (NNSR)** – This program ensures that new projects in areas with existing air quality that does not comply with the NAAQS are compliant. This review process requires the highest level of emission controls and must result in net emissions reductions to achieve compliance.



LEGEND

WIND SPEED
(m/s)

- >= 11.10
- 8.80 - 11.10
- 5.70 - 8.80
- 3.60 - 5.70
- 2.10 - 3.60
- 0.50 - 2.10

Calms: 13.73%

Notes:
Windrose Plot = Cavern City Air Terminal
Display = Wind speed direction (blowing from)
Start Date = 1/1/2014 - 00:00
End Date = 12/31/2014 - 23:00
Calm Winds = 13.73%
Avg. Wind Speed = 3.89 m/s
Modeler = Jalbert
Total Count = 8748 hrs.

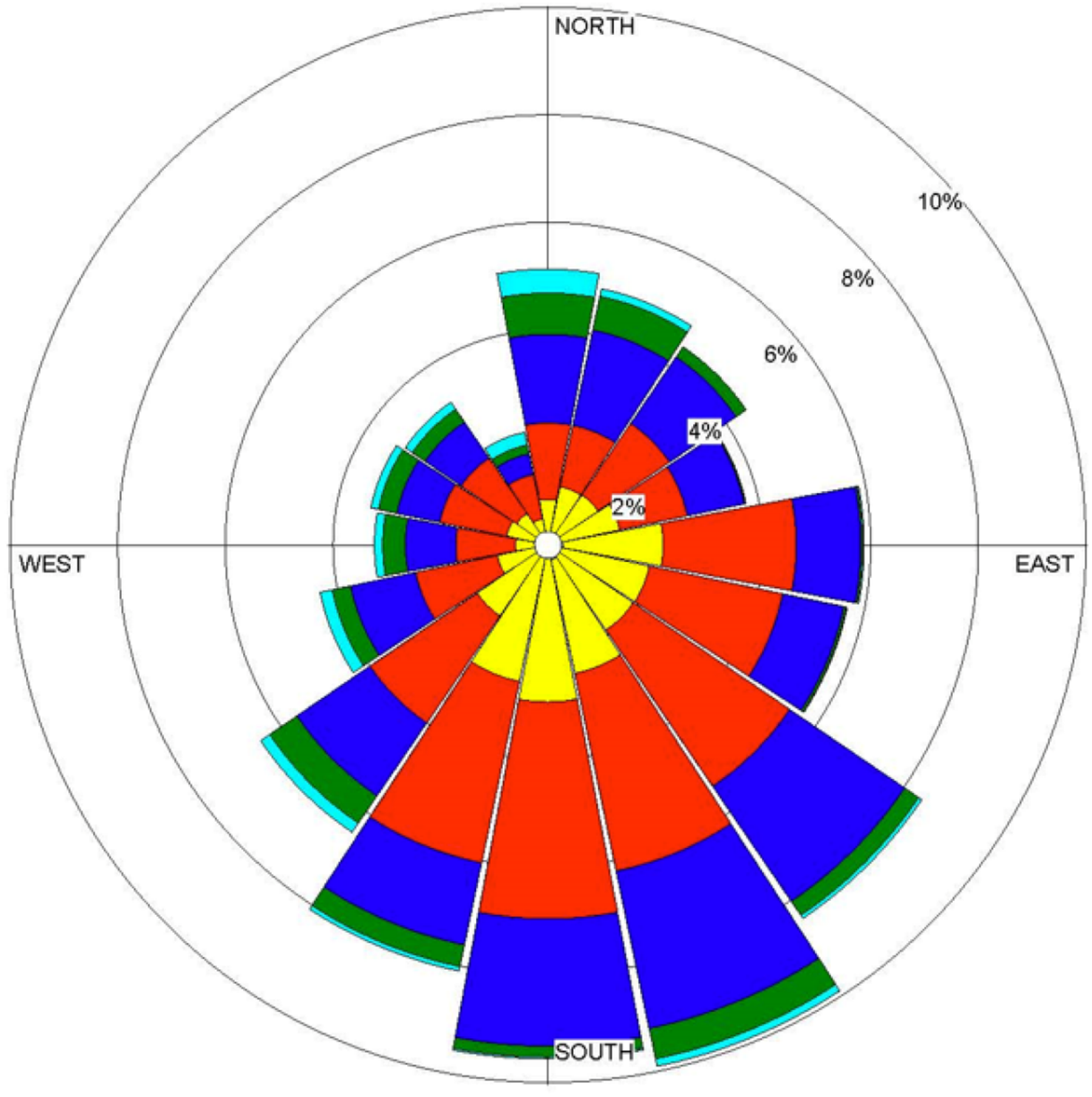
CHEVRON HAYHURST

FIGURE 3.2-1
Carlsbad, NM Windrose, 2014

ANALYSIS AREA: Eddy County, New Mexico

Date: 3/14/2016 | Prepared By: BW

Z:\G SPROJECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment Figure3.1-1_Carlsbad_Windrose.mxd



LEGEND

WIND SPEED
(m/s)

- >= 11.1
- 8.8 - 11.1
- 5.7 - 8.8
- 3.6 - 5.7
- 2.1 - 3.6
- 0.5 - 2.1

Calms: 11.66%

Notes:
Windrose Plot = Lea County Regional Airport (Hobbs, NM)
Display = Wind speed direction (blowing from)
Start Date = 1/1/2014 - 02:00
End Date = 12/31/2014 - 23:00
Calm Winds = 11.66%
Avg. Wind Speed = 4.43 m/s
Modeler = Jalbert
Total Count = 8345 hrs.

CHEVRON HAYHURST

FIGURE 3.2-2
Hobbs, NM Windrose, 2014

ANALYSIS AREA: Eddy County, New Mexico

Date: 3/14/2016 | Prepared By: BW

Z:\G SPROJECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment Figure3 3-1_Hobbs_Windrose.mxd

- **Conformity for General Federal Actions –** The purpose of these rules are to ensure that the actions taken by federal agencies in nonattainment and maintenance areas do not interfere with a state's plans to meet national standards for air quality.
- **New Source Performance Standards (NSPS) –**This program sets standards for new, modified and reconstructed stationary sources irrespective of permitting requirements. These rules establish emission limits, control requirements, and work practice standards for different source categories.
- **Maximum Achievable Control Technology (MACT) Standards** – This program promulgated under the National Emission Standards for Hazardous Air Pollutants (NESHAP) establishes technology-based standards for HAPs that require top-tier controls for affected sources.
- **Mandatory Greenhouse Gas (GHS) Reporting Rule: 40 CFR 98, Subpart W –** This rule requires data collection, monitoring, and reporting of GHG emissions to guide development of policy to reduce GHG emissions.

Details of these programs are described in the Air Quality Technical Support Document developed for the proposed action.

National Ambient Air Quality Standards

The federal CAA amendments of the 1990s require all states to control air pollution emission sources so that the NAAQS are met and maintained. In addition to these requirements, the National Park Service (NPS) Organic Act requires the NPS to protect the natural resources of the lands it manages from the adverse effects of air pollution.

The NAAQS establishes maximum acceptable concentrations for NO_2, CO, SO_2, PM_{10}, $PM_{2.5}$, ozone, and lead. Given the extremely low levels of lead emissions from project sources, the lead standards are not addressed in this analysis. These pollutants are known as criteria pollutants. The NAAQS are established by the EPA and are outlined in 40 CFR 50. These standards represent the maximum allowable atmospheric concentrations that may occur without jeopardizing public health and welfare, and include a reasonable margin of safety to protect the more sensitive individuals in the population. The NAAQS represent maximum acceptable concentrations that generally may not be exceeded more than once per year; the annual standards may never be exceeded. An area that does not meet the NAAQS is designated as a nonattainment area on a pollutant-by-pollutant basis. Applicable federal and state criteria are presented in **Table 3.2-3**.

Table 3.2-3 National Ambient Air Quality Standards

Pollutant (units)	Averaging Period	Ambient Air Quality Standards[1]	
		National	New Mexico
NO_2 (varies)	Annual[2]	100 µg/m^3	0.05 ppm
CO (varies)	1-hour[3]	40,000 µg/m^3	13.1 ppm
	8-hour[3]	10,000	8.7 ppm
SO_2 (varies)	3-hour[3]	1,300	N/A
	24-hour[3]	260 µg/m^3	0.10 ppm
	Annual[2]	60	0.02 ppm
PM_{10} (µg/m^3)	24-hour[4]	150	150
	Annual[2, 7]	50	60
$PM_{2.5}$ (µg/m^3)	24-hour[5]	35	N/A
	Annual[6]	15	N/A
Ozone (ppm)	8-hour[8]	0.070	N/A

Notes:
1 Sources: EPA 2016 and NMED 2016.
2 Never to be exceeded.
3 Not to be exceeded more than once per year.
4 Not to be exceeded more than once per year on average over 3 years.

Table 3.2-3 National Ambient Air Quality Standards

Pollutant (units)	Averaging Period	Ambient Air Quality Standards[1]	
		National	New Mexico

5 Three-year average of the 98th percentile of the 24-hour concentrations at each population-oriented monitor within an area must not exceed this standard.
6 Three-year average of the weighted annual mean concentrations from single or multiple community-oriented monitors must not exceed this standard.
7 The annual PM_{10} NAAQS of 50 µg/m^3 was revoked by EPA on September 21, 2006. See Federal Register Volume 71, Number 200, October 17, 2006.
8 Values provided reflect the new standard of 0.070 ppm. Three-year average of the fourth highest daily maximum 8-hour average measured at each monitor within an area over each year must not exceed this standard.

Prevention of Significant Deterioration and Federally Protected Areas

PSD regulations restrict the degree of ambient air quality deterioration allowed and apply to proposed new or modified major stationary sources located in an attainment area that have the potential to emit criteria pollutants in excess of predetermined threshold values (40 CFR Part 51). In New Mexico, PSD permits are required prior to construction or modification of sources subject to 20.2.74 NMAC. Increments for criteria pollutants are based on the PSD classification of the area. Class I area status is assigned to federally protected wilderness areas and allows the lowest amount of permissible deterioration. Class I areas allow the lowest amount of air quality increment consumption, while Class II designations allow higher increment consumption. There are no designated Class III or heavy industrial use areas.

In addition to more stringent PSD increments, Class I areas are protected by FLMs by management of AQRVs such as visibility and acid deposition. Though not a regulatory program under PSD, FLMs review the issuance of a PSD permit for any impacts that exceed guideline thresholds for these parameters. The air quality impacts in the area must meet the NAAQS, which apply nationwide. The locations of Class I and sensitive Class II areas within 300 kilometers of the HDA are shown on **Figure 3.2-3** and are summarized in **Table 3.2-4**. The nearest Class I area is Carlsbad Caverns National Park approximately 28 kilometers northwest of the HDA. The proximity of this Class I area provides concern that ambient air quality could experience both near-field and regional impacts.

Table 3.2-4 Class I and Sensitive Class II Areas of Concern for Air Quality Impact Analysis

Class I Areas	Sensitive Class II Areas
Carlsbad Caverns NP (NPS)	Bitter Lake National Wildlife Refuge (USFWS)
Guadalupe Mountains NP (NPS)	Grulla National Wildlife Refuge (USFWS)
White Mountain Wilderness Area (USFS)	San Andreas National Wildlife Refuge (USFWS)
Salt Creek Wilderness Area (USFWS)	White Sands National Monument (NPS)
Big Bend NP (NPS)	

Abbreviations:
NP = National Park
NPS = National Park Service
USFS = U.S. Forest Service
USFWS = U.S. Fish and Wildlife Service

Allowable deterioration to air quality can be expressed as the incremental increase to ambient concentrations of criteria pollutants, or PSD increment. Modeled air concentrations of NO_2, SO_2, and PM_{10} predicted at near-field receptors that result from emissions due to project sources are compared with the convenient threshold of allowable PSD increments. This comparison to PSD Class II increments does not represent a regulatory PSD increment consumption analysis because the focus of this study is the proposed action and alternatives under NEPA, not increment-affecting sources, which are not evaluated for regulatory purposes under NEPA. The allowable PSD increments for Class II areas are provided in **Table 3.2-5**.

Bosque del Apache (Little San Pascual U

Bosque del Apache NWR

Bosque del Apache (Chupadera Unit)

Bosque del Apache (Indian Well Unit)

Gila Wilderness

White Mountain Wilderness

Grulla National Wildlife Refuge

Salt Creek Wilderness

Bitter Lake National Wildlife Refuge

San Andreas National Wildlife Refuge

White Sands National Monument

Carlsbad Caverns NP

Carlsbad

50km radius

150km radius

300km radius

Hobbs

Study Area

Midland

Odessa

Carlsbad

El Paso

Guadalupe Mountains NP

Big Bend NP

UNITED STATES MEXICO

Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

LEGEND:

- MDP Project Area
- State Boundary
- County Boundary
- City

Clean Air Act Class I

- U.S. Fish and Wildlife Service
- U.S. National Park Service
- U.S. Forest Service

Sensitive Class II Areas

- U.S. Fish and Wildlife Service
- U.S. National Park Service

Notes:
-Impact analysis for some resources utilizes a different Area of Analysis as illustrated on resource-specific figures

Projection:
WGS 1984

NORTH

0 45 90 Miles

CHEVRON HAYHURST MDP EA

FIGURE 3.2-3
Class I and Sensitive Class II Areas of Concern Map

ANALYSIS AREA: Eddy County, New Mexico

Date: 6/2/2016 | Prepared By: BW

DIV/GROUP: ENV/MDV DB: webb LD: PIC: PM: TM:
PROJECT PATH: Z:\GIS\PRO_ECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment\Final\Figure3.2-3_SensitiveAOC.mxd DATE: 6/2/2016 3:21:57 PM

This page intentionally left blank.

Table 3.2-5 PSD Increments for Class I and Class II Areas

PSD Class	Pollutant	Allowable Increment (µg/m^3)		
		Annual Arithmetic Mean	24-hour Maximum	3-hour Maximum
Class I	NO_2	2.5	-	-
	SO_2	2	5	25
	PM_{10}	4	8	-
Class II	NO_2	25	-	-
	SO_2	20	91	512
	PM_{10}	17	30	-

Impacts from the Proposed Action

Direct and Indirect Impacts

The purpose of the air quality analysis was to assess local and regional air quality impacts from the proposed action. The approach was to develop an emissions inventory for a project base year to tabulate emissions for comparison to emissions estimates and impacts evaluated in the ARTSD prepared in support of the RMP (URS 2013). The ARTSD evaluated impacts of a 20 year projected RFD of oil and gas exploration and production within the CFO area of responsibility. This study found no significant impact from the RFD, and as such, if the proposed action's emission contributions conformed to the ARTSD analysis, then no significant impact is predicted. In cases where emissions did not conform to the ARTSD, additional modeling analysis was conducted to characterize impacts.

Emissions Data Development

Emissions data for the proposed action were developed from available emission factors, analytical methods, applicant-provided equipment specifications, and any applicant committed environmental protection measures. Further, the emissions development relied on anticipated activity levels as provided by Chevron and described in the AQTSD (Arcadis 2016b) that was developed for the proposed action. Emission rates were developed for the criteria pollutants, selected HAPs, and GHG for the maximum anticipated annual drilling, completion, and production activity. Emissions for a full list of HAPs were reviewed, but only those with greatest emissions in relation to health effects were evaluated. **Table 3.2-6** summarizes the maximum annual emissions of each pollutant by activity.

Table 3.2-6 Summary of Maximum Annual Emissions of Criteria and Hazardous Air Pollutants from the Proposed Action (in tons per year)[1]

Activity	Criteria Pollutants						Hazardous Air Pollutants			
	NO_X	CO	SO_2	PM_{10}	$PM_{2.5}$	VOC	BTEX[2]	HCHO[3]	n-Hexane	Total
Drilling and Completion	262.9	223.3	0.4	17.0	8.3	14.2	2.0	4.1	0.1	6.2
Production	102.2	85.8	0.0	6.1	6.1	193.4	1.1	0.1	5.5	6.7
Transmission	119.4	69.8	0.3	0.4	0.4	377.6	21.6	11.8	2.8	36.2
Total	484.5	378.8	0.7	23.4	14.7	585.2	24.7	16.0	8.4	49.1

Notes:
1 Arcadis 2016b
2 Total of benzene, toluene, ethy benzene, and xylene
3 Formaldehyde

Impacts on Ambient Air Quality

As shown in **Table 3.2-6**, the greatest emissions would occur during the drilling and completion of wells, particularly from diesel-fired engines powering fluid pumps during hydraulic fracturing operations. In particular, the hourly and annual emissions of NO_2 would exceed the parameters evaluated in the ARTSD (URS 2013) as shown in **Table 3.2-7**. The maximum air pollutant emissions from each well would be temporary (i.e. only occurring during well drilling and completion), would occur in unpopulated areas, and would not significantly interact with adjacent well locations. Given the temporary, transient and remote nature of these emissions, impacts to nearby receptors are not anticipated to be significant. However, due

to the proximity of Carlsbad Caverns National Park, impacts to ambient air quality, specifically the hourly NO_2 standards, were evaluated using the CALPUFF modeling system and found to not contribute to a violation of the NAAQS (Arcadis 2016b). Other Class I areas are further from the project area and presumed to have less ambient air quality impact. A summary of these impacts are provided in **Table 3.2-8**.

Table 3.2-7 Comparison of Drilling and Completion Emissions from the Proposed Action to ARTSD

Activity / Phase	Proposed Action[1]				ARTSD[2]			
	Power[3]	Maximum NO_X Emissions			Power[3]	NO_X Emissions		
	(hp)	(g/hp-hr) [4]	(lb/hr)	(ton/well)	(hp)	(g/hp-hr)[5]	(lb/hr)	(ton/well)
Drilling[6]	2,760	4.56	27.7	2.8	1,482	0.3	1.0	0.14
Fracturing and Flowback[7]	19,784	4.56	198.9	6.0	1,336	0.3	0.9	0.13
Completion	750	4.56	7.5	0.1	350	0.3	0.2	0.03
Total	23,294		198.9[8]	8.9	3,168		1.0[8]	0.30

Notes
1 Arcadis 2016b.
2 URS 2013.
3 Maximum hourly load of total engine capacity of multiple engines in simultaneous use.
4 USEPA Tier 2 emission standards for engines greater than 750 hp assuming 95% of non-methane hydrocarbon (NMHC) + NOX based on California Air Resources Board (CARB) "Emissions Factors for Compression Ignition Diesel Engines".
5 USEPA Tier 4 emissions standards for engines between 175 and 750 hp.
6 Includes primary drill rig and power generation.
7 Includes engines to power pumps to inject fluids for hydraulic fracturing, blending, and flowback. ARTSD (URS 2013) did not include hydraulic fracturing.
8 Represents maximum hourly emission rate from each phase.

Table 3.2-8 Summary of 1-hr NO_2 Ambient Air Quality Impacts Near the Project Area[3]

Criteria Pollutant	Averaging Period	Modeled Meteorological Year	Maximum Concentration ($\mu g/m^3$)			Ambient Standard ($\mu g/m^3$)[2]	Percent of Standard
			Modeled	Background[1]	Total		
NO_2	1-hr	2008	28.3	34.6	62.9	188	33.5

Notes:
1 3-year average of 98th percentile of 1-hour max used (2012-2014) (1 ppb = 1.88 $\mu g/m^3$) (NMED 2014a).
2 National Ambient Air Quality Standard of 100 ppb (1 ppb = 1.88 $\mu g/m^3$)
3 CALPUFF predicted impacts approximately 2 to 3 kilometers from the Project Area.

Acid Deposition at Class I Areas

The ARTSD (URS 2013) provided an analysis of acid deposition in nearby Class I areas. However, due the increase in NO_X emissions, CALPUFF modeling was also used to provide updated acid deposition results for nitrates in these Class I areas. **Table 3.2-9** shows the acid deposition for proposed action with the maximum added deposition from the project-related sources. The analysis predicts the incremental impacts from the project would exceed the deposition analysis threshold (DAT) of 0.005 kilogram per hectare-year (kg/ha-yr) in Carlsbad Cavern National Park during drilling operations, but would be well below the DAT once drilling has completed.

Table 3.2-9 CALPUFF Modeled Results for Nitrogen Deposition in Class I Areas from the Proposed Action

Scenario	Carlsbad Cavern National Park	Guadalupe Mountains National Park
	(kg/ha-yr)	
Scenario 1 – 2019 Drilling	0.0060	0.0008
Scenario 2 – 2025 Drilling and Production	0.0087	0.0011
Scenario 3 – 2025 Production Only	0.0036	0.0005

Notes:
1 The Deposition Analysis Threshold (DAT) is a significance threshold. If the modeled deposition rate (without adding background concentration) is below the DAT, the predicted impacts are considered to be insignificant

As prescribed in Federal Land Managers' Air Quality Related Values Work Group (FLAG) guidance (USFS et al. 2011), an exceedance of the DAT does not necessarily indicate impact, but further consider of acid deposition is required.

Carlsbad Caverns contains protected portions of the northern Chihuahuan Desert ecosystem which contains woodland, shrubland, and grassland vegetation types that can be sensitive to nitrogen deposition due to fertilization of non-native species. The NPS has identified two species of invasive grass found within the park, *Bromus rubens* (red brome) and *Avena fatua* (Wild Oats). Research has shown that additional growth can be stimulated at or above 3.0 kg/ha-yr (Rao et al. 2010) to levels that could present an increased risk of wildfire. This coincides with the FLAG guidance cumulative threshold value of 3.0 kg/ha-yr for nitrogen deposition.

The National Atmospheric Deposition Program (NADP) has developed deposition maps based on a combination of monitoring networks supplemented by mesoscale modeling using the Community Multiscale Air Quality (CMAQ) model. This data shows deposition levels from 2.7 kg/ha-yr to 3.5 kg/ha-yr (NADP, 2014). However, these are modeled values based on a coarse-grid (12 km resolution) CMAQ model, and actual deposition levels in Carlsbad Cavern National Park have not been monitored. The annual predicted nitrogen deposition impacts from the project (Arcadis, 2016b) indicate that predicted impacts from proposed production and transmission activities would be well below the DAT, peaking at 0.0036 kg/ha-yr. The proposed action would be at or slightly above the DAT, ranging from 0.0063 to 0.0086 kg/ha-yr, for a period of 8 years during drilling operations. Cumulative average impact over 20 years would be 0.0046, just below the DAT.

There is no clear evidence that Carlsbad Cavern National Park is currently impacted due to nitrogen deposition. The range of predicted deposition vary as low as 90% of critical load to exceeding critical load. The mesoscale modeling is subject to high levels of uncertainty and the modeled values have not been verified by monitored values. As such, BLM does not believe that the contribution of deposition just above the screening threshold would contribute significantly to deposition levels in Carlsbad Caverns National Park. Potential impacts to Guadalupe Mountains National Park were below the screening threshold. Based on these data, BLM cannot assert that the proposed action would have a significant impact on nitrogen deposition. However, BLM is sensitive to the concerns of Federal Land Managers to be protective of the park system and would implement mitigation measures as a precautionary measure to alleviate impacts.

Impacts on Visibility in Class I Areas

CALPUFF was used to evaluate impacts on visibility on nearby Class I areas. **Table 3.2-10** provides results of the visibility analysis for the proposed action. The results show minimal impacts to visibility from the proposed action with a maximum of 1 day greater than 0.5 deciview (dv) above the annual average and 4 days greater than the 20 percent best natural background days at Carlsbad Cavern National Park (Arcadis 2016b).

Table 3.2-10 CALPUFF Modeled Results for Impacts to Visibility in Class I Areas from the Proposed Action

Class I Area	# days with Visibility Change > 0.5 dV[1]	
	Annual Avg	20% Best
Carlsbad Cavern National Park	1	4
Guadalupe Mountains National Park	0	0

Notes:
1 USFS et al. 2010

Cumulative Impacts

Greenhouse Gases and Climate Change

The primary sources of GHG associated with oil and gas exploration and production are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). While sources of GHG from oil and gas activities may contribute to global climate change, it is not currently possible to correlate the degree of impact from these sources to any specific climate-related effect. Climate change analyses are complex and comprised of several factors, including but not limited to GHG emissions, land use management practices, mesoscale meteorology, and albedo effects. The tools necessary to quantify climatic impacts presently are unavailable. Consequently, impact assessment of specific effects of anthropogenic activities cannot be determined and specific levels of significance have not yet been established. Therefore, the climate change analysis for the purpose of this document is limited to accounting and disclosing GHG emissions that may contribute to climate change, and putting them in context of current inventories.

The ARTSD (URS 2013) evaluated GHG emissions from the RFD in context of the New Mexico GHG Inventory. **Table 3.2-11** summarizes GHG contribution from the proposed action as a percentage of both the RFD and the New Mexico inventory. The proposed action constitutes 436 of the RFD's 10,117 proposed wells (4.3%), but only contributes 2.2% of the GHG from the RFD. As such, the proposed action's impact to climate change shows a reduction in GHG relative to the level of activity compared to the ARTSD.

Table 3.2-11 Comparison of Maximum Annual Emissions of Criteria and Hazardous Air Pollutants from the Proposed Action to ARTSD (in tons per year)[1]

Activity	Greenhouse Gas			
	CO_2	CH_4	N_2O	CO_2e^2
Drilling and Completion	44,460	1.8	0.4	44,611
Production	66,088	8.6	0.7	66,504
Transmission	130,349	6.6	1.3	130,910
Total Proposed Action	240,897	17.0	2.4	242,024
CFO RMP[3]	11,547,017	46,191	208	12,763,776
% of CFO RMP	2.1	<0.1	1.1	2.2
% of New Mexico Inventory[4]				0.4

Notes:

1 Arcadis 2016b

2 Carbon dioxide equivalents (CO_2e) are calculated based on the Global Warming Potential of each pollutant from Table A-1 of 40 CFR §98 (CO_2 =1 CO_2e, 1 CH_4 = 25 CO_2e, 1 N_2O = 298 CO_2e

3 RMP AQTSD, Table 5-1 2028 Project GHG Emissions as Percentage of State Annual Inventory for RFDOTB; CO2e revised for updated GWP (See Note 2)

4 Based on *Inventory of New Mexico Greenhouse Gas Emissions: 2000-2007* (NMED 2010b)

Ozone

As part of the ARTSD (URS 2013) detailed photochemical modeling was performed to examine the ozone forming potential of the RFD in the CFO Planning Area. The proposed action lays within this planning area and the impacts from the proposed action were a part of the foreseen development analyzed in the RMP.

The emissions modeled in the Reasonable Foreseeable Development On The Books (RFDOTB) scenario and the proposed action are presented in **Table 3.2-12**. The ARTSD analyzed a future year scenario looking at the modeled ozone impacts of 10,117 producing wells. The proposed action represents a total of 436 producing wells by the end of the development. On a well count basis, the proposed action represents 4.3 percent of the foreseen new production. On an emissions basis, the proposed action represents 7.4% of the CO emissions, 8.3% of the NOx emissions and 2.1 percent of the VOC emissions. Thus, the emissions from the proposed action are a small fraction of the emissions foreseen in the RMP.

The RMP presents several different ozone metrics. On a relative basis, the full impact of the RFDOTB case is to increase the forecast design value by 0.001 ppm (URS 2013). Other absolute change metrics showed impacts of the RFDOTB case of from 0.0 to 3.0 percent. The conclusion of the ARTSD (URS 2013) was that the "Ozone impacts attributable to CFO Project and cumulative emissions are not expected to cause or contribute to violations of the ozone NAAQS" and "the two alternatives show little to no change from the future year base case". Since the emissions increases from the proposed action are a small fraction of the emissions that simulated these impacts, the project impact will be a correspondingly small percentage.

Since the ARTSD was completed the ozone standard has been lowered from 0.075 ppb to 0.070 ppb.[2] Recommendations for ozone designations for the new standard are currently being prepared and will be submitted to EPA by October 1, 2016 with formal designations to by October 1, 2017. The 2012-2014 8-hour ozone design value near the project area is 0.071 ppm at the Carlsbad monitor (AIRS ID 350151005).[3] Final guidance does not exist on application, analysis, or interpretation of single project ozone impact analysis. Thus, the analysis and interpretation of the results is handled on an ad-hoc, case-by-case basis. It is anticipated that the ozone impact of the project would be quite small and would not significantly contribute to or cause a violation of the new 0.070 ppm ozone standard.

Table 3.2-12 CFO Oil and Gas RMP Reasonably Foreseeable Development and Proposed Action Well Counts and Emissions Comparison

Parameter / Pollutant	CFO RMP[1]	Proposed Action	% of CFO RMP
Wells	10,117[2]	436	4.3
NO_x (tpy)	8885.0[3]	744.1[4]	8.3
CO (tpy)	6072.0[3]	453.5[4]	7.4
VOC (tpy)	35,797.0[3]	763.4[4]	2.1

Notes:
1 Activity and emissions level based on the RFDOTB mitigation scenario
2 ARTSD (URS 2013), Table 1-1 Total Active BLM O&G Wells in RFD Year 20
3 ARTSD (URS 2013), Table 4-11 CFO Project Emissions Alternative RFDOTB
4 See **Table 3.2-6**

Mitigation Measures and Residual Impacts

The ARTSD (URS 2013) inventory used for comparison accounts for "on the books" controls for all proposed future activity. **Table 3.2-13** provides a comparison of the applicant committed environment protection measures (ACEPM) for air quality and new regulations promulgated since the issuance of the ARTSD to the management actions of the existing RMP. Based on this comparison, the combination of the ACEPM and new regulations meet or exceed the "on the books" management actions described in the RMP.

Table 3.2-13 Comparison of Applicant Committed Environmental Protection Measures and New Regulations for Air Quality to "On the Books" Management Actions in the ARTSD for CFO RMP Revision

Source Type	CFO RFDOTB[1]	ACEPM/New Regulations
Goals	Manage oil and gas activities to comply with all local, State, Tribal, and Federal laws, regulations, standards and implementation plans.	The proposed action will comply with all local, State, Tribal, and Federal laws, regulations, standards and implementation plans.

2 https://www.epa.gov/ozone-pollution/2015-national-ambient-air-quality-standards-naaqs-ozone

3 https://www3.epa.gov/airtrends/pdfs/Ozone_DesignValues_20122014_FINAL_08_03_15.xlsx. Accessed July 13, 2016 Table 1. County Status.

Table 3.2-13 Comparison of Applicant Committed Environmental Protection Measures and New Regulations for Air Quality to "On the Books" Management Actions in the ARTSD for CFO RMP Revision

Source Type	CFO RFDOTB[1]	ACEPM/New Regulations
	Manage oil and gas activities to protect air quality and, within the scope of BLM's authority, minimize emissions that cause or contribute to violations of air quality standards or that negatively impact air quality related values (AQRV). Manage oil and gas activities to minimize emissions of GHG.	The proposed action does not cause or contribute to a violation of NAAQS or AQRV. The proposed action reduces the emissions of GHG per well when compared to the ARTSD CFO RMP Revision.
Objectives	Manage oil and gas activities to meet ambient air quality standards.	The proposed action does not cause or contribute to a violation of NAAQS or AQRV.
Level of development	Emission would reflect development of approximately 16,000 oil and gas wells (6,400 BLM and 9,600 non-BLM).	The level of development of the proposed action is within the scope of development analyzed by the ARTSD for CFO RMP Revision.
Drill Rig Engines	Drill rig and frac pump engines would meet New Mexico and EPA requirements.	Drill rig and frac pump engines meet the New Mexico and EPA requirements based on date of engine manufacture or installation. The proponent will transition nonroad engines associated with drilling, fracturing, and completion to Tier 4 (or equivalent) by 2020.
Well Completion and Testing	Following EPA New Source Performance Standards for the Oil and Gas Industry, beginning January 1, 2015, operators will be required to capture the natural gas associated with hydraulically fractured natural gas well completions, which can be accomplished by green completion practices. This would be required unless the need for exemption is documented.	On June 3, 2016, EPA promulgated changes to the 2012 NSPS and new NSPS for Oil and Gas Production (Subpart OOOOa)[2]. The new rules require reduced emission completions for oil wells in addition to hydraulically fractured gas wells. Therefore, completion controls would be more stringent than the ARTSD for CFO RMP Revision.
Construction Activities and Fugitive Dust Control	No similar action	The proposed action would include the use of watering and best management practices to reduce emissions from surface disturbance and wind erosion.
Tanks	Oil tanks, condensate tanks, and produced water tanks would be required to meet applicable EPA NSPS (2012) emission standards such that new storage tanks with VOC emissions of 6 tons per year or more must	The proposed action would comply with 2012 and 2016 NSPS which require controls of 95% or greater on tanks emitting more than 6 tons per year of VOC.

Table 3.2-13 Comparison of Applicant Committed Environmental Protection Measures and New Regulations for Air Quality to "On the Books" Management Actions in the ARTSD for CFO RMP Revision

Source Type	CFO RFDOTB[1]	ACEPM/New Regulations
	reduce VOC emissions by at least 95 percent.	
Compressor Engines	New and modified centrifugal and reciprocating compressors at gas gathering and boosting stations, well sites and gas processing plants will be required to meet EPA NSPS (2012) and New Mexico Environment Department (NMED) requirement and standards.	The proposed action would comply with the 2016 NSPS which requires reciprocating compressors to reduce emissions of VOC and methane from reciprocating compressors by replacing the rod packing every 26,000 hours or route rod packing emissions to a closed vent system. These controls are more stringent than the management actions of the ARTSD for CFO RMP Revision.
Glycol Dehydrators	Glycol dehydrators located at well sites, gathering and boosting stations, gas processing plants, and natural gas transmission stations will required to meet applicable EPA National Emission Standards for Hazardous Air Pollutants (NESHAP) for Oil and Gas Production (2012)	The proposed action would comply with the NESHAP for Oil and Gas as applicable.
Air Monitoring	No similar action	The proposed action does not include provisions for new or enhanced monitoring of air quality.
Pump and Compressor Electrification	No similar action	The proposed action does not include the electrification of pumps or compressors to reduce emission.
Pneumatic Controllers	Pneumatic controllers at gas gathering and boosting stations, well sites and gas processing plants will be required to meet EPA NSPS (2012) requirements. This would be required unless the need for exemption can be documented.	The proposed action would comply with the 2016 NSPS which requires all pneumatic controllers to be low-bleed and pneumatic diaphragm pumps will be routed to a control device or return vent gas to the process. These provisions are more stringent than the ARTSD for CFO RMP Revision.
Gas Processing Plants	New and modified natural gas sweetening units at gas processing plants will be required to meet EPA (2012) requirements.	The proposed action does not include the construction and operation of natural gas processing plants.
Equipment Leaks	No mitigation for equipment leaks was specified.	The proposed action will be required to the meet the 2016 NSPS which include requirements of Leak Detection and Repair (LDAR) using optical gas imaging or hand-hand analyzer at well sites and compressor stations. This

Table 3.2-13 Comparison of Applicant Committed Environmental Protection Measures and New Regulations for Air Quality to "On the Books" Management Actions in the ARTSD for CFO RMP Revision

Source Type	CFO RFDOTB[1]	ACEPM/New Regulations
		requirement is more stringent than the ARTSD for CFO RMP Revison.

Notes:
1 ARTSD (URS 2013), Table 2-1 for Alternative RFD On-the-Books Controls (RFDOTB)
2 See 81 FR 107 published June 3, 2016

Once operations cease and the area is reclaimed, there would be no continued emissions of air pollution above background levels. No residual impacts to air quality from the proposed action are anticipated since reclamation and revegetation would stabilize exposed soil and control fugitive emissions. As vegetation becomes established, particulate levels should return to what is typical for an arid environment. Air quality would revert to its original state.

Additional Mitigation and Conditions of Approval

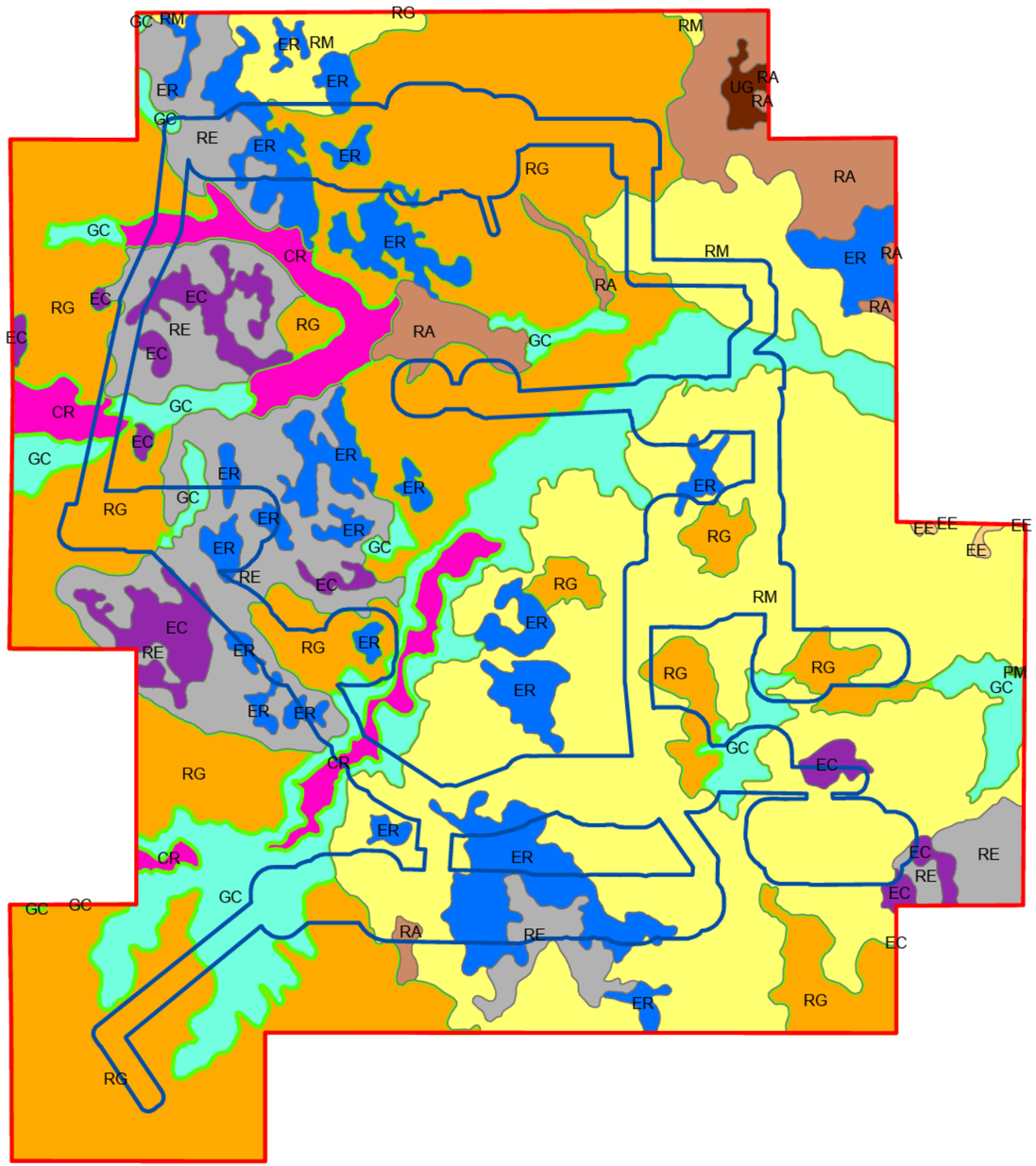
In order to ensure that the proponent's impacts are consistent with the operating parameters considered in the analysis, BLM is requiring the following mitigation measures be implemented. These mitigations measures will be Conditions of Approval for an application for a permit to drill (APD) requested under this MDP.

- All project activities including equipment emissions shall meet or exceed all state and federal standards for air quality as regulated by the New Mexico Environment Department Air Quality Bureau and the U.S. Environmental Protection Agency.
- The operator will implement a drill and completion rig schedule where Tier 4 (or equivalent) drill and completion rigs are phased in. The operator will not exceed four drill rigs at one time and will be 100% compliant with Tier 4 (or equivalent) standards in 2020.
- During the drilling phase, the operator will emit NOx emissions of 262.95 tons per year (tpy) or less from nonroad (mobile sources) between Year 1 and Year 3 and 220.7 tpy or less from nonroad (mobile sources) for the remainder of the drilling phase.
- The operator will emit 213.6 tpy or less of NOx emissions during production operations, as defined in the emission inventory analyzed in the Environmental Assessment. The operator will submit emissions and/or parameters with an Application for Permit to Drill or annual emissions inventory that show the NOx emissions are within the limits of the air quality analysis within the Environmental Assessment.

3.3. Soils

Affected Environment

Soils within the area of analysis were mapped for the soil survey of Eddy County, New Mexico (Soil Conservation Service 1971). As shown on **Figure 3.3-1**, multiple mapped soil units are present, and can be assigned to one of three general categories: loamy, shallow, or gypsum (**Table 3.3-1**; BLM 2014a). These categories represent groups of soils with different physical characteristics as well as different capabilities for producing native plants.



LEGEND:

- EA Area of Analysis
- MDP Project Area

NRCS Soils

- Ector stony loam (EC)
- Ector extremely rocky loam (EE)
- Ector-Reagan association (ER)
- Pima silt loam (PM)
- Reagan loam (RA)
- Reagan-Upton association (RE)
- Reeves-Reagan loams (RM)
- Upton (UG)

Nominated Gypsum Soils Area of Critical Environmental Concern

- Cottonwood-Reeves loams, overflow (CR)
- Gypsum land-Cottonwood complex (GC)
- Reeves-Gypsum land association (RG)

Notes:

-USDA Natural Resources Conservation Service Soil layer for Eddy County, NM obtained from BLM

-CR, GC, and RG soil map units are part of nominated Gypsum Soils Area of Critical Environmental Concern

Projection:
WGS 1984

NORTH

0 6,800 13,600 Feet

CHEVRON HAYHURST MDP EA

FIGURE 3.3-1
Soil Resources

ANALYSIS AREA: Eddy County, New Mexico

Date: 7/5/2016 | Prepared By: BW

DIV/GROUP: ENV/MDV DB: webb LD: PIC: PM: TM:
PROJECT PATH: Z:\GISPRO_ECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment\Final\Figure3.3-1_SoilResources.mxd DATE: 6/6/2016 10:02:11 PM

This page intentionally left blank.

Water erosion hazards are highest in areas of moderate to steep slopes where vegetation or soil crusts have been removed. Wind erosion hazards are generally highest for disturbed loamy or silty soils. For all soil types, careful management is needed to maintain a cover of desirable forage plants and to control erosion by water and wind. Reestablishing native plant cover could take three to five years due to unpredictable rainfall and high temperatures. Most soils within the project area have low reclamation potential and are poor sources of reclamation material, meaning that revegetation and stabilization are very difficult and costly in most cases (Soil Survey Staff 2015).

Table 3.3-1 Soil Map Units

Soil Map Unit Abbreviation – Name	Slope (%)	General Category	Water Erosion Hazard	Wind Erosion Hazard	Source of Reclamation Material	Percent of MDP Project Area
CR – Cottonwood-Reeves loams, overflow*	0-3	Gypsum	Slight	Moderate	Poor	1.2
EC – Ector stony loam	0-9	Shallow	Moderate	Moderately Low	Poor	0.7
ER – Ector-Reagan association	0-9	Shallow (Ector) (70%) / Loamy (Reagan) (30%)	Moderate	Moderately Low	Poor	8.5
GC – Gypsum land-Cottonwood complex*	0-3	Gypsum	Severe	High	Poor	8.9
RA – Reagan loam	0-3	Loamy	Slight	Low	Fair	0.4
RE – Reagan-Upton association	0-9	Loamy (Reagan) (75%) / Shallow (Upton) (25%)	Slight	Low	Fair	9.6
RG – Reeves-Gypsum land complex*	0-3	Loamy (Reeves) (60%) / Gypsum (40%)	Slight	Moderate	Poor	29.4
RM – Reeves-Reagan loams	0-3	Loamy	Slight	Moderate	Poor	41.3

Notes:
Other soil map units are present within the EA area of analysis but are not within the MDP project area and would not be affected under any alternative and are not included in the description of the affected environment.

Wind erosion hazard based on the following wind erodibility groups (WEGs): WEG 1-2 (high); WEG 3 (moderately high); WEG 4-5 (moderate); WEG 6 (moderately low); WEG 7-8 (low).

WEG for soil map unit GC is not rated; erosion hazard from BLM (2014a).

* = soil map unit is part of nominated Gypsum Soils Area of Critical Environmental Concern.

Sources: BLM 2014a; Soil Conservation Service 1971; Soil Survey Staff 2015

Microbiotic soil crusts are found throughout the CFO planning area and are expected to occur within the project area, but have not been documented. These include cyanobacteria and squamulose and gelatinous lichens. While abundant in some areas, microbiotic soil crusts are scattered throughout the project area. These soil crusts are important in binding loose soil particles together to stabilize the soil surface and reduce erosion. They also function in the nutrient cycle by fixing atmospheric nitrogen, contributing to soil organic matter, and maintaining soil moisture. In addition, they can act as a living mulch, which discourages the establishment of annual/invasive weeds. Structurally they form an uneven, rough carpet that reduces raindrop impact and slows surface runoff. Below the surface, lichen and moss rhizines, fungal hyphae, and cyanobacterial filaments act to bind the soil surface particles just below and at the surface. Horizontally, they occur in nutrient-poor areas between plant clumps. Because they lack a waxy epidermis, they tend to leak nutrients into the surrounding soil. Vascular plants such as grasses and forbs can then utilize these nutrients (Belnap et al. 2001).

Shallow

These soils are shallow to very shallow, well-drained, calcareous, stony and rocky loams over limestone and caliche. Topography ranges from nearly level ridgetops to side slopes to cliffs and escarpments. Permeability is moderate, water-holding capacity is very low to low, and runoff is rapid after soils become saturated. Shallow soils are subject to water erosion, but the stones and rock outcrops help to stabilize

the soils on nearly level to gently sloping areas. These soils typically have scattered populations of squamulose lichens and a few crustose lichens, while gelatinous lichens and cyanobacteria are occasionally present primarily in the pockets of deeper soils.

Gypsum

Gypsum type soils have a loamy surface layer, with gypsiferous materials starting at a depth of 1 to 10 inches. They are found on gently undulating uplands, with steep, broken gypsum outcrops occurring in places. Permeability varies from very low to moderate, water-holding capacity is very low to low, and runoff rapid to very rapid. Soil fertility and the rooting zone are limited by the underlying gypsiferous material. These soils are subject to severe erosion once the vegetative cover is lost. These areas have good populations of squamulose lichens, a few crustose and gelatinous lichens, and cyanobacteria, which are present throughout the top 2 millimeters of the soil.

Soil map units CR, GC, and RG constitute the nominated Gypsum Soils Area of Critical Environmental Concern (ACEC) due to the presence of fragile microbiotic soil crust, high erosion potential when the crust is disturbed, and poor revegetation potential. These soils tend to be located along the banks and sidewalls of draws and in drainage bottoms. The BLM CFO has identified the Southern Gypsum Soil Area. This 62,800-acre area is characterized by gypsum soils with low organic matter content, sparse vegetation, rapid to very rapid runoff, very low to low water-holding capacity, and high salinity that limits plant rooting. These soils are also subject to severe erosion if the vegetative cover is lost (BLM 2014a). Within this area, some off-road travel activities are restricted, but no specific management designations have been prescribed (BLM 1988). The nominated Gypsum Soils ACEC and Southern Gypsum Soil Area are shown on Figure 3.3-1.

Loamy

Generally, loamy type soils are deep, well-drained, moderately dark colored, and calcareous. These soils typically occur on gently undulating plains and in the broader valleys of the hills and mountains. Permeability is moderate, water-holding capacity is moderate to high, and runoff is likely after prolonged or heavy rains. Careful management is needed to maintain a cover of desirable forage plants and to control erosion. Reestablishing native plant cover could take three to five years due to unpredictable rainfall and high temperatures. There is a potential for wind and water erosion due to the erosive nature of these soils once the cover is lost. These soils generally have cyanobacteria throughout the area, while squamulose, crustose, and gelatinous lichens are occasionally present.

Impacts from the Proposed Action

Direct and Indirect Impacts

Construction-related impacts to soil resources may include compaction and degradation of factors necessary to support vegetation. There is a potential for wind and water erosion due to the erosive nature of some project area soils once the cover is lost, particularly within gypsum type soils. Based on the layout of project components presented in the MDP and APDs, approximately 530 acres of short-term impacts are expected in soils within the Nominated Gypsum Soils ACEC, particularly the Reeves-Gypsum land complex. Approximately 63 acres of short-term disturbance would be in soils with a severe water erosion hazard (i.e., Gypsum land-Cottonwood complex). Long-term impacts due to soil erosion could occur in areas where reclamation is difficult and where establishment of vegetation takes longer than expected.

Microbiotic soil crusts are expected to occur within the project area and may be impacted by surface disturbances, also contributing to increased potential for erosion. Recovery rates for microbiotic soil crusts are generally slow, specifically for lichen and moss, which can take 45 to 250 years, respectively (Belnap and Gillette 1997). Long-term effects would occur from surface disturbances in areas of microbiotic soil crusts. There is potential for soil contamination due to spills or leaks. Soil contamination from spills or leaks can result in decreased soil fertility, less vegetative cover, and increased soil erosion.

Impacts to soil resources are reduced by standard practices such as utilizing existing surface disturbance, minimizing surface disturbances, minimizing vehicular use, placing parking and staging areas on caliche surfaced areas, reclaiming the areas not necessary for production, and quickly establishing vegetation on the reclaimed areas.

With implementation of design features and reclamation, short-term impacts to soil resources would be moderate and long-term impacts would be minor. These features include caliche surfacing, interim reclamation, reclamation monitoring, topsoil stockpiling, segregation, and erosion prevention through the use of soil retention blankets in areas of high wind or water erosion.

Cumulative Impacts

The CIA for soils is the same as described in Section 3.1 (Figure 3.1-1). Soil types within the CIA have similar overall soil properties to those within the EA analysis area. These general properties include high gypsum concentrations in some components, poor suitability as reclamation material, slight water erosion hazards (but severe in gypsum soils), and moderate wind erosion hazards.

Project construction would result in the temporary disturbance of approximately 1,808 acres of soils. This represents approximately 22 percent of the total estimated disturbance from past, present, and reasonably foreseeable future activities within the CIA. Based on the total amount of disturbance within the CIA, minor to moderate cumulative impacts to soil resources are expected. When considering the low reclamation suitability of soils within the CIA, reclamation and reestablishment of vegetation for all past, present, and reasonably foreseeable future activities are likely to be only partially successful. Minor adverse cumulative impacts to soil resources are expected under the proposed action.

Mitigation Measures and Residual Impacts

Anticipated impacts to soil resources would be less than significant; therefore, no mitigation measures are required for the MDP or 12 submitted APDs. Additional mitigation may be required on an individual APD or ROW basis as determined by the BLM. For example, where roads are proposed in gypsum soil areas, the CFO may require the use of dust abatement measures to mitigate potential impacts to gypsum soils. The CFO has analyzed impacts from the use of dust abatement in a separate programmatic EA (DOI-BLM-NM-P020-2015-0231-EA). The need for dust abatement to mitigate impacts would be determined in future ROW applications that are submitted for gypsum soil areas. Other examples of potential additional mitigation include the potential identification of large expanses of microbiotic soil crusts during onsite reviews that may require additional avoidance measures. Impacts to microbiotic soil crusts, including increased erosion rates and loss of other soil functions, would be reduced through interim and final reclamation; however, damaged soil crusts would take up to 250 years to recover and would represent a residual impact. Overall residual impacts to soil resources with implementation of design features and mitigation that may be required for individual APDs or ROWs are expected to be less than significant.

3.4. Caves and Karst

Affected Environment

The area of analysis for cave and karst resources is the Carlsbad Underground Water Basin, as defined by the New Mexico Office of the State Engineer (NMOSE) (**Figure 3.4-1**). The project area is located in gypsum karst terrain, a landform that is characterized by underground drainage through solutionally enlarged conduits. Gypsum karst terrain may contain sinkholes, sinking streams, caves, and springs. Sinkholes leading to underground drainages and voids are common. These karst features, as well as occasional fissures and discontinuities in the bedrock, provide the primary sources for rapid recharge of the groundwater aquifers of the region.

The BLM categorizes all areas within the CFO as having either low, medium, high, or critical cave potential based on geology, occurrence of known caves, density of karst features, and potential impacts to freshwater aquifers. The southern portion of the project area occurs within a medium karst zone and all other portions are within a high karst zone. A medium karst zone is defined as an area in known soluble

rock types but may have a shallow insoluble overburden. These areas may contain isolated karst features such as caves and sinkholes. Groundwater recharge may not be wholly dependent on karst features but the karst features still provide the most rapid aquifer recharge in response to surface runoff. A high karst zone is defined as an area in known soluble rock types and contains a high frequency of significant caves and karst features such as sinkholes, bedrock fractures that provide rapid recharge of karst aquifers, and springs that provide riparian habitat.

Field notes from baseline surveys (Arcadis 2016) and onsite inspections indicate that cave and karst features are present within or near the project area. Locations of these features are illustrated on **Figure 3.4-2**. Karst features were identified within approximately 100 meters of the proposed APD Group 1 well pad access road and pipeline alignment during the onsite inspection (**Figure 2.1-3**). The majority of features identified during baseline surveys were closed depressions or fissures that may represent surface expressions of underground features. These features may represent preferential flow pathways by which surface waters could reach groundwater and are areas where surface openings may develop in the future. Collapsed sinkholes and similar features (e.g., mammal burrows that collapsed due to water intake) with observed surface openings were also identified.

Sinkholes and cave entrances collect water and can accumulate rich organic materials and soils. This, in conjunction with the stable microclimate near cave entrances, supports a greater diversity and density of plant life, which provides habitat for a greater diversity and density of wildlife such as raptors, rodents, mammals, and reptiles.

The interior of the caves support a large variety of troglobitic, or cave environment-dependent species. The troglobitic species have adapted specifically to the cave environment due to constant temperatures, constant high humidity, and total darkness. Many of the caves in this area contain fragile cave formations known as speleothems.

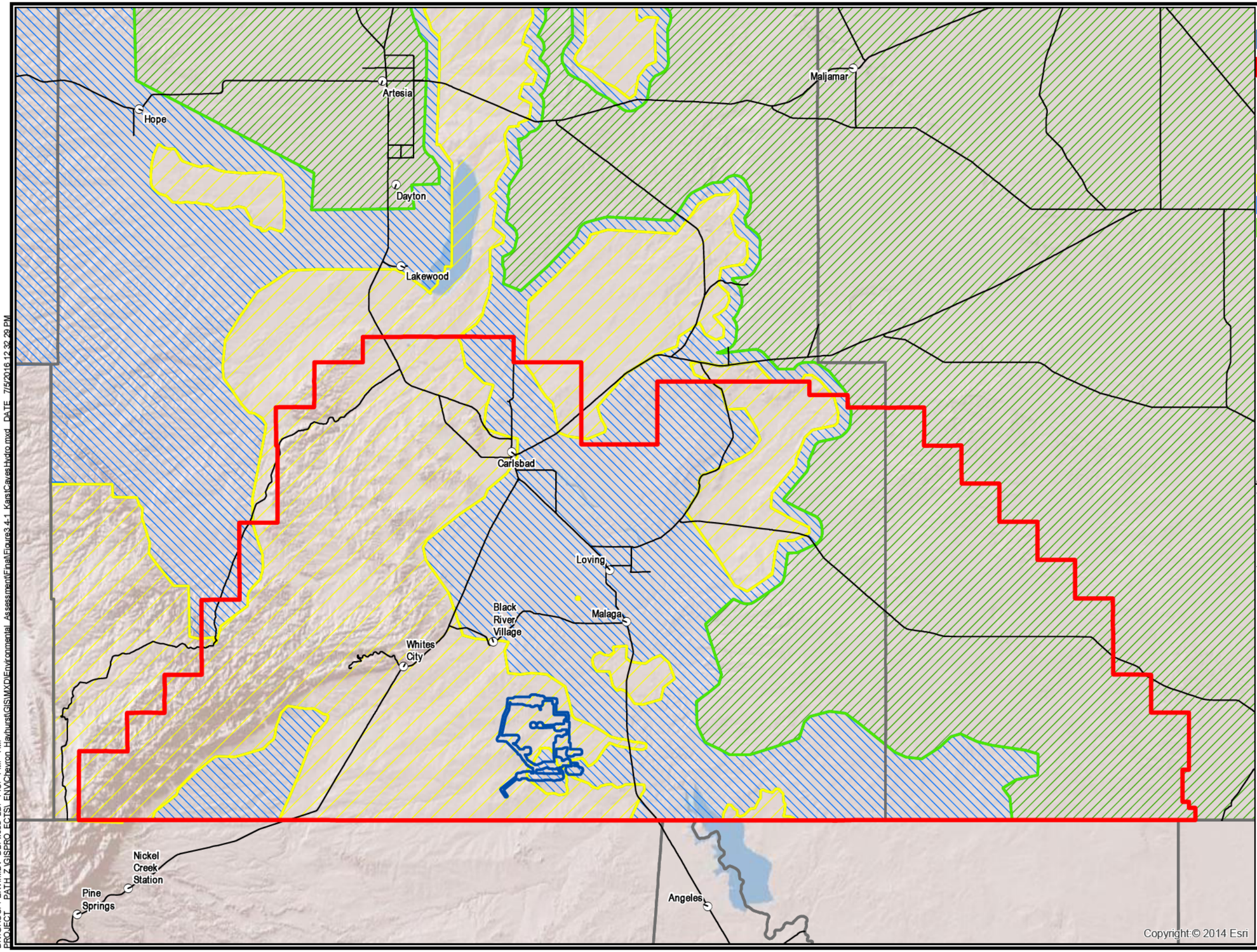
Impacts from the Proposed Action

Direct and Indirect Impacts

Cave and karst features provide direct conduits leading to groundwater. These conduits can quickly transport surface and subsurface contaminants directly into underground water systems and freshwater aquifers without filtration or biodegradation. In addition, contaminants spilled or leaked into or onto cave/karst zone surfaces and subsurfaces may lead directly to the disruption, displacement, or extermination of cave species and critical biological processes. In extreme or rare cases, a buildup of hydrocarbons in cave systems due to surface leaks or spills could potentially cause underground ignitions or asphyxiation of wildlife or humans within the cave.

In cave and karst terrains, rainfall and surface runoff is directly channeled into natural underground water systems and aquifers. Changes in geologic formation integrity, runoff quantity/quality, drainage course, rainfall percolation factors, vegetation, surface contour, and other surface factors can negatively impact cave ecosystems and aquifer recharge processes. Blasting, heavy vibrations, and focusing of surface drainages can lead to slow subsidence, sudden collapse of subsurface voids, and/or cave ecosystem damage. A more complete discussion of the impacts of oil and gas drilling is provided in the Dark Canyon Environmental Impact Statement (BLM 1992).

The BLM maintains up-to-date locations and surveys of known cave and karst features, and multiple cave and karst features were identified during baseline surveys (Arcadis 2016a). Project activities will be located away from these features whenever possible. Drilling pads, roads, utilities, pipelines, and flowlines will be routed around cave and karst features at an adequate distance to mitigate adverse impacts. Wellbore engineering plans will incorporate required cave and aquifer protection protocols.



LEGEND:

- MDP Project
- Area of Analysis for Caves, Karst, and Subsurface Hydrology
- Cities
- Major Highways
- County Boundary

Karst Occurence Potential

- High Potential Karst
- Medium Potential Karst
- Low Potential Karst

Notes:

-Impact analysis for some resources utilizes a different Area of Analysis as illustrated on resource-specific figures
-Data sources: Karts occurrence potential (BLM 2014a); Carlsbad Underground Water Basin (Office of the State Engineer, 2007).
-The cave and karst area of analysis is the Carlsbad Underground Water Basin, as designated by the NM Office of the State Engineer.

Projection:
WGS 1984

NORTH

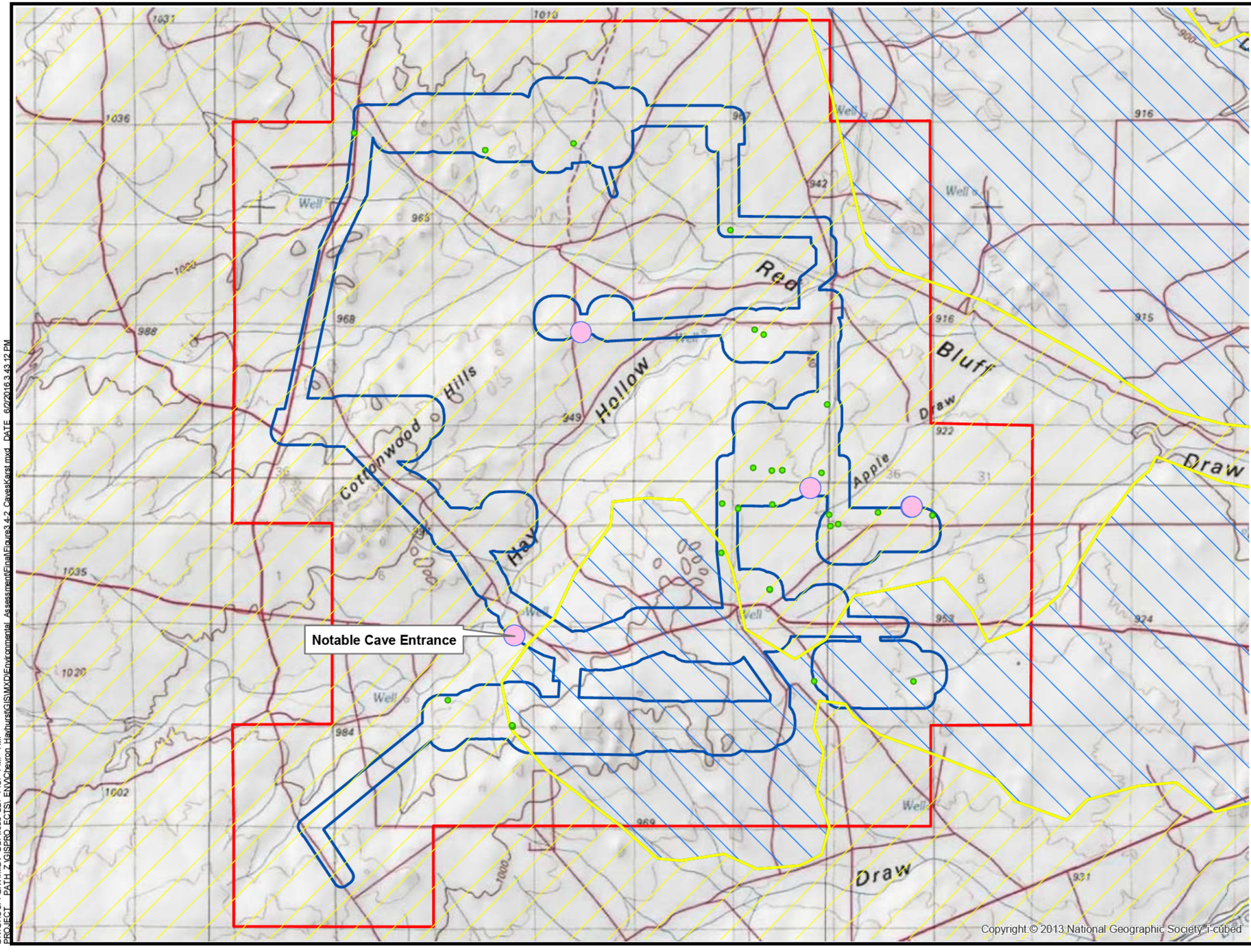
0 9 18 Miles

CHEVRON HAYHURST MDP EA

FIGURE 3.4-1
Caves, Karst, and Subsurface Hydrology

ANALYSIS AREA: Eddy County, New Mexico
Date: 7/5/2016 | Prepared By: BW

DIV/GROUP: ENV/MDV DB: webb LD: PIC: PM: TM:
PROJECT PATH: Z:\GIS\PRO_ECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment\Final\Figure3.4-1_KarstCaves\Hydro.mxd DATE: 7/5/2016 12:32:29 PM



LEGEND:

- MDP Project Area
- Area of Analysis
- Features without Surface Openings (50 meter buffer)
- Features with Surface Openings (200 meter buffer)

Karst Occurence Potential

- High Potential Karst
- Medium Potential Karst

Projection:
WGS 1984

NORTH

0 6,000 12,000 Feet

CHEVRON HAYHURST

FIGURE 3.4-2
CAVE AND KARST FEATURES

ANALYSIS AREA: Eddy County, New Mexico

Date: 6/6/2016 | Prepared By: BW

DIV/GROUP: ENV/MDV DB: webb LD: PIC: PM: TM:
PROJECT PATH: Z:\GIS\PRO_ECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment\Final\figure3.4-2_CavesKarst.mxd DATE: 6/2/2016 3:43:12 PM

Highly sensitive cave and karst areas with critical freshwater aquifer recharge concerns may have a number of special surface and subsurface planning and construction requirements based upon the risk of adverse impacts created by a specific location or process. Due to the presence of identified karst features within the Project Area, the proposed action is subject to mitigation measures designed to adequately protect known and potential cave/karst resources.

Construction Impact Analysis

The construction of roads, pipelines, well pads, and utilities can impact bedrock integrity and reroute, impede, focus, or erode natural surface drainage systems. Increased silting and sedimentation from construction can plug downstream sinkholes, caves, springs, and other components of aquifer recharge systems and result in adverse impacts to aquifer quality and cave environments. Any contaminants released into the environment during or after construction can impact aquifers and cave systems.

A possibility exists for slow subsidence or sudden surface collapse of a sinkhole, cave passage, or void during road, well pad, pipeline, ancillary facility, powerline, and other construction operations. This would cause associated safety hazards to operators of equipment, and the potential for increased negative environmental impact. Opening a new entrance into a cave system can change air flow patterns, temperatures, insurgencies, mineral development, and biological community and may cause other undetermined effects on the cave ecosystem. These subsidence processes can be triggered or enhanced by intense vibrations and rerouting or refocusing of surface drainages.

Roads and road drainage turnouts can direct or funnel runoff water into cave entrances or sinkholes. Contaminants from spills and general road runoff (such as oil and other petroleum products, salt water, and other debris) can be transported directly into the cave systems, causing negative effects on the cave environment and ecosystem. Because cave ecosystems are extremely fragile and easily disturbed, the negative effects to the cave's biological components may include disruption of some of its species. Because karst terrains and cave systems are directly and integrally linked to groundwater recharge, contaminants spilled on roads or leaking pipelines in these areas may lead directly to groundwater contamination.

Buildup of toxic or combustible fumes in caves and cave entrances from spills on roadways may harm wildlife and cave visitors and, in extreme cases, lead to asphyxiation or rapid ignition in the rare event that the fumes are ignited by visitors.

Encountering a void would also have adverse impacts on the stability of a power pole and may result in the subsequent failure of that pole. Slow subsidence or sudden collapse of sinkholes may also leave pipelines hanging and increase their possibility of leaking or failure.

Blasting will not be used as a construction method.

Drilling Impact Analysis

During drilling, previously unknown cave and karst features could be encountered. If a void is encountered while drilling and a loss of circulation occurs, lost drilling fluids can directly contaminate groundwater recharge areas, aquifers, and groundwater quality. Drilling operations can also lead to sudden collapse of underground voids. Cementing operations may plug or alter groundwater flow, potentially reducing the water quantity at springs and water wells. Inadequate subsurface cementing, casing, and cave/aquifer protection measures can lead to the migration of oil, gas, drilling fluids, and produced saltwater into cave systems and freshwater aquifers.

Production Impact Analysis

Production facilities such as tank batteries, pump-jacks, compressors, transfer stations, and piping may fail and allow contaminants to enter caves and freshwater systems. Downhole casing and cementing failures can allow migration of fluids and/or gas between formations and aquifers. Facilities may also be subject to slow subsidence or sudden collapse of the underlying bedrock.

Plugging and Abandonment Impact Analysis

Failure of a plugged and abandoned well can lead to migration of contaminants to karst resources and freshwater aquifers. While this action does not specifically approve plugging and abandonment procedures, the operator should be made aware that additional or special Conditions of Approval may apply at that time.

Cumulative Impacts

The CIA for subsurface hydrology is the Carlsbad Underground Water Basin (**Figure 3.4-1**) as well as the portions of the Red Bluff Draw watershed and Gyp Draw-Delaware River subwatershed that extend into Texas. High to moderate potential for cave and karst resources is present throughout the majority of the CIA, similar to that described for the EA area of analysis (Stafford et al. 2008).

The types impacts of past, present, and reasonably foreseeable future actions would be similar to those described for the proposed action and include potential groundwater contamination and hydrocarbon releases into cave atmospheres, leading to dangerous conditions. Containment ponds associated with some older wells are a risk of contaminant leakage, as are the multiple pipelines, tank batteries, and related facilities present within the CIA.

Dye trace studies conducted by BLM within the CIA have shown connectivity between karst aquifers and lost circulation zones encountered during oil and gas well drilling. These results indicate that past oil and gas operations have likely introduced an unknown quantity of multiple potential contaminants to karst aquifers within the CIA. The extent to which karst aquifer water quality and associated riparian and cave biological communities have been affected has not been determined.

Most ongoing and future oil and gas operations within the CFO are or will be required to incorporate design features, mitigation measures, or conditions of approval to conduct operations within karst areas. These provisions would not apply to oil and gas leases on private or state lands. Past, present, and reasonably foreseeable future actions are likely to contribute to adverse cumulative impacts on cave and karst resources, including groundwater quality and associated ecosystems.

Mitigation Measures and Residual Impacts

Any industrial activities that take place upon or within karst terrains or freshwater aquifer zones have the potential to create both short-term and long-term negative impacts to freshwater aquifers and cave systems. While a number of mitigation measures can be implemented to mitigate many impacts, it is still possible for impacts to occur from containment failures, well blowouts, accidents, spills, and structural collapses. Many of these impacts would likely have long-term, residual effects to resource conditions such as groundwater quality and cave ecosystem functionality. It is therefore necessary to implement long-term monitoring studies to determine if current mitigations measures are sufficient enough to prevent long-term or cumulative impacts.

To mitigate or lessen the probability of impacts associated with the drilling and production of oil and gas wells in karst areas, the guidelines listed in Appendix 3, Practices for Oil and Gas Drilling and Production in Cave and Karst Areas, as approved in the Carlsbad Resource Management Plan Amendment of 1997, page AP3-4 through AP 3-7 will be followed. Many of the mitigation measures provided in the 1997 RMP Amendment have been incorporated into the proposed action as design features and are not considered mitigation measures. Avoidance of known cave and karst features would be prioritized during APD and ROW review. Implementation of mitigation measures is expected to reduce short-term, long-term, and residual impacts to cave and karst resources to less than significant levels.

Additional mitigation is required for the karst features identified closer than 200 meters from the proposed APD Group 1 access road and flowlines. Prior to surface disturbances for construction of the access road, pipeline, flowline, or utility line, straw wattles would be placed along the north side of the area to be disturbed, within and a minimum of 50 feet on either side of the drainage that leads to the karst features.

Road Construction

Roads will be routed around sinkholes and other karst features to avoid or lessen the possibility of encountering near surface voids and to minimize changes to runoff or possible leaks and spills from entering karst systems. Turnout ditches and drainage leadoffs will not be constructed in such a manner as to increase or decrease the natural flow of water into or out of cave or karst features. The CFO will be informed immediately if any subsurface drainage channels, cave passages, or voids are penetrated during construction and no further construction will be done until clearance has been issued by the Authorized Officer. Special restoration stipulations or realignment may be required.

Pipeline Construction

To avoid or lessen the potential of subsidence or collapse of karst features, toxic or combustible gas buildup, or other possible impacts to cave and karst resources from buried pipelines, alignments may be rerouted to avoid karst features. The CFO will be informed immediately if any subsurface drainage channels, passages, or voids are intersected by trenching, and no pipe will be laid in the trench at that point until clearance has been issued by the Authorized Officer. Special restoration stipulations or realignment may be required at such intersections, if any. Leak detection systems, back flow eliminators, and differential pressure shut-off valves may be required to minimize the impacts of leaking or ruptured pipelines. To eliminate these extreme possibilities, good record keeping is needed to quickly identify leaks for their immediate and proper treatment.

Powerline Construction

Smaller powerlines will be routed around sinkholes and other karst features to avoid or lessen the possibility of encountering near surface voids and to minimize changes to runoff or possible leaks and spills from entering karst systems. Larger powerlines will adjust their pole spacing to avoid cave and karst features. The CFO will be informed immediately if any subsurface drainage channels, cave passages, or voids are penetrated during construction and no further construction will be done until clearance has been issued by the Authorized Officer. Special restoration stipulations or realignment may be required.

Drilling Mitigation

Federal regulations and standard Conditions of Approval applied to all APDs require that adequate measures are taken to prevent contamination to the environment. Due to the extreme sensitivity of the cave and karst resources in the Project Area, additional drilling, casing, and cementing procedures to protect cave zones and freshwater aquifers may be required for APDs covered under the MDP on a case-by-case basis.

Production Mitigation

In addition to the leak detection programs for surface facilities and containment ponds provided under the Proposed Action, additional leak detection Conditions of Approval may be applied on a case-by-case basis for production activities covered under the MDP.

Plugging and Abandonment Mitigation

Upon well abandonment in high cave karst areas additional plugging conditions of approval may be required. The BLM will assess the situation and work with the operator to ensure proper plugging of the wellbore.

3.5. Watershed

Affected Environment

Surface Hydrology

The surface hydrology area of analysis is characterized by relatively flat to gently sloping terrain dissected by ephemeral tributaries to the Pecos River (**Figure 3.5-1**). Somewhat steeper, hilly terrain is present in

the western portion of the Project Area in the Cottonwood Hills, where relief is up to about 200 feet. The main drainage within the Project Area is Red Bluff Draw, which collects runoff from North and South Hackberry Draws, Cottonwood Draw, Apple Draw, Hay Hollow Draw, and other unnamed drainages prior to its confluence with the Pecos River. Minor, unnamed drainages in the southern portion of the Project Area flow southward to Owl Draw, which is tributary to the Delaware River. The confluences of Red Bluff Draw and the Delaware River with the Pecos River are both east of State Highway 285, approximately 4 and 6 miles east of the Project Area, respectively.

Water quality and quantity is influenced by physical, chemical, and biological reactions that occur as water moves over and through the land surface toward streams and into aquifers. The rate at which water moves through the watershed strongly affects these reactions. The area is located in the semi-arid southwest on the northern edge of the Chihuahuan Desert, where annual precipitation averages 10.5 inches with the greatest rainfall occurring as monsoonal storms in late summer (July through September). About half of the annual precipitation is received during this period via brief, intense storms that can cause large amounts of runoff and potential flooding (Pecos Valley Water Users Organization [Pecos Valley WUO] 2001). Temporary ponded water may be present in drainages after heavy rains. An impoundment present in the Hay Hollow drainage in T25S, R27E, Section 28 SESE typically contains water throughout the year and is likely seep- or spring-fed. No other seeps, springs, or playas were identified during baseline surveys of the Project Area (Arcadis 2016a).

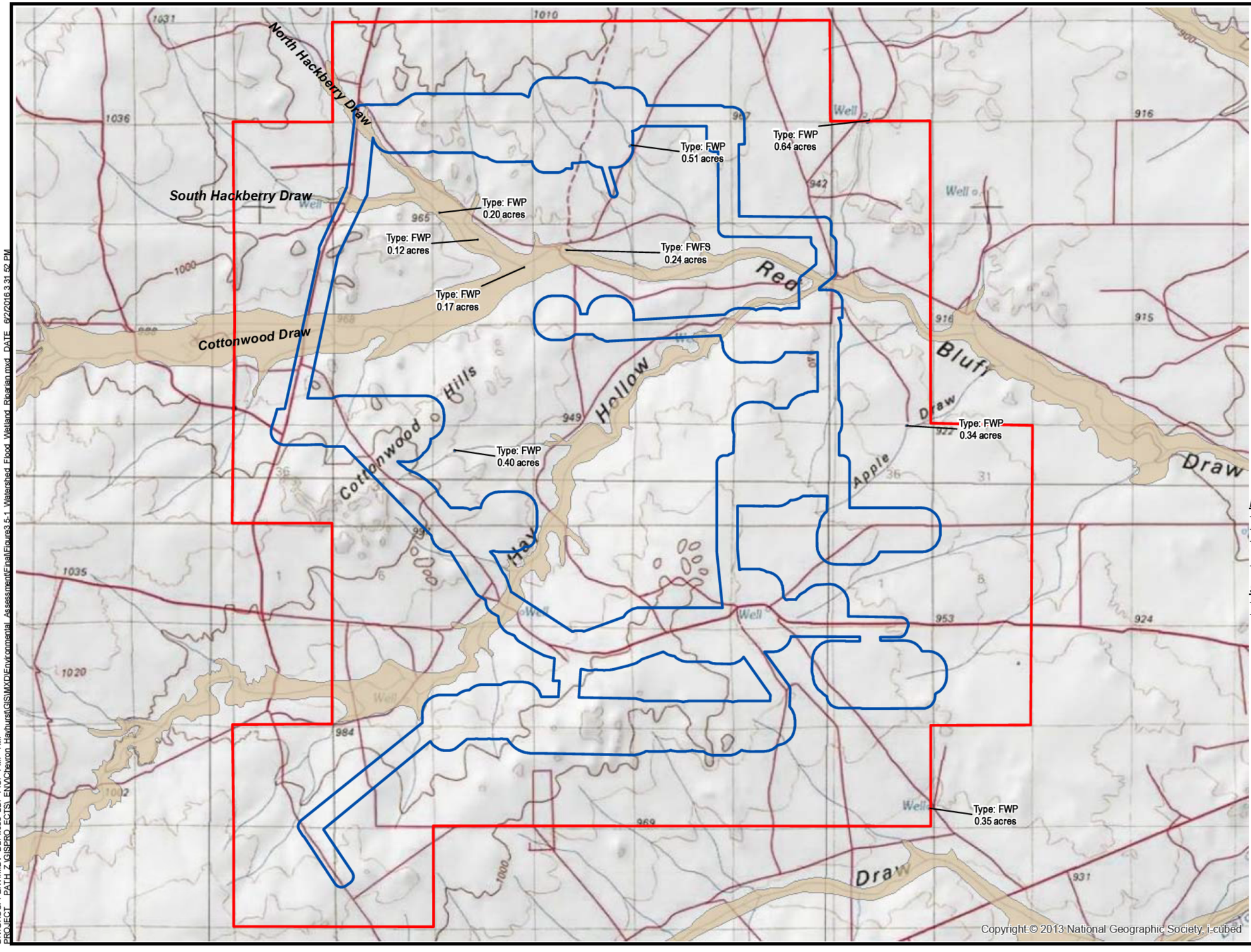
The reach of the Pecos River which Project Area drainages are tributary is impaired for two designated uses. The warm water aquatic life designated use is impaired by elevated levels of polychlorinated biphenyls (PCBs) in fish tissue and low dissolved oxygen levels. The source of PCBs is unknown and low dissolved oxygen levels are tentatively linked to discharge of groundwater with low oxygen. The irrigation designated use is impaired by elevated levels of dissolved boron, which may be linked to brine springs upstream of the Project Area near Malaga Bend (NMED 2014b).

Subsurface Hydrology

The area of analysis for subsurface hydrology is the same as for cave and karst resources (**Figure 3.4-1**). The Project Area is located in the Carlsbad Groundwater Basin, which encompasses approximately 2,347 square miles of southeastern New Mexico. No EPA-designated sole source aquifers are present within the area of analysis (U.S. Department of Agriculture [USDA] 2016). Groundwater uses within the basin include agriculture; public water supply for Carlsbad, Loving, and other towns; and industrial uses. Groundwater supplies within the basin are obtained from aquifers within underlying sedimentary units including the Dockum Group, Rustler Formation, Castile Formation, Carlsbad and Capitan Limestones, and Delaware Mountain Group. Shallow groundwater is also present in some alluvium and terrace deposits.

The Project Area is underlain by bedrock of the Permian Rustler, Salado, and Castile Formations. Formations comprising the Capitan Reef aquifer are absent. In general, the uppermost bedrock consists of the Rustler Formation in the northern and eastern portions of the Project Area; the Salado Formation in the northwestern, western, central, and southern portions; and the Castile Formation in the southwest. Within the Project Area, none of these formations has sufficient porosity and permeability to yield productive water supply wells, except where karst features are present. Water is withdrawn from the Castile Formation north of the Project Area, where it may be in hydrologic contact with alluvial aquifers (Barroll et al. 2004). Groundwater recharge is from local precipitation entering through playas, sinkholes, and swallets (disappearing streams). Precipitation in the vicinity of the project area primarily falls as rainfall during the summer and fall monsoon (Western Regional Climate Center 2016).

The Carlsbad Groundwater Basin is estimated to contain approximately 12.6 million acre-feet of groundwater within the top 100 feet of all combined aquifers (Pecos Valley WUO 2001). Sustainable groundwater yields for the basin are estimated to be at least 25,000 acre-feet per year, with potential to sustain up to approximately 93,000 acre-feet for short periods (Pecos Valley 2001).



LEGEND:

- MDP Project
- Area of Analysis for Watershed, Floodplains, Wetlands, and Riparian Areas
- National Wetland Inventory Wetlands
- FEMA 100-Year Floodplain

Notes:
-FWP = Freshwater Pond wetland
-FWFS = Freshwater Forested/Shrub wetland
-Area of analysis for these resources is the same as the Project Area
-No riparian areas identified within area of analysis

Source data:
-Wetlands - USFWS 2016
-Floodplains - FEMA 2010

Projection:
WGS 1984

NORTH

0 6,000 12,000 Feet

CHEVRON HAYHURST

FIGURE 3.5-1
WATERSHED, FLOODPLAINS, WETLANDS, AND RIPARIAN AREAS

ANALYSIS AREA: Eddy County, New Mexico
Date: 6/2/2016 | Prepared By: BW

DIV/GROUP: ENV/MDV DB: webb LD: PIC: PM: TM:
PROJECT PATH: Z:\GIS\PRO_ECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment\Final\Figure3.5-1_Watershed_Flood_Wetland_Riparian.mxd DATE: 6/2/2016 3:31:52 PM

This page intentionally left blank.

Basin-wide recharge estimates are not established; however, recharge for some individual aquifers within the basin are estimated as follows. Annual recharge is estimated to be 10,000 to 20,000 acre-feet for the Capitan Reef aquifer and an average of 8,000 acre-feet for the Pecos Valley alluvial aquifer. Irrigation seepage is also estimated to recharge approximately 36,000 acre-feet to the Pecos Valley alluvial aquifer each year. Leakage of water from Lake Avalon is estimated to recharge approximately 15,000 acre-feet each year to the Capitan Reef and Pecos Valley aquifers (NMOSE 2016). Alluvial aquifers and the Capitan Reef aquifer within the basin exhibit short-term fluctuations in water level due to precipitation and withdrawal rates. The Capitan Reef aquifer has shown a slight historical decline. Long-term trends in alluvial water levels are inconsistent. Both aquifers appear to recover quickly during periods of normal precipitation (Pecos River WUO 2001).

Basin-wide estimates of allocated withdrawals in 1996 indicate that approximately 93,500 acre-feet of water rights are recorded or permitted in the basin (Pecos Valley WUO 2001). Of that total, about one-half were supplemental to surface water rights (i.e., only to be used during drought conditions when surface water resources are limited). More recent estimates of water withdrawals for the region have been conducted on a county basis and are not distinguished by groundwater basin. County-wide withdrawals are expected to be much higher than for the Carlsbad Groundwater Basin alone, but provide a picture of distribution of water use by category. For water year 2010 in Eddy County, agriculture (109,738 acre-feet), public water supply (15,465 acre feet), and mining/oil and gas (9,303 acre-feet) comprised approximately 97 percent of all groundwater withdrawals (NMOSE 2016).

Several relatively shallow water wells have been drilled in or near the Project Area that are used primarily to support stock watering. Well yields in the Project Area and vicinity are low (typically less than 5 gallons per minute). Well depths range up to 351 feet, but most are less than 100 feet deep (Arcadis 2016a). Groundwater quality data for the area are limited. However, high sulfur and saline conditions are expected to be present based on regional water quality data and the presence of halite and gypsum/anhydrite in local bedrock (Pecos Valley WUO 2001).

Impacts from the Proposed Action

Direct and Indirect Effects

Surface Hydrology

Ephemeral surface water from local rain events will wash down-slope through the area of the proposed action. Localized decreases in vegetative surface cover combined with the caliche covering well pads, roads, and other surface facilities could result in decreased infiltration rates and increased runoff volume and velocity. This causes increased erosion, topsoil loss, and sedimentation. Water diversions (e.g., lead-off ditches, water bars), use of BMPs (e.g., straw wattles) at outlets, low water crossings, and culverts as needed would decrease the potential for erosion and sediment transport along roads. Potential sedimentation in local ephemeral drainages may occur but is not expected to contribute to downstream conditions that have caused impaired designated uses of the Pecos River. Proposed project activities would occur at least 1.25 miles from the seep- or spring-fed impoundment in the Hay Hollow drainage and are not expected to impact discharge or water quality.

Water quality can be adversely affected following the occurrence of an undesirable event such as a leak or spill. Due to typically high concentrations of dissolved solids, spills of produced water or recycled water can have adverse impacts on watershed resources.

Standard practices and design features provided in the MDP and MDP SUPO are expected to reduce potential impacts to surface hydrology. These features include utilizing a closed loop system with no reserve pits, berming, or other secondary containment production facilities; utilizing leak detection systems; utilizing existing surface disturbance; minimizing total surface disturbance; minimizing vehicular use; surfacing parking and staging areas with caliche; and reclaiming areas not necessary for production and quickly reestablishing vegetation on the reclaimed areas. Overall impacts to surface hydrology would be minor.

Subsurface Hydrology

As described in Section 3.4, cave and karst features provide direct conduits leading to groundwater and can transport contaminants into underground water systems and freshwater aquifers. Potential impacts to subsurface hydrology and groundwater associated with caves and karst are also described in Section 3.4.

Implementation of the proposed water recycling system would reduce the overall water demand compared to similar projects that would rely solely on groundwater resources for completion and other activities. Withdrawal of groundwater for use in project construction, drilling, completion, and reclamation would affect local groundwater aquifers. A total of approximately 3,770,000 bbl of freshwater would be required for construction, dust control, and hydrostatic testing over the life of the project, with an additional maximum of approximately 3,050,000 bbl required for drilling in karst zones. Over the life of the project, the maximum total withdrawal of fresh groundwater for these purposes would be approximately 6,820,000 bbl of water, or 880 acre-feet. Assuming withdrawal of the 880 acre-feet is equally distributed over the 17-year drilling phase of the project (i.e., through 2033), approximately 400,000 bbl (or approximately 52 acre-feet) would be withdrawn from local aquifers each year. This withdrawal rate is considered conservative (high), as some freshwater use for dust control and reclamation would occur after drilling operations have completed. Annual withdrawal of 52 acre-feet of groundwater from the Carlsbad Groundwater Basin would represent approximately one-twentieth of one percent of all permitted or recorded water rights in the basin and approximately one-tenth of one percent of non-supplemental water rights (Pecos Valley WUO 2001).

All freshwater utilized for the proposed action would be obtained from existing, permitted water sources, and no new water wells would be installed. NMOSE is responsible for reviewing and adjudicating all groundwater withdrawals within the subsurface hydrology area of analysis. Adjudications must, in general, ensure that other groundwater users are not impaired and that no additional depletions will occur on fully appropriated streams or streams with flows needed to fulfill interstate compact obligations, including the Pecos River. Therefore, obtaining freshwater from permitted sources is expected to have minor impacts on the availability of groundwater.

Required volumes of non-freshwater would be obtained from the proposed water recycling system, or from local vendors for the initial SWD well. Once completed, the proposed recycling system is expected to provide sufficient water for all project activities that do not require freshwater. As described above for freshwater, all groundwater sources in New Mexico must be permitted and adjudicated by NMOSE. Water sources in Texas are not similarly adjudicated, however. Compared to the volume of declared groundwater within CFO planning area water basins (BLM 2014a; Pecos Valley WUO 2001), project-related water withdrawal is expected to contribute to minor impacts on groundwater availability from the Capitan Reef and Rustler aquifers and minor impacts to discharge and associated streamflow.

Cumulative Impacts

The CIA for surface hydrology is shown on **Figure 3.1-1**. The CIA for subsurface hydrology is the same as described for cave and karst resources and consists of the Carlsbad Underground Water Basin (**Figure 3.4-1**) as well as the portions of the Red Bluff Draw watershed and Gyp Draw-Delaware River subwatershed that extend into Texas.

The types of impacts to surface and subsurface hydrology from past, present, and reasonably foreseeable future actions would be similar to those described for the proposed action.

Surface Hydrology

The proposed action is expected to contribute to minor cumulative impacts on surface hydrology within the CIA. Impaired designated beneficial uses within the Pecos River are either attributed to groundwater discharge with low oxygen or high dissolved boron concentrations or to unknown PCB sources. PCBs may be found associated with natural gas pipeline leaks or effluent from the discharge of condensate (Oregon Department of Environmental Quality 2003). However, the use and discharge of PCBs are highly regulated. As a result, reasonably foreseeable future actions are not expected to cumulatively contribute

to increased PCB concentrations in the Pecos River or to other impairments. Past, present, and reasonably foreseeable future actions are expected to contribute to minor amounts of sedimentation within the CIA, at levels consistent with current conditions. Overall cumulative impacts to surface hydrology are expected to be minor.

Subsurface Hydrology

The proposed action is expected to contribute to minor to moderate cumulative impacts to local freshwater aquifers and minor impacts within the Capitan Reef and Rustler aquifers. No EPA-designated sole source aquifers are present within the CIA of analysis (USDA 2016).

Total water consumption for reasonably foreseeable future actions is estimated as follows. As presented in T**able 3.1-1**, 638 oil and gas wells are projected to be drilled within the CIA through 2034. NMOCD data for well completion operations in Eddy and Lea counties during 2013 indicate that a mean of 28,930 bbl of water was used per well for completion operations (BLM 2014b). (This average value is higher than for the proposed action because the proposed action would utilize recycled water for the majority of well completions.) Based on this average, completion of 638 wells, including the proposed action wells, would require approximately 18.5 million bbl (2,380 acre-feet) of water, all of which is assumed to be withdrawn from local aquifers.

Similarly, if the proposed action use of 380,000 bbl of water per well for drilling operations is applied to all 638 reasonably foreseeable wells, an estimated total of approximately 242 million bbl (31,248 acre-feet) of water would be required for well drilling. Together with the above water requirements for completion activities, approximately 33,628 acre-feet of water are conservatively estimated to be required for reasonably foreseeable drilling and completion activities through 2034 within the CIA. Over the course of 19 years (2016-2034), this total withdrawal would average approximately 1,769 acre-feet per year. Additional water would be utilized for construction of related infrastructure, dust control, revegetation, and other purposes that are not quantified here.

Estimated withdrawal of 1,769 acre-feet of water per year would represent less than one-one hundredth of one percent of all stored groundwater within the Carlsbad Groundwater Basin. These withdrawals would represent approximately two percent of all permitted or recorded water rights in the basin and approximately four percent of non-supplemental water rights (Pecos Valley WUO 2001). The estimated withdrawal rate is also much less than known recharge rates for aquifers in the Carlsbad Groundwater Basin (NMOSE 2016).

Future recharge rates to Carlsbad Groundwater Basin aquifers may be affected by climate change. Climate models generally project decreased precipitation, along with increased temperatures, for the American Southwest, including the CIA (Maloney et al. 2014). However, specific precipitation projections for the region do not correspond well with historical regional observations and are not considered to be reliable precipitation forecasts (Kirtman et al. 2013). The lack of consistency among models is partly due to low precipitation totals and significant year-to-year variation in the region (Kennedy 2013). Therefore, although regional decreases in precipitation, along with increased temperatures and evaporation rates, may occur (e.g., Bureau of Reclamation 2013), quantification of climate impacts on recharge rates and groundwater availability within the CIA is not included in this analysis.

Water withdrawals for reasonably foreseeable future actions within the New Mexico portion of the CIA would be overseen by the NMOSE as described for the proposed action. Withdrawals within the Texas portion of the CIA would be at the discretion of the landowner and are not overseen by the state or a county conservation district. As such, there is higher potential for cumulative impacts due to water withdrawals in the Texas portion of the CIA. However, the only major bedrock aquifer present within the Texas portion of the CIA is the Rustler aquifer, which is limited to outcrops in the northeastern corner of Culberson County (Texas Water Development Board 2011). The Rustler aquifer in southeastern New Mexico contributes to Pecos River streamflow via upward discharge through alluvium and is similarly expected to contribute to flow within the Delaware and Pecos Rivers of Texas (Texas Department of

Water Resources 1978). However, due to the limited extent of the Rustler aquifer within the CIA, withdrawals are expected to be minimal.

Based on current water regulations, projected cumulative water withdrawals from Carlsbad Groundwater Basin aquifers, overall storage, estimated recharge rates (where available), and existing water rights, cumulative water withdrawals for past, present, and reasonably foreseeable future actions are expected to have negligible to minor impacts on water availability within the basin. Cumulative withdrawals would be minor in comparison to withdrawals for irrigation expected to continue to occur in other parts of the basin (NMOSE 2016). Negligible impacts to discharge from the Rustler aquifer to the Pecos River are expected, largely due to the limited extent of the Rustler aquifer within the CIA.

Mitigation Measures and Residual Impacts

With implementation of design features provided in the MDP, MDP SUPO, and APDs, anticipated impacts to watershed resources would be less than significant. Any water erosion that may occur due to the construction of well pads, access roads, or other project components during the life of the project would be quickly corrected and proper measures would be taken to prevent future erosion. Additional mitigation may be required on an individual APD or ROW basis as determined by the BLM. No residual impacts to watershed resources are anticipated.

3.6. Floodplains, Wetlands, and Riparian Areas

Affected Environment

Floodplains

Within the area of analysis, floodplains are ephemeral and are up to approximately 0.5 miles wide. Floodplains provide important water sources for animals and plants in the Chihuahuan Desert. For administrative purposes, the Federal Emergency Management Agency (FEMA)-designated 100-year floodplain serves as the basis for floodplain management within the Project Area. As shown on **Figure 3.5-1**, designated floodplains within the Project Area are located along the following drainages: North and South Hackberry Draw, Cottonwood Draw, Red Bluff Draw, and Hay Hollow (FEMA 2010).

Wetlands and Riparian Areas

Within the area of analysis, the USFWS National Wetlands Inventory (USFWS 2016a) identifies 3.4 acres of wetlands. Most of these (2.9 acres) are in the form of freshwater pond wetlands, with lesser amounts (0.5 acres) of freshwater forested/shrub wetland. One freshwater pond wetland is located within the Project Area boundary in T25S, R27E, Section 16 and was confirmed by baseline surveys (Arcadis 2016a) to represent an ephemeral dirt-bermed pond created to support grazing. All other National Wetlands Inventory-recorded wetlands within the area of analysis occur in bottomland drainages and are 0.5 miles or more downgradient from the Project Area. Baseline surveys by Arcadis (2016) did not identify any additional wetlands or riparian areas within the Project Area.

Impacts from the Proposed Action

Direct and Indirect Effects

No permanent aboveground facilities would be constructed within FEMA-designated 100-year floodplains. Temporary direct impacts to floodplains would occur during construction of access roads, flowlines, and pipelines. No direct impacts to wetlands or riparian areas would occur under the proposed action. Indirect effects such as sedimentation due to runoff from project roads or facilities could occur but are expected to be negligible as a result of implementation of project design features and the downstream distances from project features to wetlands and riparian areas.

Standard practices or design features of the proposed project that minimize impacts to the watershed and water quality include utilizing a closed loop system with no reserve pits, berming production facilities,

utilizing existing surface disturbance, minimizing total surface disturbance, minimizing vehicular use, surfacing parking and staging areas with caliche, and reclaiming the areas not necessary for production and quickly reestablishing vegetation on the reclaimed areas.

Cumulative Impacts

The CIA for floodplains, wetlands, and riparian areas is the same as described in Section 3.1 (**Figure 3.1-1**). Riverine wetlands and riparian areas are prevalent along the Delaware River; otherwise, the majority of the CIA is similar to the EA area of analysis, with isolated wetland and riparian areas occurring in some drainages or associated with springs.

The types of impacts from past, present, and reasonably foreseeable future actions would be similar to those described for the proposed action. Overall, it is expected that negligible, short-term impacts to floodplains, wetlands, and riparian areas would occur within the CIA. The proposed action is expected to contribute to negligible cumulative impacts, primarily in the short-term during construction activities prior to reclamation.

Mitigation Measures and Residual Impacts

With implementation of design features provided in the MDP, MDP SUPO, and APDs, anticipated impacts to floodplains, wetlands, and riparian area resources would be less than significant. Additional mitigation may be required on an individual APD or ROW basis as determined by the BLM. No residual impacts to floodplains, wetlands, or riparian areas are anticipated.

3.7. Vegetation

Affected Environment

The area of analysis is located within the Chihuahuan Basins and Playas Level IV ecoregion. The Chihuahuan Basins and Playas ecoregion has deep depressions filled with sediment that form flat to rolling basins surrounding major rivers. Streams are ephemeral in this area, and annual precipitation ranges from 9 to 13 inches annually. The temperature/moisture regimes are characterized as thermic/aridic, ustic aridic. The dominant land cover type in the ecoregion is shrub/scrub. Vegetation communities within the area of analysis vary based on soil properties. Plant community information was developed using the data available from the Soil Survey of Eddy County, New Mexico and the associated ecological site descriptions (Soil Conservation Service 1971; Natural Resource Conservation Service 2006). The BLM uses the ecological site descriptions and other site-specific information to classify the geographical regions into one of the three vegetative communities described below. A species list developed from baseline environmental surveys (Arcadis 2016a) is included as **Appendix E**. Special status vegetation species (e.g., federal- or state-listed threatened and endangered species) are discussed in Section 3.10.

Loamy Soil Type Plant Communities

Loamy soil types typically are dominated by grasslands made up of warm season, mid- and short-grasses. There is a fair scattering of shrubs and half-shrubs throughout the landscape. Forb production fluctuates greatly from season to season and year to year. Gramas (*Bouteloua spp.*) hairy woollygraass (*Erioneuron pilosum*), threeawns (*Aristida spp.*), muhlys (*Muhlenbergi*a spp.) dropseeds (*Sporobolus spp.*), tobosa (*Pleuraphis mutica*), and burrograss (*Scleropogon brevifolius*) are the dominant grasses. The most common shrubs in the area are tarbush (*Flourensia cernua)*, creosote (*Larrea tridentata)*, honey mesquite (*Prosopis glandulosa*), cactus (*Opuntia spp.*), and yucca (*Yucca spp.*). Common forbs include filaree (*Erodium spp*.), croton (*Croton spp.)*, bladderpod (*Lesquerella spp.*), and globemallow (*Sphaeralcea spp.*).

Shallow Soil Type Plant Communities

Shallow soil types are typically dominated in the understory by warm season, mid- and short-grasses. Typical grasses include gramas, tridens, dropseeds, threeawn, and green sprangletop (*Leptochloa dubia*). The shrub overstory consists primarily of cactus, catclaw (*Mimosa aculeaticarpa var. biuncifera)*, yucca, sumac (*Rhus spp.*), juniper (*Juniperus spp.*) and broom snakeweed (*Gutierrezia sarothrae)*. A large variety of forbs, including croton, bladderpod, buckwheat (*Eriogonum spp.*), and globemallow, can be found, with large fluctuations from season to season based on rainfall. Curlyleaf muhly (*Muhlenbergia setifolia*), bristly wolfstail (*Lycurus setosus*), sotol (*Dasylirion leiophyllum*), agaves (*Agave lechuguilla*), sacahuista (*Nolina texana*), and piñon (*Pinus spp.*) may be present in limited areas, but are typically confined to limestone hills.

Gypsum Soil Type Plant Communities

Common grasses found in gypsum soil types include gramas, gyp dropseed (*Sporobolus nealleyi*), and alkali sacaton (*Sporobolus airoides*). The shrub component is made up of four-wing saltbush (*Atriplex canescens)*, mormon tea (*Ephedra spp.*), spiny althorn (*Koeberlinia spinosa*), javelin bush (*Condalia ericoides*), and sumac. Forbs include jimsonweed (*Datura stramonium*), scarlet beeblossom (*Oenothera suffretescens*), globemallow, and croton. Shrubs and forbs are a minor component of the plant community.

Impacts from the Proposed Action

Direct and Indirect Impacts

Construction of the proposed action would remove approximately 1,808 acres of vegetation: 1,394 acres of loamy soil type plant communities, 156 acres of shallow soil type plant communities, and 258 acres of gypsum soil type plant communities. These impacts would last as long as the well is productive. However, interim reclamation would be conducted within six months of well completion and would reduce the long-term impacts. Once a well is plugged and abandoned, the well pad would be reclaimed and revegetated. It is expected that revegetation would be complete within three to five years, depending on rainfall. The use of proper seed mix (Seed Mixture #1/Loamy Sites; Seed Mixture #3 Shallow Soil Types; and/or Seed Mixture #4 Gypsum Sites), good seed bed preparation, and proper seeding techniques should reduce impacts to vegetation. It is expected that impacts to vegetation would be short term (approximately three to five growing seasons).

In addition to the removal of vegetation for project infrastructure, vegetation could also be indirectly affected by dust caused by construction and operation of the proposed action. Near roads and construction sites, dust can coat surrounding vegetation and disrupt photosynthesis, respiration, and transpiration of plants, ultimately leading to decreased vegetation productivity (Coffin 2007; Trombulak and Frissell 2000). In turn, this can decrease vegetation quality and viability beyond the actual footprint of direct disturbance.

Impacts to vegetation could also occur from unintentional releases of hazardous wastes or other liquid wastes associated with hydraulic fracturing. If such release occurred, nearby vegetation could be killed. Mitigation and regulations associated with containment of hazardous waste and spill prevention measures is discussed in Section 3.16.

Impacts to vegetation would be reduced by standard practices such as utilizing existing surface disturbance, minimizing surface disturbance from well pad and access roads, utilizing steel tanks instead of reserve pits, minimizing vehicular use, placing parking and staging areas on caliche surfaced areas, and reclaiming the areas not necessary for production and quickly establishing vegetation on the reclaimed areas.

Cumulative Impacts

The CIA for vegetation is the same as that generally described for all resources in Section 3.1. The vegetation communities found within the Project Area are typical of those found within the CIA.

The proposed action will impact approximately 1,808 acres of vegetation, which represents a small percentage of the total vegetation within the CIA, approximately 1 percent. The types of primary direct and indirect impacts within the CIA are similar to those described for the proposed action, as oil and gas projects comprise the majority of past, current, and future activities in the CIA. Vegetative disturbance due to past and present oil and gas activities within the CIA is approximately 4,863 acres, and reasonable foreseeable future activities are anticipated to disturb approximately 3,479 acres. The proposed project would result in an additional 22 percent of vegetative disturbance within the CIA. Most vegetative disturbance would be reclaimed within six months following the completion of the last well on any given pad. In addition, a number of described standards would limit impacts to vegetation. Therefore, the proposed action is expected to contribute to negligible to minor impacts on vegetation in the CIA. Impacts are expected to be short-term, primarily occurring during construction, drilling, and maintenance activities throughout the CIA.

Mitigation Measures and Residual Impacts

With implementation of design features provided in the MDP, MDP SUPO, and APDs, anticipated impacts to vegetation would be less than significant. Additional mitigation may be required on an individual APD or ROW basis as determined by the BLM. While design features would reduce impacts, residual impacts could occur from potential erosion, dust, trampling, or ineffective reestablishment.

3.8. Noxious Weeds and Invasive Plants

Affected Environment

New Mexico's Noxious Weed Act of 1963 (76-7-23 to 76-7-30 NMSA 1978), Noxious Weed Control Act (76-7-1 to 76-7-22 NMSA 1978), and Noxious Weed Management Act (76-7D-1 to 76-7D-6 NMSA 1978) provide direction to the New Mexico Department of Agriculture (NMDA) to develop the noxious weed list for the state, identify methods of control, and educate the public about noxious weeds. The NMDA also coordinates weed management between landowners. The BLM currently identifies four plant species within the CFO on the New Mexico Noxious Weed List, Noxious Weed Management Act of 1998. These species are African rue (*Peganum harmala)*, Malta starthistle *(Centaurea melitensis)*, Russian olive *(Elaeagnus angustifolia)*, and salt cedar *(Tamarix spp.)*. African rue and Malta starthistle populations have been identified throughout the CFO and mainly occur along the shoulders of highway, state and county roads, lease roads, and well pads (especially abandoned well pads). The CFO has an active noxious weed monitoring and treatment program, and partners with county, state, and federal agencies and industry to treat infested areas with chemical and monitor the counties for new infestations.

Populations of African rue were identified along existing roads and ROWs within the Project Area during baseline surveys (Arcadis 2016a). In addition, non-native salt cedar was identified along some draws and drainages.

Impacts from the Proposed Action

Direct and Indirect Effects

Any surface disturbance could increase the possibility of establishment of new populations of invasive, non-native species. The construction of the proposed action may contribute to the establishment and spread of African rue and Malta starthistle. The main mechanism for seed dispersion would be by equipment and vehicles that were previously used and/or driven across noxious weed infested areas. Noxious weed seed could be carried to and from the HDA by construction equipment and transport vehicles. Noxious weed introductions could indirectly impact vegetation by reducing habitat quality or changing the trophic structure. The potential for noxious weeds to spread would be highest in newly

disturbed areas. Once established, weeds could displace native plant species and change the structure of the habitat (Evangelista et al. 2011, DiTomaso 2000). Noxious weeds could also indirectly affect ecosystem function by changing species composition and the physical environment by altering burn cycles and erosion rates (Evangelista et al. 2011, DiTomaso 2000).

Cumulative Impacts

The CIA for noxious weeds and invasive plants is the same as that generally described for all resources in Section 3.1.

The primary direct and indirect impacts in the CIA would be similar to those described for the proposed action, as oil and gas projects comprise the majority of past, current, and future activities in the CIA. Past and present oil and gas activities make up approximately 4,863 acres of disturbance in the CIA, and reasonable foreseeable future activities, including the proposed action, are anticipated to disturb approximately 3,479 acres.

Noxious weed populations would likely increase to some degree in the short term, as additional well, linear corridor, and facility sites are disturbed. A number of described standards would limit and potentially decrease to manageable levels noxious weed populations in the proposed disturbed areas over the long-term. The use of these measures would likely result in improved weed management. Therefore, the proposed action is expected to contribute to negligible to minor impacts on short-term impacts to noxious weed and invasive plant communities in the CIA. These minor impacts are expected to occur during construction, drilling, and maintenance activities throughout the CIA. However, long-term positive minor impacts may occur due to the implementation of the noxious weed and invasive plant mitigation measures. Therefore, the activities associated with the project would not contribute to the long-term increase in noxious weed populations in the region and no increase in cumulative impacts would be expected.

Mitigation Measures and Residual Impacts

Chevron would be held responsible if noxious weeds become established within the areas of operations. Weed control will be required on the disturbed land where noxious weeds exist both prior to construction and throughout construction, operation, and restoration. These areas include the roads, pads, associated pipeline corridor, and adjacent lands that may be affected by the establishment of weeds due to the proposed action. Chevron would consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies. Chevron, in coordination with the BLM, may develop a noxious weed plan to include recommendations and guidelines for noxious weed and invasive species management throughout the Project Area and to minimize the spread of weeds to adjacent areas.

With implementation of these mitigation measures and design features provided in the MDP, MDP SUPO, and APDs, anticipated impacts from noxious weed propagation would be less than significant. Additional mitigation may be required on an individual APD or ROW basis as determined by the BLM. With the implementation of mitigation measures and design features, residual impacts from noxious weeds are not anticipated.

3.9. Wildlife

Affected Environment

The analysis area occurs in the Chihuahuan Deserts Level III Ecoregion. This desert ecoregion extends from the Madrean Archipelago in southeast Arizona to the Edwards Plateau in south-central Texas. It is the northern portion of the southernmost desert in North America that extends more than 500 miles south into Mexico. Outside major river drainages, such as the Rio Grande and Pecos River, the landscape is largely internally drained (Griffith et al. 2006). As described in Section 3.3, vegetation types in the analysis area vary based on soil properties and chemical makeup.

The aforementioned landscape and vegetation characteristics of the analysis area can provide habitats for a variety of wildlife including large mammals, small mammals, birds, and herpetofauna (amphibians and reptiles). Baseline surveys (Arcadis 2016a) and available literature suggest that wildlife species with potential to occur in the study area may include, but are not limited to, those presented below in **Table 3.9-1**.

Table 3.9-1 Wildlife Species with Potential or Known to Occur in the Analysis Area[1]

Common Name	Scientific Name
Mule deer	*Odocoileus hemionus*
Pronghorn antelope	*Antilocapra americana*
Coyote	*Canis latrans*
Common gray fox	*Urocyon cinereoargenteus*
Red fox	*Vulpes vulpes*
Northern raccoon	*Procyon lotor*
American badger	*Taxidea taxus*
Mexican ground squirrel	*Spermophilus mexicanus*
Yellow-faced pocket gopher	*Cratogeomys castanops*
Kangaroo rat species	*Dipodomys sp.* (*D. merriami, D. ordii, and D. spectabilis* are possible)
Hispid cotton rat	*Sigmodon hispidus*
Woodrat species	*Neotoma sp.* (*N. Leucodon* and *N. micropus* are possible)
Long-tailed weasel	*Mustela frenata*
Desert cottontail	*Sylvilagus auduboni*
Black-tailed jackrabbit	*Lepus californicus*
Western spotted skunk	*Spilogale gracilis*
Striped skunk	*Mephitis mephitis*
Feral pig	*Sus scrofa*
Collared peccary	*Pecari tajacu*
Mexican free-tailed bat	*Tadarida brasiliensis mexicana*
Pallid bat	*Antrozous pallidus*
Western pipistrelle	*Pipistrellus hesperus*
Big brown bat	*Eptesicus fuscus*
Hoary bat	*Lasiurus cinereus*
Pocketed free-tailed bat	*Nyctinomops femorosaccus*
Eastern red bat	*Lasiurus borealis*
Western small-footed myotis	*Myotis ciliolabrum melanorhinus*
California myotis	*Myotis californicus*
Yuma myotis	*Myotis yumanensis yumanensis*

Notes:
1 Several ground squirrel, mouse, rat, and shrew species have potential to occur in the analysis area (BLM 2014a).
Sources: BLM 2014a, Arcadis 2016a, DesertUSA 2016

The greater CFO contains a large concentration of limestone caves, many of which serve as important roosting and nursery habitat for bats (BLM 2014a). One cave and a number of other karst features (including one large collapsed sinkhole, two small and collapsed sinkholes, three collapsed mammal holes, and a number of closed depressions and fissures) have been identified within the Project Area ROW (Arcadis 2016a). No roosts or hibernacula were identified in the Project Area during baseline surveys (Arcadis 2016a); however, there is potential for bats to roost in the aforementioned cave. Further, there are likely other karst features within the analysis area that provide suitable roosting habitat. Carlsbad Caverns, located approximately 8 to 20 miles west of the analysis area, supports a maternity roost of approximately one million Mexican free-tailed bats and provides habitat for several other species including the BLM sensitive cave myotis and fringed myotis (U.S. Geological Survey 2016). Roosting bats at Carlsbad Caverns may forage within the analysis area as they have been documented foraging more than 56 kilometers (35 miles) from Carlsbad Caverns (Best and Geluso 2003). Further, these bats may migrate through and forage in the analysis area on their way to and from wintering grounds in Mexico.

Baseline surveys and available literature suggest that a variety of avian species have potential to pass through, nest in, and/or winter in the analysis area. Some avian species with potential to occur in the analysis area may include, but are not limited to, those presented below in **Table 3.9-2**.

Table 3.9-2 Avian Species with Potential or Known to Occur in the Analysis Area

Common Name	Scientific Name
Raptors	
Swainson's hawk	*Buteo swainsoni*
Ferruginous hawk	*Buteo regalis*
Red-tailed hawk	*Buteo jamaicensis*
Harris' hawk	*Parabuteo unicinctus*
Rough-legged hawk	*Buteo lagopus*
Cooper's hawk	*Accipiter cooperii*
Northern harrier	*Circus cyaneus*
American kestrel	*Falco sparverius*
Prairie falcon	*Falco mexicanus*
Peregrine falcon	*Falco peregrinus*
Bald eagle	*Haliaeetus leucocephalus*
Golden eagle	*Aquila chrysaetos*
Great-horned owl	*Bubo virginianus*
Burrowing owl	*Athene cunicularia*
Barn owl	*Tyto alba*
Western screech owl	*Otus kennicotti*
Mississippi kite	*Ictinia mississippiensis*
Turkey vulture	*Cathartes aura*
Other Migratory Birds	
Black-chinned sparrow	*Spizella atrogularis*
Blue-throated hummingbird	*Lampornis clemenciae*
Brewer's sparrow	*Spizella breweri*
Cactus wren	*Campylorhynchus brunneicapillus*
Cassin's sparrow	*Aimophila cassinii*
Chestnut-collared longspur	*Calcarius ornatus*
Common nighthawk	*Chordeiles minor*
Fox sparrow	*Passerella iliaca*
Grace's warbler	*Dendroica graciae*
Gray vireo	*Vireo vicinior*
Greater roadrunner	*Geococcyx californianus*
Lark bunting	*Calamospiza melanococrys*
Lewis's woodpecker	*Melanerpes lewis*
Loggerhead shrike	*Lanius ludovicianus*
Long-billed curlew	*Numenius americanus*
Mccown's longspur	*Calcarius mccownii*
Painted bunting	*Passerina ciris*
Pinyon jay	*Gymnorhinus cyanocephalus*
Rock wren	*Salpinctes obsoletus*
Rufous-crowned sparrow	*Aimophila ruficeps*
Scaled quail	*Callipepla squamata*
Sonoran yellow warbler	*Dendroica petechial* ssp. *Sonorana*
Varied bunting	*Passerina versicolor*
Virginia's warbler	*Vermivora virginiae*
Williamson's sapsucker	*Sphyrapicus thyroideus*

Sources: Arcadis 2016a, USFWS 2016b, Garber and Young 2005

Field baseline survey data indicate that there are a number of raptor nests (including 12 hawk nests and 18 burrowing owl burrows) within the Project Area (Arcadis 2016a). Trees within the Project Area are limited; therefore, raptor nests (other than burrows, which seem to be more concentrated along the northern ROW buffers) are limited in location to these trees or large brush and yucca plants (Arcadis 2016a). This is expected to be the case for the analysis area as a whole. A number of outcroppings have been identified within the Project Area, which could provide suitable nesting habitat for falcons; however, no falcon nests have been confirmed in the area (Arcadis 2016a). Field baseline surveys also indicate the presence of several non-raptor bird nests along the proposed project footprint (Arcadis 2016a).

Herpetofauna documented in the analysis area during baseline surveys include ornate box turtle (*Terrapene ornata*), Texas horned lizard (*Phrynosoma comutum*), round-tailed horned lizard (*Phrynosoma modestum*), whiptails (*Aspidoscelis* spp.), gophersnake (*Pituophis catenifer*), and western diamondback rattlesnake (*Crotalus atrox*) (Arcadis 2016a). Herpetofauna often depend on water sources for breeding and survivorship. Permanent water sources are limited in the analysis area, but numerous human-made water sources (e.g., wells and troughs) have been installed within the boundaries of the BLM CFO. These are important to all wildlife in the desert ecosystem as they provide readily available water and areas of sanctuary. No designated wildlife water sources are located within the analysis area; however, one Wildlife Habitat Project Avoidance is located in the analysis area and minimally intersects the buffer area for the ROW in Sections 3 to 4 of Township 26 South, Range 27 East.

Impacts from the Proposed Action

Direct and Indirect Effects

At the programmatic level, direct impacts of the proposed action to wildlife may include, but are not limited to, possible mortality, habitat degradation and fragmentation, and exposure to chemicals. The primary indirect impacts to wildlife could include avoidance of the analysis area and behavioral/physiological changes as a result of habitat loss/fragmentation, noise, and human presence. These direct and indirect impacts are described further below and would also be applicable at the site-specific level (i.e., the 12 APDs submitted with the MDP [APD Group 1 and APD Group 2]), albeit on a smaller scale.

Wildlife could be susceptible to mortality from collision with or trampling by vehicles and equipment, particularly during construction. At the programmatic level, Chevron would use existing county and lease roads as well as new resource roads during construction, drilling, and completion operations. Vehicle collisions with wildlife may occur along proposed access roads and may be more likely to occur in the short-term, during construction, when traffic would be highest (telemetry and SCADA equipment would be used to remotely monitor oil and gas wells during operations to reduce traffic to and from well locations). Posted speed limits would be followed and minimize collision impacts with wildlife (30 to 40 mph is adequate in most cases [Wyoming Game and Fish Department 2010]). To the greatest extent practical, traffic would also be limited during high wildlife use hours (within three hours of sunrise and sunset).

Birds, including raptors, and their nests may be at risk of morality or degradation during construction. Birds may also abandon nests or alter breeding behavior in the vicinity of construction and operations activities. To mitigate for these impacts, ground-breaking activities will be timed to occur outside the avian nesting season (March to late June), if possible. Note that the BLM CFO generally requires a 50-meter buffer during the non-nesting season (September 1 to February 28) for inactive raptor nests. Should construction activities need to occur during the nesting season, Chevron will perform a pre-construction wildlife survey to identify new nests and verify the status of previously identified nests. No surface disturbance will be allowed within 200 meters of active bird (raptor and non-raptor) nests, or construction activity will be delayed up to 90 days (or a combination of both). Chevron will only consider construction within 200 meters of a nest if it is confirmed to be inactive, the proposed construction activity is of short duration (e.g., fence or pipeline installation), and construction will not result in continuing activity in proximity to the nest.

Birds may also be susceptible to collision and electrocution with the proposed 12.47 kV powerlines at the programmatic and site-specific levels (although on a much smaller scale at the site-specific level).

Powerlines would be located within the same ROWs as roads and pipelines so as to not contribute to additional habitat loss/fragmentation. The powerlines would be constructed to APLIC standards to minimize collisions and electrocutions (e.g., installing bird flight diverters on the top grounding wire, separating conductors by more than the wingspan or height of a landing or perching bird, and grounding hardware or equipment cases and locating them in proximity to energized conductors). Smaller wildlife, including birds and bats, may also be at risk of mortality by getting trapped (or exposed to chemicals) in open-topped tanks or open-vent exhaust stacks. To mitigate for these types of impacts, Chevron will net, screen, or cover all open-topped tanks until they are removed or no longer contain harmful substances. Further, Chevron would construct, modify, equip, and maintain all open-vent exhaust stacks on production equipment to prevent birds and bats from entering and to discourage perching, roosting, and nesting.

Oil and gas extraction activities under the proposed action could expose wildlife to hazardous chemicals. Hydraulic fracturing fluids could contain chemicals such as acids, salts, surfactants, biocides, and corrosion inhibitors. These or other chemicals may seep from leaks in boreholes, spill from tanks and trucks, or be placed into containment ponds along with other fluids. Impacts of exposure of contaminants to wildlife under the proposed action are expected to be reduced through implementation of a variety of design features as described in Section 2.1.

Under the proposed action, approximately 1,808 acres of wildlife habitat would be removed in the short term, and 782 acres would be removed in the long term. At the site-specific level, 106 acres of wildlife habitat would be removed over the short term and 63 acres would be removed over the long term. Loss of habitat and fragmentation associated with roads and infrastructure under the proposed action may influence wildlife to avoid the area in and around the HDA MDP, and to a lesser extent, the 12 APDs submitted with the MDP. When wildlife are displaced due to habitat loss and fragmentation, they can move into areas of lower habitat value or quality, and/or areas that are already occupied at their carrying capacity. Habitat fragmentation by roads can also increase accidental roads kill (Jankowitz and Gruber 2007). Most habitat disturbance and associated impacts would be short term and would be reclaimed in the interim. Chevron would complete interim reclamation within six months following the completion of the last well on any given pad. Chevron would meet with the BLM to devise an appropriate seed mix, free of noxious weeds, and reclamation plan to best restore the land to preexisting conditions. Final reclamation for long-term habitat disturbance would occur when a well pad is no longer producing. At that point, habitat-related impacts on wildlife are expected to cease.

Wildlife may avoid new noises and human activity associated with the proposed action at both the programmatic and site-specific level. Sawyer et al. (2009) found that during the first five years of natural gas development on the Pinedale Anticline in Wyoming, the amount of predicted winter mule deer avoidance generally increased with a decreased distance to well pads (the researchers predicted that deer use would be half the normal deer use within an average distance of 1.2 miles from well pads). Results of a five-year study of pronghorn antelope in the same region indicate reduced usage and abandonment of small habitat parcels, and avoidance of areas of highly concentrated oil field development (Blickley and Patricelli 2010). Schaub et al. (2008) monitored noise impacts on foraging bats and found that foraging areas near highways and other sources of intense, broadband sound degraded their suitability as bat foraging areas. Impacts of noise associated with the proposed action could also include masking and behavioral disruptions, particularly for nesting birds. Masking may occur when the perception of a sound is affected by the presence of background noise. Many animals use acoustic signals to attract and retain mates, settle territorial disputes, promote social bonding, and alert other individuals to predators (Blickley and Patricelli 2010). Presence of noise could also work to the advantage of some wildlife. For example, one study found that birds nesting near noisy natural gas pads had higher nesting success, likely due to the reduced presence of the most common nest predator, the western scrub jay (Quinn et al. 2006). Wildlife exposure to noise could also result in chronic effects, including elevated stress levels and associated physiological responses (Blickley and Patricelli 2010). To minimize impacts to wildlife associated with noise, Chevron would not use blasting during construction and would install exhaust mufflers on fixed equipment so as to not exceed 75 decibels measured at 30 feet from the source of the noise.

Artificial night lighting associated with the proposed action could affect nocturnal species, such as birds and bats, by triggering unnatural periods of attraction or repulsion that could lead to impacts on foraging and reproductive behavior, biological clocks, predator-prey interactions, movement and dispersal patterns, community structure, and interactions among and within species (The Nature Conservancy 2016, Longcore and Rich 2016). Birds have been shown to alter the timing of morning choruses and reproductive patterns in response to artificial lighting (Miller 2005; Kempenaers et al. 2010). There is also growing evidence of artificial light impacts on bats such as avoidance of lighted areas which could alter flight routes and habitat use (Longcore and Rich 2016; Kuijper et al. 2008; Patriarca and Debernardi 2010). Such impacts could affect bat populations, notably populations at the nearby Carlsbad Caverns National Park, in the analysis area at both a programmatic- and site-specific level. To minimize impacts of artificial lighting on nocturnal wildlife, Chevron would use minimal light necessary for site safety, security, and operations; would direct light downward on fixed equipment; would use low-pressure sodium lamps, such as yellow LED lighting, to reduce sky glow; and would use full cutoff shielding on mounted lights during production to reduce sky glow from upward pointing light. Water-dependent wildlife such as fish and some herpetofauna are not expected to be impacted under the proposed action as there would be minor direct impacts on surface waters, specifically wetlands and streams (Section 3.5). The BLM also requires that activities within 200 meters from an artificial wildlife water source be limited and short term in nature; therefore, the proposed action is not expected to disrupt wildlife use or activities of these water sources. In summary, the analysis area (at both the programmatic and site-specific level) is not known to include any state or federal wildlife management areas, refuges, parks or recreation areas, BLM areas of critical environmental concern, major bird or mammal migration corridors, or critically important habitats such as playas, extensive wetlands or riparian areas, and critical winter and breeding areas. For these reasons, previously described impacts under the proposed action are expected to be limited to individual or small groups of wildlife. Through implementation of described design features and mitigation measures, the proposed action is expected to have a negligible to minor impact on wildlife, with most impacts being short term until interim reclamation and some impacts being long term until final reclamation.

Cumulative Impacts

The CIA for wildlife is the same as described in Section 3.1 (**Figure 3.1-1**). The CIA is applicable to this discussion as it is expected to encompass the daily movements of wildlife (aforementioned large and small mammals, birds, and herpetofauna) that could occur in the analysis area and be affected by the proposed action. Oil and gas industry-related actions are the most prevalent activities within the CIA; therefore, the following discussion focuses on associated impacts.

As described previously, the proposed action may result in negligible to minor direct impacts on wildlife including mortality/collision, habitat degradation/fragmentation, and exposure to chemicals. The primary indirect impacts could include avoidance of the proposed action and behavioral/physiological changes as a result of habitat loss/fragmentation, noise, and human presence. Past, present, and future activities within the CIA are generally the same or similar as those described for the proposed action; therefore, impacts to wildlife within the CIA as a whole are expected to be similar. Past and present oil and gas activities make up approximately 4,863 acres of disturbance in the CIA, and reasonable foreseeable future activities, including the proposed action, are anticipated to disturb approximately 3,479 acres.

Within the CIA, previous, current, and future oil and gas exploration, road construction, and utility line construction have or will result in habitat loss and wildlife displacement, to which the proposed action could contribute. The proposed action would contribute to a minor, short-term loss of wildlife habitat (approximately 1,808 acres). Most habitat disturbance from linear features would be reclaimed immediately and well pads would be reclaimed in the interim, within six months following the completion of the last well on any given pad. Some wildlife habitat, for instance raptor nest habitat, would be avoided altogether; therefore, the proposed action would contribute to negligible impacts in the CIA in these cases.

Noise and human disturbances within the CIA are likely to be temporary and negligible, present only during construction, drilling, and maintenance activities. Past, current, and proposed actions in the CIA are less concentrated west of the proposed action; therefore, wildlife may more readily displaced to

habitats in this area (if not outside the CIA). As noted previously, displacement of wildlife can result in competition for available resources, but this competition is expected to be short term, lasting until disturbed areas are reclaimed.

Road and utility lines are present or will be constructed in the CIA. The proposed action, through reduced travel speeds during construction, remote monitoring during operations, and implementation of APLIC standards, is expected to contribute to negligible wildlife mortality and collisions in the CIA. Such is true for potential exposure to chemicals as all open tanks and ponds with hazardous materials would be covered, fenced, or otherwise mitigated to negate use by wildlife.

Overall, it is expected that wildlife may be susceptible to minor, short-term impacts of habitat removal/fragmentation, mortality/collision, avoidance, and exposure to chemicals in the CIA. The proposed action is expected to contribute to negligible to minor impacts on wildlife, primarily in the short term during construction, drilling, and maintenance activities.

Mitigation Measures and Residual Impacts

With implementation of design features provided in the MDP, MDP SUPO, and APDs, anticipated impacts to wildlife would be less than significant. These design features conform to BLM CFO management standards and generally follow New Mexico Department of Game and Fish (NMDGF) Oil and Gas Development Guidelines (Jankowitz and Gruber 2007). Additional mitigation may be required on an individual APD or ROW basis as determined by the BLM. Residual impacts could still occur after implementation of the design features and may include loss of habitat from ineffective reestablishment of vegetation and displacement.

Pond Stipulations:

Fencing: Ponds shall have 8-foot game fencing installed around the perimeter, outside of the bottom berm. The fence bottom shall be keyed-in around the perimeter of the pond site and include the use of 2-foot silt fencing to prevent access of smaller animals.

Wildlife Protection: Typical bird deterrent options include molded decoy owls and noise-making streamers. Wildlife protection measures, including those for migratory birds, shall be monitored at least monthly to ensure deterrents are effective. Additional bird deterrent options include sound-activated devices that mimic predatory calls. These deterrents would be monitored on a periodic basis and enhanced as necessary to ensure effectiveness.

Avian Nest Stipulations:

Chevron would protect raptor nests on special, natural habitat features – such as trees, large brush, cliff faces, and escarpments – by not allowing surface disturbance within up to 200 meters of active nests or by delaying activity for up to 90 days, or a combination of both.

Prior to initiating construction activities, Chevron or the BLM would perform a wildlife survey to identify raptor nests in the proximity and to determine if the raptor nests are active. Chevron would contact a BLM Wildlife Biologist if any raptor nests within 200 meters of the construction site are active.

Avian Power line Protection Stipulation:

Power lines shall be constructed and designed in accordance to standards outlined in "Suggested Practices for Avian Protection on Power lines: The State of the Art in 2006" Edison Electric Institute, APLIC, and the California Energy Commission 2006. The holder shall assume the burden and expense of proving that pole designs not shown in the above publication deter raptor perching, roosting, and nesting. Such proof shall be provided by a raptor expert approved by the Authorized Officer. The BLM reserves the right to require modification or additions to all power line structures placed on this right-of-way, should they be necessary to ensure the safety of large perching birds. The holder without liability or expense shall make such modifications and/or additions to the United States.

3.10. Special Status Species, including Threatened and Endangered Species

Affected Environment

Federally Listed Species

Under the Endangered Species Act (ESA), the BLM is mandated to conserve and protect federally listed threatened, endangered, candidate, and proposed species (federal threatened and endangered [T&E] species) and designated critical habitat on public land. There are 11 federal T&E wildlife species listed for Eddy County. Some species are also designated as sensitive by the BLM State Director and require special management consideration to promote their conservation and reduce the need for future listing under the ESA. All federal candidate species, proposed species, and species delisted for five years or less are considered BLM sensitive species (BLM 2014a). **Table 3.10-1** lists USFWS T&E and BLM sensitive species along with their potential to occur in the analysis area. Those species listed for Eddy County or the CFO but not expected to occur within the analysis area are summarized in **Table 1.7-1** and not discussed further in this EA.

Table 3.10-1 USFWS T&E and BLM Sensitive Species Listed for Eddy County[1] and CFO

Species	Listing Status[2]	Habitat	Occurrence in Analysis Area[3]
Mammals			
Cave myotis (*Myotis velifer incautus*)	NMSO	This is a desert and lower elevation grassland species, but it has been collected from juniper-pinyon woodlands; roosts in caves (BISON-M 2016); roosting bats not observed in Project Area (Arcadis 2016a); bats may forage in the area.	May occur
Fringed myotis (*Myotis thysanodes thysanodes*)	NMSO	Commonly roosts in caves and abandoned mines; forages in a variety of habitats ranging from mountain pine to desert scrub, but seems to prefer grassland areas at intermediate elevations (BISON-M 2016); roosting bats not observed in Project Area (Arcadis 2016a); bats may forage in the area.	May occur
Long-legged myotis (*Myotis volans interior*)	NMSO	Summers in New Mexico; has an ecoregion association of Chihuahuan desert tarbush creosote and a life zone association of lower Sonoran mesquite creosote (BISON-M 2016) roosting bats not observed in Project Area during baseline surveys (Arcadis 2016a); bats may forage in analysis area.	May occur
Guadalupe pocket gopher (*Thomomys bottae guadalupensis*)	NMSO	Found in the Upper Pecos and Upper Pecos Black River basins; lives in underground burrows in nearly every habitat within New Mexico so long as sufficient tuberous roots and plant material are available and soil is suitable for digging tunnels; in desert habitats, occurs in close association with clumps of lechuguilla, yucca, sotol, catclaw, and cacti (BISON-M 2016); suitable habitat is present in the analysis area.	May occur
Pale Townsend's big-eared bat (*Corynorhinus townsendi pallescens*)	NMSO	Found in Upper Pecos and Upper Pecos Black River basins; found during day mostly in caves or mine tunnels, but at night they rest in abandoned buildings; in summer, occur widely in New Mexico and can be found in a variety of habitats (BISON-M 2016); may forage in analysis area, no roosting bats observed during baseline surveys (Arcadis 2016a).	May occur
Spotted bat (*Euderma maculatum*)	NMSO	Can be found in the Upper Pecos and Upper Pecos Black River basins; dwells in cliffs and diurnally roosts in cracks and crevices of canyons and cliffs; rocky cliffs are necessary to provide suitable roosting habitats (BISON-M 2016); no bats observed roosting in Project Area (Arcadis 2016a); bats may forage in the analysis area.	May occur

Table 3.10-1 USFWS T&E and BLM Sensitive Species Listed for Eddy County[1] and CFO

Species	Listing Status[2]	Habitat	Occurrence in Analysis Area[3]
Western small-footed bat (*Myotis ciliolabrum melanorhinus*)	NMSO	This species shows little geographic variability in New Mexico, and the center of distribution seems to be in the ponderosa pine zone, although they can occur as low as desert and as high as the spruce-fir zone (BISON-M 2016); also utilizes a variety of riparian habitats (BISON-M 2016); may forage in analysis area.	May occur
Yuma myotis bat (*Myotis yumanensis yumanensis*)	NMSO	Found in Upper Pecos and Black River basins; known to occur at Carlsbad Caverns; roosts in caves and buildings; forages in a variety of habitats including those associated with Chihuahuan desert communities (BISON-M 2016); roosting bats not observed in Project Area during baseline surveys (Arcadis 2016a), but may forage in the analysis area.	May occur
Birds			
Baird's sparrow (*Ammodramus bairdii*)	NMSO	Migrants or vagrants; use shortgrass prairies, including desert grasslands; habitat available in analysis area.	May occur
Burrowing owl (*Athene cunicularia hypugaea*)	NMSO	Nest within burrows (typically) built by smaller mammals; burrows are often associated with prairie dog colonies (BISON-M 2016); active burrows have been documented in analysis area (Arcadis 2016a).	Known to occur
Sprague's pipit (*Anthus spragueii*)	C	A wintering population occurs in southern New Mexico; prefers dry, open grasslands (NMPIF 2016b); may use grassland habitat in analysis area.	May occur

Notes:
1 Sources: USFWS 2016b; NMRPTC 1999a,b,c,d
2 C = Candidate for Federal Listing; NMSO = BLM CFO Sensitive Species. Note, some species are also listed as T&E by the state of New Mexico. These species are discussed in subsequent sections.
3 Known to occur, may occur, or not expected. *Species that are not expected to occur in the analysis area are identified in **Table 1.7-1** and are not discussed further.

Additional information on the listing status, life history, and current distribution information for USFWS T&E and BLM sensitive species that may occur in the analysis area is provided below.

In addition, information on the listing status, life history, and current distribution information for federal T&E species that may occur in the Project Area is provided below.

BLM Sensitive Bats

BLM sensitive bats include the following: Big Free-Tailed Bat (*Nyctinomops macrotis*), Cave Myotis (*Myotis velifer incautus*), Fringed Myotis (*Myotis thysanodes thysanodes*), Long-Legged Myotis (*Myotis volans interior*), Pale Townsend's Big-Eared Bat (*Corynorhinus towndendii pallescens*), Spotted Bat (*Euderma maculatum*), Western Small-Footed Myotis (*Myotis ciliolabrum melanorhinus*), and Yuma Myotis (*Myotis yumanensis yumanensis*).

All bat species listed in **Table 3.9-1** are listed as BLM sensitive species; none are USFWS T&E species. Distributions of these species range over a large geographic area and a variety of habitats, but all species have been documented in or are suspected to occur in the CFO (BLM 2014a). The greater CFO contains a large concentration of limestone caves, many of which serve as important roosting and nursery habitat for bats (e.g., Carlsbad Caverns), including the BLM sensitive species listed above (BLM 2014a). In the analysis area, one cave has been identified as well as some closed sinkholes, closed mammal holes, and a number of depressions and fissures. No bats or roosting activities have been identified using karst features in the analysis area. BLM sensitive bat species known to roost elsewhere in the CFO (e.g., Carlsbad Caverns) may forage within the analysis area. Further, sensitive bat species may stop over within the analysis area during migration to and from wintering grounds in Mexico.

BLM Sensitive Birds

BLM sensitive birds include Baird's Sparrow (*Ammodramus bairdii*) and Burrowing Owl (*Athene cunicularia hypugaea*).

Baird's sparrows were historically noted as common or abundant within limited breeding range on the northern Great Plains. Despite their abundance on breeding grounds, there are relatively few historical records of the sparrow on migratory routes in the central and southern Great Plains, and their winter range is poorly delineated (Wiggins 2006). In New Mexico, Baird's sparrows migrate in the eastern and extreme southern areas of the state and are considered rare to uncommon. They use a variety of habitats, including desert grasslands, and tend to arrive the first week of August and leave by November (BISON-M 2016). Suitable habitat is predominantly present throughout desert grassland in the analysis area, although the species has not been observed in the analysis area (Arcadis 2016a). If present, the bird is only expected to temporarily stop over within the analysis area to forage or rest during migration.

Burrowing owls breed in North America and spend their nonbreeding time primarily south of the United States; they can winter south to Guatemala and El Salvador. In New Mexico, they are uncommon to fairly common in open grassland areas, particularly adjacent to prairie dog towns (BISON-M 2016). Burrowing owls utilize small dens in the ground as their nesting sites, typically abandoned by small burrowing mammals such as prairie dogs, coyotes, foxes, ground squirrels, and badgers (BLM 2014a). Suitable habitat and active burrowing owl burrows were identified throughout the Project Area during baseline surveys (Arcadis 2016a [Figure 10]).

USFWS T&E Bird - Sprague's Pipit (*Anthus spragueii*)

Sprague's pipit is recognized as a candidate for federal listing under the ESA. An endemic grassland species of the northern Great Plains, Sprague's pipit breeds in southern portions of Alberta, Saskatchewan, and Manitoba, eastern Montana, and North Dakota. It winters from southeast Arizona east across most of Texas to Louisiana and Mississippi, and south in Mexico. In New Mexico, Sprague's pipit winters sporadically in southern desert grasslands, primarily in the lower Pecos River Valley, Otero Mesa, and the Animas Valley (NMPIF 2016b). They are generally present in southern New Mexico from October to early April (NMPIF 2016b).

Sprague's pipit prefer dry, open grasslands. Native grass species are preferred over prairie exotics. Wintering habitat may consist of taller grass than in areas typically used for breeding (i.e., intermediate grass height). Wintering areas may have grasses taller than 1 foot and greater than 60 percent grass canopy cover (Jones 2010; NMPIF 2016b). Shrub cover has been known to have a strong negative influence on pipit abundance (Panjabi et al. 2010).

Sprague's pipits were not observed within the Project Area during field surveys (Arcadis 2016a). Grass height in the area (documented as short- to mid-height [Arcadis 2016a]) may not be suitable for use by wintering Sprague's pipits. Further, shrubs are a major component of some grass communities in the Project Area (Arcadis 2016a); therefore, the analysis area may not offer optimum wintering habitat for Sprague's pipits but may be used opportunistically as foraging/stopover habitat.

State-Listed Species

The NMDGF is directed under the New Mexico Wildlife Conservation Act (WCA) to develop recovery plans for species listed by the state of New Mexico as threatened or endangered. The current list of state threatened and endangered wildlife includes 37 mammal, bird, herpetofauna, and fish species for Eddy County (BISON-M 2016). These species, along with their state listing status, habitat, and occurrence within the analysis area, are presented in **Table 3.10-2**. Those species listed for Eddy County but not expected to occur within the HDA are not discussed further in this EA.

Table 3.10-2 State T&E Species Listed for Eddy County, New Mexico[1,2]

Species	NM WCA Listing Status[3]	Habitat[4]	Occurrence in Analysis Area[5]
Mammals			
Spotted bat (*Euderma maculatum*)	ST (also NMSO)	See information in **Table 3.10-1**.	May occur
Birds			
Baird's sparrow (*Ammodramus bairdii*)	ST (also NMSO)	See information in **Table 3.10-1**.	May occur
Common ground-dove (*Columbina passerina*)	SE	Rare visitor to southern New Mexico; uses open stands of creosote bush and large succulents; suitable habitat present in analysis area.	May occur
Gray vireo (*Vireo vicinior*)	ST	Most often found in juniper woodlands and foothills/mesas with oaks and well-developed grasses; rare breeder in the state; grasslands with some juniper found in the analysis area.	May occur
Peregrine falcon (*Falco peregrinus*)	ST	Found in a variety of habitats, typically forested, and nest on cliff escarpments; may nest on karst associated rock walls/cliffs in analysis area. May also fly through the area to neighboring habitats.	May occur
Varied bunting (*Passerina versicolor*)	ST	Summers in small numbers in Eddy County; prefers dense stands of mesquite and associated growth in canyon bottoms; may use mesquite stands in analysis area.	May occur
Amphibians and Reptiles			
Gray-banded kingsnake (*Lampropeltis alterna*)	SE	Only specimen collected in New Mexico is from Carlsbad Caverns National Park; species uses Chihuahuan deserts with abundant limestone outcroppings; suitable habitat present in analysis area.	May occur
Mottled rock rattlesnake (*Crotalus lepidus lepidus*)	ST	Pine-oak forests, mesquite-grasslands, and deserts; suitable habitat present in analysis area.	May occur

Notes:
1 Source: Biota Information System of New Mexico Report County Federal/State Species Status for Eddy County (BISON-M 2016).
2 Source: NMAC. Title 19. Chapter 21. Part 2. 8. List of New Mexico State Endangered Plant Species.
3 NMSO = BLM CFO Sensitive Species; SE = State Endangered; ST = State Threatened
4 Habitat information obtained from Biota Information System of New Mexico website (BISON-M 2016).
5 Known to occur, may occur, or not expected. *Species that are not expected to occur in the analysis area are identified in **Table 1.7-1** and not discussed further in this section.

Additional information on the listing status, life history, and current distribution information for state-listed species that may occur in the analysis area (spotted bat, birds [Baird's sparrow, common ground-dove, gray vireo, peregrine falcon, and varied bunting], and herpetofauna [gray-banded kingsnake and mottle rock rattlesnake]) is provided below.

State T&E Mammals – Spotted Bat (*Euderma maculatum*)

The spotted bat is listed as a state threatened mammal by the NMDGF and is also a BLM CFO sensitive species. Only a patchy distribution is known for this species, which has been deduced from about 100 scattered specimens. From late spring to early fall, spotted bats have been captured as far north as British Columbia and through most of the western states, including New Mexico. They are known to range south along the Sierra Madre in central Mexico (NMDGF 2007).

The rarity of this bat and the diverse habitats in which it has been seen have caused confusion about its preferences. In New Mexico, spotted bats are known only from about 20 locations in western and southern portions of the state. At almost all of these sites, bats were captured in mist nets over water, so information about their roosts is speculative. However, since most capture sites had rock cliffs within 1 mile, and there are almost no records of spotted bats roosting in caves, it is assumed that cracks and crevices in cliffs and canyons are their refuges (NMDGF 2007).

Due to the rarity of spotted bats documented in New Mexico, and the uncertainty about/variety in habitat use, the potential for this species to occur in the analysis area is only speculative and based on their known occurrence in Eddy County and potential to roost in cracks and cliffs (which are limited, but associated with karst features, including one cave, in the analysis area [Arcadis 2016a]). No roosts or individual spotted bats were observed in the Project Area during baseline field surveys (Arcadis 2016a). The species could opportunistically forage in or stop over in the analysis area during migration.

State T&E Birds

State T&E birds include Baird's Sparrow (*Ammodramus bairdii*), Common Ground-Dove (*Columbina passerina*), Gray Vireo (*Vireo vicinior*), Northern Aplomado Falcon (*Falco femoralis septentrionalis*), Peregrine Falcon (*Falco peregrinus*), and Varied Bunting (*Passerina versicolor*).

Information on the Baird's Sparrow (state threatened and BLM CFO sensitive species) is presented above under the federally listed T&E section.

The common ground-dove occurs from southeastern California to southern Texas and southward into Latin America. In New Mexico, the dove is a very local, mainly warm season (April to September) visitor to the southernmost part of the state, including presently at San Simon Cienaga and sparingly in the lowermost Rio Grande and Pecos valleys. The dove is typically found in agricultural and developed areas, although it may use open stands of creosote bush and large succulents in Chihuahuan deserts. Suitable habitat is present, although the species has not been observed in the analysis area (Arcadis 2016a). If present, the bird is only expected to rarely and temporarily stop over within the area to forage or rest during migration.

Gray vireos summer from southern California to western Oklahoma, and southward locally to northern Baja California, southern Arizona, southern New Mexico, western Texas, and northern Coahuila. In New Mexico, the bird occurs rarely during the summer in arid juniper woodlands on foothills and mesas, often associated with oaks with a well-developed grass component. Gray vireos are medium-sized passerines (BISON-M 2016). There is a well-developed grass component with some scattered juniper in the analysis area that this species may utilize; however, no gray vireos have were observed during baseline surveys (Arcadis 2016a).

Peregrine falcons breed throughout much of North America and spend their winters primarily south of the Mexico border. In New Mexico, they occur in upper montane areas, lower montane areas, grassland areas, and desert scrubs (dominated by mesquite, yucca, and cactus). They are found in various forest types, but in the Chihuahuan deserts, they can use open stands of creosote bush and large succulents. This species also nests on cliff walls (BISON-M 2016). No peregrine falcons or cliff nests on karst features were observed in the area during baseline field surveys (Arcadis 2016a). They may, however, transiently migrate through the analysis area.

Varied buntings range from the southwestern United States southward to Guatemala, summering in the United States from southern Arizona to southern Texas. In New Mexico, the species summers in two widely separated areas: Carlsbad Caverns National Park area and in Guadalupe Canyon and vicinity. Vagrants have been reported elsewhere in the south, including Eddy County (BISON-M 2016). Varied buntings are found in Chihuahuan desert scrub habitat and seem to prefer dense stands of mesquite and associated growth in canyon bottoms. Canyons are absent within the analysis area, but varied buntings could potentially utilize mesquite shrubs in the area, especially near karst features. No varied buntings were documented during baseline surveys (Arcadis 2016a).

State T&E Amphibians and Reptiles

State-listed T&E herpetofauna with potential to occur in the Project Area include gray-banded kingsnake (state endangered) and mottled rock rattlesnake (state threatened).

Gray-banded kingsnakes could be expected to occur throughout limestone broken rock-Lozier associated with Otero, Eddy, and southwestern Chaves counties in New Mexico. Habitat requirements include typical Chihuahuan desert habitat with abundant limestone outcroppings (BISON-M 2016). Karst features and associated outcroppings within the analysis area may provide suitable habitat for the gray-banded kingsnake; however, no individuals have been observed (Arcadis 2016a).

Mottled rock rattlesnakes occur from southeastern Arizona and southern New Mexico southward in the highlands to Jalisco and San Luis Potosi. The species is known only from the southern Guadalupe Mountains in Eddy and possibly Otero counties. Key habitats include Walnut and Gunsight canyons and Carlsbad Caverns National Park (BISON-M 2016). The snake uses a variety of habitats, including pine-oak forests, mesquite-grasslands, and deserts. No mottled rock rattlesnakes have been observed in the analysis area (Arcadis 2016a). However, suitable habitat is present in the form of mesquite grasslands and deserts.

Impacts from the Proposed Action

Direct and Indirect Impacts

Federally Listed Species

As summarized in **Table 3.9-1**, there are several BLM sensitive species (all birds or bats) and one USFWS T&E species (Sprague's pipit [Candidate]) that has potential to occur in the analysis area based on their known occurrences in the CFO and/or Eddy County. Potential impacts to these species from the proposed action are described below.

BLM Sensitive Bats - Big Free-Tailed Bat (Nyctinomops macrotis), Cave Myotis (Myotis velifer incautus), Fringed Myotis (Myotis thysanodes thysanodes), Long-Legged Myotis (Myotis volans interior), Pale Townsend's Big-Eared Bat (Corynorhinus townddendii pallescens), Spotted Bat (Euderma maculatum), Western Small-Footed Myotis (Myotis ciliolabrum melanorhinus), and Yuma Myotis (Myotis yumanensis yumanensis)

Baseline surveys for the project indicate that roosting habitats for bats (caves, mines, tree cavities, etc.) are limited in the analysis area (Arcadis 2016a). The proposed action would proactively avoid surface disturbance within 200 meters of caves, sinkholes, and mammal holes and 50 meters of depressions and fissures. Therefore, no direct disturbance to potential bat roosting habitat is expected. Therefore, any effects of the proposed action on bats are expected to be limited to foraging or migrating individuals, rather than larger roosting populations like those that occur elsewhere in the CFO (e.g., Carlsbad Caverns [BLM 2014a]). Impacts to bats, at both a programmatic and site-specific level, would be the same as those described for wildlife/bats in Section 3.9. In summary, foraging and/or migrating bats may be susceptible to direct impacts such as collision with vehicles and infrastructure and exposure to chemicals. Chevron plans to reduce these impacts by following posted speed limits, minimizing traffic during evening to early morning hours when bat activity would be highest, constructing open-vent exhaust stacks on production equipment, and installing effective exclosure systems on all secondary containment systems to prevent wildlife (including bat) exposure to contaminants (e.g., fencing, netting, expanded metal mesh, lids, and grate covers [maximum mesh size of 1.5 inches]).

Bats may also be subject to indirect impacts associated with new noise and artificial lighting under the proposed action. Schaub et al. (2008) monitored noise impacts on foraging bats and found that foraging areas near highways and other sources of intense, broadband sound degraded their suitability as foraging areas. Some bat species also appear to be sensitive to artificial lighting and avoid lighted areas by changing flight routes and habitat use (Longcore and Rich 2016; Kuijper et al. 2008; Patriarca and Debernardi 2010). To reduce noise and artificial lighting impacts, Chevron would not blast during construction, would install exhaust mufflers on fixed equipment, would use minimal light necessary, would use low-pressure sodium lamps (yellow LED lighting) to reduce glow, would properly shield mounted lights via full cutoff method (during production) to reduce glow, and would use directional lighting on fixed equipment to minimize light pollution. Anticipating that these mitigation measures would be implemented,

the proposed action, at both the programmatic and site-specific level, may have minor impacts on foraging and/or migrating bats.

BLM Sensitive Birds - Baird's Sparrow (Ammodramus bairdii) and Burrowing Owl (Athene cunicularia hypugaea)

The Baird's sparrow, if present, is only expected to temporarily stop over within the analysis area to forage or rest during migration. Therefore, impacts of the proposed action on this species are expected to be limited to such individuals (the bird is not known to breed in New Mexico [BISON-M 2016]). At the programmatic level, the proposed action would result in the short-term loss of 1,808 acres of suitable stopover desert grassland habitat and the long-term loss of 782 acres. At the site-specific level, short-term habitat loss would be 106 acres and long-term loss would be 63 acres.

The burrowing owl is known to nest in the analysis area (Arcadis 2016a [Figure 10]). While the project has been designed to avoid direct impacts to known burrows, the proposed action, at the programmatic level, would result in the short-term loss of 1,808 acres of usable grassland habitat and the long-term loss of 782 acres. At the site-specific level, short-term habitat loss would be 106 acres and long-term loss would be 63 acres.

Direct and indirect impacts on the Baird's sparrow and burrowing owl would be the same as those described for wildlife/birds in Section 3.9. In summary, the birds may be susceptible to the following direct impacts under the proposed action: collision with or trampling by vehicles and equipment, collision with or electrocution by aboveground powerlines, exposure to chemicals, and loss of habitat and degradation to nests or burrows.

To reduce these impacts, Chevron would implement design features described in Section 2.1.

Potential indirect impacts on birds include displacement as a result of habitat loss/fragmentation, noise, and artificial lighting. Noise impacts could also include masking and behavioral disruptions, particularly for nesting birds (Blickley and Patricelli 2010). Presence of noise could also work to the advantage of birds. For example, one study found that birds nesting near noisy natural gas pads had higher nesting success, likely due to the reduced presence of common nest predators (Quinn et al. 2006). Wildlife exposure to noise could also result in chronic effects, including elevated stress levels and associated physiological responses (Blickley and Patricelli 2010). To minimize impacts to birds and other wildlife associated with noise, Chevron would not blast during construction and would install exhaust mufflers on fixed equipment so as to not exceed 75 decibels measured at 30 feet from the source of the noise.

Artificial night lighting associated with the proposed action could affect nocturnally active birds by triggering unnatural periods of attraction or repulsion (The Nature Conservancy 2016). Birds have been shown to alter the timing of morning choruses and reproductive patterns in response to artificial lighting (Miller 2005; Kempenaers et al. 2010). To minimize impacts of artificial lighting on nocturnal wildlife, Chevron would use directional lighting on fixed equipment. The lighting would be installed in a way that minimizes light pollution and protects visual resources, while ensuring adequate light for safe and reliable production operations.

Overall, through implementation of previously described design features, proposed action impacts on Baird's sparrow and burrowing owl are expected to be minor, and primarily short term during construction (although some impacts, such as some habitat loss and fragmentation, would occur over the long term).

USFWS T&E Bird - Sprague's Pipit (Anthus spragueii)

Should the Sprague's pipit occur in the analysis area (the species has not been confirmed in the area to date and habitat quality within the analysis area is marginal), impacts of the proposed action, at both the programmatic and site-specific level, would be limited to wintering individuals using tall grass in desert grassland habitat. At the programmatic level, 1,808 acres of potential foraging habitat would be lost in the short term and 782 acres in the long term. At the site-specific level for APD Group 1 and Group 2,

106 acres of potential foraging habitat would be lost in the short term and 63 acres over the long term. Direct and indirect impacts on the Sprague's pipit would be the same as those described above for the Baird's sparrow. With implementation of previously discussed design features, the proposed action is expected to have minor impacts, if any, on the Sprague's pipit.

State-Listed Species

As mentioned in the affected environment section (**Table 3.9-2**), some bats, birds, and herpetofauna listed by the State of New Mexico as T&E species may occur in the analysis area. Potential impacts to all of these species would be the same as those previously described for federally listed species and general wildlife (in Section 3.9). Overall, impacts on these species are expected to range from negligible to minor (due to a variety of design features that would be implemented to protect wildlife and habitats) and most impacts would occur in the short term during construction.

Cumulative Impacts

The CIA for special status species is the same as described in Section 3.1 (**Figure 3.1-1**). The CIA is applicable to this discussion as it is expected to encompass the daily movements of special status species that could occur in or near the analysis area and be affected by the proposed action. As described previously, BLM sensitive bats, BLM sensitive birds, USFWS T&E species (Sprague's pipit, and a number of state-listed wildlife species have potential to occur in or near the analysis area and therefore the CIA.

The types of primary direct and indirect impacts in the CIA would be similar to those described for the proposed action, as oil and gas projects comprise the majority of past, current, and future activities in the CIA. Past and present oil and gas activities make up approximately 4,863 acres of disturbance in the CIA, and reasonably foreseeable future activities, including the proposed action, are anticipated to disturb approximately 3,479 acres.

For BLM sensitive bats, past, present, and foreseeable actions outside the analysis area are expected to contribute to impacts on foraging, migrating, and roosting bats (particularly where activities occur closer to Carlsbad Caverns, other areas with caves and abandoned mines, and treed areas near water sources). The proposed action is anticipated to contribute to negligible impacts on bats. This is because baseline surveys for the project indicate a lack of roosting habitat in the analysis area. Therefore, any impacts from the proposed action are expected to be limited to foraging bats and their habitats. A number of previously described design features would facilitate negligible impacts on bats in the CIA.

The proposed action is also expected to contribute to negligible impacts on sensitive BLM birds (Baird's sparrow and burrowing owl) and the USFWS T&E bird (Sprague's pipit) in the CIA. This is because a number of design features will be implemented to reduce or avoid impacts to these birds and their habitats (e.g., burrowing owl nests would be avoided through implementation of non-disturbance buffers, APLIC standards would be implemented to reduce collisions and electrocutions, directional lighting would be installed, etc.). Birds may avoid the proposed action in the short term and move to other habitats within the CIA. Past, present, and future activities in the CIA would contribute to reduced habitat/fragmentation, which could result in increased competition for resources among displaced and resident birds. These impacts are expected to be short term in the CIA, occurring primarily during construction, maintenance, and drilling activities (until successful reclamation).

The Texas hornshell, although not expected to occur in the analysis area, is known to occur in the Black River within the CIA, located approximately 2.9 miles northwest of the proposed action. The proposed action is not expected to contribute to impacts on this species as tributaries in the analysis area primarily drain south/southeast to Red Bluff Draw, which flows east to the Pecos River. Therefore, the Black River is not expected to be impacted by the proposed action.

As mentioned in the affected environment section (**Table 3.10-2**), there are a number of state-listed wildlife species that may occur in the analysis area and therefore the CIA. A number of previously

described design features would limit impacts to state-listed wildlife. Therefore, the proposed action is expected to contribute to negligible to minor impacts on state-listed wildlife and their habitats in the CIA. Impacts are expected to be short term, primarily occurring during construction, drilling, and maintenance activities throughout the CIA.

Mitigation Measures

With implementation of design features provided in the MDP, MDP SUPO, and APDs, anticipated impacts to special status species would be less than significant. The following mitigation measures will be implemented to minimize impacts on non-raptor avian special status species and their nests. These measures conform to BLM CFO management standards and generally follow NMDGF Oil and Gas Development Guidelines (Jankowitz and Gruber 2007). Additional mitigation may be required on an individual APD or ROW basis as determined by the BLM. Residual impacts could still occur after implementation of the design features and may include loss of habitat from ineffective reestablishment of vegetation and displacement.

3.11. Range

Affected Environment

The Project Area is located in a rural area with a mixture of open rangeland used for livestock grazing, grasslands, and extensive oil and gas development. Livestock grazing within the analysis area includes grazing of domestic cattle and horses. The most common livestock operations in the Project Area are cattle and calf operations.

The BLM is responsible for managing livestock grazing on BLM-managed lands in the CFO Resource Management Planning Area. The CFO manages livestock grazing on 1,947,890 federal acres within the planning area (BLM 2014a). Within the BLM-administered livestock grazing allotments in the analysis area, BLM manages 105,307 acres for the grazing of domestic cattle and horses.

The boundaries of the grazing allotments, range improvements, and range study plots are depicted on **Figure 3.11-1** and listed in **Table 3.11-1**. There are eight grazing allotments and eleven range study plots within the Project Area. All eight allotments are yearlong cow-calf rotation operations and two allotments also include horses.

Table 3.11-1 Grazing Allotments, Range Improvements, and Range Study Plots within Analysis Area

Allotment Name	Allotment Number	Total Acres	AUMs		Range Improvements		Range Study Plots within the Analysis Area
			Cattle	Horse	Windmills/ Water Supply	Fences, Troughs, and Corrals	
Big Hackberry	78087	20,652	1,676		Water wells and storages Water pipelines	Barbed wire fences Troughs and corrals	Hackberry – 2
Cottonwood Hills	78104	10,318	1,549		Water wells and storages Water pipelines	Retention dam Barbed wire fences	East Hay Hollow – 1 East Hay Hollow – 2 West Hay Hollow – 3 West Hay Hollow – 4
China Draw	78094	22,838	564		Water wells and storages Water pipelines	Barbed wire fences Troughs and corrals	None identified
Lower Reed Well	78102	4,463	673	21	Water wells and storages Windmill Water pipelines	Barbed wire fences Troughs and corrals	Big – 1 Big – 2 Big – 3
Red Bluff Draw	78101	7,332	72		Water well and storage	Barbed wire fences Troughs	None identified
Delaware River West	78142	19,846	504		Water wells and storages	Barbed wire fences Troughs	Polk-1

Table 3.11-1 Grazing Allotments, Range Improvements, and Range Study Plots within Analysis Area

Allotment Name	Allotment Number	Total Acres	AUMs		Range Improvements		Range Study Plots within the Analysis Area
			Cattle	Horse	Windmills/ Water Supply	Fences, Troughs, and Corrals	
Tecolote Peak	78103	9,574	1,056	48	Water wells and storages Water pipelines	Barbed wire fences Troughs	North – 1
Hay Hollow	78107	10,284	1,200		None identified	Hay hollow interior Fence	Big – 1
Total Acreage		**105,307**	**7,294**	**69**			

Source: BLM 2014a
Total acres for each allotment calculated from GIS files.

The amount of forage required by one animal unit (cow with calf pair) for one month is referred to as an Animal Unit Month (AUM). Based on the total acreage of the allotments and total number of AUMs within the Project Area as listed in **Table 3.11-1**, the rangeland within the Project Area averages 14 acres per AUM.

The number of livestock permitted for each grazing allotment is determined by quantitative measurements of the amount of forage present and to provide for plant recovery to enhance rangeland health. When rangelands are not meeting standards or resource objectives, changes in grazing management are implemented to improve rangeland health, such as adjusting permitted livestock numbers (AUMs), adding additional waters and fences, or providing rest in certain pastures during the growing season. Drought conditions and rangeland wildfires are also a threat to rangeland health (BLM 2014a).

Range improvements in the Project Area include water wells, water delivery systems (pipelines, windmills, storage tanks, and water troughs), fences, feed troughs, corrals, and retention dams. In addition, there is one windmill located within the Lower Reed Well Allotment. Noxious weeds, which can affect range quality, are described in Section 3.8, Noxious Weeds and Invasive Plants.

There are four range study plots located within the Cottonwood Hills Allotment, three within the Lower Reed Well Allotment, and one range study plot within the Tecolote Peak, Big Hackberry, Delaware River West, and Hay Hollow Allotments, as shown on **Figure 3.11-1**. There are no range study plots within the China Draw and Red Bluff Draw allotments.

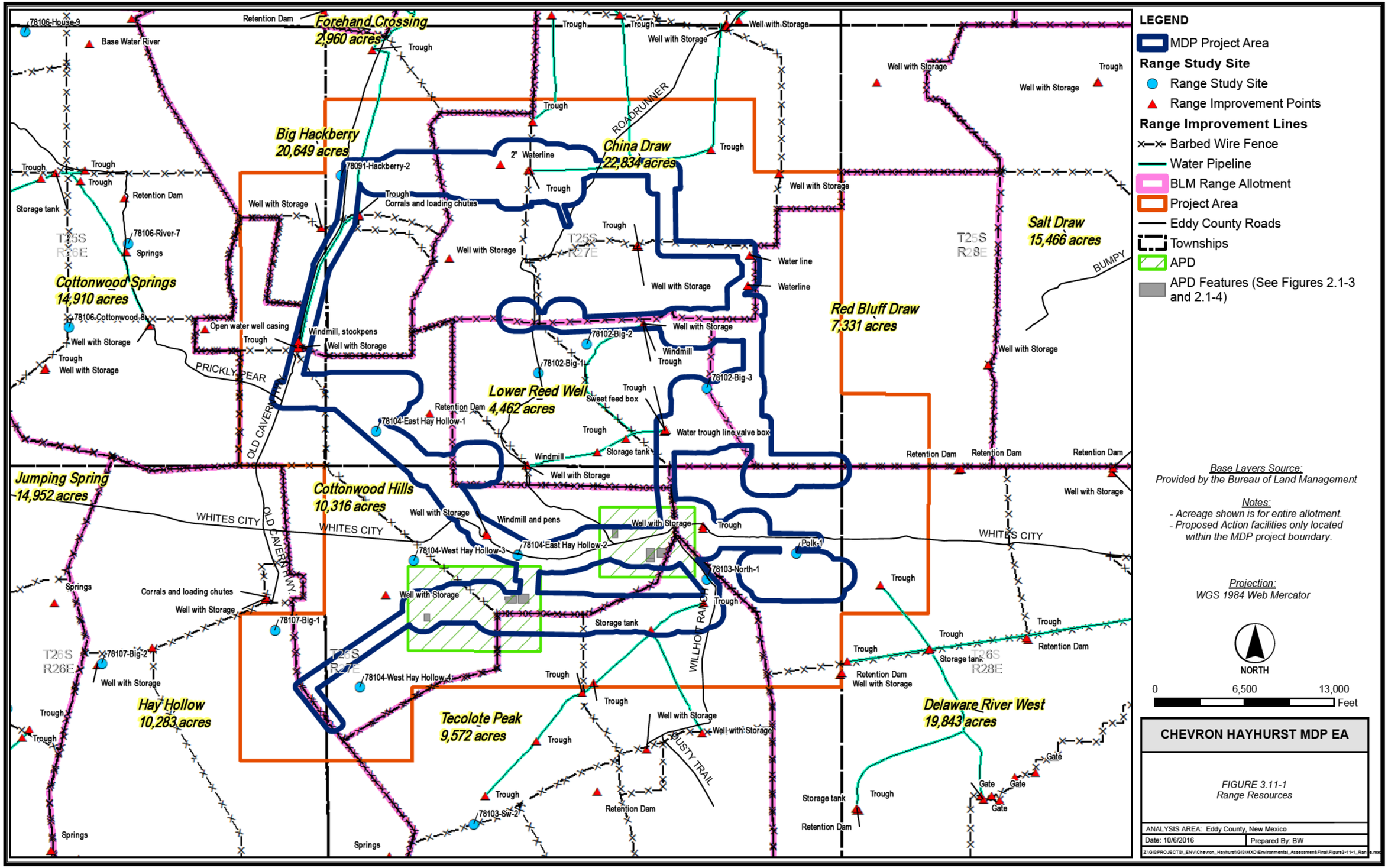
Impacts from the Proposed Action

Direct and Indirect Impacts

The loss of 1,808 acres of vegetation would not substantially affect the AUMs authorized for livestock use in this area. There could be occasional livestock injuries or deaths due to accidents such as collisions with vehicles, falling into excavations, and ingesting plastic or other materials present at the work site. If further development occurs, the resulting loss of vegetation could reduce the AUMs authorized for livestock use in this area.

Under the proposed action, a total of 1,808 acres of short-term surface disturbance would occur within the eight grazing allotments shown on **Figure 3.11-1**. The proposed action as shown on **Figure 2.1-1**, **Figure 2.1-2**, **Figure 2.1-3**, and **Figure 2.1-4** is not likely to impact the range study plots. Following interim reclamation, approximately 782 acres would be disturbed for the life of the project. Under the proposed action, long-term loss of potential forage would represent a reduction of about 1.7 percent of the total acreage of the grazing allotments within the Project Area (105,307 acres) and a 1.8 percent reduction in the AUMs authorized for livestock use in these grazing allotments.

The disturbance associated with the proposed pipelines and roads would expand existing road improvements. Some of these areas may be difficult to reclaim. If reclamation succeeded in these areas, grasses and forbs could begin to provide vegetative cover and forage, possibly as soon as three years after reclamation, if reclamation was protected from livestock grazing.



LEGEND

- MDP Project Area

Range Study Site

- Range Study Site
- Range Improvement Points

Range Improvement Lines

- Barbed Wire Fence
- Water Pipeline
- BLM Range Allotment
- Project Area
- Eddy County Roads
- Townships
- APD
- APD Features (See Figures 2.1-3 and 2.1-4)

Base Layers Source:
Provided by the Bureau of Land Management

Notes:
- *Acreage shown is for entire allotment.*
- *Proposed Action facilities only located within the MDP project boundary.*

Projection:
WGS 1984 Web Mercator

NORTH

0 6,500 13,000 Feet

CHEVRON HAYHURST MDP EA

FIGURE 3.11-1
Range Resources

ANALYSIS AREA: Eddy County, New Mexico

Date: 10/6/2016 | Prepared By: BW

Z:\GIS\PROJECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment\Final\Figure3-11-1_Range.mxd

This page intentionally left blank.

In addition to the loss of forage, there may be occasional livestock injuries or deaths due to accidents such as collisions with vehicles, falling into excavations, and ingestion of plastic or other materials present at the work site. An increase in vehicle traffic and other human activity could disturb cattle and cause them to move away from productive allotment areas. The proposed action includes several measures to reduce vehicular traffic, which would also reduce impacts to range management.

Impacts to vegetation could also occur from unintentional releases of hazardous wastes or other liquid wastes associated with hydraulic fracturing. If such release occurred, livestock could potentially ingest contaminated vegetation and result in livestock death. Mitigation and regulations associated with containment of hazardous waste and spill prevention measures is discussed in Section 3.16.

In accordance with the BLM CFO Standard COAs, the proposed action would avoid damage to range improvements if practicable. If range improvements are damaged, they would be repaired immediately. These measures would reduce potential impacts to range resources.

Livestock Water Pipelines

Since some of the proposed access roads may travel within 20 feet of buried livestock water pipelines, the pipelines could be damaged during the life of the access roads. The pipelines may be compressed or punctured during construction or heavy vehicle traffic, which would decrease the water flow to water troughs in the area that provide water for livestock.

If a freshwater pipeline or drinking trough is damaged, livestock could run out of water, resulting in stress or death. For the 12 APDs submitted with the MDP (**Figure 2.1-3** and **Figure 2.1-4**), no water pipelines are anticipated to be crossed and no troughs, storages, or water wells impacted by the proposed facilities. Potential impacts to livestock water resources for MPD features would be analyzed during an APD or ROW submittal.

Disturbances to structures that provide water to livestock, such as windmills, pipelines, drinking troughs, and earthen reservoirs would be avoided to the extent possible. Prior to crossing any livestock water pipelines, the private surface landowner or the grazing allotment holder would be notified. Freshwater pipelines, troughs, and windmills would be safeguarded and maintained at all times.

Fence Crossings

The operator would notify the landowner or grazing allotment holder prior to crossing any fences. To reduce impacts to range resources, including livestock and vegetation, Chevron would implement design features including bracing and tying off on both sides of the passageway with H-braces prior to cutting the fence, installing and maintaining appropriately sized cattle guards, and installing wire gates in the fence opening during infrastructure installation to prevent livestock from crossing the fence. The gate would be in place during construction inactivity. Once the work is completed and roads are abandoned, the fences would be restored to its prior condition, or better.

For the 12 APDs submitted with the MDP (**Figure 2.1-3** and **Figure 2.1-4**), one pasture fence and five allotment fences may be crossed by proposed facilities. If a range improvement, such as a fence, is damaged and not immediately repaired and the BLM or grazing allottee is not immediately notified, livestock could move from one pasture/allotment to the next. Impacts to livestock and grazing operations would include added cost in time and money to gather and move the livestock.

Boundary fences and cross fences would be safeguarded and maintained at all times. Fences would not be cut without prior approval of the Authorized Officer. Prior to crossing any fences, the private surface landowner or the grazing allotment holder would be notified. Upon completion of operations, fences would be restored to their original condition or better. Fences and other existing infrastructure would also be returned to their pre-construction condition as approved by landowners and/or land management agencies.

Cumulative Impacts

The CIA for range resources is the CIA as defined in Section 3.1. Past, present, and reasonably foreseeable future actions in the CIA include oil and gas exploration and development, utility construction, mineral (non-hydrocarbon) exploration and extraction, livestock grazing, recreation, and off-road travel. Oil and gas exploration and development is the most prevalent activity within the CIA and is expected to continue to be over the life of the proposed action. When added to the disturbance associated with the proposed action, the total cumulative surface disturbance is estimated to be 8,342 acres, some of which is on BLM-administered grazing allotments, within the 165,927-acre CIA. The proposed roads, well pads, and other long-term facilities associated with the proposed action would displace forage available for livestock for the life of the project (up to 45 years). The cumulative loss of rangeland would represent approximately 5 percent of the rangeland in the CIA.

Cumulative impacts to range resources would fluctuate with the gradual abandonment and reclamation of wells. It is likely that reclamation activities would occur throughout the CIA during the life of the project; therefore, there would be little or no net increase in the visibility of oil and gas-related components and activities despite an increase in total surface disturbance within the CIA. As new wells are drilled, other wells would be abandoned and reclaimed, reducing impacts to range resources in terms of total cumulative acres disturbed at any given point in time. As the oil field plays out, the cumulative impacts would be reduced as more areas are reclaimed and fewer areas are developed.

Projected vehicle traffic would increase the risk for livestock collisions, wildland fire, and the spread of noxious weeds and invasive species. Reclamation of disturbed areas and the use of BMPs for erosion control would reduce impacts to overall rangeland health. Revegetation efforts would restore the amount of available forage available for livestock grazing in the majority of the CIA. Impacts to vegetation from reclamation efforts resulting from road and well pad construction would include short-term alterations to native plant composition but would ultimately contribute to stable plant communities comparable to pre-disturbance plant densities through time.

Cumulative impacts to livestock and grazing operations would include increased disturbances to range improvements, potentially including damage to fences (allotment boundary and cross fences), windmills, water pipelines, drinking troughs, earthen reservoirs and water wells used by livestock. Fence damages would result in added cost in time and money. Disturbances to structures that provide water to livestock would increase the risk of livestock health issues.

With implementation of design features provided in the MDP, MDP SUPO, and APDs, impacts to range resources would be minor under the proposed action. When considering past, present, and reasonably foreseeable future actions, and the probability for successful reclamation and reestablishment of vegetation, cumulative impacts to range resources are expected to be minor.

Mitigation Measures and Residual Impacts

With implementation of design features provided in the MDP, MDP SUPO, and APDs, anticipated impacts to range resources would be less than significant. The following additional mitigation requirements would be implemented to further reduce potential impacts to range resources. Additional mitigation may be required on an individual APD or ROW basis as determined by the BLM

Removal or alteration of existing range improvements (e.g., fences, cattle guards) would not be allowed without prior approval of the Authorized Officer.

Temporary Fence Crossing Requirement

All gates would remain in place during construction inactivity. Once the work is completed, the fence would be restored to its prior condition or better. The operator shall notify the private surface landowner or the grazing allotment holder prior to crossing any fences.

Livestock Watering Requirement

Structures that provide water to livestock, such as windmills, pipelines, drinking troughs, and earthen reservoirs, would be avoided by moving the proposed action or paying to relocate the structure. The operator must contact the allotment holder prior to construction to identify the locations of water pipelines. The operator must take measures to protect water pipelines from compression or other damages. If a pipeline is damaged or compromised in any way near the proposed project as a result of oil and gas activity, the operator is responsible for repairing the pipeline immediately. The operator must notify the BLM office (575-234-5972) and the private surface landowner or the grazing allotment holder if any damage occurs to structures that provide water to livestock.

Following implementation of the design features and mitigation, residual impacts may remain and include the permanent reduction (1.8 percent) in the AUMs authorized for livestock use in grazing allotments and possible ineffective reclamation, resulting in a loss of forage.

3.12. Cultural and Historical Resources

Affected Environment

The HDA falls within the Southeastern New Mexico Archaeological Region. Aboriginal cultural traditions represented in this region include (Railey 2012): Paleoindian (ca.11,500 through 7,000 B.C.), Archaic (ca. 6,000 B.C. through A.D. 500), Ceramic (ca A.D. 500 through 1400), and Post-Formative Native American (ca. A.D. 1400 to Present). Sustained historic Euroamerican presence in the area began in approximately A.D. 1865. The Spanish had passed through the region beginning in the mid-1500s, but did not establish any permanent settlements. Beginning in around A.D. 1865, cattle ranches developed in the region, and cattle drives to move cattle to railheads or mining districts also passed through the region. Beginning in the 1920s, oil and gas exploration and development also expanded into the region. Sites representing all of these periods are known to occur in the region. A more complete discussion of the cultural context of the MDP area is presented in the baseline cultural resource inventory (Boggess et al. 2016).

Lone Mountain Archaeology (Boggess et al. 2016) completed a cultural resources survey and based the survey area on the design and layout of the proposed action, as envisioned before the cultural resource inventory. They then added a survey buffer of 1,000 feet around pad and other facility locations and 200 feet to each side of 120-foot-wide linear ROWs. The irregular and overlapping block areas were squared off into rectangular survey blocks. As a result, Lone Mountain Archaeology surveyed 11 block areas and 35 miles of 520-foot-wide corridor outside these blocks for a total of approximately 7,649 acres. This cultural resource survey area is approximately 21 percent of the total EA analysis area for cultural and historical resources. Records searches of the cultural resource survey area and a 0.25-mile buffer through the State of New Mexico Archaeological Records Management Section and the BLM Carlsbad Field Office conducted before the field survey identified 45 previously recorded sites (Boggess et al. 2016). Sixteen of these previously recorded sites were located with the cultural resource survey area.

The baseline cultural resources inventory (Boggess et al. 2016) identified 37 cultural resource sites in the cultural resource survey area. The 37 sites comprised 16 previously recorded sites that were updated and 21 new sites. Subsequently, McCormack et al. (2016) conducted cultural resource inventory of an additional 424 acres. This additional inventory identified three new sites and updated documentation on seven previously recorded sites. A total of 19 sites in the combined survey area are recommended eligible for the NRHP, and four sites are unevaluated. Sites that are eligible for the NRHP or potentially eligible (e.g., status undetermined) are considered historic properties.

The historic properties in the cultural resource survey area include 22 aboriginal sites of unknown affiliation and one historic Euroamerican feature. The aboriginal sites are considered eligible under National Register Eligibility Criterion D for their potential to yield information important in prehistory or history. The historic Euroamerican feature is unevaluated for eligibility.

Native American Religious Concerns

The BLM consults with Native American tribes regarding traditional cultural properties (TCPs), sacred sites, and traditional use areas that may be affected by land-use planning or federal undertakings. During the oil and gas leasing process, Native American consultation is conducted to identify TCPs, sacred sites, and traditional use areas whose continued use may be incompatible with oil and gas or other land-use authorizations. Knowledge of sacred sites and traditional use areas is culturally sensitive and may not be disclosed to the BLM until there is an adverse effect or tangible threat to those traditional concerns. In addition, these culturally sensitive sites may not be apparent to archaeologists or other cultural resource specialists performing surveys in advance of proposed projects.

Impacts from the Proposed Action

Direct and Indirect Effects

Twenty-three historic properties have been identified within the APE of the proposed project. The project would avoid or mitigate all impacts to historic properties. There would be no adverse impact to historic properties. An avoidance and mitigation plan would be prepared before any ground-disturbing activity. Avoidance measures may include exclusionary fencing for historic properties near project activities or monitoring of project activities near sensitive areas. The avoidance and mitigation plan will also include procedures for the treatment of unanticipated discoveries. If any skeletal remains that might be human or any associated funerary objects are discovered by any project activities, all project activities in the area of the discovery will be stopped, and the BLM will be notified promptly. If any historic properties cannot be avoided, a treatment plan for mitigation of adverse effects would be prepared.

Impacts to cultural resources could also occur from unintentional releases of hazardous wastes or other liquid wastes associated with hydraulic fracturing. If such release occurred, nearby cultural resources could be impacted. Mitigation and regulations associated with containment of hazardous waste and spill prevention measures is discussed in Section 3.16.

Cumulative Impacts

The CIA for cultural resources is the same as described in Section 3.1 (**Figure 3.1-1**).The proponent would avoid or mitigate all historic properties. If there are no unanticipated discoveries of cultural resources during the undertaking, the project would have no adverse effect to historic properties. Any historic properties that cannot be avoided and any unanticipated discoveries would be mitigated under a mitigation plan approved by the BLM. Given the avoidance of known historic properties and the implementation of mitigation and design measures for unanticipated discoveries, the proposed action would not contribute to cumulative impacts to historic properties.

Mitigation Measures and Residual Impacts

Chevron shall be responsible to avoid or mitigate all known NRHP eligible and potentially eligible cultural resources within the areas of operations. These areas of operation include the roads, pads, associated pipeline corridor, and adjacent land affected due to this action. Chevron shall cease activities and notify the BLM within 24 hours of any unanticipated discoveries including but not limited to possible human remains. With implementation of these mitigation measures and design features provided in the MDP, MDP SUPO, and APDs, anticipated impacts to cultural resources would be less than significant. Additional mitigation may be required on an individual APD or ROW basis as determined by the BLM. No residual impacts are anticipated following the implementation of design features and mitigation.

3.13. Paleontology

Affected Environment

Paleontological resources are any fossilized remains, traces, or imprints of organisms, preserved in or on the earth's crust, that are of paleontological interest and that provide information about the history of life on earth. Fossil remains may include bones, teeth, tracks, shells, leaves, imprints, and wood. Paleontological resources include not only the actual fossils but also the geological deposits that contain them and are recognized as non-renewable scientific resources protected by federal statutes and policies.

The primary federal legislation for the protection and conservation of paleontological resources occurring on federally administered lands are the Paleontological Resources Preservation Act of 2009, the Federal Land Policy and Management Act of 1976, and the National Environmental Policy Act of 1970 (NEPA). The BLM has also developed policy guidelines for addressing potential impacts to paleontological resources (BLM 1998, 2008b, 2009). In addition, paleontological resources on state trust lands are protected by state policy from unauthorized appropriation, damage, removal, or use.

The Potential Fossil Yield Classification (PFYC) is a tool the BLM uses to predict the likelihood of a geologic unit to contain paleontological resources. The PFYC is based on a numeric system of 1 through 5, with PFYC 1 carrying little likelihood of containing paleontological resources, whereas a PFYC 5 value is a geologic unit that is known to contain abundant scientifically significant paleontological resources.

All Project Area bedrock is Permian in age (about 299 to 251 million years old) and considered PFYC Class 2 geologic units, with the exception of the lower Rustler Formation (e.g., Culebra Member), which is Class 3 (BLM 2013). Previous geologic mapping and field observations indicate that bedrock consists of the upper Castile Formation, Salado Formation, and lower Rustler Formation (King 1949; New Mexico Bureau of Geology and Mineral Resources [NMBGMR] 2003). The Castile and Salado Formations are generally composed of evaporates, such as anhydrite and halite, which are typically devoid of fossils (NMBGMR 2003). The lowermost Rustler Formation is composed of about 120 feet of siltstone, gypsum, and very fine-grained sandstone. These deposits are in turn overlain by approximately 30 feet of dolomite and 115 feet of gypsum (Vine 1963). No fossils are known from the Rustler Formation of New Mexico, but mollusk fossils (e.g., brachiopods, pelecypods, gastropods) have been identified in the lower Rustler Formation in Culberson County, Texas within dolomite, siltstone, and limestone units (Walter 1953). The lower Rustler Formation may be exposed in isolated, topographically high parts of the area of analysis. Quaternary alluvial deposits are likely Holocene or upper Pleistocene (NMBGMR 2003) and are also considered PFYC 2 deposits. Occurrences of Ice Age mammals have been recovered from Pleistocene and younger deposits, including deposits associated with the Black River (Morgan and Lucas 2005).

Paleontological surveys of the Project Area have not been required or conducted; no paleontological resources were opportunistically observed during other baseline surveys (Arcadis 2016a).

Impacts from the Proposed Action

Direct and Indirect Effects

Direct impacts would result in the immediate physical loss of scientifically significant fossils and their contextual data. Impacts indirectly associated with ground disturbance could subject fossils to damage or destruction from erosion, as well as creating improved access to the public and increased visibility, potentially resulting in unauthorized collection or vandalism. However, not all impacts of construction are detrimental to paleontology. Ground disturbance can reveal significant fossils that would otherwise remain buried and unavailable for scientific study. In this manner, ground disturbance can result in beneficial impacts. Such fossils can be collected properly and curated into the museum collection of a qualified repository, making them available for scientific study and education.

The Project Area contains PFYC 2 (low potential) bedrock deposits, isolated PFYC 3 (moderate potential), and PFYC 2 Quaternary deposits. A pedestrian survey for paleontological resources was not considered necessary. Because of the low potential for scientifically significant paleontological resources to be present within the Project Area, impacts to paleontological resources are expected to be negligible.

Cumulative Impacts

The CIA for paleontology is the same as described in Section 3.1 (**Figure 3.1-1**). Geologic units present at the surface within the CIA are generally the same as within the EA analysis area. Outcrops of the Rustler Formation are more prevalent, but still uncommon in the CIA. The Bell Canyon Formation, which marks the top of the Delaware Mountain Group, is present in the western portion of the CIA. The Bell Canyon Formation is considered a PFYC Class 2 geologic unit based on isolated occurrences of vertebrate fossils (Hunt et al. 2006).

Proposed Action

Due to the low potential for scientifically significant paleontological resources to be present within the dominant surficial geologic units of the CIA, cumulative impacts of past, present, and reasonably foreseeable future actions are expected to be negligible.

Mitigation Measures and Residual Impacts

If fossils are found, the operator shall cease activities in the immediate area of the discovery and notify the BLM within 24 hours. Because discovery often occurs during construction with heavy equipment, damage to paleontological resources may occur prior to implementation of mitigation. Any impacts to paleontological resources would be permanent, and hence residual; however, because of the low potential for these resources to be present, less than significant residual impacts to paleontological resources are anticipated.

3.14. Visual Resource Management

Affected Environment

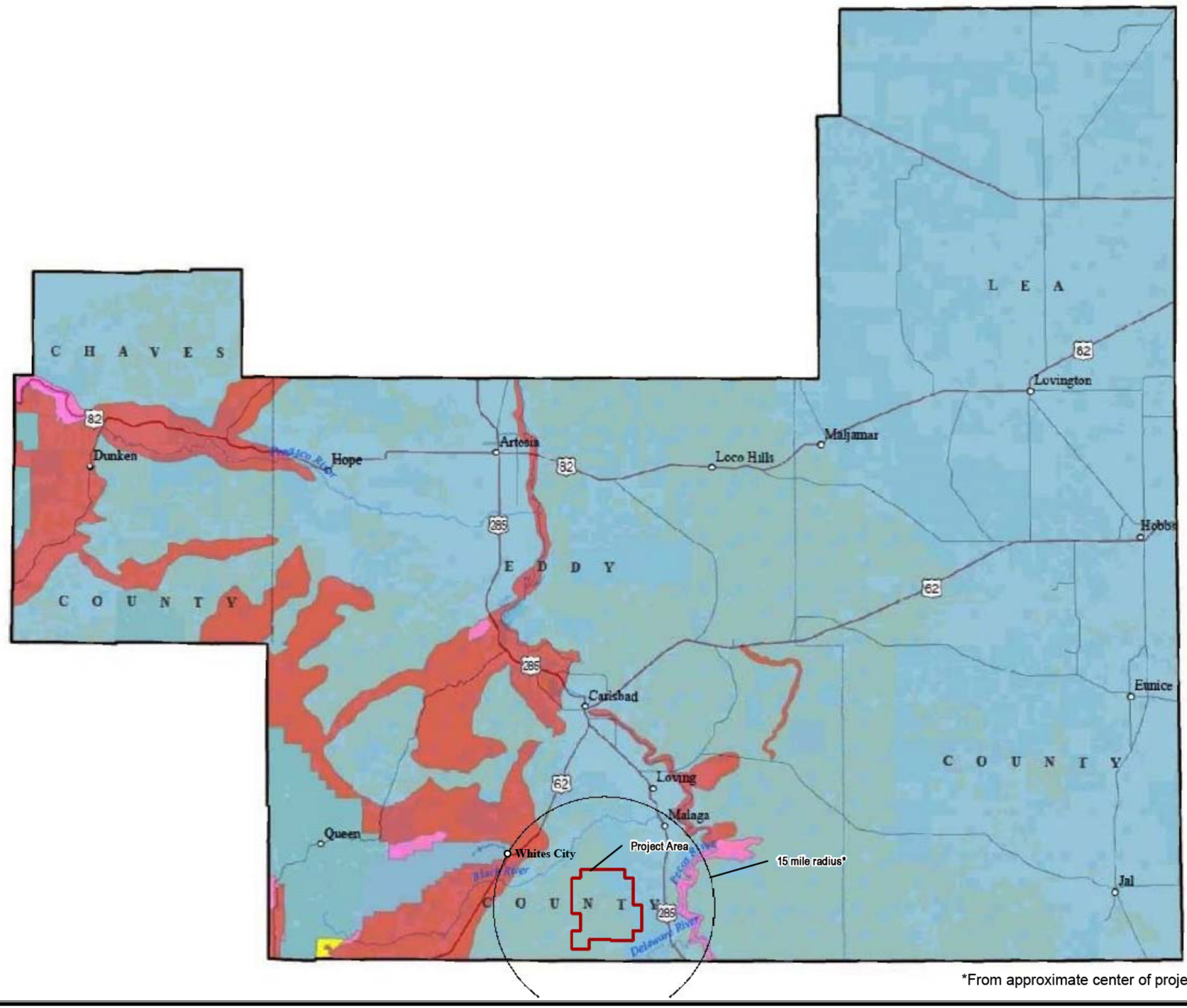
The CFO is responsible for protection of scenic landscapes to consider scenic values before allowing uses that may have negative visual impacts. Scenic resources are typically evaluated using the BLM Visual Resource Management (VRM) system, along with a qualitative assessment of dark sky considerations as discussed in the following subsections.

BLM Visual Resource Management System

The BLM uses the VRM system to identify and classify visual resources on BLM-administered as described in BLM Manual 8400 (BLM 1984). The VRM system classifies land based on visual appeal, public concern for scenic quality, and visibility from travel routes or observation points. Factors typically considered when measuring public concern for visual resources include type of users, amount of public use, public interest, adjacent land uses, and viewing distance. The system is based on the premise that public lands have a variety of visual values, and these values mandate different levels of management and provide a means to evaluate proposed projects to ensure that visual management objectives are met.

Management of visual resources is guided by the approved 1988 BLM CFO RMP (BLM 1988), as amended by the 1997 Carlsbad Approved Resource Management Plan Amendment (BLM 1997). The RMP established objectives for managing visual or scenic values within the CFO Resource Management Planning Area by designating the Planning Area as one of the following four VRM classes as shown on **Figure 3.14-1**.

- Class I: The level of change to the characteristic landscape should be very low and must not attract attention. Class I provides for natural ecological changes; however, it does not preclude very limited management activity.



Source:
BLM 2014
Analysis of the Management Situation
for the Bureau of Land Management
Carlsbad Field Office
September 2014

NORTH

10 5 0 10 Miles

CHEVRON HAYHURST MDP EA

FIGURE 3.14-1
Visual Resource Management Classes

ANALYSIS AREA: Eddy County, New Mexico

Date: 6/2/2016 | Prepared By: BW

Z:\GIS\PROJECT\0_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment\Final\Figure3-14-1_VRM.mxd

This page intentionally left blank.

- Class II: The level of change to the characteristic landscape should be low. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the landscape.
- Class III: The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer.
- Class IV: The level of change to the characteristic landscape can be high. Management activities may dominate the view and be a major focus of the viewer's attention. However, every attempt should be made to minimize the impact of these activities through careful location; minimal disturbance; and repeating basic elements of form, line, color, and texture found in the predominant natural features of the landscape.

The degree of visual modification allowed is specific for each VRM class. However, the goal of the VRM system is to minimize the visual impacts of all surface-disturbing activities regardless of the class in which they occur.

The Project Area is located within a BLM-designated VRM Class IV area as shown on **Figure 3.14-1**. Within the CFO Resource Management Planning Area, approximately 1,853,780 acres of BLM-managed land parcels are designated as VRM Class IV (BLM 2014a).

The objective for VRM Class IV areas is to provide for management activities which require major modifications of the existing character of the landscape; therefore, the level of change to the characteristic landscape resulting can be high. Within a VRM Class IV area, management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location; minimal disturbance; and repeating the basic landscape elements of color, form, line and texture.

The Project Area is relatively flat and largely undeveloped. Areas identified in the vicinity of the Project Area that may have views of the Project Area include the existing roads, primarily Whites City Road, Old Cavern Highway, Roadrunner Road, and Willhoit Ranch Road. The existing vegetation within the Project Area is primarily grasses and sagebrush shrubland with a variety of grasses, shrubs, forbs, and cacti in various shades of yellow, brown, and green. The land form topography is rolling to flat terrain with scattered hilltops visible in the distance.

The existing landscape character reflects influences of human activities. Current modifications to the landscape character have resulted from existing roads, fences, well pads, pipelines, powerlines, tank batteries, frac ponds, salt water disposal (SWD) wells, and large oil storage facilities within the Project Area.

Vertical elements in the surrounding landscape include cylindrical water storage tanks and troughs; windmills; along with pumpjacks and aboveground oil storage tanks associated with the existing oil and gas production facilities in various colors of shale green, tan, and black. Linear features are present in the form of oil and gas access roads, overhead powerlines, and fences. Colors are tans and browns from the sandy soils and light and medium greens from the vegetation.

The BLM Manual 8410-1, Visual Resource Inventory, defines distance zones for the visibility of visual resources, typically during daylight hours, as follows:

- Foreground/Middleground: 0 to 5 miles
- Background: >5 to 15 miles
- Seldom Seen Area: Beyond 15 miles

The Special Land Designations within a 15-mile radius from the approximate center of the Project Area (within the background distance zone) are shown on **Figure 3.15-1**. The Nominated Gypsum Soils and Chihuahuan Desert Rivers Areas of Critical Environmental Concern (ACECs) is located within the Project Area. Scenic values identified for the nominated ACECs include portions of the Pecos, Black, and Delaware Rivers, which provide unique scenic values that are enhanced by topographic and riparian

diversity not commonly found in the CFO planning area. In addition, the Guadalupe Escarpment provides a dramatic background with sheer, rugged peaks that extend 2,000 feet above the desert floor. The Pecos, Black, and Delaware Rivers and the Guadalupe Escarpment are not located in the vicinity of the Project Area.

There are no other ACECs, BLM-designated Scenic Area Special Management Areas (SMAs), Wild and Scenic Rivers (eligible, suitable, or designated), Wild or Scenic River Corridors, or Scenic Byways in the vicinity of the Project Area (BLM 2014a). Scenic areas within a 15-mile radius from the approximate center of the Project Area include the Dark Canyon Scenic Area SMA, located 19 miles to the west; the Guadalupe Escarpment Scenic Area Zone 2 SMA, approximately 9 miles to the west; and the Pecos River Corridor 14 miles to the northwest. Portions of the Project Area, primarily artificial lighting of existing facilities, may be visible in the background distance zone from some of these scenic areas. The VRM system includes effects of artificial lighting on night skies as described in the following subsection.

Dark Skies

The dark night skies of many parts of the western United States are valued by residents and visitors to the region and are a tourist amenity in some areas. Low light pollution conditions, or dark skies, is one of the most important properties for viewing stars, constellations, and other astronomical features, such as comets.

Carlsbad Caverns National Park, Guadalupe Mountains National Park, and the Living Desert Zoo and Gardens State Park share boundaries with the CFO. The Carlsbad Caverns National Park is located approximately 9 miles west-northwest of the Project Area on the other side of the Guadalupe Escarpment Scenic Area Zone 2.The McDonald Observatory in Texas is located 90 aerial miles south of the CFO Planning Area. All of these facilities advertise the pristine beauty of night skies and hold special viewing events.

Air quality studies conducted at Carlsbad Caverns National Park show visibility from the park to be up to 170 miles on a clear day. This radius would encompass the entire CFO Planning Area and the McDonald Observatory. The National Park Service has retrofitted its lighting to help protect the night sky and has scientists monitoring light pollution levels at several parks across the country.

Existing sources of artificial night time light in the vicinity of the Project Area include traffic along existing roads (White City Road, Old Cavern Highway, Roadrunner Road, Willhoit Ranch Road, and U.S. Highway 62/180); rural residences; and the communities of Carlsbad, Loving, Malaga and White City as shown on **Figure 3.14-1**.

The Project Area is remote, rural, and isolated from major communities, and there are very few existing stationary light sources in the vicinity. Thus, the ambient light level in the Project Area is low during the night, and the sky is considered to be very dark. The very low ambient light level allows visibility of astronomical features.

Impacts from the Proposed Action

Direct and Indirect Impacts

Implementation of the proposed action would cause some short-term and long-term visual impacts to the natural landscape. Short-term impacts would occur during construction and operations and prior to interim reclamation. Impacts to visual resources due to fugitive dust and other project-related emissions are described in Section 3.2 – Air Resources.

During the construction period, the removal of vegetation, grading, and project-related activities would detract from the visual quality of the landscape in the immediate vicinity of the proposed facilities. Impacts to visual quality would result from the presence of workers, construction equipment (drill rigs and other heavy equipment), vehicle traffic, vehicle lights, and the bustle of activities and associated dust. Although

slopes and vegetative screening would likely obscure direct views of some project-related activities and facilities, vehicle lights and dust raised by vehicle movements may be visible many miles away.

Some project-related facilities and activities would be visible to casual observers traveling (by vehicle) on White City Road and other roads in the Project Area. The potential viewers (casual observers) of the Project Area would be local residents and ranchers, visitors, and motorists traveling through in the Project Area. Direct views of the project facilities would typically be limited to areas in the immediate vicinity of the facilities and activities and short-term during the time it took to drive past the facilities.

Interim reclamation, conducted within 6 months after well completion, would reduce the area of ground disturbance by recontouring and revegetating. The areas planned for interim reclamation would be recontoured to the original contour if feasible, or if not feasible, to an interim contour that blends with the surrounding topography as much as possible. Following interim reclamation, total long-term disturbance is estimated to be 782 acres for the life of the project, primarily resulting from the proposed facilities displacing existing vegetation.

Long-term impacts would be visible to the casual observer throughout the life of the wells. These include the introduction of storage tanks, piping, pumpjacks, pads, and roads, which would result in visible contrasts to form, line, color, and texture relative to the existing surrounding landscape. Removal of vegetation during construction would expose bare soils lighter in color and smoother in texture than the existing surrounding vegetation. The surfacing of these areas with caliche materials would cause further contrasts, which would be visible to local residents and visitors to the area.

BLM Visual Resource Management System

The BLM's Visual Contrast Rating System, as described in the BLM Manual H-8431 (BLM 1986), was used to describe and analyze the effects of the proposed action on visual resources. As part of the analysis process, the visual impacts of a typical well were analyzed. The basic elements (form, line, color, and texture) of a typical well were then compared to those of the existing surrounding landscape to quantify the degree of contrast of the proposed action components relative to the existing and surrounding landscape and to assess whether the contrasts would meet BLM management objectives for VRM Class IV areas.

Based on the expected degree of contrast under the proposed action, the project-related activities are anticipated to dominate the view in some localized areas; however, every attempt would be made to coordinate with the BLM to minimize the impacts of these activities through careful selection of infrastructure locations; minimizing ground disturbances; and repeating the basic landscape elements of color, form, line, and texture.

Given that the Project Area is located in an area designated as VRM Class IV by the BLM, where major modification of the existing landscape may occur and existing oil and gas facilities are present, the introduction of additional oil and gas facilities under the proposed action would be consistent with the BLM management objectives for VRM Class IV areas.

Recontouring for final reclamation would consist of returning the pads, material storage piles, cut- and fill-slopes, and storm water control features to natural contours that blend with adjacent undisturbed areas, as specified in the final reclamation plan or final reclamation plat approved by the BLM. Requirements for seedbed preparation, soil amendments, seed, seeding procedures, mulching, erosion control fencing, security, and monitoring would be as specified for interim reclamation.

Some areas may be difficult to reclaim. If reclamation succeeded in these areas, grasses and forbs could begin to provide vegetative cover, which would reduce visual impacts, possibly as soon as 3 years after reclamation. Upon successful revegetation, visual impacts would be minimal.

Short- and long-term impacts would be minimized by best management practices such as color selection, reducing cut and fill, screening facilities with natural features and vegetation, interim reclamation, and contouring roads along natural changes in elevation.

Dark Skies

During night hours, the proposed action would have a substantially different type of impact on visual resources relative to the visual effects during day hours. Most of the form, line, color, and texture elements of the proposed facilities and activities would not be visible from publically accessible areas during the night. However, lights would be used on project equipment and vehicles during night time activities, and stationary lights would be positioned at various locations within the Project Area.

Drilling operations would require night lighting on a 24-hour basis. Night lighting typically consists of low-pressure sodium vapor fixtures arranged around the site so equipment can be safely operated during darkness. Permanent lighting may be installed for safety and security. Flaring would only occur during emergencies.

Night time lighting generally results in two forms of visual impacts:

- Sky glow (also known as artificial sky glow, light domes, or fugitive light) which is the brightening of the night sky from light scattered in the atmosphere)
- Glare resulting from the direct shining of light.

Both of these forms can impact the natural landscape and limit the visibility of faint dark sky features in the night. In most areas, project-related lights are anticipated to seem quite dim to the casual observer; however, visual impacts could be perceived as sky glow at long distances. Sky glow may be visible in some remote areas many miles from the Project Area.

The Project Area includes dark sky areas that are optimal for viewing stars and constellations because there are few existing light sources in the area, and the ambient light level is low. Under the proposed action, illumination of the night sky would be increased in some areas, and the number of visible astral and stellar features may be reduced. The effects of project-related lights may adversely affect the visual character of some dark sky areas.

Local residents and visitors may experience bright glares from the lighting used during oil and gas operations while driving down roadways within the Project Area. Bright glares could represent a safety hazard to motorists. These effects would typically be limited to areas in the immediate vicinity of the project facilities and short-term, occurring only during the time it took to drive past the facilities.

Cumulative Impacts

The CIA for visual resources is the CIA as defined in Section 3.1. Past, present, and reasonably foreseeable future actions in the CIA include oil and gas exploration and development, utility construction, mineral (non-hydrocarbon) exploration and extraction, livestock grazing, recreation, and off-road travel. Oil and gas exploration and development is the most prevalent activity within the CIA and is expected to continue to be over the life of the proposed action. When added to the disturbance associated with the proposed action, the total cumulative surface disturbance is estimated to be 8,342 acres within the 165,927-acre CIA. Cumulative effects to visual resources would occur as a result of additional industrial components and activities and an increase in the areal extent of oil and gas infrastructure within the CIA. The proposed action long-term facilities (such as roads and well pads) would constitute a visual intrusion for the life of the project (up to 45 years); however, the individual footprints for the project facilities would be relatively small.

The introduction of roads and well pads, along with the visual effects associated with the cumulative disturbances and removal of vegetation, would represent noticeable contrasts in form, line, color, and texture relative to native vegetation and topography within the CIA. Reclamation of disturbed areas in the

CIA would reduce the visual contrast in the disturbed areas with adjacent vegetation. Any newly reclaimed or unreclaimed linear features would continue to represent a visual contrast with the adjacent vegetation, but would not be as obvious a visual impact as the proposed oil and gas-related activities themselves. In time, the reclaimed and seeded areas would be less visible. BMPs, such as requiring that oil and gas infrastructure be painted with colors to blend with the overall landscape, would minimize some of these contrasts.

The proposed action is anticipated to have cumulative impacts on the night sky during operation because lighting would occur in some relatively remote locations within the CIA. Implementation of BMPs for light fixtures would minimize the potential for sky glow and glare. Past, present, and reasonably foreseeable future oil and gas-related projects within the CIA would be expected to require numbers and types of light sources for operation similar to those required for the proposed action. Lights associated with the proposed action are anticipated to be widely separated from the other activities within the CIA, such that the intensity or concentration of light sources in any given area would not increase to a level producing regional light pollution. Upon completion of reclamation, light sources associated with the proposed project would be permanently removed from the Project Area and the CIA.

The cumulative effects of the proposed action on the visual resources of the CIA would be long-term; however, the degree of contrast of the proposed project activities would comply with the objectives of BLM VRM Class IV. With implementation of design features provided in the MDP, MDP SUPO, and APDs, impacts to visual resources would be minor under the proposed action. When considering past, present, and reasonably foreseeable future actions, and the probability for successful reclamation and reestablishment of vegetation, cumulative impacts to visual resources are expected to be minimal.

Mitigation Measures and Residual Impacts

With implementation of design features provided in the MDP, MDP SUPO, and APDs, anticipated impacts to visual resources, including night skies, would be minor. Additional mitigation for visual resources includes the following:

- Chevron would use minimal light necessary for site safety, security, and operations.
- Light should be directed downward or only where needed.
- Low-pressure sodium lamps, such as yellow LED lighting (3,000 Kelvin or less) or equivalent, would be used to reduce sky glow and wildlife impacts.
- Properly shielded and mounted light fixtures would be used to reduce sky glow from upward pointing light, as well as trespass from light falling outside of desired area of illumination. Full cutoff shielding would be used during production.

An exception to this mitigation is during the use of temporary light plants during construction, as lighting during this phase is necessary for safety.

Other paint colors may be required by the BLM if onsite inspections determine that shale green is not the appropriate color. Additional mitigation may be required on an individual APD or ROW basis as determined by the BLM. Residual impacts following the implementation of design features, and mitigation may include long-term impacts from the visibility to the casual observer throughout the life of the wells and associated infrastructure and glare during the evening drilling operations.

3.15. Special Land Designations

Affected Environment

Public lands with Special Land Designations within a 15-mile radius from the approximate center of the Project Area are shown on **Figure 3.15-1**. Land management in the CFO Planning Area is guided by the approved 1988 BLM CFO RMP (BLM 1988), as amended by the 1997 Carlsbad Approved RMP

Amendment (BLM 1997).The Planning Area for the RMP revision encompasses 6,257,412 acres, not all of which are public lands (BLM 1997). This acreage includes all of Eddy and Lea Counties and a portion of Chaves County.

Special Land Designations are designed to protect watersheds, scenic and natural values, wildlife habitat, streams, and other natural values. A variety of management activities may be used to implement the management prescriptions for areas with Special Land Designations. These generally include posting boundaries, installing information signs, conducting inventory and monitoring of resources and their uses, acquiring access where appropriate, acquiring additional lands from willing parties as necessary to meet management objectives, and resolving unauthorized uses.

An ACEC is defined as an area within public lands where special management attention is required to protect and prevent irreparable damage to important historical, cultural, and scenic values; fish and wildlife and other natural systems or processes; and life and safety from natural hazards. ACEC designation indicates that significant value or resources exist that must be accommodated for future management actions and land use proposals. ACEC nominations that meet the relevance and importance criteria are incorporated in appropriate RMP alternatives. Two ACECs have been nominated for designation within the Project Area (Gypsum Soils ACEC and Carlsbad Chihuahuan Desert Rivers ACEC) as shown on **Figure 3.15-1**. Both Nominated ACECs meet relevance and importance criteria for the following resources: historic, cultural, scenic, fish, wildlife, and natural systems or processes (including karst, paleontological, riparian, soils, and special status plants), and natural hazards.

SMAs are considered land use authorization avoidance areas because they contain resource values that pose special constraints for, and can result in denial of, applications for land uses that cannot be designed to be compatible with management objectives and prescriptions. The Project Area is within SMA 25, Southern Gypsum Soil Area. This SMA is addressed in Section 3.3, Soils. There are no other SMAs in the vicinity of the Project Area.

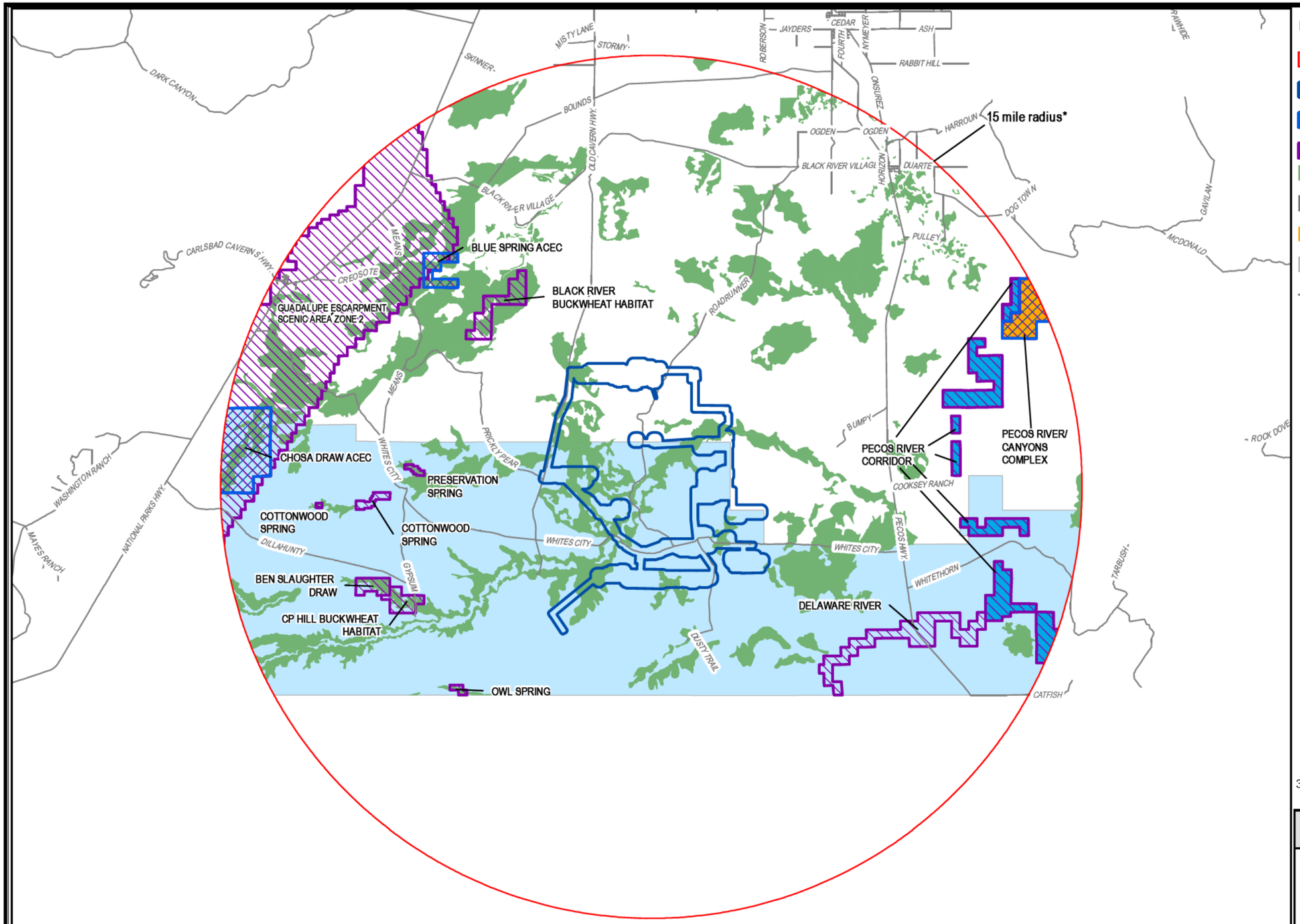
There are two Special Recreation Management Areas and two Off Road Vehicle Recreation Areas within the CFO Planning Area, neither of which are in the vicinity of the Project Area. There are no Outstanding Natural Areas, Research Natural Areas, or Scenic or Backcountry Byways in the vicinity of the Project Area.

Impacts from the Proposed Action

Direct and Indirect Impacts

Impacts resulting from proposed project activities would occur within the boundaries of the Nominated Gypsum Soils and Carlsbad Chihuahuan Desert Rivers ACECs. Relevant and important values for both Nominated ACECs could be affected. Impacts to each of the potentially affected values are described elsewhere within this EA. In summary, with the implementation of proposed design features and BLM-required mitigation measures for each resource, impacts to these resources would be less than significant and would not affect values, resources, systems, processes, or hazards to the point where the Nominated ACECs would no longer be eligible for nomination.

There are no other BLM-designated special land designation areas within the Project Area; therefore, the proposed action would have no direct impacts to other ACEC, SMAs, or other special land designation areas. Indirect effects may include noise, visual effects from the removal of vegetation and night lighting associated with construction activities and facility lights, and short-term traffic delays on some of the roads in the vicinity of the Project Area. Night lighting of project facilities may be visible in the background distance zone from some of the ACECs, scenic areas, or other special land designation areas many miles away from the project. Impacts to visual resources are analyzed in Section 3.14.



*From approximate center of project area

LEGEND

- Special Land Designation Area of Analysis
- MDP Project
- Areas of Critical Environmental Concern
- Special Management Area
- Nominated Gypsum Soils
- Special Recreation Management Area
- Research Natural Area
- Nominated Carlsbad Chihuahuan Desert Rivers ACEC
- County Roads

Notes:

1. *Only the Special Land Designations located within 15-mile radius from approximate center of project area are shown.*
2. *There are no Wilderness Areas, Wilderness Study Areas, Scenic Area Special Management Areas, Special Recreation Management Areas, Off Highway Vehicle Recreation Areas, Research Natural Areas or Outstanding Natural Areas within the EA Area of Analysis.*

Source:
BLM 2014
Analysis of the Management Situation for the Bureau of Land Management Carlsbad Field Office September 2014

NORTH

3.5 1.75 0 3.5 Miles

CHEVRON HAYHURST MDP EA

FIGURE 3.15-1
Special Land Designations

ANALYSIS AREA: Eddy County, New Mexico

Date: 6/2/2016 | Prepared By: BW

Z:\GIS\PROJECTS_ENV\Chevron_Hayhurst\GIS\MXD\Environmental_Assessment Final\Figure3-15-1_SpecialLandDesignations.mxd

This page intentionally left blank.

Cumulative Impacts

The CIA for special land designation areas is the CIA defined in Section 3.1. Relevant and important values for the Nominated Gypsum Soils and Carlsbad Chihuahuan Desert Rivers ACECs are expected to sustain some level of cumulative impacts over time. Cumulative impacts would fluctuate with the gradual abandonment and reclamation of wells. As new wells are drilled, other wells would be abandoned and reclaimed, reducing impacts to the Nominated ACECs in terms of total cumulative acres disturbed at any given point in time. As the oil field plays out, the cumulative impacts would be reduced as more areas are reclaimed and fewer areas are developed.

With implementation of design features provided in the MDP, MDP SUPO, and APDs, impacts to the Nominated ACECs would be minor under the proposed action. When considering past, present, and reasonably foreseeable future actions, and the probability for successful reclamation and reestablishment of vegetation, cumulative impacts to special land designation areas are expected to be minor.

Mitigation Measures and Residual Impacts

With implementation of design features provided in the MDP, MDP SUPO, and APDs, anticipated impacts to special land designations or Nominated ACEC designations would be less than significant. Therefore, no additional mitigation measures are required for approval of the MDP. Additional mitigation may be required on an individual APD or ROW basis as determined by the BLM. Potential residual impacts to values associated with the Nominated ACECs are described in other resources sections (cultural and historic resources, wildlife, and visual resources management).

3.16. Wastes – Hazardous and Solid

Affected Environment

The affected environment for hazardous materials includes air, water, soil, and biological resources that could be affected by an accidental release of hazardous materials during transportation to and from the Project Area, storage, and use in construction and operations. Sensitive areas for hazardous materials releases include, but are not limited to, areas adjacent to water bodies; locations above or that drain to aquifers; and areas where humans or wildlife would be directly impacted such as parks, recreation sites, cave/karst terrain, and T&E and sensitive species habitat.

The BLM requires that all NEPA documents list and describe any hazardous and/or extremely hazardous materials that would be produced, used, stored, transported, or disposed of as a result of a proposed project. Many industry practices for use of materials commonly used for oil and gas projects are mandated by various federal and state laws and regulations, as well as the BLM standard lease terms and stipulations that would accompany any authorization resulting from this analysis. Pertinent federal laws dealing with hazardous material contamination are as follows:

- The Oil Pollution Act (Public Law 101-380), August 18, 199) prohibits discharge of pollutants into waters of the U.S., which by definition includes any perennial stream or any tributary stream, including any ephemeral drainage that conveys water to a perennial stream.
- CERCLA provides for liability, compensation, cleanup, and emergency response for hazardous substances released into the environment. It also provides national, regional, and local contingency plans. Petroleum, including crude oil, natural gas, natural gas liquids, liquefied natural gas and synthetic gas, is exempt from CERCLA regulations.
- RCRA regulates the use of hazardous substances and the disposal of hazardous wastes from the time they are produced until their disposal. On January 6, 1988, EPA determined that most oil and gas exploration, development, and production wastes would not be regulated as hazardous wastes under RCRA.
- Hazardous Materials Transportation Uniform Safety Act of 1990 provides for safe transport of hazardous material in intrastate, interstate, and foreign commerce.

- 49 U.S. Code Chapter 51 Transportation of Hazardous Material regulates the transportation, including security, of hazardous material in intrastate, interstate, and foreign commerce.
- 49 CFR parts 171 through 180: Hazardous Material Transportation Regulations provides procedures and policies, material designations, and packaging requirements and operational rules for hazardous material transportation.
- 49 CFR 171.8 Hazardous material provides the definition of hazardous material, “a substance or material that the Secretary of Transportation has determined is capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and has designated as hazardous under section 5103 of Federal hazardous materials transportation law (49 U.S.C. 5103).”
- 43 CFR 3162.1 General Requirements state the operating rights owner or operator, as appropriate, shall comply with applicable laws and regulations; with the lease terms, Onshore Oil and Gas Orders, Notice to Lessee; and with other orders and instructions of the authorized officer. These include, but are not limited to, conducting all operations in a manner which ensures the proper handling, measurement, disposition, and site security of leasehold production; which protects other natural resources and environmental quality; which protects life and property; and which results in maximum ultimate economic recovery of oil and gas with minimum waste and with minimum adverse effect on ultimate recovery of other mineral resources.
- 43 CFR 3162.5-1 Environmental Obligations requires that the operator conduct operations in a manner which protects the mineral resources, other natural resources, and environmental quality. It also requires the operator to exercise due care and diligence to assure that leasehold operations do not result in undue damage to surface or subsurface resources or surface improvements. All produced water must be disposed of by injection into the subsurface, by approved pits, or by other methods which have been approved by the authorized officer. Upon the conclusion of operations, the operator shall reclaim the disturbed surface in a manner approved or reasonably prescribed by the authorized officer. All spills or leakages of oil, gas, produced water, toxic liquids, or waste materials, blowouts, fires, personal injuries, and fatalities shall be reported by the operator in accordance with these regulations and as prescribed in applicable order or notices. The operator shall exercise due diligence in taking necessary measures, subject to approval by the authorized officer, to control and remove pollutants and to extinguish fires. An operator's compliance with the requirements of the regulations in this part shall not relieve the operator of the obligation to comply with other applicable laws and regulations.
- Onshore Order #6 Hydrogen Sulfide Operations protects public health and safety and those personnel essential to maintaining control of the well. This Order identifies the BLM’s national requirements and minimum standards of performance expected from operators when conducting operations involving oil or gas that is known or could reasonably be expected to contain hydrogen sulfide (H_2S) or which results in the emission of sulfur dioxide (SO_2) as a result of flaring H_2S. This Order also identifies the gravity of violations, probable corrective action(s), and normal abatement periods.

Use and/or production of hazardous materials connected to the project could be related to drilling materials, cementing and plugging materials, hydraulic fracturing materials, production products (natural gas, condensates, produced water), fuels and lubricants, pipeline materials, combustion emissions, and miscellaneous materials.

Illegal dumping of oil and gas wastes (fluid and solid waste) has been documented in the BLM CFO Planning Area, particularly the Black River region (BLM 2016b). Documented industrial waste dumps in the Black River watershed contained: high salinity produced water; waste oil; produced oil (including gasoline and diesel range components); drilling fluids/cuttings/pit liners; BTEX (benzene, toluene, xylene); H2S gas (entrained in dumped fluids), frac sand; hydraulic fracturing fluids; waste water (predominantly contaminated rinsate from tanker truck); truck fluids (hydraulic fluids and motor oil); and miscellaneous leaks and spills from transported chemical containers. Illegal dumping of oil and gas wastes is creating

surface disturbances, public roadway hazards, environmental degradation, and natural and cultural resource damage across the region. There are a number of oil and gas industry state and federal regulatory mandates for proper waste stream containment and disposal from “cradle to grave;” some of these regulations are listed above. Oil and gas operators are responsible for the actions and activities of company personnel as well as contractors and contract personnel.

Hydraulic Fracturing

Chemicals serve many functions in hydraulic fracturing, from limiting the growth of bacteria to preventing corrosion of the well casing. Chemicals are needed to ensure that the hydraulic fracturing job is effective and efficient. Typically, fracturing fluid consists of about 99 percent water and sand, with about 1 percent chemical additives. The number of chemical additives used in a typical fracture treatment varies depending on the conditions of the specific well to be fractured. The predominant solutions currently in use for fracture treatments are water-bearing fracturing fluids mixed with friction-reducing additives (Groundwater Protection Council 2009). The chemicals used in hydraulic fracturing operations are typically transported in concentrated bulk and diluted at the project site. A typical fracture treatment uses very low concentrations of three to dozens of additive chemicals, depending on the characteristics of the water and the formation being fractured. Each component serves a specific, engineered purpose (see https://fracfocus.org/chemical-use/what-chemicals-are-used for examples of the more commonly used additives).

Impacts from the Proposed Action

Direct and Indirect Effects

Potentially harmful substances used in well construction, drilling, completion, production, and other operations would be trucked to and from the Project Area as required and kept onsite in limited quantities, stored under appropriate conditions (e.g., stored out of direct sunlight). No hazardous substance, as defined by 40 CFR 355 would be used, produced, stored, transported, or disposed of in amounts above threshold quantities. Waste generated by construction activities would not be exempt from hazardous waste regulations under the oil and gas exploration and production exemption of RCRA. Wastes exempt from hazardous waste classification under RCRA include those associated with well production and transmission of oil and natural gas through the gathering lines and the hydrocarbons themselves. These wastes may also be subject to state hazardous or non-hazardous waste regulations or other federal regulations such as hazardous materials transportation regulations and the National Pollutant Discharge Elimination System. Some wastes exempt from hazardous waste classification under RCRA can still be harmful to human health and the environment if not properly managed. Chevron would comply with all appropriate federal, state, and local regulatory requirements to minimize impacts to the environment or human health and safety. Chevron’s methods for handling waste is described in **Appendix B** (Surface Use Plan).

Chevron would comply with the reporting requirements under Title III of the Superfund Amendments and Reauthorization Act for materials used in quantities of 10,000 pounds or more such as produced hydrocarbons, ethylene glycol (antifreeze), lubricants, and amine compounds. No chemicals used in construction meet the criteria to be considered an acutely hazardous material/substance or would be present in quantities that would exceed criteria. In addition, no extremely hazardous substance, as defined in 40 CFR 355, would be produced, used, stored, transported, or disposed of during construction or operation of the facilities in amounts above threshold permissible quantities.

H_2S is a naturally occurring byproduct of oil and gas development in the vicinity of the Project Area. H_2S is both an irritant and a chemical asphyxiant with effects on both oxygen utilization and the central nervous system. In 1993, EPA found that there is a potential for human and environmental exposure from routine emission of H_2S from oil and gas wells; however, there was insufficient evidence to suggest that these exposures were a significant threat. While there are no national ambient air quality stands for H_2S, the state of New Mexico has set standards for H_2S (BLM 2016a). Chevron is not anticipating to encounter

H_2S, but would be required to meet any NMED H_2S air permit requirements. Chevron has also developed an H_2S Contingency Plant in the event that H_2S is encountered.

Waste, including fluid and solid, produced during drilling and completion operations would be collected in a container and disposed of properly at a state approved disposal facility. Following drilling and completion operations, solid waste, chemicals, salts, frac sand, and other waste material would also be removed and disposed of properly at a state approved disposal facility. Potential unplanned releases could have serious effects on human health and environment. Many common industrial processes use chemicals that would be hazardous in large enough quantities or if not handled properly. Similarly, drilling and hydraulic fracturing chemical additives are safe when properly handled, but could otherwise be hazardous.

Because numerous chemicals could be present on a well site, the potential exists for spills and leaks. The BLM regulations require prevention of spills and leaks (to the extent possible), reporting of undesirable events (via Notice to Lessees 3-A), emergency response to stop the release at the source, clean up measures to state and federal standards, and surface reclamation of impacted areas. Causes and sources of undesirable events are multiple and variable. Small spills may happen at faulty pipe connections; large spills might occur as the result of a major well failure. Spills may result from human error (e.g., vehicle collisions, improper handling or equipment operation/installation), while others could stem from equipment failure (e.g., broken pipe, damaged pit liner, leaking tank) or acts of nature (Fletcher 2012). Equipment failure and corrosion tend to be common causes of spills (Wenzel 2012). Regular inspection and maintenance by the operator can mitigate the potential for adverse events and impacts.

The cause of an undesirable event, the extent of the event, the hazard rating of the involved material(s), response and cleanup times, and cleanup effectiveness play critical roles in determining the overall impacts. Spill volumes and types vary, and small spills occur with greater frequency. Secondary containment and recovery of small spills minimizes potential impacts.

With the use and production of solid and hazardous wastes, potential exists for accidental contamination of surface water or groundwater. An accident could occur that would result in a release of such materials directly or indirectly into surface waters or in a way that posed a potential threat for transport to groundwater. For example, improper casing and cementing could result in contamination of groundwater resources (see Environmental Consequences – Hydrology). Hazardous substances could also contaminate soil and damage or kill nearby vegetation or wildlife, as well as react with other chemicals and/or naturally occurring elements; ignite or explode; result in air pollution; cause evacuation of personnel and/or nearby residences, and become a major public health hazard.

Public concerns have been raised nationwide regarding the human health impacts of the chemicals used during well development, particularly during hydraulic fracturing. Chemicals used in hydraulic fracturing have been found to affect the skin, eyes, and other sensory organs; the respiratory and gastrointestinal systems; as well as brain/nervous system; immune and cardiovascular system; kidneys; endocrine system; and also cause cancer and mutations (Colborn et al. 2011). These chemicals could be released through an accidental spill and result in impacts to the environment and human health. The New Mexico Department of Health and the EPA are responsible for assessing and authorizing chemical use. Individuals most susceptible to any potential impacts from chemicals are those directly involved with handling them. Worker chemical exposure risks are mitigated by compliance with chemical safety and OSHA regulations as well as safe operating procedures implemented operators, third-party contractors, and by the Occupational Health and Safety Administration. Because active oil and gas development activities (e.g., drilling through completion phases) are closed to the public, public health and safety risk is generally limited to exposure to air, water, and other emissions that could migrate outside the Project Area. These impacts have been described in their respective sections of this analysis.

Cumulative Impacts

Implementation of the proposed action, in combination with past, present, and reasonably foreseeable future actions (including ongoing oil and gas development), would continue to increase the quantities of

hazardous substances used, the potential for spills or accidents, and the amounts of wastes generated. With continued compliance with regulatory requirements, and implementation of similar design features for other projects within the CFO, cumulative impacts would be less than significant.

Mitigation Measures and Residual Impacts

With implementation of design features provided in the MDP, MDP SUPO, and APDs, anticipated impacts due to the accidental release of hazardous and non-hazardous substances are expected to be less than significant. If successfully implemented, the proposed water treatment and recycling system could be used to recycle water from other operators and reduce the volume of produced water to be disposed of through injection within the CIA.

Safety measures and precautions are included in the proposed action as design features to ensure hazardous wastes are not released into the environment. For example, Chevron would install and maintain an impervious secondary containment system for any tank or barrel containing hazardous, poisonous, flammable, or toxic substances sufficient to contain the contents of the tank or barrel and any drips, leaks, and anticipated precipitation. Additionally, the proposed action would be subject to compliance with any applicable federal, state, county, municipal, and local permits, including all necessary environmental clearances and permits.

In the event of any reportable release of a hazardous substance to the environment, EPA regulations require the responsible party to implement an SPCC Plan (and/or a Federal Response Plan) and take responsibility for cleanup and damages. Should the operator fail to comply with spill obligations, a third-party emergency cleanup contractor could be activated by the BLM and paid for by the operator. Compliance with hazardous waste laws and regulations, standard lease stipulations, contingency plans, and emergency response resources would be expected to adequately mitigate any potential hazardous or solid waste issues associated with the proposed action.

Oil and gas operators, including third-party contractors, are required to adhere to all federal, state, and local regulations regarding the proper handling, storage, and disposal of all hazardous and non-hazardous wastes. Once a waste is taken to a disposal facility, facility operators are also required to comply with all federal and state regulations regarding proper handling and disposal of the waste. Analysis of the potential for contamination at these sites is beyond the scope of this analysis, and regulation of such facilities is overseen by state agencies. In New Mexico, injection operations related to oil and natural gas production are regulated under the provisions of the Oil and Gas Act, NMSA 1978, Sections 70-2-1 et seq. and the Water Quality Act, NMSA 1978, Sections 74-6-1 et seq.

Additional mitigation measures may be identified for individual APDs based on the results of onsite inspections. Residual impacts from the accidental release of hazardous and non-hazardous substances are expected to be less than significant.

This page intentionally left blank.

4. SUPPORTING INFORMATION

4.1. Consultation/Coordination

Prior to the onsite meetings for APD Group 1 and Group 2, submitted with the MDP, letters were sent to the allotment permittees providing notification of the onsite and inviting the permittees to attend the onsite. No response was received, and no permittees attended the onsite. Prior to any future onsite meetings, notification letters will be sent to allotment permittees.

Identification and evaluation of historic properties and land assessments and resolution of adverse effect was determined through consultation between the BLM and New Mexico SHPO pursuant to the regulations (36 CFR 800 et seq.) implementing Section 106 of the NHPA of 1966 as amended (54 U.S.C. 306108 et seq.), the NAGPRA (U.S. Code 25, §3001, et seq.).

4.2. List of Preparers and Reviewers

This EA was prepared by the BLM Carlsbad Field Office. Technical assistance for the preparation of the EA was provided by Arcadis U.S., Inc. The following individuals were responsible either for the preparation or review of the EA.

Bureau of Land Management, Carlsbad Field Office

Name	Title	Resource/Responsibility
Paul Murphy	Natural Resource Specialist	Project Lead
TBD	Assistant Field Manager	EA Review
Todd Bowen	Planning & Environmental Coordinator	EA Review
Ross Klein	New Mexico State Office, Natural Resource Specialist	EA Review
Robert Gomez	Supervisory Realty Specialist	EA Review
Solomon Arreola	Realty Specialist	EA Review
Bob Ballard	Supervisory Natural Resource Specialist	EA Review
Stan Allison	Cave/Karst Resource Specialist	Caves and Karst
Steve Daly	Soil Conservationist	Soil Resources; Vegetation; Noxious Weeds and Invasive Plants; Watershed; Floodplains, Wetlands, and Riparian Areas; Range
Cassie Brooks	Wildlife Biologist	Wildlife; Special Status Species, including T&E Species
Deanna Younger	Recreation Specialist	Visual Resource Management, Special Land Designation
Stephanie Bergman	Archaeologist	Cultural and Historical Resources; Paleontology
Terry Gregston	Environmental Protection Specialist	Wastes – Hazardous and Solids
David Herrell	New Mexico State Office, Natural Resource Specialist	Air Resources; Watershed; Floodplains, Wetlands, and Riparian Areas
Forrest Cook	Colorado State Office, Air Resource Specialist	Air Resources
Marissa Garner	Cartographic & Geographic Information Systems Specialist	Geographic Information Systems

Arcadis U.S., Inc.

Name	Resource/Responsibility
Rachel Cruz	Project Manager
Jason Adams, PG	Assistant Project Manager; Soils; Watershed; Caves and Karst; Floodplains, Wetlands and Riparian Areas; Paleontology; Wastes – Hazardous and Solid
Eric Hodek	Air Resources
Cary Ellmers	Air Resources
Dennis McNally (Alpine Geophysics, LLC)	Air Resources
Jocelyn Finch	Vegetation; Noxious Weeds and Invasive Species; Wildlife; BLM Special Status Species, including Threatened and Endangered
Kelly Portue	Vegetation; Noxious Weeds and Invasive Species; Wildlife; BLM Special Status Species, including Threatened and Endangered
Kathryn Cloutier	Range; Visual Resource Management; Special Land Designations
Carl Späth, PhD	Cultural and Historic Resources
Brian Webb	Geographic Information Systems
Carrie Womack	Document Control and Preparation, Project Record

4.3. References

Arcadis U.S., Inc. (Arcadis). 2016a. Environmental Field Survey – Hayhurst Development Area. Prepared for Chevron U.S.A., Inc. May 27, 2016. 114 p.

Arcadis. 2016b. Air Quality Technical Support Document for Chevron's Hayhurst Master Development Plan. Draft.

Barroll, P., D. Jordan, and G. Ruskauff. 2004. The Carlsbad Area Groundwater Flow Model. Prepared by New Mexico Office of the State Engineer. January 2004. 164 pages including appendices.

Belnap, J., J.H. Kaltnecker, R. Rosentreter, J. Williams, S. Leonard, and D. Eldridge. 2001. Biological Soil Crusts: Ecology and Management. U. S. Department of Interior, Bureau of Land Management and U. S. Geological Survey. Technical Reference 1730-2. 118p.

Belnap, J. and D.A. Gillette. 1997. Disturbance of Biological Soil Crusts: Impacts on Potential Wind Erodibility of Sandy Desert Soils in Southeastern Utah. Land Degradation & Development. 8: 355-362.

Best, T.L. and K.N. Geluso. 2003. Summer Foraging Range of Mexican Free-Tailed Bats (*Tadarida Brasiliensis Mexicana*) from Carlsbad Cavern, New Mexico. The Southwestern Naturalist 48(4): 590-596.

Biota Information System of New Mexico (BISON-M). 2016. Report County Federal/State Species Status for Eddy County. [Web Page]. Located at http://www.bison-m.org/. Accessed: February 2, 2016.

Blickley, J.L. and G.L. Patricelli. 2010. Impacts of Anthropogenic Noise on Wildlife: Research Priorities for the Development of Standards and Mitigation. Journal of International Wildlife Law & Policy, 12:274-292.

Boggess, D., B. McCormack, K. Boggess, and A. Murray. 2016. Class III Cultural Resource Survey for the Chevron Hayhurst Development Area MDP Project, Eddy County, New Mexico. Lone Mountain

Archaeological Services, Inc., Albuquerque, NM. Prepared for Chevron North America, Exploration and Production Company, Houston, TX. 54 pages and appendices.

Bohannon, P. 2009. The RCRA Exploration & Production Exemption. Bohannon Legal PLLC. [Web Page]. Located at http://bohannonlegal.com/pauls-oil-gas-manual-the rcra-ep-exemption/. Accessed: April 5, 2016.

Bureau of Land Management (BLM). 1984. Visual Resource Management. BLM Manual 8400. April 1984.

BLM. 1986. Visual Resource Contrast Rating. BLM Manual 8431. January 1986.

BLM. 1988. Carlsbad Resource Management Plan. Bureau of Land Management, Roswell District, New Mexico. September 1988.

BLM. 1992. Dark Canyon Draft Environmental Impact Statement. BLM New Mexico State Office and BLM Roswell District Office, Carlsbad Resource Area. August 1992.

BLM. 1997. Carlsbad Approved Resource Management Plan Amendment and Record of Decision. Carlsbad Resource Area, Roswell District Office, New Mexico. October 1997.

BLM. 2007. Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development – The Gold Book. BLM/WO/ST-06/021+3071/REV 07. Bureau of Land Management. Denver, Colorado. 84 pp.

BLM. 2008a. National Environmental Policy Act. Handbook H-1790-1. January 2008. 184 p.

BLM. 2008b. Paleontological Fossil Yield Classification (PFYC) System for Paleontological Resources on Public Lands. Instructional Memorandum 2008-009. October 15, 2007. 11 p.

BLM. 2009. Assessment and Mitigation of Paleontological Resources. Instructional Memorandum 2009-011. October 10, 2008.

BLM. 2012. Reasonable Foreseeable Development (RFD) Scenario for the BLM New Mexico Pecos District. Final Report.

BLM. 2013. Ochoa Mine Draft Environmental Impact Statement. Carlsbad Field Office. August 2013.

BLM. 2014a. Analysis of the Management Situation for the Bureau of Land Management Carlsbad Field Office. September 2014. 312 p.

BLM. 2014b. Update to the Reasonable Foreseeable Development (RFD) for the BLM Pecos District, SENM. Final Report. November 2014. 27pp.

BLM. 2015. Hydraulic Fracturing White Paper. BLM New Mexico State Office, Division of Fluid Minerals. June 24, 2015. 19 pages.

BLM. 2016a. Air Resources Technical Report for Oil and Gas Development. New Mexico, Oklahoma, Texas, and Kansas. BLM New Mexico State Office. January 2016. 71 pp.

BLM. 2016b. Summary Report: Incidents of Illegal Industrial Dumping in the Black River Region. June 2016. 58 pp.

Bureau of Reclamation (BOR). 2013. West-Wide Climate Risk Assessment: Upper Rio Grand Impact Assessment. BOR, Sandia National Laboratories, and U.S. Army Corps of Engineers, Albuquerque District. 138 pages including appendices.

Carman, S.M. 2007. Texas Hornshell Popenaias popeii Recovery Plan. New Mexico Department of Game and Fish, Conservation Services Division, Santa Fe, New Mexico.

Cedar Lake Ventures (Cedar Lake), Inc. 2016. WeatherSpark - Average Weather for Carlsbad, NM, USA. [Web Page]. Located at https://weatherspark.com/averages/29937/Carlsbad-New-Mexico-United-States. Accessed: February 12, 2016.

Coffin, A. 2007. From roadkill to road ecology: A review of the ecological effects of roads. Journal of Transport Geography 15:396-406.

Colborn et al. 2011. Natural Gas Operations from a Public Health Perspective. Human and Ecological Risk Assessment. 17:1039-1056.

Council on Environmental Quality (CEQ). 1997. Considering Cumulative Effects under the National Environmental Policy Act. January 1997. 64 pages plus appendices.

DesertUSA. 2016. Bats in the Desert and the Southwest. [Web Page]. Located at http://www.desertusa.com/animals/bats.html. Accessed: February2, 2016.

DiTomaso, J. 2000. Invasive weeds in rangelands: Species, impacts, and management. Weed Science 48:255-265.

Environmental Protection Agency (EPA). 1990. Overview of the Clean Air Act and Air Pollution. [Web Page]. Located at https://www.epa.gov/clean-air-act-overview. Accessed: February 12, 2016.

EPA. 2011. National Air Toxics Assessment, 2011 NATAAssessment for Cancer, Neurological and Respiratory Risks for Eddy and Lea Counties in New Mexico. [Web Page]. Located at https://www.epa.gov/national-air-toxics-assessment. Accessed: March 7, 2016.

EPA. 2015. Counties Designated “Nonattainment” for Clean Air Act’s National Ambient Air Quality Standards (NAAQS). [Web Page]. Located at https://www3.epa.gov/airquality/greenbook/mapnpoll.html. Accessed: February 12, 2016.

EPA. 2016. Ambient Air Quality Standards [Web Page]. Located at https://www.epa.gov/criteria-air-pollutants/naaqs-table. Accessed: February 12, 2016.

Evangelista, P.H., A.W. Crall, and E. Bergquist. 2011. Invasive Plants and their Response to Energy Development. Pages 115-129 *in* Naugle, D.E. ed. Energy Development and Wildlife Conservation in Western North America. Island Press, Washington, D.C. 344 pages.

Federal Emergency Management Agency (FEMA). 2010. Flood Insurance Rate Map 35015C1825D. Eddy County, New Mexico and Incorporated Areas. Effective June 4, 2010.

Fletcher, S. M. 2012. Risk Assessment of Groundwater Contamination from Hydraulic Fracturing Fluid Spills in Pennsylvania. *Thesis (M.S.)*. Massachusetts Institute of Technology, Engineering Systems Division, Technology and Policy Program. [Web Page]. Located at http://hdl.handle.net/1721.1/72885. Accessed: April 21, 2016.

Garber, G. and S. Young. 2005. Common Raptors and other Large Birds of New Mexico. Prepared for New Mexico Avian Protection Working Group. 23 pages.

Griffith, G.E., J.M. Omernik, M.M. McGraw, G.Z. Jacobi, C.M. Canavan, R.S. Schrader, D. Mercer, R. Hill, and B.C. Moran. 2006. Ecoregions of New Mexico (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,400,000).

Groundwater Protection Council (GWPC). 2009. Modern Shale Gas Development in the United States: A Primer. Prepared for the U.S. Department of Energy, Office of Fossil Energy, and National Energy Technology Laboratory (NETL). DE-FG26-04NT15455. Oklahoma City, OK. [Web Page]. Located at http://energy.gov/sites/prod/files/2013/03/f0/ShaleGasPrimer_Online_4-2009.pdf. Accessed: April 21, 2016.

Hunt, R.K., V.L. Santucci, and J. Kenworthy. 2006. A Preliminary Inventory of Fossil Fish from National Park Service Units. In: Lucas, S.G., Spielmann, J.A., Hester, P.M., Kenworthy, J.P. and V.L Santucci (eds), Fossils from Federal Lands. New Mexico Museum of Natural History Bulletin 34. Pp. 63-69.

Jankowitz, R. and M. Gruber. 2007. Oil and Gas Development Guidelines, Conserving New Mexico's Wildlife Habitats and Wildlife. New Mexico Department of Fish and Game, State Game Commission. 39 pages.

Jones, S.L. 2010. Sprague's Pipit (*Anthus spragueii*) conservation plan. U.S. Department of Interior, Fish and Wildlife Service, Washington, D.C. 56 pages.

Kempenaers, B., P. Borgstroem, P. Loes, E. Schlicht, and M. Valcu. 2010. Artificial Night Lighting Affects Dawn Song, Extra-Pair Siring Success, and Lay Date in Songbirds. *Current Biology* 20 (19): 1735–1739.

Kennedy, C. 2013. Precipitation Changes over North America: Do the Models Agree? National Oceanic and Atmospheric Administration. [Web page.] Located at https://www.climate.gov/print/119751. September 26, 2013. Accessed: July 6, 2016.

King, P.B. 1949. Regional Geologic Map of Parts of Culberson and Hudspeth Counties, Texas. United States Geological Survey Oil and Gas Investigations Preliminary Map 90. 1 sheet. Scale 1:50,000.

Kirtman, B., S.B. Power, G.J. Boer, R. Bojariu, I. Camilloni, F.J. Doblas-Reyes, A.M. Fiore, M. Kimoto, G.A. Meehl, M. Prather, A. Sarr, C. Schar, R. Sutton, G.J. van Oldenborgh, G. Vecchi, and H.J. Wang. 2013. Near-term Climate Change: Projections and Predictability. In: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Stocker, T.F., D. Quin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschun, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Kuijper, D., J. Schut, D. Van Dullemen, H. Toorman, N. Goossens, J. Ouwehand, and H.J.G.A. Limpens. 2008. Experimental evidence of light disturbance along the commuting routes of pond bats (Myotis dasycneme). *Lutra* 51 (1): 37–49.

Lang, B.K. 2001 (*as cited in Carman 2007*). Status of the Texas hornshell and native freshwater mussels (Unionoidea) in the Rio Grande and Pecos River of New Mexico and Texas. New Mexico Department of Game and Fish, Completion Report, E-38, submitted to the Division of Federal Aid, U. S. Fish and Wildlife Service, Albuquerque, New Mexico.

Lang, B.K. 2004 (*as cited in Carman 2007*). Artificial culture and captive rearing of the Texas hornshell. New Mexico Department of Game and Fish, Completion Report, E-51, submitted to the Division of Federal Aid, U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

Lang, B.K. 2005 (*as cited in Carman 2007*). Texas hornshell, Popenaias popeii (Bivalvia: Unionoida), population monitoring. New Mexico Department of Game and Fish, Performance Report, T-30-P-1, submitted to the Division of Federal Aid, U. S. Fish and Wildlife Service, Albuquerque, New Mexico.

Lang, B.K. 2006 (*as cited in Carman 2007*). Texas hornshell, Popenaias popeii (Bivalvia: Unionoida), population monitoring. New Mexico Department of Game and Fish, Annual Performance Report, T-30-P-1 to the Federal Assistance Division, U. S. Fish and Wildlife Service, Albuquerque, NM.

Longcore T. and C. Rich. 2016. Artificial night lighting and protected lands: Ecological effects and management approaches. Natural Resource Report. NPS/NRSS/NSNS/NRR—2016/1213. National Park Service. Fort Collins, Colorado.

Maloney, E.D., S.J. Camargo, E. Chang, B. Colle, R. Fu, K.L. Geilw, Q. Hu, X. Jiang, N. Johnson, K.B. Karnauskas, J. Kinter, B. Kirtman, S. Kumar, B. Langenbrunner, K. Lombardo, L. Long, A. Mariotti, J.E. Meyerson, K. Mo, J.D. Neelin, Z. Pan, R. Seager, Y. Serraw, A. Seth, J. Sheffield, J. Thibeault, S.P. Xie, C. Wang, B. Wyman, and M. Zhao. 2014. North American Climate in CMIP5 Experiments – Part III: Assessment of 21st Century Projections. Journal of Climate. Vol 27. Pp. 2230-2270.

McCormack, Beth, Douglas Boggess, and Amber Murray. 2016. Class III Cultural Resource Survey for the Chevron Hayhurst Development Area MDP Add-on, Eddy County, New Mexico. Lone Mountain Archaeological Services, Inc., Albuquerque, NM. Prepared for Chevron North America, Exploration and Production Company, Houston, TX. NMCRIS NO. 135812. 32 pages including appendices.

Miller, M.W. 2005. Apparent effects of light pollution on singing behavior of American robins. *Condor* 108 (1): 130–139. November 4.

Morgan, G.S. and S.G. Lucas. 2005. Pleistocene Vertebrate Faunas in New Mexico from Alluvial, Fluvial, and Lacustrine Deposits. In: Lucas, S.G., Morgan, G.S., and K.E. Zeigler (eds.), New Mexico's Ice Ages. New Mexico Museum of Natural History and Science Bulletin No. 28. Page 185-248.

National Climatic Data Center (NCDC). 2014. Hourly Recorded Wind Speed and Direction in Carlsbad, NM (Cavern City Air Park). [Web Page]. Located at http://www.ncdc.noaa.gov/. Accessed: December 2015.

National Oceanic and Atmospheric Administration (NOAA). 2011. Data Tools: 1981-2010 Normals, for Carlsbad, NM. [Web Page]. Located at https://www.ncdc.noaa.gov/cdo-web/datatools/normals. Accessed: February 12, 2016.

Natural Resource Conservation Service (NRCS). 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.

New Mexico Administrative Code (NMAC). 2016.Title 19. Chapter 21. Part 2. 8. List of New Mexico State Endangered Plant Species.

New Mexico Bureau of Geology and Mineral Resources (NMBGMR). 2003. Geologic Map of New Mexico. Scale 1:500,000.

New Mexico Department of Game and Fish (NMDGF). 2007. Wildlife Notes: spotted bat. [Web Page]. Located at http://www.wildlife.state.nm.us/download/education/conservation/wildlife-notes/mammals/spotted-bat.pdf. Accessed: February 3, 2016.

New Mexico Environment Department (NMED). 2014a. Air Monitoring Web Site – Design Concentrations for Various Pollutants [Web Page]. Located at https://www.env.nm.gov/aqb/monitor/airmonitoringnetwork.html. Accessed: February 12, 2016.

NMED. 2014b. 2014-2016 State of New Mexico Clean Water Act Section 303(d)/Section 305(b) Integrated Report. November 18, 2014.

NMED. 2016. Ambient Air Quality Standards. [Web Page]. Located at: https://www.env.nm.gov/aqb/. Accessed: February 12, 2016.

New Mexico Office of State Engineer (NMOSE). 2016. DRAFT 2016 Region 10 - Lower Pecos Valley Regional Water Plan. [Web page.] Located at http://www.ose.state.nm.us/Planning/RWP/region_10.php. Accessed: July 6, 2016.

New Mexico Oil Conservation Division (NMOCD). 2016. Well Search results for Eddy County, including Plugged Wells. [Web Page]. Located at https://wwwapps.emnrd.state.nm.us/ocd/ocdpermitting/Data/Wells.aspx. Accessed: May 12, 2016.

New Mexico Partners in Flight (NMPIF). 2016a. Least Tern (*Sterna antillarum*). [Web Page]. Located at http://www.nmpartnersinflight.org/leasttern.html. Accessed: February 2, 2016.

NMPIF. 2016b. Sprague's Pipit (*Anthus spragueii*). Species Profile. [Web Page]. Located at http://www.nmpartnersinflight.org/spraguespipit.html. Accessed: February 2, 2016.

New Mexico Rare Plant Technical Council (NMRPTC). 1999a. Echinocereus fendleri var. kuenzleri (Kuenzler's Hedgehog cactus). [Web Page]. Located at http://nmrareplants.unm.edu/rarelist_single.php?SpeciesID=70. Accessed: March 12, 2014.

NMRPTC. 1999b. Escobaria sneedii var. leei (Lee's Pincushion cactus). [Web Page]. Located at http://nmrareplants.unm.edu/rarelist_single.php?SpeciesID=56. Accessed: March 12, 2014.

NMRPTC. 1999c. Cirsium wrightii (Wright's Marsh Thistle). [Web Page]. Located at http://nmrareplants.unm.edu/rarelist_single.php?SpeciesID=52. Accessed: March 12, 2014.

NMRPTC. 1999d. Amsonia tharpii (Tharp's blue-star). [Web Page]. Located at http://nmrareplants.unm.edu/rarelist_single.php?SpeciesID=9. Accessed: March 12, 2014.

NMRPTC. 1999e. Coryphantha robustispina ssp. Scheeri (Mulee, needle mulee, beehive cactus, pineapple cactus, Scheer pincushion). [Web Page]. Located at http://nmrareplants.unm.edu/rarelist_single.php?SpeciesID=55. Accessed: February 2, 2016.

NMRPTC. 1999f. Hexalectris nitida (Shining crested coralroot, Glass Mountain crested coralroot). [Web Page]. Located at http://nmrareplants.unm.edu/rarelist_single.php?SpeciesID=99. Accessed: February 2, 2016.

New Mexico Statute Annotated (NMSA). 1978. Oil and Gas Act, Sections 70-2-1 et seq. Water Quality Act, Section 74-6-7 et seq.

Nico, L. and P. Fuller. 2016. Gambusia nobilis. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. Revision Date: 8/23/2011. [Web Page]. Located at http://nas.er.usgs.gov/queries/FactSheet.aspx?speciesID=851. Accessed: February 2, 2016.

Oregon Department of Environmental Quality (ODEQ). 2003. Fact Sheet: Sources of Polychlorinated Biphenyls. [Web Page]. Located at http://www.deq.state.or.us/lq/cu/nwr/PortlandHarbor/docs/SourcePCBs.pdf. Accessed: May 27, 2016.

Panjabi, A.O., G. Levandoski, and R. Sparks. 2010. Wintering bird density and habitat use in Chihuahuan desert grasslands. Unpublished report I-MXPLAT-08-02. Rocky Mountain Bird Observatory, Brighton, Colorado.

Patriarca, E. and P. Debernardi. 2010. Bats and light pollution. EUROBATS. Centro Regionale Chirotteri, Turin.

Pecos Valley Water Users Organization (Pecos Valley). 2001. Lower Pecos Valley Regional Water Plan. Prepared for New Mexico Interstate Stream Commission Regional Water Planning Program. July 2001.

Quinn, J.L., M.J. Whittingham, S.J. Butler, and W. Cresswell. 2006. Noise, predation risk compensation and vigilance in the chaffinch Fringilla coelebs. Journal of Avian Biology 37:601–608.

Railey, J.A. 2012. The Human Landscape in Southeastern New Mexico: A Class I Overview of Cultural Resources Within the Bureau of Land Management's Carlsbad Field Office Region. SWCA Environmental Consultants, Albuquerque, New Mexico.

Sawyer, H.H., R. Nielson, and D. Strickland. 2009. 2007 Final Report for the Sublette Mule Deer Study (Phase II): Long-term monitoring plan to assess potential impacts of energy development on mule deer in the Pinedale Anticline Project Area. Western Ecosystems Technology, Inc. Cheyenne, WY. USA.

Schaub, A., J. Ostwald, and B. M. Siemers. 2008. Foraging bats avoid noise. *Journal of Experimental Biology* 211 (19): 3174–3180.

Soil Conservation Service (SCS). 1971. Soil Survey, Eddy Area, New Mexico. March 1971.

Soil Survey Staff (SSS). 2015. Web Soil Survey. [Web Page]. Located at Natural Resources Conservation Service. Located at: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx. Accessed: December 16, 2015.

Stafford, Kevin W., Laura Rosales-Lagarde, and Penelope J. Boston. 2008. Castile evaporite karst potential map of the Gypsum Plain, Eddy County, New Mexico and Culberson County, Texas: A GIS methodological comparison. *Journal of Cave and Karst Studies* 70 (1): 35-46.

Texas Commission on Environmental Quality (TCEQ). 2014. Air Monitoring Web Site – Design Concentrations for Various Pollutants. [Web Page]. Located at https://www.tceq.texas.gov/airquality/monops/sites/mon_sites.html. Accessed: February 12, 2016.

Texas Department of Water Resources (TDWR). 1978. Geohydrology of Major Johnson Springs and Carlsbad Springs, New Mexico. TDWR Report LP-23. 22 pages plus figures.

Texas Railroad Commission (TRRC). 2016. Digital map data for Culberson County (FIPS 109). Accessed via FTP: May 17, 2016.

Texas Water Development Board (TWDB). 2011. Aquifers of Texas. TWDB Report 380. 172 pages.

The Nature Conservancy. 2016. Artificial Lighting. [Web Page]. Located at http://www.nature.org/ourinitiatives/regions/northamerica/areas/centralappalachians/recommended-shale-practices-artificial-lighting.pdf. Accessed: April 5, 2016.

Trombulak, S.C. and C.A. Frissell. 2000. Review of ecological effects of roads on terrestrial and aquatic communities. Conservation Biology 14(1):18-30.

U.S. Department of Agriculture (USDA). 2016. Sole Source Aquifer Recharge Area. USDA Rural Development. [Web page]. Located at http://www.rd.usda.gov/files/TX_21SoleSourceAquiferRechargeArea.pdf. Accessed: July 5, 2016.

U.S. Department of Defense (DOD) and U.S. Fish and Wildlife Service (USFWS). 2010. Northern Aplomado Falcon Factsheet. [Web Page]. Located at https://webcache.googleusercontent.com/

search?q=cache:4bRgPrkQZgcJ:https://www.fws.gov/endangered/esa-library/pdf/aplomado_falcon_fact_sheet.pdf+&cd=1&hl=en&ct=clnk&gl=us. Accessed: February 2, 2016.

U.S. Forest Service (USFS), National Park Service (NPS) and U.S. Fish and Wildlife Service (USFWS). 2010. Federal land managers' air quality related values work group (FLAG): phase I report – revised (2010). Natural Resource Report NPS/NRPC/NRR – 2010/232. National Park Service, Denver, Colorado.

USFS, NPS, USFWS. 2011. Federal land managers' interagency guidance for nitrogen and sulfur deposition analyses: November 2011. Natural Resource Report NPS/NRSS/ARD/NRR – 2011/465. National Park Service, Denver, Colorado.

U.S. Fish and Wildlife Service (USFWS). 2009. Piping Plover (Charadrius melodus). 5-Year Review: Summary and Evaluation. 214 pages.

USFWS. 2016a. National Wetlands Inventory. [Web Page]. Located at http://www.fws.gov/wetlands/Data/Data-Download.html. Accessed: February 10, 2016.

USFWS. 2016b. Chevron Hayhurst EA – T&E Species List, Eddy County. IPaC Trust Resource Report. iPaC v2.3.2. [Web Page]. Located at https://ecos.fws.gov/ipac/. Accessed: February 1, 2016.

USFWS. 2016c. Mexican Spotted Owl (Strix occidentalis lucida). [Web Page]. Located at https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B074. Accessed: February 2, 2016.

USFWS. 2016d. Southwestern Willow Flycatcher (Empidonax traillia extimus). [Web Page]. Located at https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B094. Accessed: February 2, 2016.

USFWS. 2016e. Yellow-billed Cuckoo (Coccyzus americanus). [Web Page]. Located at https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=B06R. Accessed: February 2, 2016.

U.S. Geological Survey (USGS). 2016. Cave Roosting Bats of the Southwest. [Web Page]. Located at http://sbsc.wr.usgs.gov/cprs/research/projects/caves/bats.asp. Accessed: February 2, 2016.

URS Group Inc. (URS). 2013. Air Resources Technical Support Document. Carlsbad Field Office, Oil and Gas Resource Management Plan Revision. April 25, 2013.

Van Pelt, W.E., S. Kyle, J. Pitman, D. Klute, G. Beauprez, D. Schoeling, A. Janus, and J. Haufler, 2013. The Lesser Prairie-Chicken Range-wide Conservation Plan. Western Association of Fish and Wildlife Agencies. Cheyenne, Wyoming, 367 pages.

Vine, J.D. 1963. Surface Geology of the Nash Draw Quadrangle, Eddy County, New Mexico. United States Geological Survey Bulletin 1141-B. 46 pages.

Walter, J.C. 1953. Paleontology of Rustler Formation, Culberson County, Texas. Journal of Paleontology. Vol. 27, No. 5. Pp. 679-702.

Wenzel, C. 2012. A Case Study—Hydraulic Fracturing Geography: The Case of the Eagle Ford Shale, TX, USA. *Thesis (M.S.).* Texas State University-San Marcos, Department of Geography. [Web Page]. Located at https://digital.library.txstate.edu/handle/10877/4247. Accessed: April 21, 2016.

Western Regional Climate Center (WRCC). 2016. Carlsbad Caverns New Mexico (291480) – Monthly Climate Summary. [Web page.] Located at http://www.wrcc.dri.edu/cgi-bin/cliRECtM.pl?nm1480. Accessed: July 6, 2016.

Wiggins, D.A. 2006. Baird's Sparrow (*Ammodramus bairdii*): A Technical Conservation Assessment. [Web Page]. Located at http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5182050.pdf. Accessed: February 6, 2016.

Wyoming Game and Fish Department (WGFD). 2010. Recommendations for Development of Oil and Gas Resources within Important Wildlife Habitats. Version 6.0. Wyoming Game and Fish Department. Cheyenne, Wyoming. 244 pages.

Xcel Energy, Inc. (Xcel). 2016a. Power for the Plains – China Draw-Yeso Hills 115 kV Transmission Line Project. [Web Page]. Located at http://www.powerfortheplains.com/projects/china-draw-yeso-hills/index.asp. Accessed: May 12, 2016.

Xcel. 2016b. Power for the Plains – Kiowa-North Loving-China Draw 345 kV Transmission Line Project. [Web Page]. Located at http://www.powerfortheplains.com/projects/kiowa-north-loving/index.asp. Accessed: May 12, 2016.

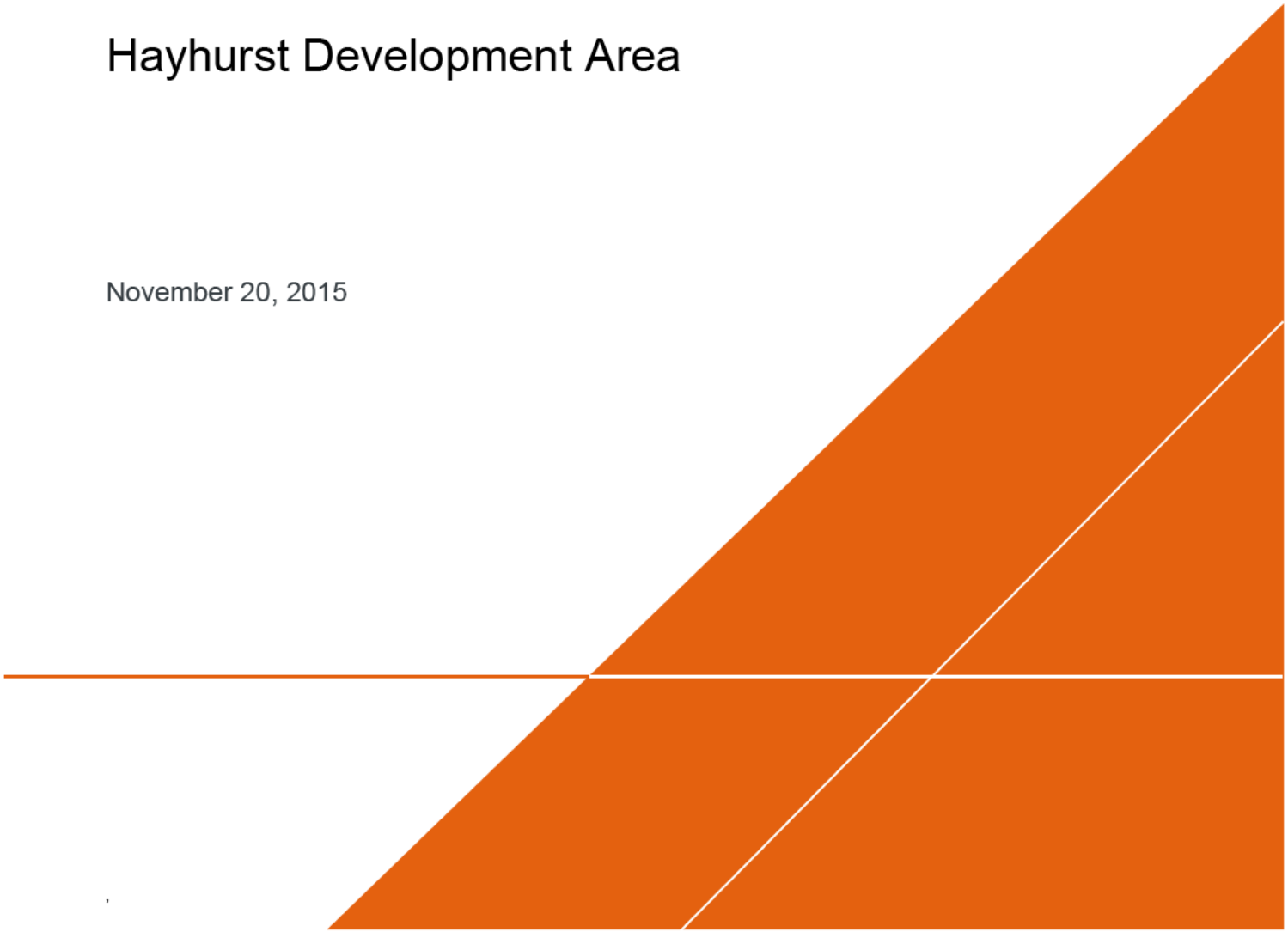
ARCADIS Design & Consultancy for natural and built assets

Chevron U.S.A. Inc.

ENVIRONMENTAL FIELD SURVEY

Hayhurst Development Area

November 20, 2015



ENVIRONMENTAL FIELD SURVEY

Hayhurst Development Area

Jennifer Van Curen

Environmental Scientist

Ethan Jahnke

Project Scientist

Priscilla V. Yelvington

Project Manager

Prepared for:

Sean Cheben

Project Manager

Chevron U.S.A. Inc.

1400 Smith Street

Houston, Texas 77002

Prepared by:

Arcadis U.S., Inc.

2929 Briarpark Drive

Suite 300

Houston

Texas 77042

Tel 713 953 4800

Fax 713 977 4620

Our Ref.:

B0048782.0000

Date:

November 20, 2015

This document is intended only for the use of the individual or entity for which it was prepared and may contain information that is privileged, confidential and exempt from disclosure under applicable law. Any dissemination, distribution or copying of this document is strictly prohibited.

CONTENTS

Acronyms and Abbreviations vi

1 Introduction 1-1

1.1 Project Area 1-1

1.2 Methods 1-1

1.3 Key Constraint Findings 1-2

2 Visual Resource Management 2-1

2.1 Survey Findings and Mitigation 2-1

3 Range 3-1

3.1 Survey Findings and Mitigation 3-1

4 Soil 4-1

4.1 Soil Type Descriptions 4-1

4.1.1 Shallow 4-1

4.1.2 Gypsum 4-2

4.1.3 Loamy 4-2

4.2 Survey Findings and Mitigation 4-3

5 Vegetation 5-1

5.1 Vegetation Types 5-1

5.1.1 Shallow Soil Type Plant Communities 5-1

5.1.2 Gypsum Soil Type Plant Communities 5-1

5.1.3 Loamy Soil Type Plant Communities 5-1

5.2 Survey Findings and Mitigation 5-1

6 Noxious Weeds 6-1

6.1 Survey Findings and Mitigation 6-1

7 Wildlife 7-1

7.1 Survey Finding and Mitigation 7-1

8 Special Status Species 8-1

8.1 Texas Hornshell Mussel 8-1

8.2 Wild Gypsum Buckwheat 8-1
8.3 Survey Findings and Mitigation 8-1
9 Areas of Critical Environmental Concern 9-1
9.1 Survey Findings and Mitigation 9-1
10 Paleontological 10-1
10.1 Survey Findings and Mitigation 10-1
11 Karst 11-1
11.1 Survey Findings and Mitigation 11-1
12 Hydrology 12-1
12.1 Surface Hydrology 12-1
12.2 Floodplain 12-1
12.3 Wetland and Riparian Areas 12-2
12.4 Subsurface Hydrology 12-2
12.4.1 Shallow Geology 12-2
12.4.2 Carlsbad Basin 12-3
12.5 Survey Findings and Mitigation 12-3
13 Cultural 13-1
13.1 Survey Findings and Mitigation 13-1
14 Other observations 14-1
14.1 Existing and Former Operations 14-1
14.2 Slopes 14-2
15 Recommendations 15-1
15.1 Soils 15-1
15.2 Vegetation and Wildlife 15-1
15.3 Special Status Species 15-1
15.4 Karst 15-1
15.5 Hydrology 15-1

TABLES

Table 1. Affected Allotments, Range Improvements, and Range Studies 3-1

Table 2. Soils within Chevron's Proposed Project Area 4-1

Table 3. Vascular Plant List for the Hayhurst Development Area 5-2

Table 4. Noxious Weeds Within Chevron's Proposed Project Area 6-1

Table 5. Wildlife Observed Within the HDA 7-1

Table 6. Plugged Wells within the HDA 14-1

FIGURES

Figure 1. Environmental Field Survey Area

Figure 2. Existing Development

Figure 3. Key Constraint Findings

Figure 4. Visual Resource Management Classes

Figure 5. Range Allotments

Figure 6. Range Resources

Figure 7. Habitat or Shade Trees

Figure 8. Soil Resources

Figure 9. Noxious Weeds

Figure 10. Raptor Nests and Burrows

Figure 11. Migratory & Non-Migratory Bird Nests

Figure 12. Wildlife Habitat Project

Figure 13. Special Status Species – Aquatic & Plants

Figure 14. Special Status Species

Figure 15. Areas of Critical Environmental Concern

Figure 16. Gypsum Soils

Figure 17. Paleontological Potential Fossil Yield Classifications

Figure 18. Karst Occurrence Zones

Figure 19. Karst Potential Zones

Figure 20. Collapsed Sinkholes

Figure 21. Depressions / Fissures

Figure 22. Rock or Gyp Outcroppings

Figure 23. Surface Hydrology Topographic Map

Figure 24. Surface Hydrology

Figure 25. Geologic Resources

Figure 26. Regional Aquifers

Figure 27. Groundwater Wells

Figure 28. Slope Constraints

Figure 29. Hilltops or Steep Slopes

APPENDICES

Appendix A – Visual Contrast Rating

Appendix B – Glossary

Appendix C – References

Appendix D – Resumes

ACRONYMS AND ABBREVIATIONS

CCA	Candidate Conservation Agreement
CCAA	Candidate Conservation Agreement with Assurances
ACEC	Area of Critical Environmental Concern
APD	Application for Permit to Drill
AUM	Animal Unit Month
BLM	Bureau of Land Management
CFO	Carlsbad Field Office
Chevron	Chevron U.S.A. Inc.
cm	centimeter
COA	Condition of Approval
CTB	Central Tank Battery
CWA	Clean Water Act
EA	Environmental Assessment
EIS	Environmental Impact Study
FEMA	Federal Emergency Management Agency
FLPMA	Federal Land Policy and Management Act
gpm	gallons per minute
HDA	Hayhurst Development Area
MBTA	Migratory Bird Treaty Act
MDP	Master Development Plan
m	meter
mm	millimeter
NEPA	National Environmental Policy Act
NHD	National Hydrographic Dataset
NHPA	National Historical Preservation Act
NRHP	National Register of Historic Places
OSE	Office of the State Engineer
PFYC	Potential Fossil Yield Classification
RMP	Resource Management Plan

ROW	Right of Way
SHPO	State Historic Preservation Office
SWD	Salt Water Disposal
T&E	Threatened and Endangered
THM	Texas Hornshell Mussel
VRM	Visual Resource Management
WGB	Wild Gypsum Buckwheat
WSA	Wilderness Study Area

1 INTRODUCTION

An environmental field survey was completed as the initial step in the planning process for Chevron U.S.A. Inc.'s. (Chevron) creation of a Master Development Plan for the Hayhurst Development Area (HDA). The HDA is located southwest of Carlsbad, New Mexico and east of Whites City, New Mexico (Figure 1).

This report summarizes the existing resources, conditions, and concerns identified during the environmental field survey conducted between September 9 and October 2, 2015, and documents the potential impacts to those resources, what changes need to be made to lessen these impacts, and what mitigation will be needed to further reduce potential impacts. This report will be used in conjunction with all National Environmental Policy Act (NEPA) reviews of actual areas to be utilized by Chevron and in writing of the Environmental Assessment (EA). It will be updated should further surveys be completed in the HDA on behalf of Chevron.

During meetings with Chevron and the Bureau of Land Management (BLM) held on July 23rd and October 14th, 2015, several environmental resources located within the HDA were identified; including:

- Karst features,
- Wildlife and biologic concerns,
- Archeology,
- Proposed areas of critical environmental concern (ACEC) due to soil type, and
- Other development impacts.

The purpose of the environmental field survey was to evaluate multiple resources within the specific areas where Chevron's development is planned.

1.1 Project Area

Chevron is planning to develop and produce oil and gas from the HDA, which, when fully developed, will encompass approximately 436 oil and gas wells from the Wolfcamp, Harkey, and 1st-3rd Bone Springs formations (Figure 2). Chevron will require approximately 16 central tank batteries (CTB); eight compressor stations; six deep salt water disposal (SWD) wells; and four frac ponds designed for fresh, brackish, and recycled/reuse water. There are 17.5 sections within Township 25 South (T25S), Range 27 East (R27E) and Township 26 South (T26S), Range 27 East (R27E) encompassing federal, state, and private surface lands. Chevron is planning to place four or more wells on each well pad, resulting in 109 or fewer total well pads.

1.2 Methods

Prior to conducting field surveys, records of known resource issues, such as visual resources, raptor nests, karst features, soil types, and other pertinent biological information within the survey area was gathered from the BLM Carlsbad Field Office (CFO) and other resource databases. These features were plotted on maps along with the HDA to aid in locating resource features and habitat that could be affected by the activities associated with drilling and development within the proposed project area.

A team of Arcadis scientists (see Appendix D) conducted the surveys between September 9 and October 2, 2015. Survey protocol varied, but was guided based on previous discussions with the BLM CFO. The proposed project area was surveyed by foot with the aid of global positioning systems (GPS) and ESRI Collector applications. The area was

systematically searched by walking through the proposed project area/feature and right-of-way (ROW) buffer areas. To aid in navigation and data recording, a Trimble XT GPS receiver, using North American 1983 Datum and Universal Trans Mercator (UTM) coordinates in Zone 13 North, was connected to a smartphone with the ESRI Collector Application to record resource locations or other relevant resource features observed during the survey. In addition to GPS points collected at each 'finding', a picture was also collected and stored in-sync with the GPS point.

1.3 Key Constraint Findings

Multiple features were observed in the HDA that warrant avoidance to reduce potential impacts; these features are illustrated on Figure 3. All development should avoid or minimize the disturbance across the 100-year flood zones by 200 meters (m) and is represented on the figure as "200 m Avoid and Minimize". These areas should also be avoided to minimize impacts on the Texas Hornshell Mussel (THM) habitat. On the figure there are 200 m buffers for sinkholes and range improvements (water wells, water troughs, feed troughs, water storage tanks) that should be avoided to prevent disturbing livestock in the area. The smaller karst features are represented with 50 m buffers for reasonability of planning. The smaller karst features will require further investigation to definitively identify voids present in the subsurface. During the nesting season, active raptor nests should be avoided by 200 m. For this evaluation, the buffers on the figure are set at 50 m with a recommendation that surface disturbing activities be initiated in the non-nesting months when possible.

Additional constraints were observed; however, they were not seen as a key finding since certain design features can be utilized to mitigate the constraints. Recommendations regarding these constraints will be further explained in Section 15 of this report.

2 VISUAL RESOURCE MANAGEMENT

A Visual Resource Management (VRM) survey identifies visual scenic values and provides a means to evaluate proposed projects to confirm that visual management objectives are met. The process involves completing a visual contrast rating for the project area, determining if the project area is visible from travel routes or observation points, and measuring public concern for the scenic quality. The BLM offers this data for public consumption to better plan projects. A visual contrast rating was completed by Arcadis from Whites City Road and is provided in Appendix A.

There are four classes in VRM per the BLM Handbook on Visual Resource Inventory and they are comprised of the following:

- Class I – very minimal changes to the landscape. Activities should not be visible and must not attract attention. The objective is to preserve the existing character of the landscape.
- Class II – minimal changes to the landscape. Activities could be visible but should not attract attention. The objective is to retain the existing character of the landscape.
- Class III – moderate changes to the landscape. Activities will be visible and may attract attention, but the activity should not be the focus or dominate the view. The objective would be to partially retain the existing character of the landscape.
- Class IV – significant changes to the landscape. Activities will be visible, may attract attention, and may dominate the view. This class is still mitigated to minimize impacts to the landscapes and to account for foreseeable future activities.

2.1 Survey Findings and Mitigation

Chevron's proposed project occurs within a BLM designated VRM Class IV zone (Figure 4). The level of change to the characteristic landscape within this project area can be high based on the level of development. The infrastructure of the HDA may dominate the view; however, every attempt should be made to coordinate with the BLM to minimize the impact of these activities through careful location consideration, minimal disturbance, and repeating the basic landscape elements of color, form, line, and texture. Additionally, Chevron plans to proceed with build-out as needed and perform vigorous reclamation. This reclamation would include vegetating along the sides of roads for erosion mitigation, downsizing well pads to what is needed for daily operations, utilizing subsurface pipelines and seeding after installation is complete, reducing slopes (cuts and fills) and seeding to mitigate erosion, and seeding areas around pads where equipment tracking took place for rapid recovery of vegetation.

There are existing well pads, pipelines, powerlines, tank batteries, frac ponds, SWD facilities, and large oil storage facilities within the HDA. The newer sites were observed to be painted to blend with the surrounding area. At this time, disturbances blended well with the rough texture, horizontal and vertical lines, and hues of green colors. The visual impact of cleared land was decreased greatly through vigorous reclamation of pipeline and powerline corridors and downsizing of pads.

3 RANGE

There are seven allotments within the HDA and all are yearlong cow-calf deferred rotation operations. Range improvement projects such as windmills, water delivery systems (pipelines, storage tanks, and water troughs), earthen reservoirs, fences, and brush control projects are located within the allotments. In general, an average rating of the range land within this area is 6 acres per Animal Unit Month (AUM). In order to support one cow for one year, about 72 acres are needed; this equals about nine cows per section.

Table 1 provides a summary of the seven allotments within Chevron's proposed project area and Figure 5 depicts the boundaries of the allotments.

Table 1. Affected Allotments, Range Improvements, and Range Studies

Allotment Name	Windmills / Water Supply	Range Improvements	Range Studies
Big Hackberry - 78087	Water wells and storages Water pipelines	Barbed wire fences Troughs and corrals	
Cottonwood Hills - 78104	Water wells and storages Water pipelines	Retention Dam Barbed Wire Fences	East Hay Hollow – 1 East Hay Hollow – 2 West Hay Hollow – 3 West Hay Hollow – 4
China Draw - 78094	Water wells and storages Water pipelines	Barbed Wire Fences Troughs and corrals	
Lower Reed Well - 78102	Water wells and storages Windmill Water pipelines	Barbed Wire Fences Troughs and corrals	
Red Bluff Draw - 78101	Water well and storage	Barbed Wire Fences Troughs	
Delaware River West - 78142	Water wells and storages	Barbed Wire Fences Troughs	
Tecolote Peak - 78103	Water wells and storages Water pipelines	Barbed Wire Fences Troughs	North – 1

3.1 Survey Findings and Mitigation

The range studies listed in Table 1 will need to be avoided when determining placement of proposed development so that it does not occur in or impact these BLM range areas (Figure 6).

There are several range improvements in the HDA including water wells, troughs, storage tanks, windmills, and feed troughs (Figure 6). Livestock watering areas are located within Chevron's proposed project area, and will require a 200 m buffer to prevent any development from occurring within that buffer that may affect the livestock. Any damage

to structures that provide water to livestock throughout the life of Chevron's proposed project or caused by operations from the project, must be immediately corrected to help support rangeland use.

Impacts to ranching operations can be reduced by utilizing standard operating practices such as using existing surface disturbances, minimizing the well pad and access road total surface disturbance, using steel tanks instead of reserve pits, minimizing vehicular use, placing parking and staging areas on caliche surfaced areas, reclaiming the areas not necessary for production, and quickly establishing vegetation on the reclaimed areas. There are areas where Chevron's proposed project will need entry through a fence and cattle guards will need to be installed and maintained at permanent fence crossings. There will also need to be braces installed on both sides of temporary fence entries to protect the integrity of the fence line.

Some trees identified during the field survey provide shade for livestock and other wildlife habitat in the area; they should be avoided or mitigated if disturbance is necessary. The locations of these trees are depicted in Figure 7.

4 SOIL

Descriptions of soil characteristics and quality are based on visual, physical, chemical, and biological observations. Visual characteristics relate to erodibility due to sensitivity of soil structure. Soil is typically changed by wind or water exposure. Erodibility is also seen through the physical characteristics of the soil and the ability or inability of water to drain due to the solid particles and pore space. The chemical characteristics of soil are factors that promote or hinder vegetative growth due to soil-plant relations, availability of nutrients, and chemical properties of soil such as salinity, pH, contaminants, and physical characteristics. Biological characteristics of soil are exhibited through the living organisms within the soil. Healthy soil indicates that there is high activity of micro- and macro-organisms.

The soils within the HDA are listed in Table 2 and the general types of soils observed are described in Section 4.1. A map depicting the soils mapped within the HDA is provided in Figure 8.

Table 2. Soils within Chevron's Proposed Project Area

Soil Abbreviation and Name	Slope
CR – Cottonwood-Reeves Loams Overflow	0 to 3 percent slope
EC – Ector Stony Loam	0 to 9 percent slope
ER – Ector – Reagan association	0 to 9 percent slope
GC – Gypsum land – Cottonwood complex	0 to 3 percent slope
RA – Reagan loam	0 to 3 percent slope
RE – Reagan-Upton association	0 to 9 percent slope
RG – Reeves-Gypsum land complex	0 to 3 percent slope
RM – Reeves-Reagan loams	0 to 3 percent slope
UG - Upton-gravelly loam	0 to 9 percent slope

Note: Highlighted soils are within the proposed ACEC area.

4.1 Soil Type Descriptions

4.1.1 Shallow

Shallow soils are primarily of the Ector and Upton series with several other minor soil types. These soils are shallow to very shallow, well-drained, calcareous, stony and rocky loams over limestone and caliche. Topography ranges from nearly level ridgetops to side slopes to cliffs and escarpments. Permeability is moderate, water-holding capacity is very low to low, and runoff is rapid after soils become saturated. Shallow soils are subject to water erosion, but the stones and rock outcrops help to stabilize the soils on nearly level to gently sloping areas. Careful management is needed to maintain a cover of desirable forage plants and to control erosion. Reestablishing native plant cover could take 3 to 5 years due to unpredictable rainfall and high temperatures.

These soils typically have scattered populations of squamulose lichens and a few crustose lichens, while gelatinous lichens and cyanobacteria are occasionally present primarily in the pockets of deeper soils. These soil crusts are important in binding loose soil particles together to stabilize the soil surface and reduce erosion. Biological soil crusts can contribute positively to soil stability, fixing atmospheric nitrogen, nutrient contributions to plants, water infiltration,

and plant growth. They function in the nutrient cycle by fixing atmospheric nitrogen, contributing to soil organic matter, and maintaining soil moisture. In addition, they can act as living mulch which discourages the establishment of annual/invasive weeds. Structurally they form an uneven, rough carpet that reduces rain drop impact and slows surface runoff. Below the surface, lichen and moss rhizines, fungal hyphae, and cyanobacterial filaments all act to bind the soil surface particles just below and at the surface. Horizontally, they occur in nutrient-poor areas between plant clumps. Because they lack a waxy epidermis, they tend to leak nutrients into the surrounding soil. Vascular plants such as grasses and forbs can then utilize these nutrients.

4.1.2 Gypsum

Gypsum type soils have a loamy surface layer, with gypsiferous materials starting at a depth of 1 to 10 inches. They are found on gently undulating uplands, with steep, broken gypsum outcrops occurring in places. Permeability varies from very low to moderate, water-holding capacity is very low to low, and runoff rapid to very rapid. Soil fertility and the rooting zone are limited by the underlying gypsiferous material. These soils are subject to severe erosion once the vegetative cover is lost. Reestablishing native plant cover could take 3-5 years due to unpredictable rainfall and high temperatures.

These areas have good populations of squamulose lichens, a few crustose and gelatinous lichens, and cyanobacteria, which are present throughout the top 2 millimeters (mm) of the soil. These soil crusts are important in binding loose soil particles together to stabilize the soil surface and reduce erosion. They also function in the nutrient cycle by fixing atmospheric nitrogen, contributing to soil organic matter, and maintaining soil moisture. In addition, they can act as a living mulch which discourages the establishment of annual/invasive weeds. Structurally they form an uneven, rough carpet that reduces rain drop impact and slows surface runoff. Below the surface, lichen and moss rhizines, fungal hyphae, and cyanobacterial filaments all act to bind the soil surface particles just below and at the surface. Horizontally, they occur in nutrient-poor areas between plant clumps. Because they lack a waxy epidermis, they tend to leak nutrients into the surrounding soil. Vascular plants such as grasses and forbs can then utilize these nutrients.

4.1.3 Loamy

Generally, loamy type soils are deep, well-drained, moderately dark colored, and calcareous. These soils typically occur on gently undulating plains and in the broader valleys of the hills and mountains. Permeability is moderate, water-holding capacity is moderate to high, and runoff is likely after prolonged or heavy rains. Careful management is needed to maintain a cover of desirable forage plants and to control erosion. Reestablishing native plant cover could take 3 to 5 years due to unpredictable rainfall and high temperatures.

These soils generally have cyanobacteria throughout the area, while squamulose, crustose, and gelatinous lichens are occasionally present. These soil crusts are important in binding loose soil particles together to stabilize the soil surface and reduce erosion. Biological soil crusts can contribute positively to soil stability, fixing atmospheric nitrogen, nutrient contributions to plants, water infiltration, and plant growth. They function in the nutrient cycle by fixing atmospheric nitrogen, contributing to soil organic matter, and maintaining soil moisture. In addition, they can act as living mulch, which discourages the establishment of annual/invasive weeds. Structurally they form an uneven, rough carpet that reduces rain drop impact and slows surface runoff. Below the surface, lichen and moss rhizines, fungal hyphae, and cyanobacterial filaments all act to bind the soil surface particles just below and at the surface. Horizontally, they occur in nutrient-poor areas between plant clumps. Because they lack a waxy epidermis, they tend to leak nutrients into the surrounding soil. Vascular plants such as grasses and forbs can then utilize these nutrients.

There is a potential for wind and water erosion due to the erosive nature of these soils once the cover is lost. There is always the potential for soil contamination due to spills or leaks. Soil contamination from spills or leaks can result in decreased soil fertility, less vegetative cover, and increased soil erosion.

4.2 Survey Findings and Mitigation

The soils identified in Chevron's proposed project area are shallow, gypsum, and loamy soils. Some of the proposed project area is located within the proposed ACEC where sensitive gypsum soils are located. The ACEC areas are further discussed in Section 9 of this report.

An area that seems to have been affected by loss of vegetation and slow to no recovery is in Section 18 of T26S, R27E. An area north of an existing producing well (Owl 20504 JV-P Well No.5 [API 30-015-35435] operated by COG Operating LLC) has two areas where vegetation was lost for an unknown reason. There is some erosion damage from the drainage entering the area from the south where a reclaimed pit is located, but there is no evidence of contamination within the drainage area. There does seem to be some chlorides on the barren area, but the source is unknown. This area is of the GC soil classification and is located adjacent to the proposed ACEC gypsum soil.

It is recommended that water controls are added to the road upslope and water bars are placed between the reclaimed pit and this barren area after surface disturbance activities take place. The reclaimed pit to the south will need to have some erosion prevention added to the reclamation procedure to prevent the drainage from road disturbances from washing across this area of sensitive soils.

5 VEGETATION

Vegetation types will vary from area to area due to the soil properties and chemical makeup. Within the HDA, there were three different soil types with gypsum as the primary soil whether at the surface or beneath the other soils. This also allowed for many gypsum soil type vegetation to grow throughout the area. The HDA consisted of three soil types (shallow, gypsum, and loamy), and known plant communities within these soil types are described below.

5.1 Vegetation Types

5.1.1 Shallow Soil Type Plant Communities

The understory of the shallow soil type plant community is mostly made up of warm season, mid- and short-grasses. These include gramas, tridens, curlyleaf muhly, wolftail, dropseeds, threeawn, and green sprangletop. The shrub overstory consists primarily of viscid acacia, yucca, cactus, catclaw, and broom snakeweed. Forbs fluctuate seasonally with rainfall and may include croton, bladderpod, buckwheat, and globemallow.

5.1.2 Gypsum Soil Type Plant Communities

Potential plant communities observed in the gypsum soil type plant community would include gramas, gyp dropseed, and alkali sacaton. The shrub component is made up of four-wing saltbush, mormon tea, acacia whitethorn, spiny althorn, javelin bush, and sumac. Forbs include gyp weed, scarlet guara, globemallow and croton. Shrubs and forbs are a major component of the plant community around draws and drainages.

5.1.3 Loamy Soil Type Plant Communities

Loamy soil types tend to support grasslands with warm season, mid- and short-grasses, with a modest shrub and half-shrub density and a seasonal fluctuation of forb production. The dominant grasses include gramas, tridens, threeawns, muhlys, dropseeds, tobosa, and burrograss. The most common shrubs are tarbush, creosote, mesquite, cactus, and yucca. Forbs include filaree and croton.

5.2 Survey Findings and Mitigation

The vegetation in the area is typical to the types of terrain within the HDA. As the terrain changed, so did the vegetation with some overlap. This area is intermixed throughout with many different types of vegetation growing in different soil types and growing successfully. Vegetation seen throughout the surveyed area were three-awn, grama, burrograss, puff grass, acacia whitethorn, creosote, mesquite, cactus, and yucca.

During the environmental field survey, a variety of grasses, shrubs, forbs, and cacti were observed. Table 3 lists the vegetation observed within and adjacent to Chevron’s proposed project area.

Table 3. Vascular Plant List for the Hayhurst Development Area

Common Name	Scientific Name
CUPRESSACEAE BARTL. CYPRESS FAMILY	
One-Seeded Juniper	Juniperus monosperma (Engelm.) Sarg.
EPHEDRACEAE DUM. EPHEDREA FAMILY	
Torrey Ephedra, Mormon Tea	Ephedra torreyana S. Wats.
BERBERIDACEAE JUSS. BARBERRY FAMILY	
Agarito, Current-of-Texas, Algerita	Berberis trifoliolata Moric.
CACTACEAE JUSS. CACTUS FAMILY	
Nipple Beehive Cactus	Coryphantha macromeris
Purple Prickly Pear	Opuntia macrocentra
Rainbow Hedgehog Cactus	Echinovereus rigidissimus
Fendler's Hedgehog Cactus	Echinovereus Fendleri
Horse Crippler Cactus	Echinocactustexensis
Engelmann's Prickly Pear	Opuntia engelmannii Salm-Dyck.
Indian Fig Prickly Pear	Opuntia ficus-indica (L.) Mill.
Cane Cholla, Tree Cholla	Opuntia imbricate (HAW.) DC
Tasajillo, Pencil Cholla, Christmas Cholla	Opuntia leptocaulis DC.
CHENOPODIACEAE VENT. GOOSEFOOT FAMILY	
Fourwing Saltbush, Chamizo, Chamiza	Atriplex canescens (Pursh) Nutt.
Russian Thistle	Salsola kali L.
POLYGONACEAE JUSS. KNOTWEED FAMILY	
Havard's Buckwheat	Eriogonum havardii S. Watson.
TAMARICACEAE LINK. TAMARISK FAMILY	
Tamarisk, Salt Cedar	Tamarix sp. L.
CUCURBITACEAE GOURD FAMILY	
Coyote Melon, Buffalo Gourd	Cucurbita foetidissima
Deer-Apples, Slimlobe, Globeberry	Ibervillea tenuisecta
CAPPERACEAE JUSS. CAPER FAMILY	
Allthorn, Crown of Thorns, Spiny Allthorn	Koeberlinia spinose Zucc.
FABACEAE LINDL. LEGUME FAMILY	
Catclaw Acacia, Gregg Catclaw	Acacia greggii Gray.

Common Name	Scientific Name
Whitethorn Acacia	Acacia neovernicosa Isley
Honey Mesquite	Prosopis glandulosa Torr.
EUPHORBIACEAE JUSS. SPURGE FAMILY	
Bush Croton, Encinilla, Hierba Loca	Croton fruticulosus Engelm. ex Torr.
RHAMNACEAE JUSS. BUCKTHORN FAMILY	
Javelinabush	Condalia ericoides (Gray.) M.C. Johnst.
Graythorn, Lotebush	Ziziphus obtusifolia (Hook. ex T.&D.) Gray.
ANACARDIACEAE LINDL. SUMAC FAMILY	
Littleleaf Sumac, Desert Sumac	Rhus micorphylla Engelm. Ex Gray.
ZYGOPHYLLACEAE R. BR. CALTROP FAMILY	
Creosotebush, Gobernadora	Larrea tridentata (Sesse & Moc. ex DC.) Cov.
Peganum, African Rue	Peganum harmala L. HARMAL
Goathead, Puncturevine	Tribulus terrestris L.
VERBENACEAE J.St.-Hil. VERVAIN FAMILY	
Blue Verbena, Swamp Verbena	Verbena hastate L.
SCROPHULARIACEAE JUSS. FIGWORT FAMILY	
Big Bend Silverleaf, Big Bend Barometer Bush, Big Bend Cenizo	Leucophyllum minus Gray.
ASTERACEAE DUM. SUNFLOWER FAMILY	
Prairie Broomweed	Ampiachyris dracunculoides (DC.) Nutt.
White Sagebrush, Gray Sagewort, Prairie Sage	Artemisia ludoviciana Nutt.
Broom Snakeweed	Gutierrezia sarothrae (Pursh) Britt. & Ruby.
Guadalupe Goldenweed, Rubber Rabbitbrush	Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird.
Tarbush, Hojase	Flourensia cernua D.C.
Curlycup GumweedURLYCUP GUMWEED	Grindelia squarrosa (Pursh) Dunal
Coulter's Horseweed	Laennecia coulteri (A. GRAY) G.L.
Creeping Zinna, Threadleaf Glowwort	Sartwellia flaveriae A. Gray
Long-Stalk Greenthread	Theleperma longipes Gray.
POACEAE L. GRASS FAMILY	
Silver Bluestem	Bothriochloa laguroides (DC.) Herter.
Sideoats Grama	Bouteloua curtipendula (Michx.) Torr.

Common Name	Scientific Name
Gyp Grama	Bouteloua breviseta Vasey.
Red Grama	Bouteloua trifida S. Wats.
Alkali Sacaton, Wright's Dropseed	Sporobolus airoides (Torr.) Torr.
Gypgrass, Gypsum Dropseed	Sporobolus neallei Vasey
Tobosa	Hilaria mutica (Buckl.) Benth.
AGAVACEAE ENDL. AGAVE FAMILY	
Smooth Sotol, Desert Candle	Dasylirion leiophyllum Engelm. ex Trel.
Soaptree Yucca, Palmella, Soapweed	Yucca elata (Engelm.) Engelm.
Spanish Dagger, Torrey Yucca	Yucca torreyi Shafer.

The vegetation is very diverse throughout the proposed project area. There is an abundance of nesting areas for birds and habitat areas for mammals and herpetofauna species, with patchy and repetitive vegetation across the HDA. There were three different soils types at the surface, but all areas will have gypsum beneath. Shovel samples were taken within each area and regardless of soil type, gypsum was reached within 3 to 14 inches below ground surface.

The shallow soil areas were along slopes and hills and primarily contained grama grass with some annuals in large patches, broom snakeweed, and acacia whitethorn as the primary brush. Yucca grew abundantly in these areas.

The gypsum soils were in areas around draws and drainage bottoms and were heavily vegetated in alkali sacaton with grama grasses along tops of draws and where gypsum outcroppings occurred. Mesquite and acacia whitethorn are the primary brush in these areas and yuccas were abundant.

Loamy soils were found mostly across the plains and lower areas between hills and draws. These soils allow for quicker recovery of vegetation post-disturbance. These areas have an abundance of grama and three-awn grasses, although they also tended to be brushy with creosote as the primary brush. Yuccas were abundant in the loamy soil areas and cholla grew well.

There were a large number of yuccas that did not meet the BLM height recommendation of 5 foot or more for nesting, but were suitable for nesting and excellent habitat for herpetofauna. Several trees were found throughout the area that were used for shade for cattle and co-existing wildlife such as javalina and coyote. These trees and large yucca should be avoided if at all possible. If disturbance is required, mitigation may be needed. There were no other vegetation types of limited availability.

Mitigation for these areas will be to utilize the correct BLM seed mixture (BLM seed mix 1 for loamy soil areas, BLM seed mix 3 for shallow soil areas, and BLM seed mix 4 for gypsum soil areas) when reclaiming areas not needed for daily operations, and avoidance of existing nests for raptors as well as migratory and non-migratory birds. The nests present during the survey have been mapped to enable all surface disturbing activity to be planned outside of a buffer. It is recommended that a follow-up nesting survey be completed two weeks prior to any surface disturbance to determine the level of activity for nests within 200 m of the activity.

6 NOXIOUS WEEDS

There are four plant species within the BLM's Carlsbad Field Office (CFO) that are identified in the New Mexico Noxious Weed List Noxious Weed Management Act of 1998. These species are African rue, Malta starthistle, Russian olive, and salt cedar. African rue and Malta starthistle populations have been identified throughout the CFO and mainly occur along the shoulders of highway, state and county roads, lease roads and well pads (especially abandoned well pads). The CFO has an active noxious weed monitoring and treatment program, and partners with county, state, and federal agencies and industry to chemically treat infested areas and monitor the counties for new infestations.

Any surface disturbance can increase the possibility of establishment of new populations of invasive, non-native species. Construction may contribute to the establishment and spread of African rue and Malta starthistle. The main mechanism for seed dispersion would be via equipment and vehicles that were previously used and/or driven across noxious weed infested areas. Noxious weed seed could be carried to and from the project area by construction equipment and transport vehicles.

6.1 Survey Findings and Mitigation

Noxious weed inventories were conducted along the proposed rights-of-way (ROWs) during the environmental field survey. Because the HDA includes a number of existing oil and gas projects, existing surface disturbances are present in the general area. These previous disturbances have resulted in some populations of a State-listed noxious weed, African Rue, along the existing roads and ROWs and in existing plant communities in the vicinity of the HDA. Cover by noxious weeds in the area was less than 1% of the total plant cover.

Invasive, non-native species included Salt Cedar along the draws and some drainages. Adherence to standard surface-use Conditions of Approval (COAs) would minimize the spread of invasive, non-native species and reduce impacts from these species on other natural resources.

Table 4 lists the location of noxious weeds observed within the HDA. All plants found were African Rue located near new disturbances and along existing roads. All plants were in their first year as there were no visible signs of seed pods around the base of the plants and are shown in Figure 9.

Table 4. Noxious Weeds Within Chevron's Proposed Project Area

Name	Location	Latitude	Longitude
African Rue	On side of road	32.10852	-104.166864
African Rue	On pipeline ROW	32.107874	-104.194662
African Rue	On side of road in draw	32.117943	-104.197829

7 WILDLIFE

The HDA occurs in the Chihuahuan Desert habitat type. The Chihuahuan desert is one of the four most biologically rich and diverse desert ecoregions in North America. Numerous plant species live in this desert. The Chihuahuan Desert stretches from the southeastern corner of Arizona across southern New Mexico and west Texas to the Edwards Plateau in the United States. In New Mexico, Chavez and Eddy Counties, west of the Pecos River, consist largely or entirely of Chihuahuan Desert habitat type. The dominant plant species throughout the Chihuahuan desert is creosote bush. Depending on diverse factors such as type of soil, altitude, and degree of slope, creosote bush can be found in association with other woody and grass species.

The Chihuahuan Desert supports a large number of wide-ranging mammals, herpetofauna, and avian species. Mammals include but are not limited to: pronghorn antelope, mule deer, grey fox, collared peccary, bobcat, desert cottontail, black tailed jack rabbit, kangaroo rat, pocket mice, woodrats and deer mice. Herpetofauna include but are not limited to: Texas horned lizard, greater earless lizard, several species of spiny and whip tail lizards, and several species of venomous and non-venomous snakes. Avian species include but are not limited to the following: greater roadrunner, curve-billed thrasher, scaled quail, Scott's oriole, black-throated sparrow, phainopepla, Worthen's sparrow, and cactus wren. In addition, numerous raptors inhabit the desert and include the great horned owl, burrowing owl, Aplomado falcon, and red-tailed hawk.

The Migratory Bird Treaty Act (MBTA) includes guidance for the protection of native passerines (flycatchers and songbirds) as well as birds of prey, migratory waterbirds (waterfowl, wading birds, and shorebirds), and other species such as doves, hummingbirds, swifts, and woodpeckers. Within the context of the MBTA, "migratory" birds include non-migratory "resident" species as well as true migrants, essentially encompassing most native bird species. The nesting time period is of special importance as the ability to create a nest, incubate, and rear chicks to fledging is a vulnerable time period for birds, and disturbances to nesting activities can lead to larger consequences for individual birds. In addition, because birds are generally territorial during the nesting season, their ability to access and utilize sufficient food is limited by the quality and availability of the territory occupied. During non-breeding seasons, birds are generally non-territorial and able to feed across a larger area and wider range of habitats.

7.1 Survey Finding and Mitigation

Bird, mammal, and amphibian species observed directly or through secondary observations during the environmental field survey in the HDA are summarized in Table 5 below. Additional discussion regarding Threatened and Endangered (T&E) species is provided in Section 8 of this report.

Table 5. Wildlife Observed Within the HDA

Common Name	Scientific Name
Birds	
Burrowing Owl	Athene cunicularia Molina.
Rock Wren	Salpinctes obsoletus Say.
Cactus Wren	Campylorhynchus brunneicapillus Lafr.
Turkey Vulture	Cathartes aura L.
Swainsons Hawk	Buteo swainsoni Bon.

Common Name	Scientific Name
Loggerhead Shrike	Lanius ludovicianus L.
Scaled Quail	Callipepla squamata Vigors.
Greater Roadrunner	Geococcyx californianus Lesson.
Brewer's Sparrow	Spizella breweri Cassin.
Common Nighthawk	Chordeiles minor Forster, JR.
Mammals	
Coyote	Canis latrans Say.
Common Gray Fox	*Urocyon cinereoargenteus Schreber.
Northern Racoon	Procyon lotor Linnaeus.
American Badger	*Taxidea taxus Schreber.
Western Spotted Skunk	*Spilogale gracilis Merriam.
Feral Pig	*Sus scrofa Linnaeus.
Collared Peccary	Pecari tajacu Linnaeus.
Mule Deer	Odocoileus hemionus Rafinesque.
Mexican Ground Squirrel	Spermophilus mexicanus Erxleben.
Yellow-Faced Pocket Gopher	*Cratogeomys castanops Baird.
Kangaroo Rat Species	*Dipodomys sp. (D. merriami Merns, D. ordii Woodhouse, D. spectabilis Merriam are possible)
Hispid Cotton Rat	Sigmodon hispidus Say and Ord. *Neotoma sp. (N. Leucodon Merriam., N. micropus Baird. are possible)
Woodrat Species	*Neotoma sp. (N. Leucodon Merriam., N. micropus Baird. are possible)
Desert Cottontail	Sylvilagus audubonii Baird.
Black-Tailed Jackrabbit	Lepus californicus Gray.
Herpetofauna	
Ornate Box Turtle	Terrapene ornata Agassiz.
Texas Horned Lizard	Phrynosoma cornutum Harlan.
Round-Tailed Horned Lizard	Phrynosoma modestum Girard
Little Striped Whiptail	Cnemidophorus (Aspidoscelis) inornatus Baird
Gophersnake	Pituophis catenifer Blainville.
Western Diamond-Backed Rattlesnake	Crotalus atrox Baird and Girard.

* Species observed through secondary observations (i.e., scat, tracks, burrows, middens, etc.)

Chevron's proposed project could displace some raptors and other migratory birds over the life of the development and operation. There is an abundance of vegetation suitable for nesting raptors, so it is unlikely that Chevron's proposed project would greatly affect the available vegetation suitable for raptors to build nests. Therefore, while habitat loss and associated habitat fragmentation may affect a small number of individual migratory or resident birds, these impacts are likely to be insignificant at the population or species levels.

Construction activities undertaken during the nesting season could result in the destruction of active nests, including any eggs or young within the nests. To reduce these potential impacts, raptor and burrowing owl surveys were conducted to identify nests and burrows. All development can be planned around these areas to prevent disturbance of nesting areas for raptors and burrows for owls. Additional surveys of the identified nesting areas, and possible new nests constructed in the interim prior to the start of construction, should be completed at least two weeks prior to vegetation removal. The BLM CFO Resource Management Plan (RMP 1997) requires a 200 m buffer around active raptor nests during nesting season (estimated to be March 1 through August 31 pending weather conditions) and the BLM CFO generally requires a 50 m buffer during the non-nesting season around inactive raptor nests (estimated to be September 1 to February 28). It is recommended that surface disturbing activities be initiated in the non-nesting months when possible in order to minimize the possibility of disturbing raptors during nesting season. The recommendation that surface disturbing activities take place during the non-nesting season would allow construction activity to be adjacent (50 m) to inactive nests. Figure 10 depicts locations of observed raptor nests and burrowing owl holes.

Figure 11 shows all other nests in the area for residential (non-migratory) birds to avoid during nesting season. These should also have follow-up survey prior to vegetation removal to ensure there are no inhabitants.

Numerous wildlife water sources have been installed within the boundaries of the BLM CFO (discussed in Section 3 of this report). These wildlife water sources are important to all wildlife in the desert ecosystem as they provide readily available water and areas of sanctuary for wildlife species in the area. No wildlife water sources are located within Chevron's proposed project area; however, one Wildlife Habitat Project Avoidance is located directly north of the buffer area for the ROW in Section 3-4, T26S, R27E (Figure 12).

8 SPECIAL STATUS SPECIES

There are 17 T&E species listed within Eddy County, New Mexico; however, of those, only two have the potential to occur within the HDA based on habitat in the area (Figure 13).

8.1 Texas Hornshell Mussel

The THM is a bivalve mollusk; the outer shell surface appears olive green to dark brown and they may grow as long as 7 inches. Inside the shell is a muscular foot for movement, siphons for water exchange, gills, and the viscera.

The THM occurs in clays, silts, sands, and sand-cobbles accumulated in undercut riverbanks, crevices, shelves, and at the base of large boulders at depths of 0.8 to 4.5 feet and at flow rates of 0.78 to 29.5 inches per second, often in colonies and at the head or lower end of travertine runs (Carmen 2007). The species imbeds itself in softer bottoms, exposing only the siphonal areas in such situations. In rocky sites, it lodges itself in cracks and crevices. In the latter situation, the species is likely immobile, whereas it undoubtedly moves about in substrates such as mud and sand. The THM is known to thrive where there are no or low levels of pollutants, such as the Black River and Delaware River located in Southern Eddy County. A map showing the distribution of the THM in the HDA is provided in Figure 14.

8.2 Wild Gypsum Buckwheat

Wild Gypsum Buckwheat (WGB) is a small woody plant with dense clumps that reach 20 centimeters (cm). The leaves are dark green, thick, and fairly smooth. The leaves are approximately 1-3 cm wide and attached at the base. The small flower is white to yellow in color. WGB is found near the Black River in Sections 3-4 and 9-10 of T25S, R26E and in a drainage area leading into a draw west of the HDA in Sections 21-22 and 27-28 of T25S, R26E. Figure 14 shows the distribution of the WGB in the HDA.

8.3 Survey Findings and Mitigation

The environmental field survey of the HDA indicated no suitable habitat for the THM in Chevron's proposed project area. THM habitat is known to be along the Black River and has been introduced into the Delaware River. The tributaries or drainages in the area of the HDA tends to flow south to southeast to a main tributary that flows east. The Black River sets to the northwest 2.86 miles, the Pecos River sets 5.24 miles to the east, and the Delaware River is sets 4.04 miles to the southeast from the closest point of Chevron's proposed project area. The THM tributaries near the HDA with buffers from these tributaries are depicted in Figure 14. A 100 m tributary buffer shows the area to avoid or minimize the need for disturbance. This area will have maintained roads, off-road two tracks, or short term impacts such as buried pipelines, but no long-term disturbances such as well pads or facilities. The 200 m buffer area is shown to avoid or minimize impacts from well pads or facilities. This area also falls into the 100-year flood zone. Well pads do fall within this area, but best management practices along with the protection of the THM, will limit this access.

The environmental field survey of the HDA identified no WGB in Chevron's proposed project area. There are two WGB habitats near the Black River, located 2.86 miles northwest from the closest point of Chevron's proposed project area and southwest of Black River, located 3.1 miles west of closest point of Chevron's proposed project area. The WGB habitats near the HDA are depicted on Figure 14. WGB should not be impacted by the development of this proposed project.

9 AREAS OF CRITICAL ENVIRONMENTAL CONCERN

ACEC designation indicates to the public that the BLM recognizes that an area has significant value and has established special management measures to protect those values. It also serves as a reminder that significant value or resources exist that must be accommodated for future management actions and land use proposals. According to the BLM CFO RMP / Environmental Impact Study (EIS) for gypsum soils, the HDA has qualities or circumstances that make it fragile, sensitive, rare, irreplaceable, exemplary, unique, endangered, threatened, or vulnerable to adverse change (Figure 15).

During a meeting with the BLM, it was discussed that there was a proposed ACEC within the HDA. The proposed ACEC is covering an area mainly around the draws and drainages, containing three sensitive gypsum soils (Figure 16). These soils are known as CR, GC, & RG (Figure 8). These gypsum soils tend to be located along the banks and sidewalls of draws and in bottom of drainages. Erodibility and the inability to vegetate makes these soils extremely sensitive. Once disturbance is initiated, re-vegetating will take several years to accomplish, so soil disturbing activities and overgrazing can be a major concern. These areas are highly probable to contain dry sinkholes, and surface water is not attainable; furthermore, good quality groundwater is hard to locate. High temperatures and unreliable rainfall also contribute to the difficulty of revegetating.

9.1 Survey Findings and Mitigation

The gypsum soil ACEC areas should be avoided as much as possible during development. If avoidance cannot be attained, careful planning of disturbing activities, reclamation, and vigorous revegetating in areas not needed for daily activities should take place. These soils tend to be susceptible to wind erosion, especially when the seedbed is being prepared and the soil is bare. All areas that are reclaimed should be tracked or trodden in order to prevent the soils from wind erosion. These areas should be seeded with an alkali sacaton and 4-wing saltbush seed mix (BLM seed mix 4) to ensure quick recovery and erosion prevention. Since vegetation is difficult to establish, these areas should be seeded in the fall to take advantage of winter moisture and get a head start on annual weeds. If winter moisture is not available, these areas should be watered long enough to establish a good root. Quick revegetation will protect these sensitive soils from water erosion.

10 PALEONTOLOGICAL

The current classification system utilized by the BLM for assessing impacts to fossil resources is the Potential Fossil Yield Classification (PFYC) System. This system classifies geologic units based on the relative abundance of vertebrate fossils or scientifically important invertebrate and plant fossils and their sensitivity to adverse impacts. This classification is applied to a geologic formation, member, or other distinguishable unit. This classification system recognizes that although significant fossil localities may occasionally occur in a geologic unit, a few widely spaced localities do not necessarily indicate a higher class. The primary purpose of the PFYC System is to assess the possible impacts from surface disturbing activities and help determine the need for pre-disturbance surveys and monitoring during construction.

All bedrock geologic deposits within the HDA are considered PFYC 2. Bedrock in the project area is Permian in age (about 299 to 251 million years ago). Previous geologic mapping and field observations indicate that deposits include the upper Salado Formation and lower Rustler Formation (King 1949; NMBGMR 2003). The Salado Formation is generally composed of evaporites such as halite, which are typically devoid of fossils (NMBGMR 2003). The lowermost Rustler Formation is composed of about 120 feet of siltstone, gypsum, and very fine-grained sandstone. These deposits are in turn overlain by approximately 30 feet of dolomite and 115 feet of gypsum (Vine 1963). No fossils are known from the Rustler Formation of New Mexico, but mollusk fossils (e.g., brachiopods, pelecypods, gastropods) have been identified in the lower Rustler Formation in Culberson County, Texas within dolomite, siltstone, and limestone units (Walter 1953). Quaternary alluvial deposits are likely Holocene or upper Pleistocene (NMBGMR 2003) and are also considered PFYC 2 deposits.

10.1 Survey Findings and Mitigation

A specific paleontological survey of the project area was not conducted; however, no fossils were incidentally observed during the environmental field survey of the HDA. Although, this area is classified as a PFYC 2, if at any time fossils are discovered, all activities must stop and the BLM must be contacted within 24 hours. A BLM paleontological zoning map is provided as Figure 17.

11 KARST

The term karst describes distinct terranes that are attributable to high solubility of underlying bedrock. Common features of such terranes include sinkholes and caves, which are formed as the bedrock is dissolved by groundwater. Karst aquifers represent saturated bedrock where its permeability has been enhanced by dissolution processes. Such aquifers can be important sources of potable groundwater.

The HDA lies near the western end of the Delaware Basin, and is situated predominantly in a region referred to as the Gypsum Plain (Hill 1996). Bedrock cropping out beneath the proposed project area is predominantly the Castile Formation, although a relatively thin veneer of the overlying Rustler formation may be present in the western portion of the area. The Salado formation, which regionally occurs between the Rustler and Castile formations, is absent beneath the HDA. The bedrock geology of the proposed project area and the surrounding area is discussed in greater detail in Section 12 of this report.

The Castile and Rustler formations are highly soluble and karst development in them (i.e., sinkholes and associated caves) is well recognized, particularly in the Gypsum Plain. Stafford et al. (2008) prepared a karst potential map for the Castile Formation outcrop which includes the majority of the HDA. That map shows that karst development is distinctly clustered in the region. The two densest regions of karst development occur within approximately three miles of the western limits of the HDA (Figure18); however, most of the proposed project area is situated in an area where karst development is expected to be less intense. The northernmost of these two regions contains the second longest known gypsum cave in North America and is largely included in a BLM critical resource area that does not allow for surface occupancy (Stafford et al. 2008). Sinkholes play an important role in recharging groundwater to underlying aquifers by allowing rapid infiltration of precipitation during and following rainfall events. As such, mitigation measures would be required in development areas to prevent contaminants from entering sinkholes.

11.1 Survey Findings and Mitigation

Karst features were identified within the HDA. Included in these findings were one large collapsed doline (also known as sinkholes), one small collapsed doline, two mammal holes that collapsed due to water intake, and a number of closed depressions and fissures.

A 200 m buffer was placed around all collapsed sinkholes and a 50 m buffer was placed around all closed depressions and fissures. It is recommended that the closed depressions and fissures are investigated by a Karst Specialist from the BLM for categorizing the importance of these features. Mitigation can be completed to protect these features by placing all long term disturbances such as pads and facilities horizontally from features and berming all pads to prevent any contaminants from potentially reaching the feature. Monitoring these features and reporting to the BLM of any changes in the feature would then be required. Outcroppings were also identified during the survey due to the possibility of uncovering a void. There are no buffers for outcroppings, but careful attention around these outcroppings is warranted.

During construction activities, if a void occurs, all activities must stop immediately. The BLM should then be contacted within 24 hours to devise the best management plan to protect karst and human safety. These voids could occur in any area of the HDA. There were a number of outcroppings (rock and gyp) where voids are possible and close attention and further evaluation should be required for human safety.

During the meeting with the BLM in October 2015, it was recommended that geophysical surveys be performed to identify any shallow voids within the construction area. If any shallow voids should be discovered, the BLM should be

contacted prior to any construction activities to devise a plan to best manage these features. Karst potential is found to be medium in the southeastern portion of the project area and high in all other areas. The zoning of these potential karst levels is illustrated on Figure 19. A map showing observed karst sinkholes features is provided in Figure 20, observed closed depressions and fissures in Figure 21, and all outcroppings in Figure 22.

12 HYDROLOGY

Potential impacts due the construction and operation of Chevron's proposed project to water resources in the HDA were evaluated by comparing the location of these features (ponds, streams, wetlands, etc.) to the proposed surface disturbance. The analysis is based on the examination of Carlsbad BLM RMP 1988 and evaluation of data compared to the environmental field survey.

12.1 Surface Hydrology

Chevron's proposed project area is situated approximately 18 to 30 miles south of the City of Carlsbad and between State Highway 62/180 to the west and State Highway 285 to the east. This area is characterized by relatively flat to gentle sloping terrain dissected by tributary draws of the Pecos River (Figure 23).

Surface water within the HDA is affected naturally by geology, precipitation, and water erosion. The area is located in the semi-arid southwest on the northern edge of the Chihuahuan Desert, where annual precipitation averages 10.5 inches with the greatest rainfall occurring as monsoonal storms in late summer (July – September). About half of the annual precipitation is received during this period via brief, intense storms that can cause large amounts of runoff and potential flooding (Lower Pecos Valley Regional Water Plan 2001).

Southern Eddy County, including Chevron's proposed project area, lies within the Lower Pecos River Basin. The major stream flowing through this part of the county is the Pecos River. Surface water in the Lower Pecos River Basin comes from three main sources: inflow from the Upper Pecos River Basin, flood inflow from storm events, and groundwater base inflow. The Pecos River bisects Eddy County and runs through the center of the City of Carlsbad. The Pecos River is dammed by Brantley Dam and by Avalon Dam 10-miles northwest and 5-miles north of Carlsbad, respectively, and by Red Bluff Dam located just across the New Mexico – Texas State line.

Several Pecos River tributary draws, including Red Bluff Draw, North and South Hackberry Draws, Cottonwood Draw and Hay Hollow Draw all of which feed into Red Bluff Draw, and Owl Draw (which feeds into Delaware Draw) traverse the HDA and join the Pecos River east of State Highway 285. These are ephemeral streams that typically contain and carry water only for short periods of time following precipitation. Temporary ponded water has been observed along these draws for some time after heavy rains.

The Black River is a perennial stream and tributary of the Pecos River that is located west and northwest of the HDA. It flows to the northeast and joins the Pecos River east of State Highway 285 and northeast of Chevron's proposed project area.

Anthropogenic activities that currently affect surface water resources in the HDA include livestock grazing management and oil and gas development. Surface water flow direction for various parts of the HDA depends on the specific location relative to the nearby tributary draw of the Pecos River. At its closest point, the Pecos River is located approximately 5.5 miles east of the HDA. Flow in the tributary draws is generally to the northeast and east.

12.2 Floodplain

Executive Order 11988 (Floodplain Management) requires Federal agencies to take action to reduce the risk of flood loss; to minimize the impact of floods on human safety, health, and welfare; and to restore and preserve the natural and beneficial values served by floodplains. Floodplains are relatively low, flat areas of land that surround some rivers and waterbodies and convey overflows during flood events. Floodwater energy is dissipated as flows spread out over

a floodplain, and significant storage of floodwater can occur through infiltration and surficial storage in localized depressions on a floodplain.

Current management provides protection from permitted surface-disturbing activities within up to 200 m of the Federal Emergency Management Agency (FEMA) 100-year floodplain seen in Figure 24. Aboveground facilities should avoid floodplains and waterbodies to the maximum extent possible. Eddy County oil and gas ordinance does not require specific management practice, but does have a setback provision: “Drilling location requiring that oil and natural gas wells be located at least 300 feet away from a residence, mercantile establishment, school or church without written consent of the owner.” It should be noted that any oil or gas well in a floodplain must comply with Eddy County’s Flood Plain Management Ordinance (New Mexico County and Municipal Law).

12.3 Wetland and Riparian Areas

Wetlands are defined as “areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of wetland vegetation typically adapted for life in saturate soil condition” (USACE 1987). Section 404 of the Clean Water Act (CWA) provides for the protection of waters of the US through regulations of the discharge of dredged or fill materials. Wetlands occur in spaces between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water (Cowardin et al. 1979). Wetlands must have one or more of the following three attributes:

- At least periodically, the land supports predominantly hydrophytes;
- The substrate is predominantly undrained hydric soil; and
- The substrate is non-solid, is saturated with water or covered by shallow water at some time during the growing season of each year.

12.4 Subsurface Hydrology

12.4.1 Shallow Geology

The HDA is underlain by the Permian Castile and Rustler formations (Figure 25). The Castile Formation outcrops to the west of the project area in the Gypsum Hills. The Rustler formation outcrops to the east of the HDA (and east of the Pecos River in the Rustler Bluffs) and is underlain by the Castile Formation west of the river and the Salado Formation east of the river. The Rustler outcrop area extends to the north in a narrow band to the Chaves county line and the formation dips to the east. Strata belonging to the Triassic Dockum Group outcrops to the east of the Rustler outcrop. Alluvium occurs to the north and west of the project area along the Pecos River and the Black River. The Capitan Reef occurs to the west and northwest of the HDA.

Geologic units in the HDA and nearby that contain potentially usable groundwater are the Pecos Alluvium, Rustler Formation, and the Dockum Group. The western leg of the reef in Eddy County and Culberson County is very productive, but it occurs well to the west, northwest and north of the HDA.

Southeast of the Black River, gypsum of the Castile formation outcrops in the escarpment of the Gypsum Hills. Farther to the east near the Pecos River, the Castile Formation is overlain in places by redbeds, limestone and gypsum of the Rustler formation (Hendrickson and Jones 1952). East of the Pecos River, the Castile Formation is overlain by the Salado Formation.

12.4.2 Carlsbad Basin

The HDA occurs within the Carlsbad Groundwater Basin which encompasses approximately 2,347-square miles located in the southern region of Eddy County. This basin extends east into Lea County, south of Carlsbad to the state line and west to the Guadalupe Mountains. The Pecos River enters the basin in the northwest corner and exits the basin near the south-central part of the basin.

Groundwater uses include agriculture; public supply for Carlsbad, Loving, and other towns; and industrial uses, including mining for potash and salt. Groundwater supplies in the Carlsbad Basin are derived from underlying sedimentary formations, including the Delaware Mountain Group, the Carlsbad and Capitan Limestones, the Castile Formation, the Rustler Formation, and the Dockum Formation, as well as shallower alluvium and terrace deposits. The primary groundwater supplies come from Capitan and Carlsbad Limestone Reef Aquifer (Capitan Reef) and the shallow groundwater found in alluvium and terrace deposits. Irrigation wells have primarily been developed in the farming areas from Carlsbad south to Malaga, and along the Black and Delaware Rivers. Groundwater quality varies from good to poor (Figure 26).

Water Well and Water Quality Information – HDA

In the HDA, neither the Rustler Formation nor the Castile Formation has sufficient porosity and permeability development (aside from karst features) to yield productive water supply wells. Several relatively shallow water wells have been drilled in the area that are used primarily to support stock watering (Figure 27) and well yields are low – typically less than 5 gallons per minute (gpm). Water well depths range up to 351 feet, but most of the wells are less than 100 feet deep. No recent water level data for these wells have been found in the New Mexico Office of the State Engineer (OSE) database. In the outcrop area of the gypsum of the Castile Formation (near the Black River), the groundwater quality reflects high calcium and sulfate content derived from the gypsum and is undesirable for human consumption (Hendrickson & Jones 1952). The sulfate content increases from west to east toward the Pecos River and the chloride content of the water increases near the Pecos River, likely due to water from a brine aquifer at the base of the Rustler formation near Malaga Bend.

12.5 Survey Findings and Mitigation

Figure 24 (FEMA 100-year flood plain map) shows the 100-year flood plain in the HDA as delineated by FEMA. Except for original roads and ROW's, the HDA is not located in any new paths within the 100-year floodplain zones. These areas will need to be widened for temporary disturbance for buried pipelines, but this could be mitigated and completed during the dry season.

Some mitigation has taken place from previous actions by adding culverts or low water crossings. When new construction activities begin, these mitigation measures need to be carried through the new project work and/or protected to prevent damage during on-going construction.

Other mitigation measures would be to reclaim pipeline ROWs by mixing soil with straw or similar to increase the potential for the soil to bind in place, aid vegetation growth by protecting seed, holding moisture in the soil and reduce the likelihood of erosion. Rubble can be used to prevent soil erodibility where water movement could be present. Silt ponds should be placed in all low lying areas surrounding construction areas to capture any material run-off from roads or pads. Mineral material from pads and roads could cause vegetation loss due to change in soil chemistry. If native material is used, silt ponds will not be needed.

Monitoring should take place to ensure mitigation strategy is effective through-out the life of the project. If the mitigation strategy should become ineffective, an on-site with the BLM should be scheduled to devise the best management plan to protect the 100-year flood plain.

Small portions of the buffer zones for three development areas touch or slightly impinge on the 100-year flood plain for the North Hackberry Draw and the Hay Hollow Draw, but no installations (drilling pads, oil or saltwater tanks, etc.) will be located less than 200 m away from the 100-year flood plain.

Most of the identified water wells are not located within the survey area for the HDA. One well situated along Whites City Road in Section 2, T26S, R27E is located within the survey area but it is buffered for 200 m from any planned installations (Figure 27).

No wetlands were identified within the HDA; therefore, there would be no potential impacts to wetlands.

No riparian areas were identified within the HDA; therefore, there would be no potential impacts to riparian areas.

13 CULTURAL

Cultural resources are fragile and nonrenewable remains of prehistoric and historic human activity, occupation, or endeavor as reflected in districts, sites, structures, buildings, objects, artifacts, ruins, works of art, architecture, and natural features. Cultural resources comprise the physical remains themselves and the areas where significant human events occurred.

The National Historic Preservation Act (NHPA) of 1966 and the Archaeological Resource Protection Act of 1979 provide for the protection of significant cultural resources and traditional cultural properties. Section 106 of the NHPA describes the process that Federal agencies must follow to identify, evaluate, and coordinate their activities and recommendations concerning cultural resources. Significant cultural resources are defined as those listed on, or eligible for, listing on the National Register of Historic Places (NRHP) and are referred to as historic properties.

13.1 Survey Findings and Mitigation

Survey findings will remain confidential but will be supplied under separate cover to State Historic Preservation Offices (SHPO) and the BLM.

All cultural resources must be avoided. If any cultural resources are discovered while construction activities are taking place, construction activities must cease and the BLM will be contacted within 24 hours.

14 OTHER OBSERVATIONS

14.1 Existing and Former Operations

Several buried lines from different operators are in place or are in the process of being constructed and will need to be avoided or mitigated when crossing.

During the surveys, there were some plugged wells that may or may not have been reclaimed. The locations of these wells are listed in Table 6 below with constraints and mitigation that will need to take place.

Table 6. Plugged Wells within the HDA

Latitude	Longitude	Qtr.Qtr.-S-T-R	Constraint	Mitigation
32.05643	104.197579	NESW-9-26-27	P&A with former pit within the planned ROW.	Pit is to the north and should be avoided. It is recommended that this area should be fenced off to prevent spread of pit contaminants.
32.09266	104.15314	NE/NE-35-25-27	P&A with former pit at left edge of ROW buffer.	Pit is to the north and should be avoided. It is recommended that this area should be fenced off to prevent spread of pit contaminants.
32.106698	104.155914	NENE-26-25-27	P&A with former pit in left 200' of ROW buffer	Pit looks to be to the south and should be avoided. It is recommended that this area should be fenced off to prevent spread of pit contaminants.
32.106575	104.188614	NENE-28-25-27	P&A with former pit - reclaimed	Pit is unknown, but should be avoided to prevent spread of pit contaminants.
32.12085	104.154558	NENE-23-25-27	P&A with former pit at the left edge of planned ROW	Pit is to the north and should be avoided. It is recommended that this area should be fenced off to prevent spread of pit contaminants.
32.150922	104.167401	NWNW-23-25-27	P&A with former pit inside the left 400' ROW buffer	Pit is to the north and should be avoided. It is recommended that this area should be fenced off to prevent spread of pit contaminants.
32.125542	104.16869	SWSW-14-25-27	P&A with former pit inside the right center ROW buffer	Pit looks to be to the south and should be avoided. It is recommended that this area should be fenced off to prevent spread of pit contaminants.

Latitude	Longitude	Qtr.Qtr.-S-T-R	Constraint	Mitigation
32.132611	104.232618	SENW-18-25-27	P&A with former pit inside the right edge of ROW	Pit is unknown, but should be avoided to prevent spread of pit contaminants.
32.058778	104.145652	SENW-12-26-27	P&A with former pit inside the right edge of ROW	Pit is unknown, but should be avoided to prevent spread of pit contaminants.
32.054613	104.209766	NWSE-8-26-27	P&A with former pit inside the north edge of 1000' buffer	Pit is unknown, but should be avoided to prevent spread of pit contaminants.
32.139138	104.185301	SWSW-10-25-27	P&A with former pit inside the north edge of 1000' buffer	Pit is unknown, but should be avoided to prevent spread of pit contaminants.
32.139138	104.185301	NWNE-23-25-27	P&A with former pit inside the south edge of planned ROW	Pit is unknown, but should be avoided to prevent spread of pit contaminants.

14.2 Slopes

Other constraints that will need to be mitigated with design features in plan will be slopes (Figure 28) and hills (Figure 29). The mitigation would include developing around hills and through areas with less slope and reclamation of these areas to prevent erosional damage to lower lying areas.

15 RECOMMENDATIONS

With careful planning of well pads, facilities, SWD wells, frac ponds, and ROWs within this area of development, impacts will be low in sensitive areas and moderate in non-sensitive areas. Roads are in place for most of the project area with the majority maintained by the county, and the ROWs or corridors are in place for a portion of the proposed project area. Keeping the footprint of these corridors as small as possible is highly recommended as the overall amount of impact will drive the BLM approval process. The following provides a summary of the recommendations for each of the resources evaluated during the field event.

15.1 Soils

A 200 m buffer should keep most construction activity from damaging the sensitive gypsum soils surrounding the draws, but the construction that will need to be within the proposed gypsum ACEC will need to be kept to a minimum or be mitigated to have minimal impacts to these sensitive areas.

15.2 Vegetation and Wildlife

It is recommended that all surface disturbing activities within 200 m of active raptor nests occurs between the months of September 1 to February 28 (outside of nesting season) in order to avoid nesting raptors or birds. Nesting surveys should be completed two weeks prior to any surface disturbance to verify nests are not active with late or early bloomers. The BLM CFO generally requires a 50 m buffer during the non-nesting season (estimated to be September 1 to February 28) for inactive raptor nests. At the onsite inspections, Chevron could discuss the proposed activities and associated mitigation with the BLM Natural Resource Specialist to potentially allow the proposed activities to occur within 50 m of inactive raptor nests.

15.3 Special Status Species

BLM and Chevron should work closely to avoid all possible impacts to the THM. A Candidate Conservation Agreement (CCA) / Candidate Conservation Agreement with Assurances (CCAA) is currently in process to aid in the mitigation for the THM and participation is highly recommended. The largest threat to the THM is loss of water, decline in water quality, and low water crossings. Well siting will be important along with adequate spill containment measures, and erosion will need to be mitigated heavily in order to not impact the THM.

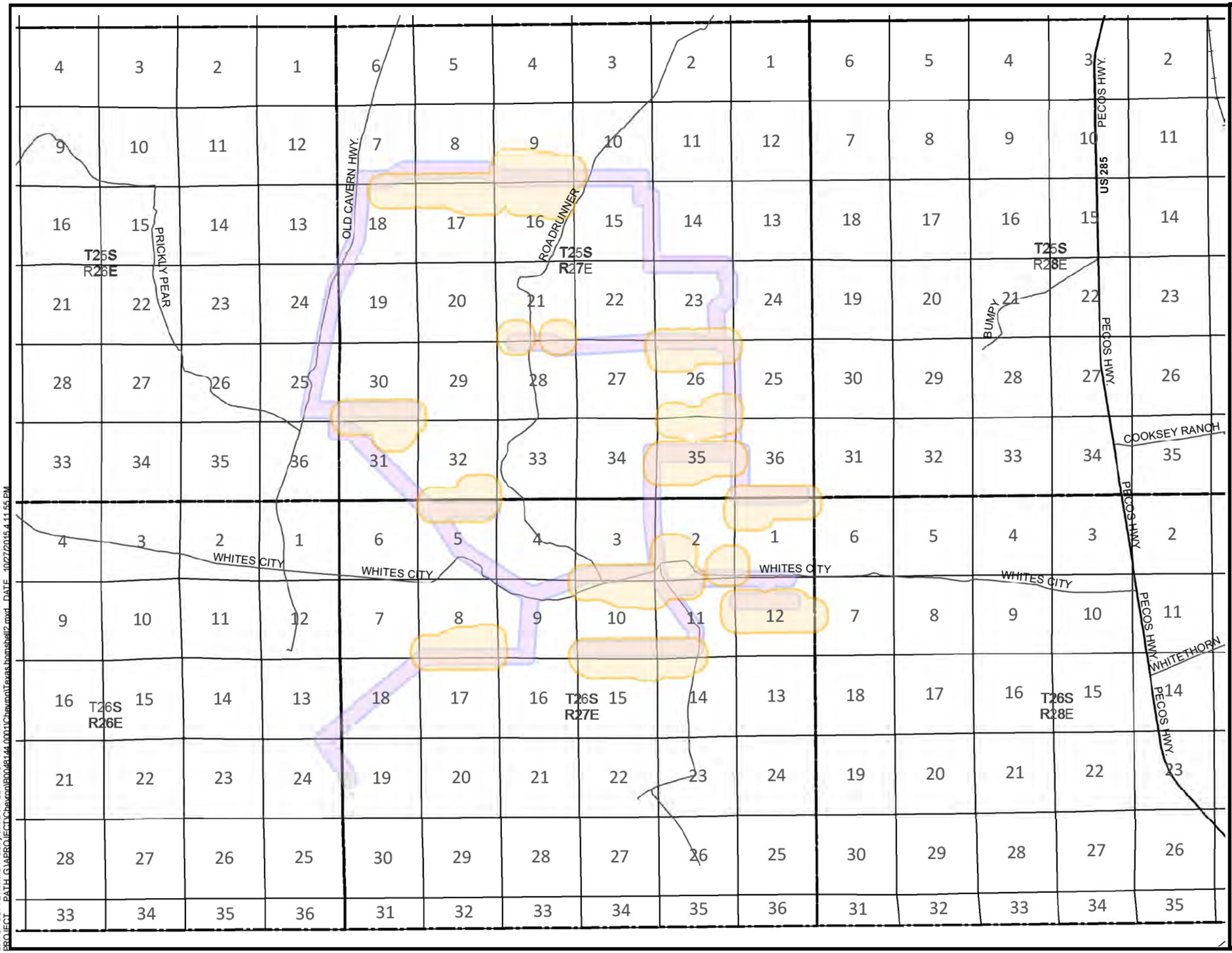
15.4 Karst

It is recommended that Chevron meet with the BLM to review the smaller karst features referred to as closed depressions and fissures. Various methods are available if the BLM decides they would like to have further evaluation of these areas. Depending on the depth of the desired evaluation, electro-resistivity, electro-magnetic, ground penetrating radar, and seismic technologies can be utilized. It is recommended that further evaluation is completed to maximize the efficiency of both Chevron and BLM efforts.

15.5 Hydrology

Early planning on the construction designs for crossing drainages is very important. These designs need to take into account that some of the draws can bring enough water to wash out a road or pad during peak rain seasons. These drainages should be allowed to pass through or reroute around unless the construction is at the start of a drainage. It is recommended that silt ponds be constructed to prevent any pad material washing down drainages.

FIGURES



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships

0 1 2

Miles

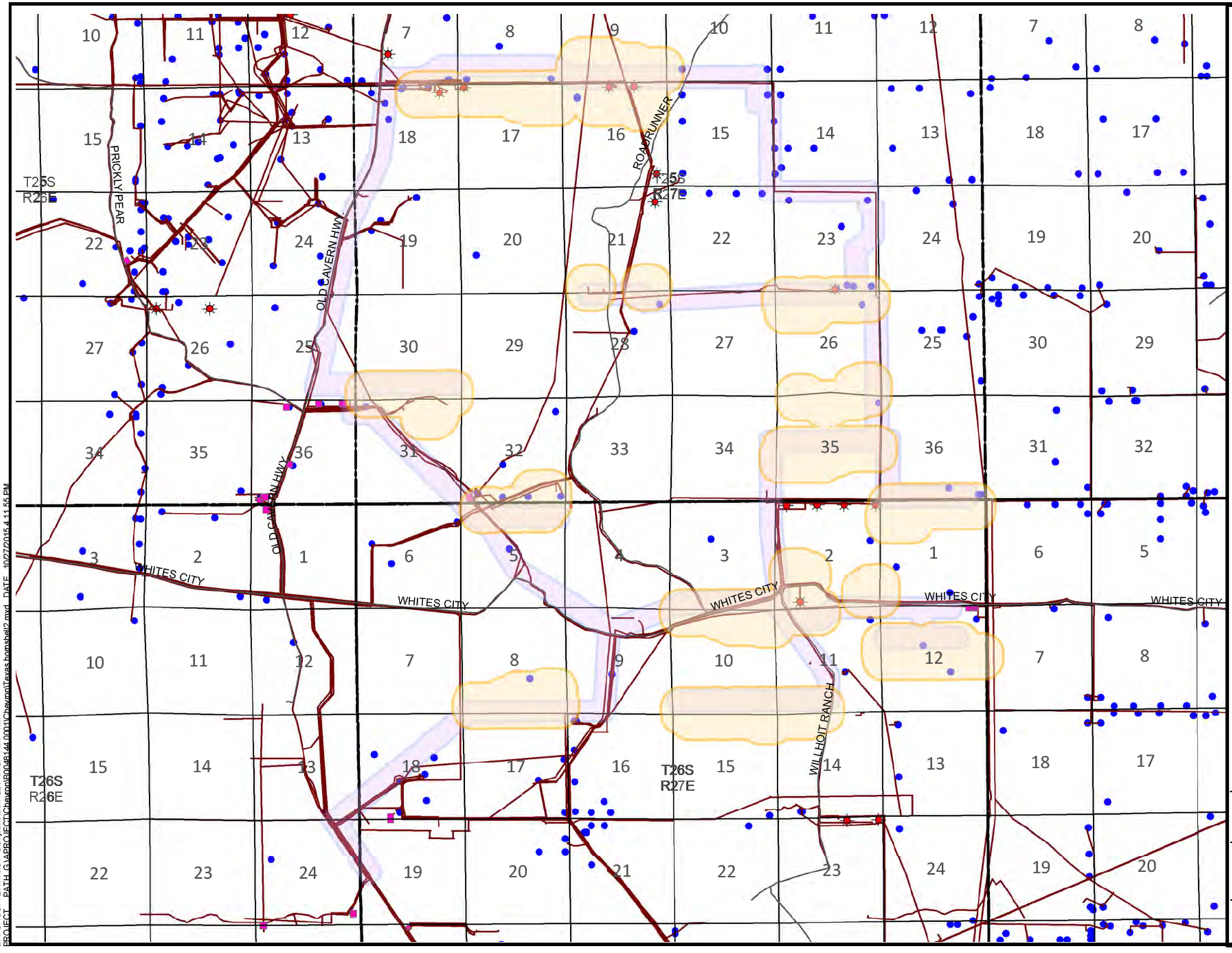
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

ENVIRONMENTAL FIELD SURVEY AREA

ARCADIS

FIGURE 1

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH: G:\APROJECT\Chevron\E00481440001\Chevron\Texas bomshell2.mxd DATE: 10/27/2015 4:11:55 PM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- Pads
- ROWs
- Chevron's Wells
- Completed Wells

0 1 2
Miles

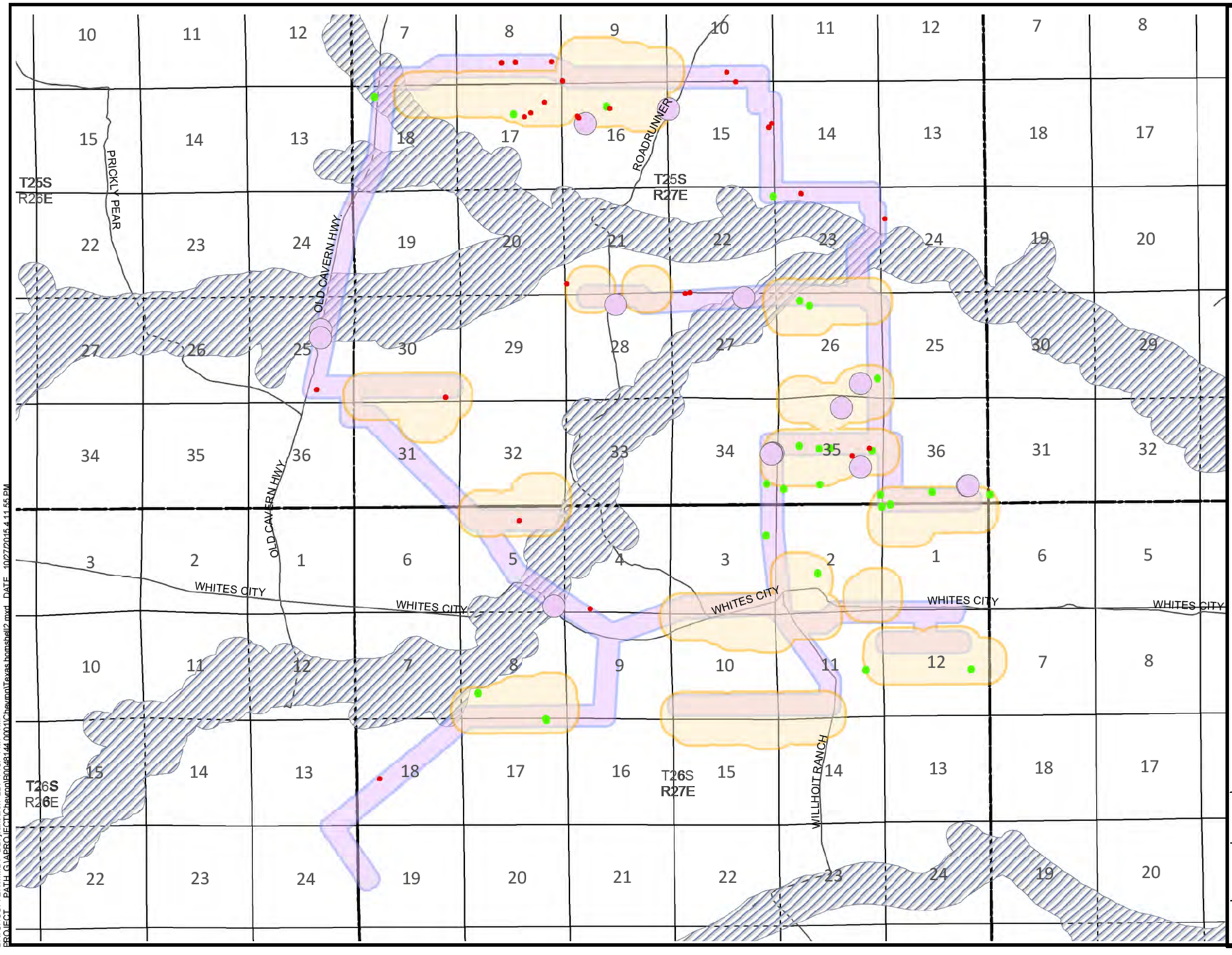
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

EXISTING DEVELOPMENT

ARCADIS

FIGURE 2

DIV/GROUP: ENV/EMDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH: G:\APROJECT\Chevron\B0048144.0001\Chevron\Texas bonnshell2.mxd DATE: 10/27/2015 4:11:55 PM



LEGEND

- Eddy County Roads
- Sections
- Townships
- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- 200 m Avoid & Minimize Buffer
- 200 m Sinkholes Buffer
- 25 m Raptor Buffer
- 50 m Closed Depressions Buffer

0 1 2

Miles

CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

KEY CONSTRAINT FINDINGS

ARCADIS

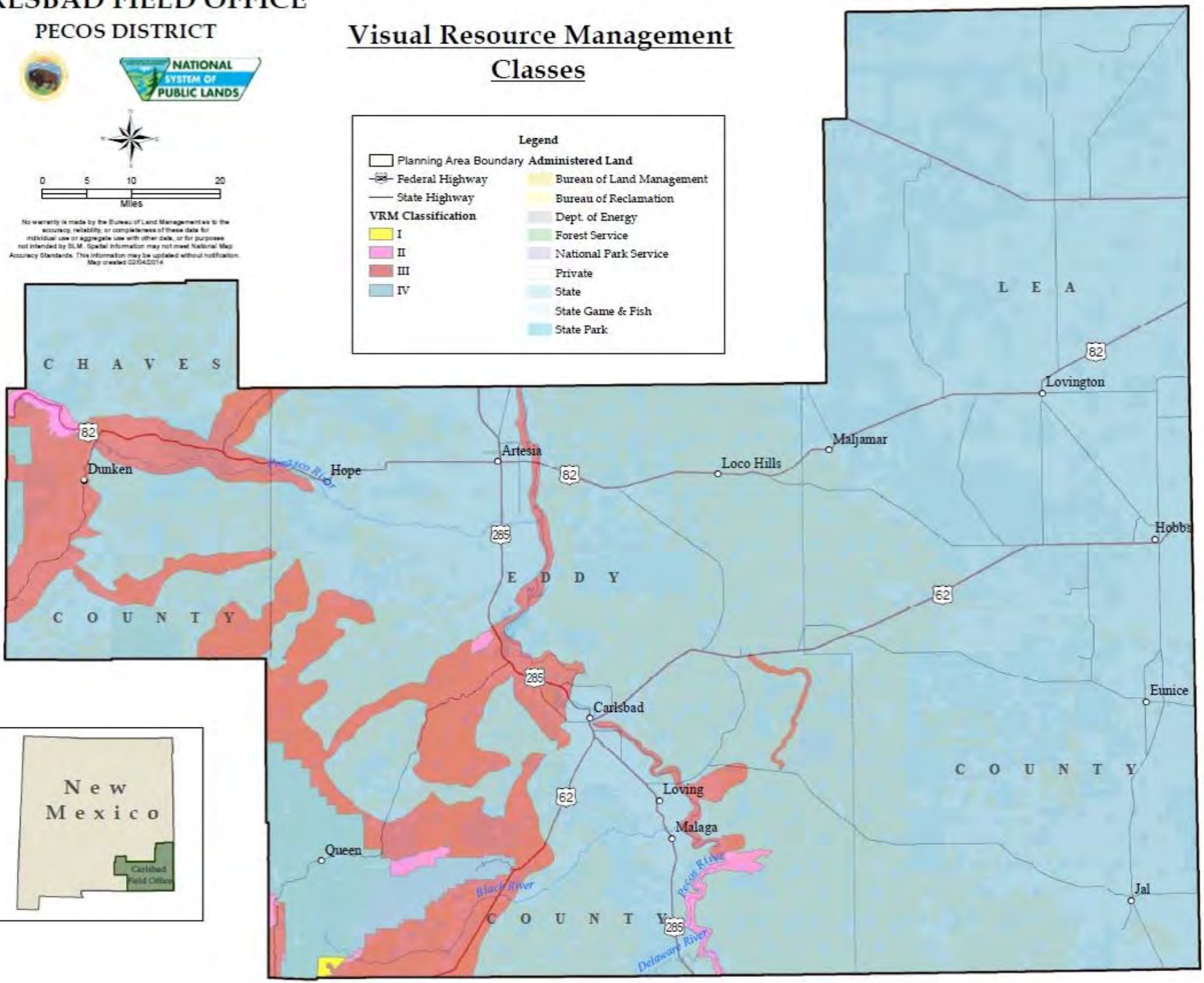
FIGURE 3

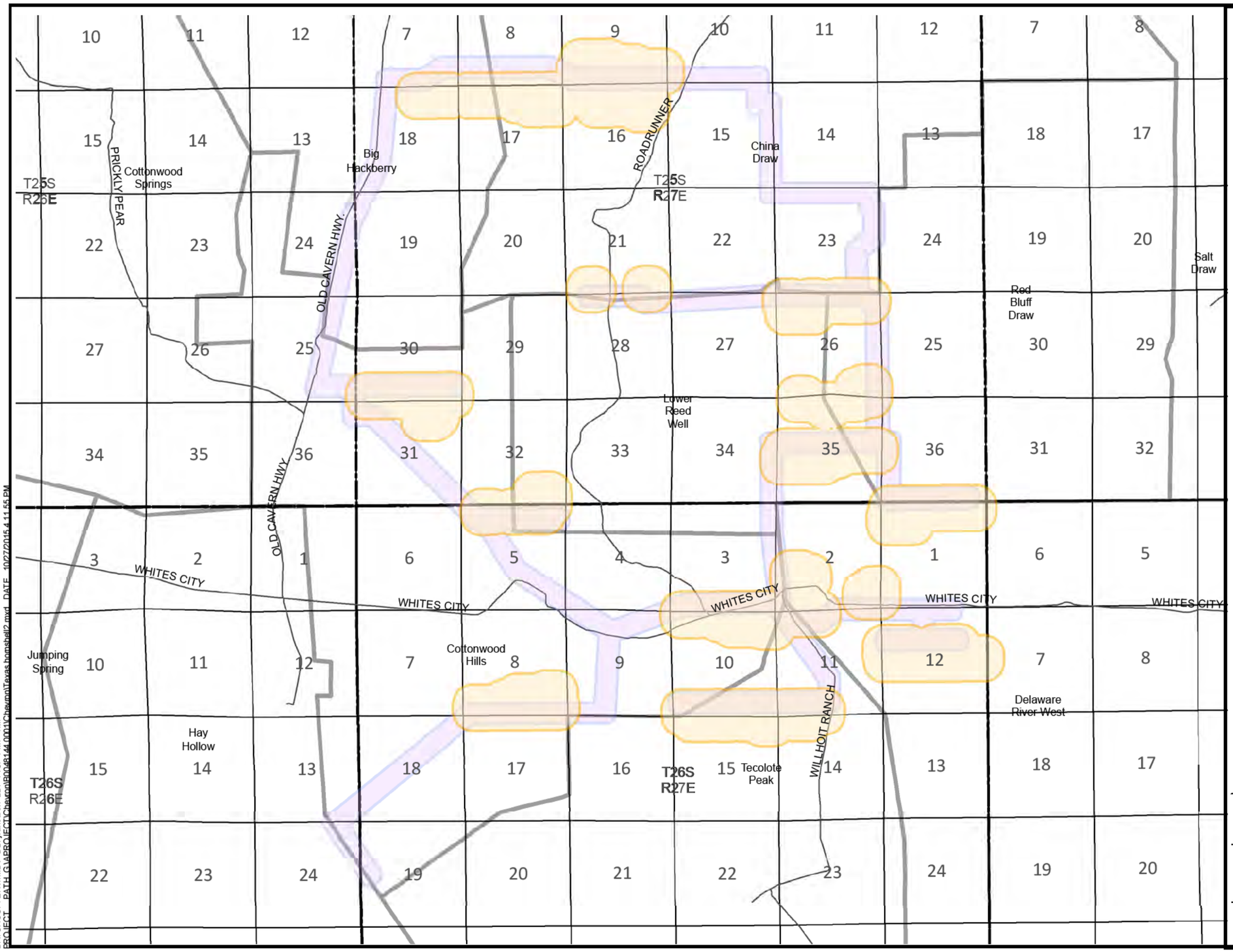
DIV/GROUP: ENV/MDV DB: jvarcuren LD: PIC: PM: TM:
PROJECT PATH: G:\APROJECT\Chevron\E00048144.0001\Chevron\Texas hornshell2.mxd DATE: 10/27/2015 4:11:55 PM

CARLSBAD FIELD OFFICE

PECOS DISTRICT

Visual Resource Management Classes





LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- Allotment Boundary

0 1 2

Miles

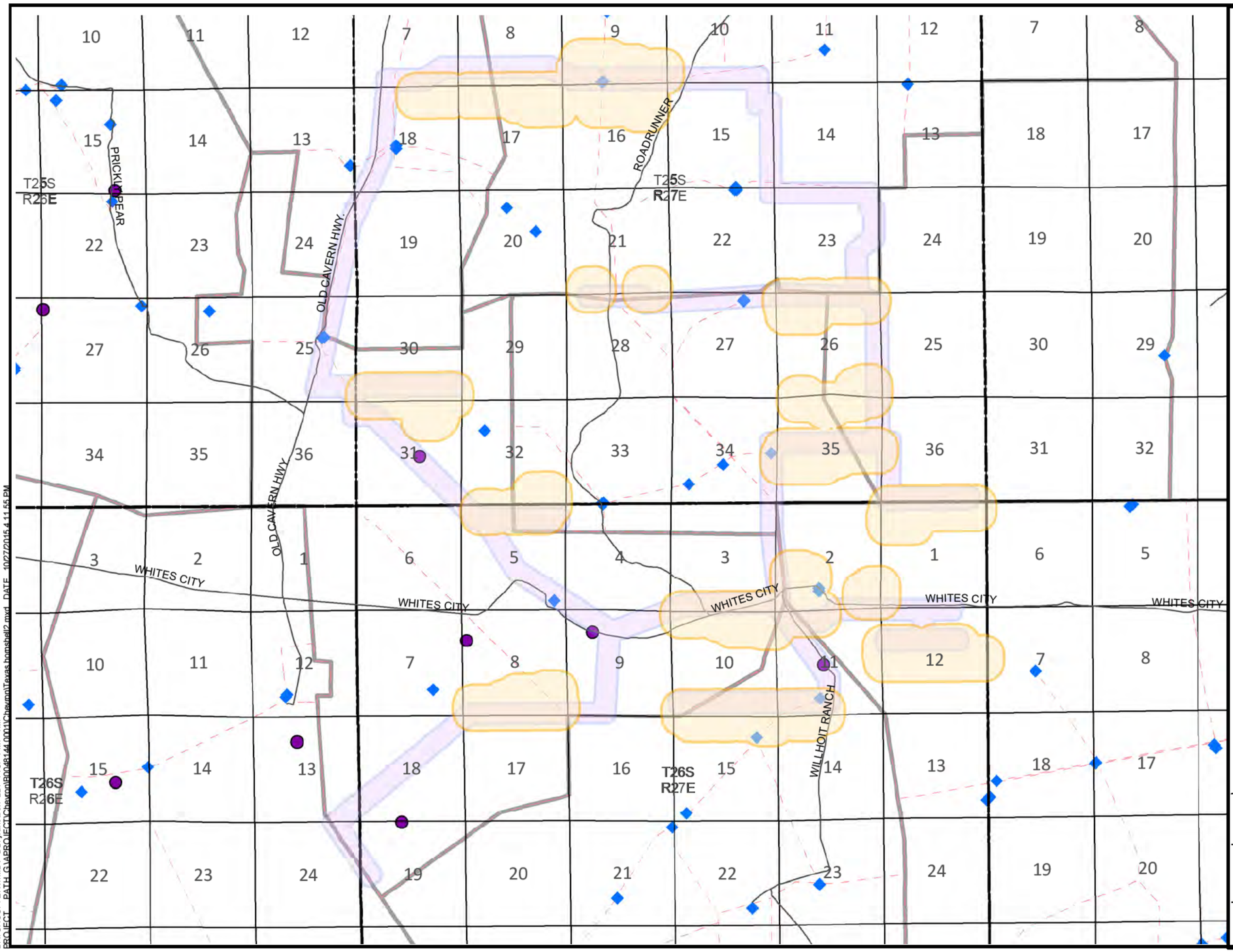
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

RANGE ALLOTMENTS

ARCADIS

FIGURE
5

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH: G:\AB\PROJECT\Chevron\B0048144.0001\Chevron\Texas.bombshell2.mxd DATE: 10/27/2015 4:11:55 PM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- Allotment Boundary
- Water Lines
- Range Studies
- Water wells, troughs, and storage

0 1 2

Miles

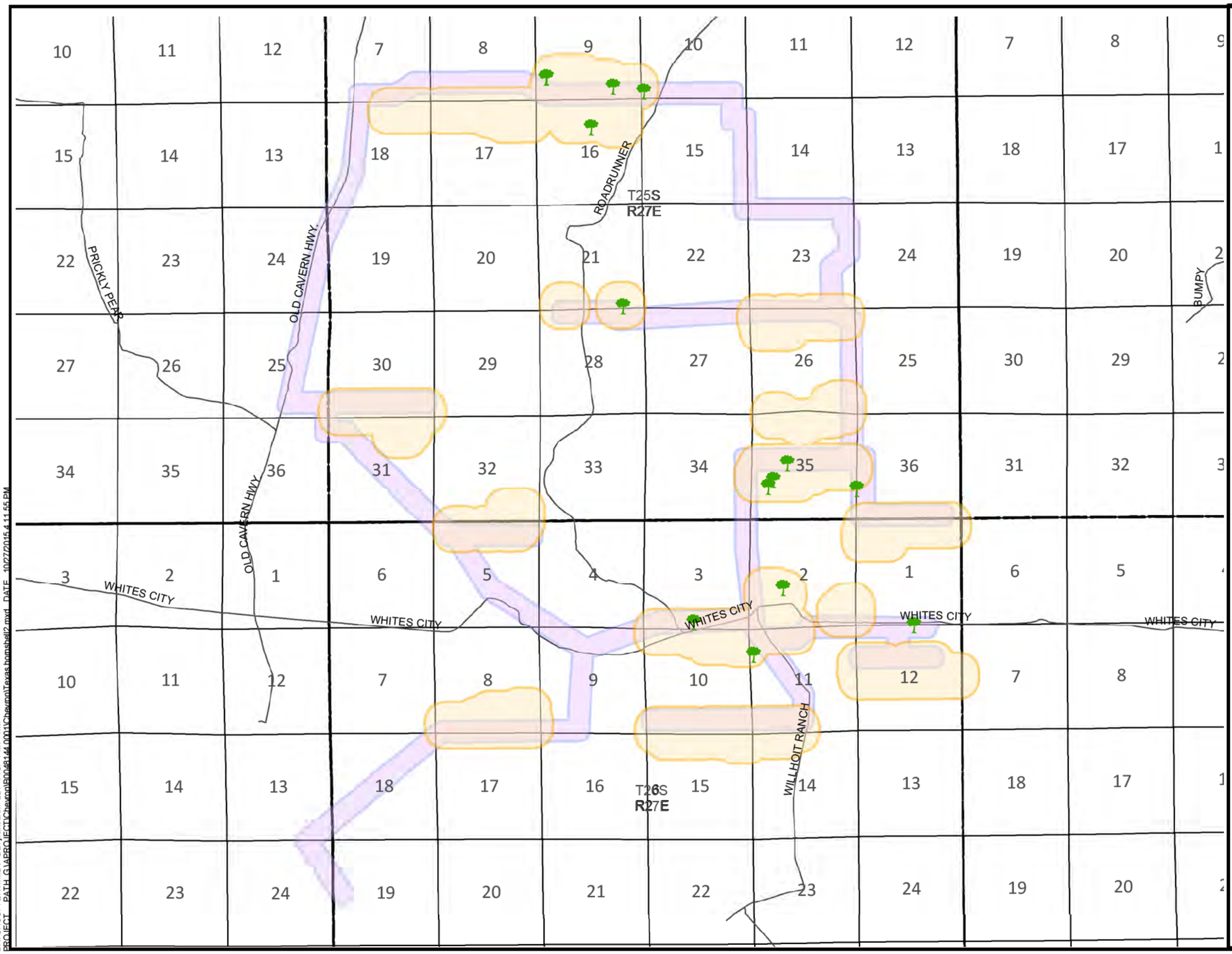
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

RANGE RESOURCES

ARCADIS

FIGURE
6

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH: G:\AB\PROJECT\Chevron\B0048144.0001\Chevron\Texas hornshell2.mxd DATE 10/27/2015 4:11:55 PM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- Tree

0 1 2

Miles

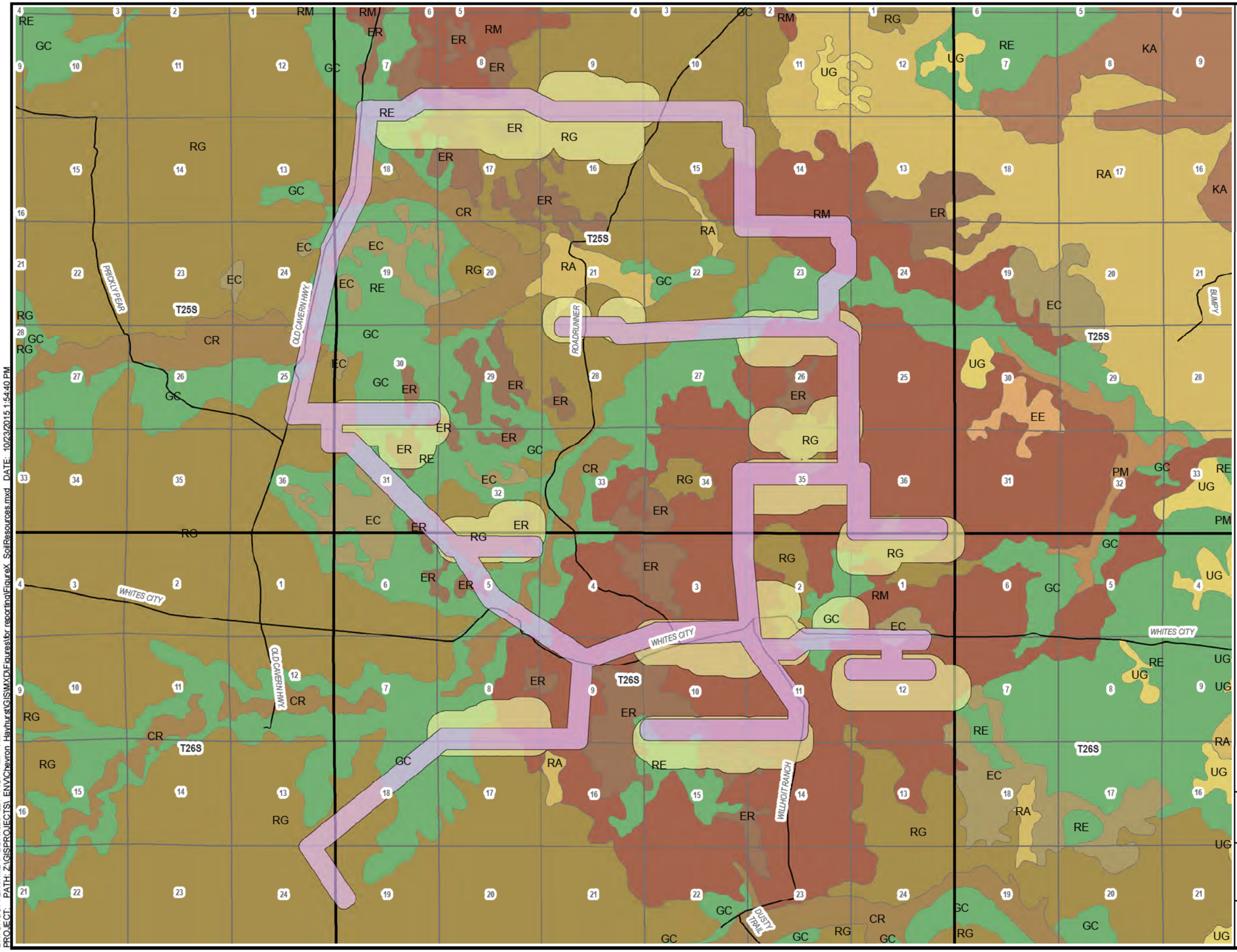
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

HABITAT OR SHADE TREES

ARCADIS

FIGURE 7

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH: G:\ABR\PROJECT\Chevron\B0008144.0001\Chevron\Texas hornshell2.mxd DATE 10/27/2015 4:11:55 PM



LEGEND:

- 400 Ft ROW Buffer
- 1,000 Ft Feature Buffer
- Townships
- Sections
- County Roads

Eddy County Soil Data

- CR
- EC
- EE
- ER
- GC
- KA
- PM
- RA
- RE
- RG
- RM
- UG
- Gypsum

0 1 2

Mile

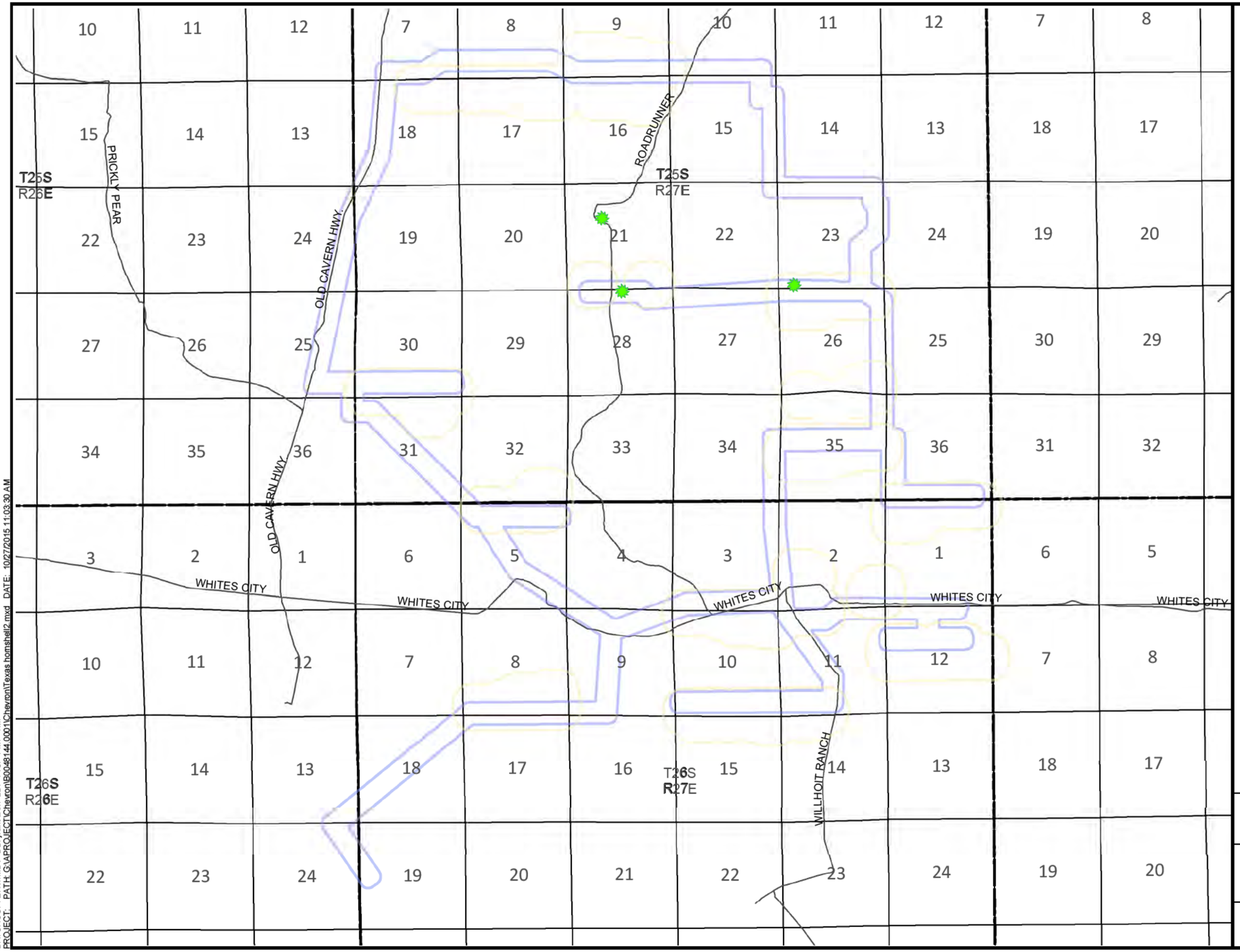
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

SOIL RESOURCES

ARCADIS

FIGURE 8

DIV/GROUP: ENV/MDV DB: webb LD: PIC: PM: TM:
PROJECT: PATH: Z:\GIS\PROJECTS_ENV\Chevron_Hayhurst\GIS\MXD\Figures\for reporting\FigureX_SoilResources.mxd DATE: 10/23/2015 1:54:40 PM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- Noxious Weed

0 1 2

Miles

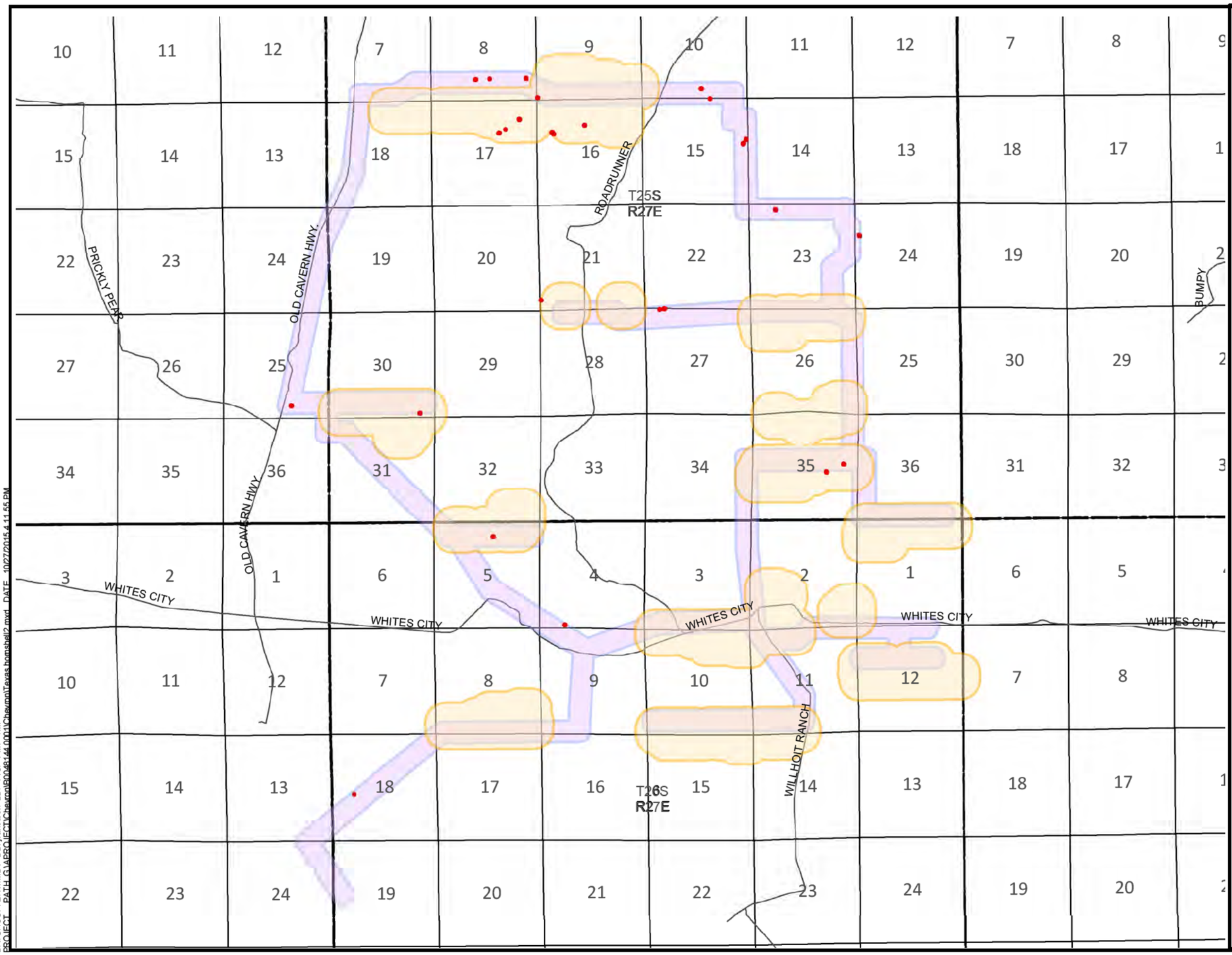
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEYS
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

NOXIOUS WEEDS

ARCADIS

FIGURE
9

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT: PATH: G:\APROJECT\Chevron\B0048144.0001\Chevron\Texas hornshell2.mxd DATE: 10/27/2015 11:03:30 AM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- 50m Raptor and Burrow Buffer

0 1 2

Miles

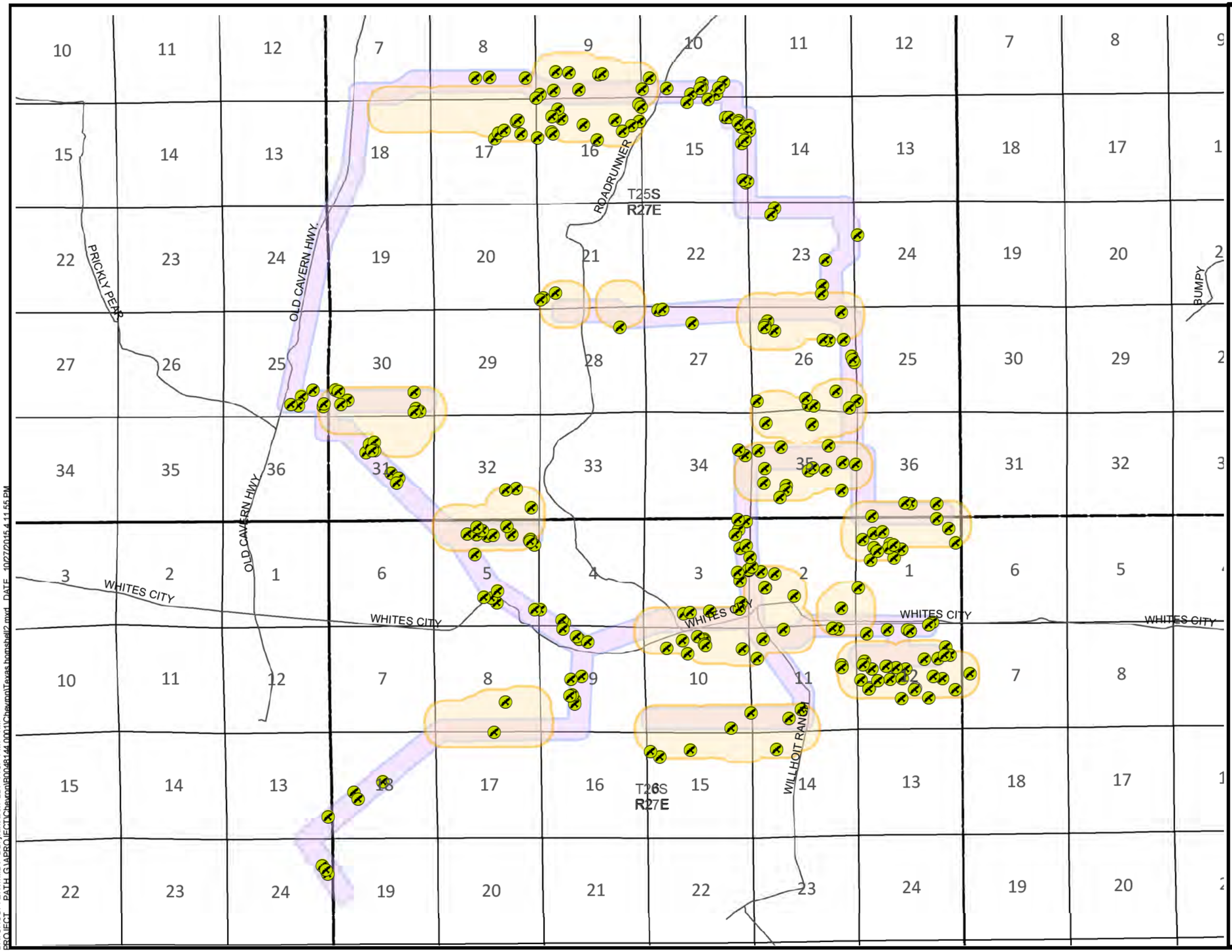
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

RAPTOR NESTS AND BURROWS

ARCADIS

FIGURE 10

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH: G:\ARPROJECT\Chevron\B0008144.0001\Chevron\Texas hornshell2.mxd DATE: 10/27/2015 4:11:55 PM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- Nests

0 1 2
Miles

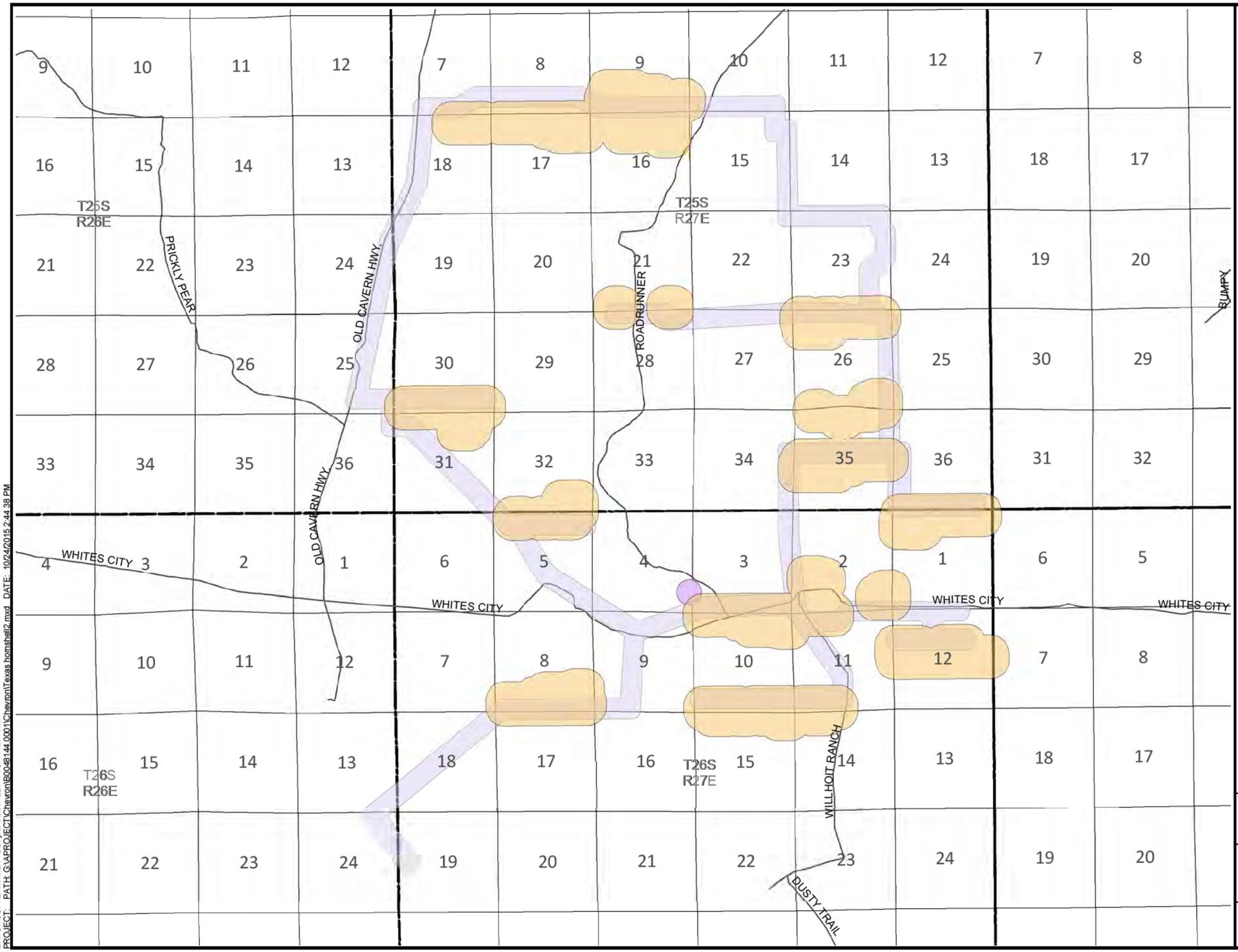
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

MIGRATORY & NON-MIGRATORY BIRD NESTS

ARCADIS

FIGURE
11

DIV/GROUP: ENV/IMDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH G:\APROJECT\Chevron\B0048144.0001\Chevron\Texas hornshell2.mxd DATE 10/27/2015 4:11:55 PM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- Wildlife Habitat Project

0 1 2

Miles

CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

WILDLIFE HABITAT PROJECT

ARCADIS

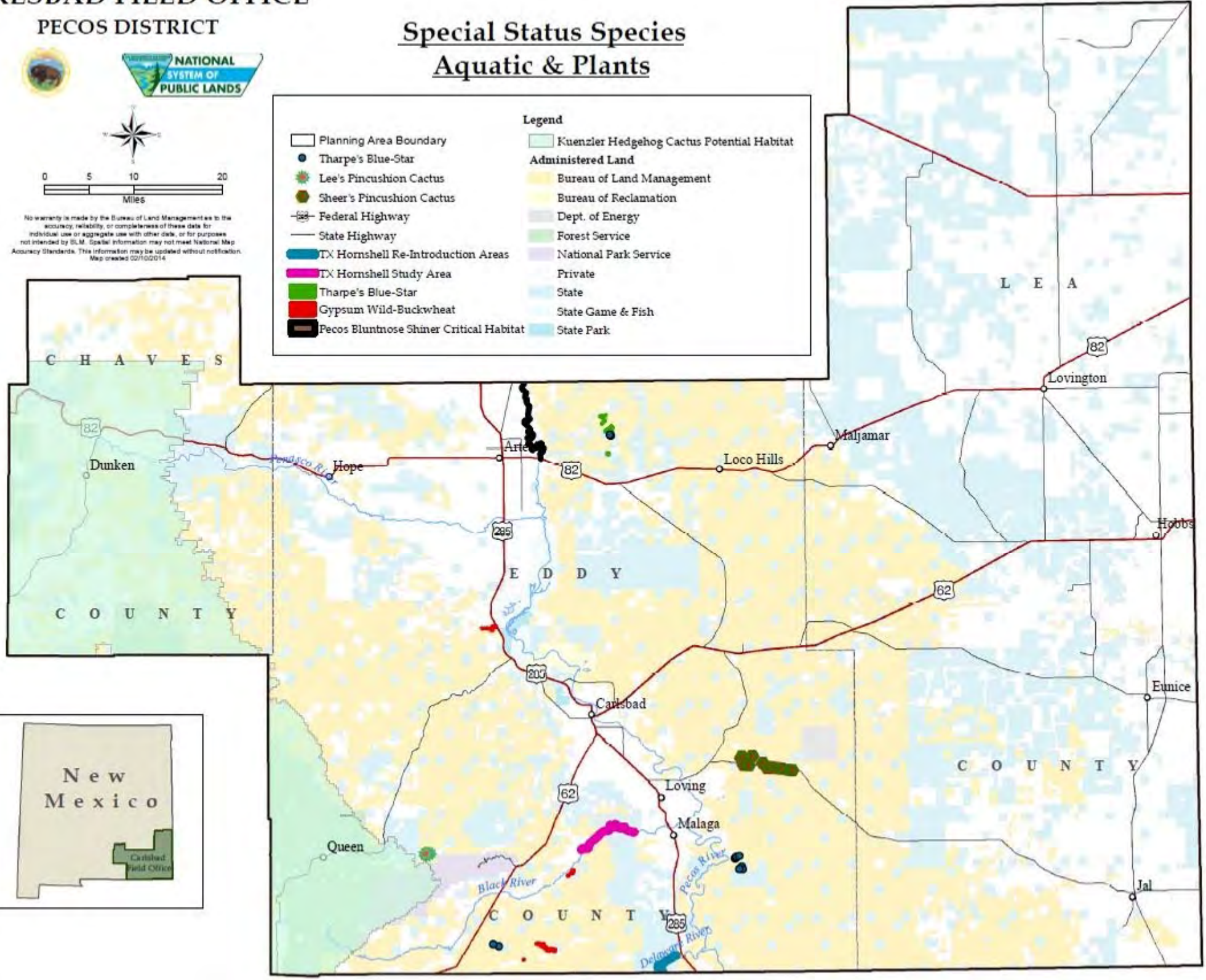
FIGURE
12

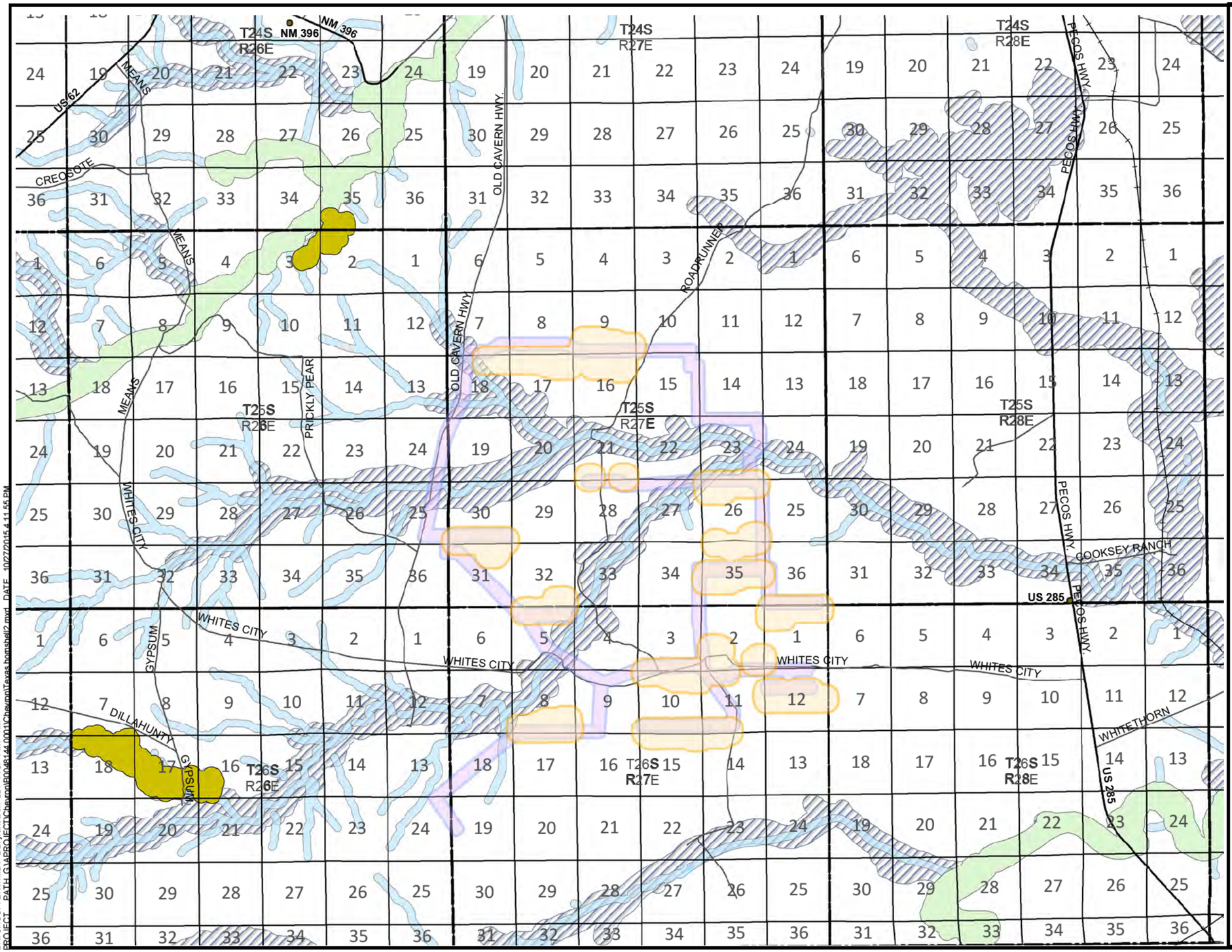
DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT: PATH: G:\APROJECT\Chevron\B0048144.0001\Chevron\Texas hornshell2.mxd DATE: 10/24/2015 2:44:38 PM

CARLSBAD FIELD OFFICE

PECOS DISTRICT

Special Status Species
Aquatic & Plants





LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- 200m THM Exclusion
- 100 m Tributary Buffer
- 200m WGB Buffer
- 200m Avoid and Minimize

0 3.5

Miles

CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

SPECIAL STATUS SPECIES

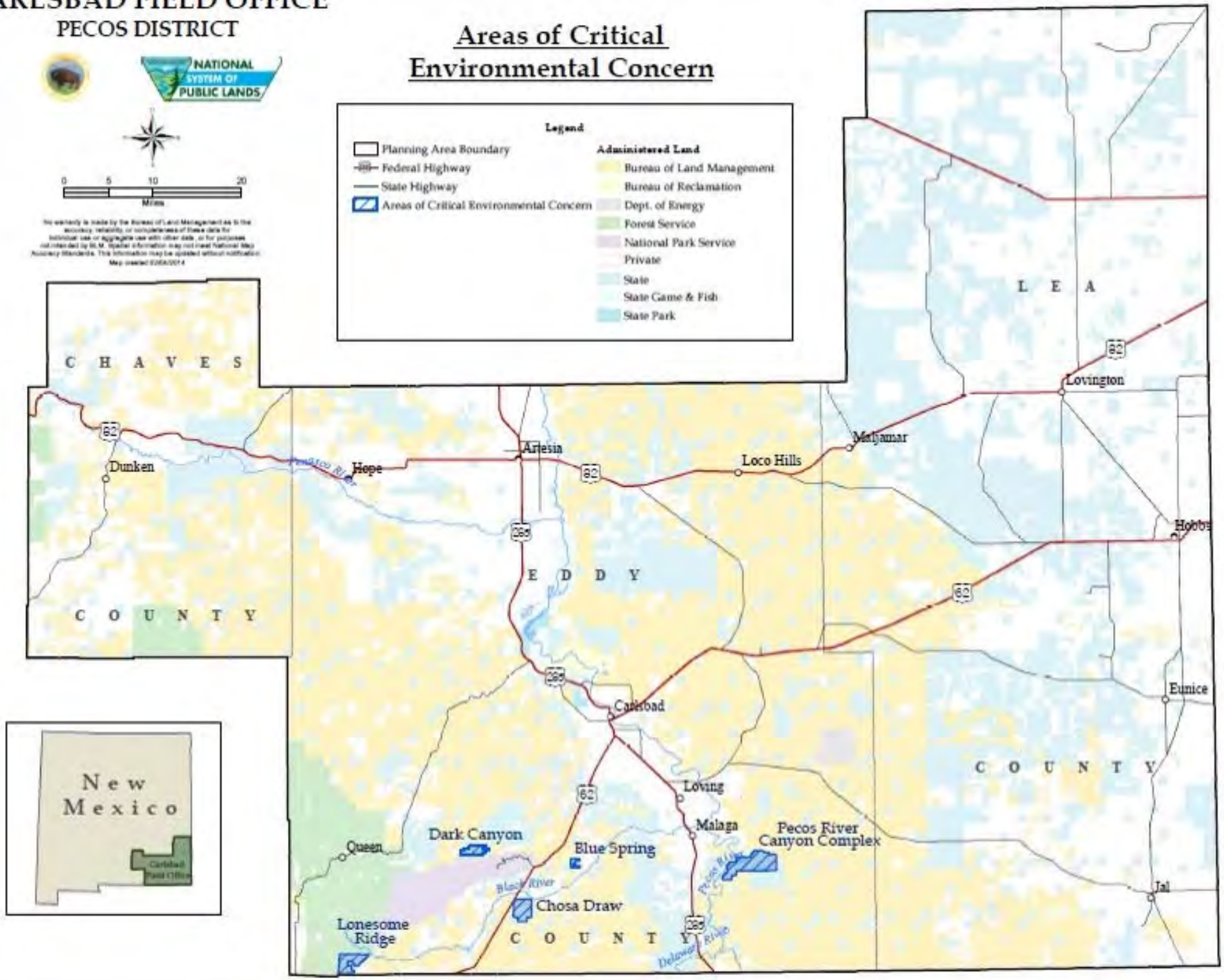
ARCADIS

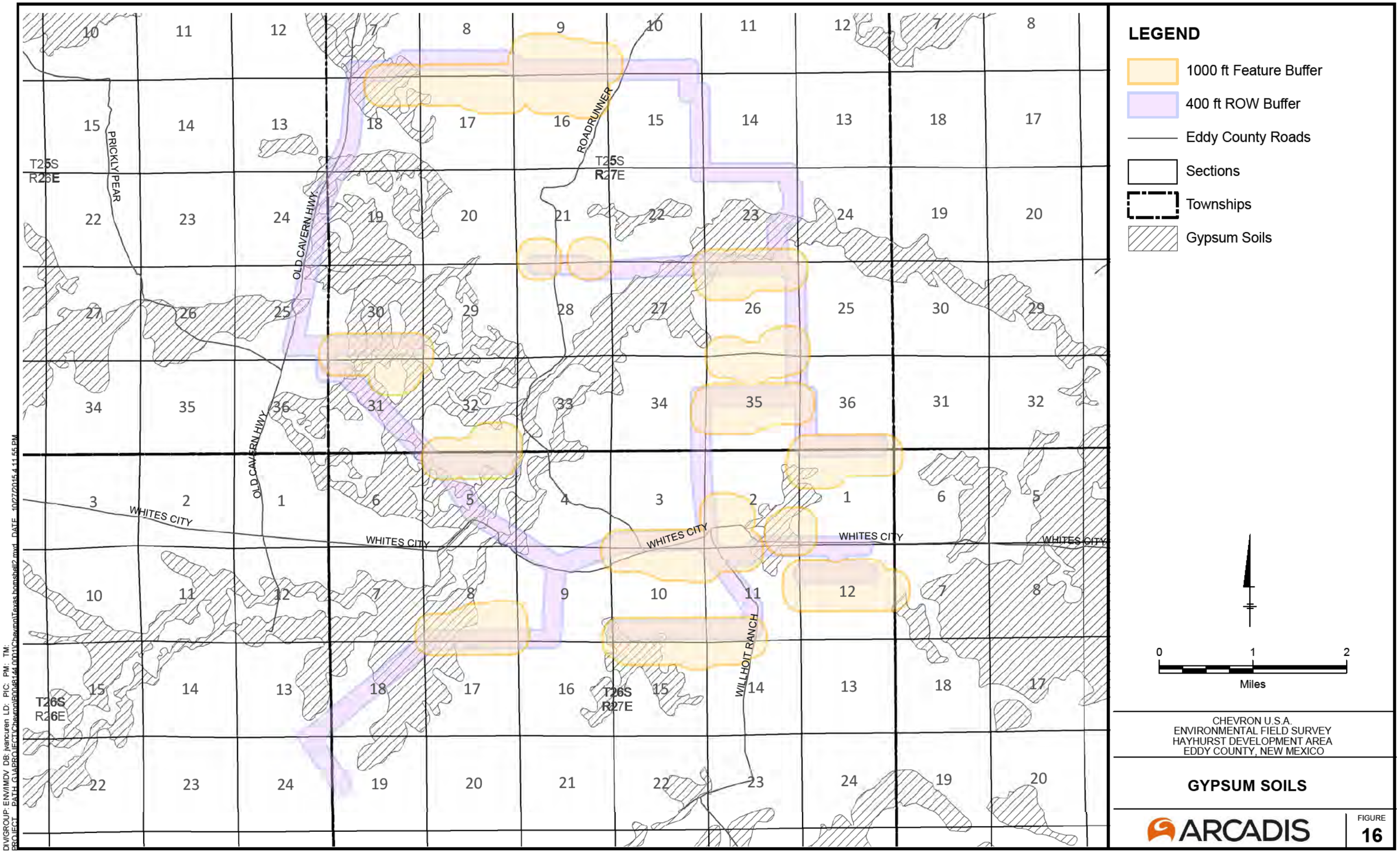
FIGURE 14

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH: G:\APROJECT\Chevron\B0048144.0001\Chevron\Texas.bomshell2.mxd DATE: 10/27/2015 4:11:55 PM

CARLSBAD FIELD OFFICE
PECOS DISTRICT

Areas of Critical Environmental Concern





CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

GYPSUM SOILS

ARCADIS

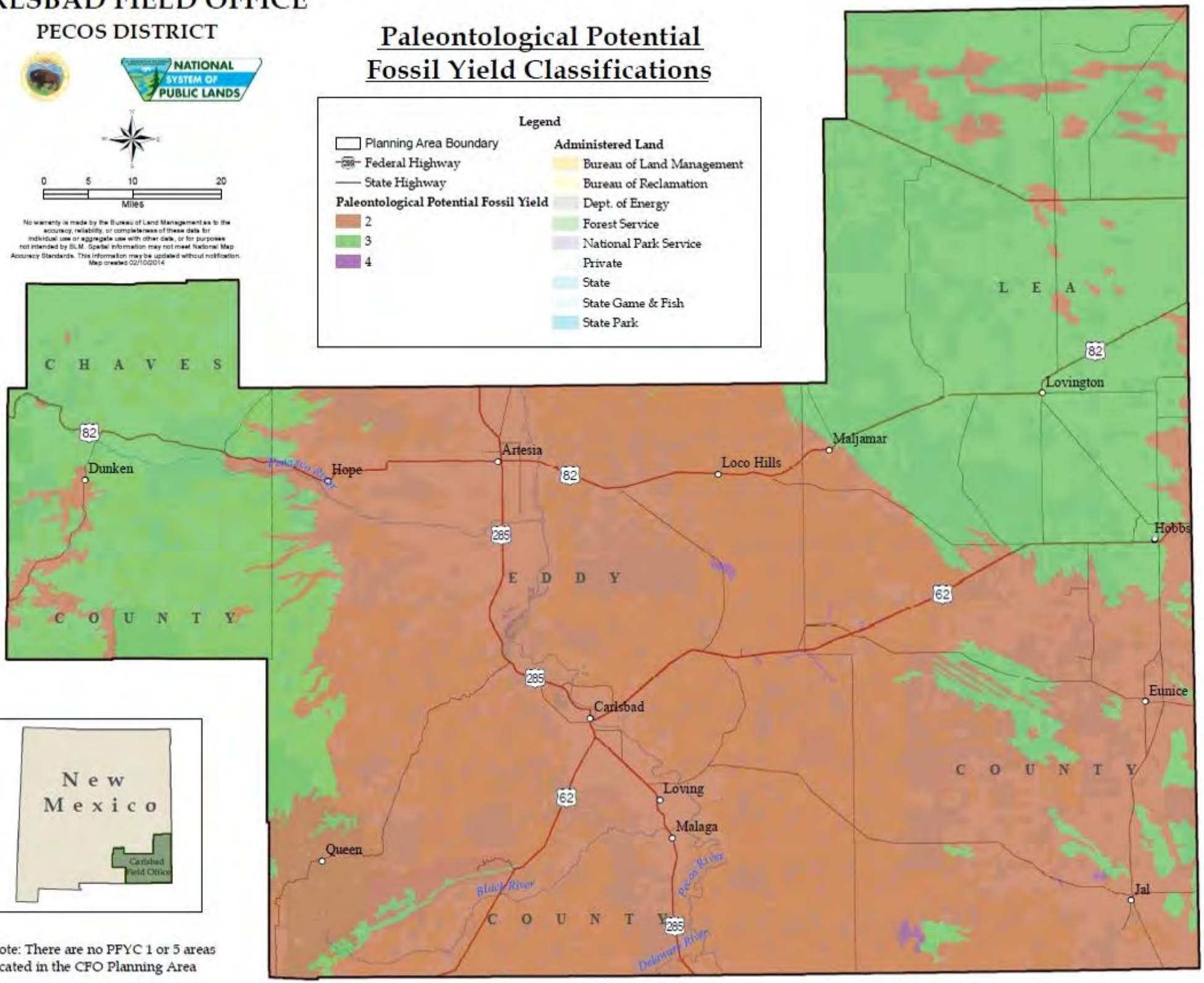
FIGURE
16

DIV/GROUP: ENV/IMDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH: G:\APROJECT\Chevron\B0048144.0001\Chevron\Texas homshell2.mxd DATE 10/27/2015 4:11:55 PM

CARLSBAD FIELD OFFICE

PECOS DISTRICT

Paleontological Potential Fossil Yield Classifications

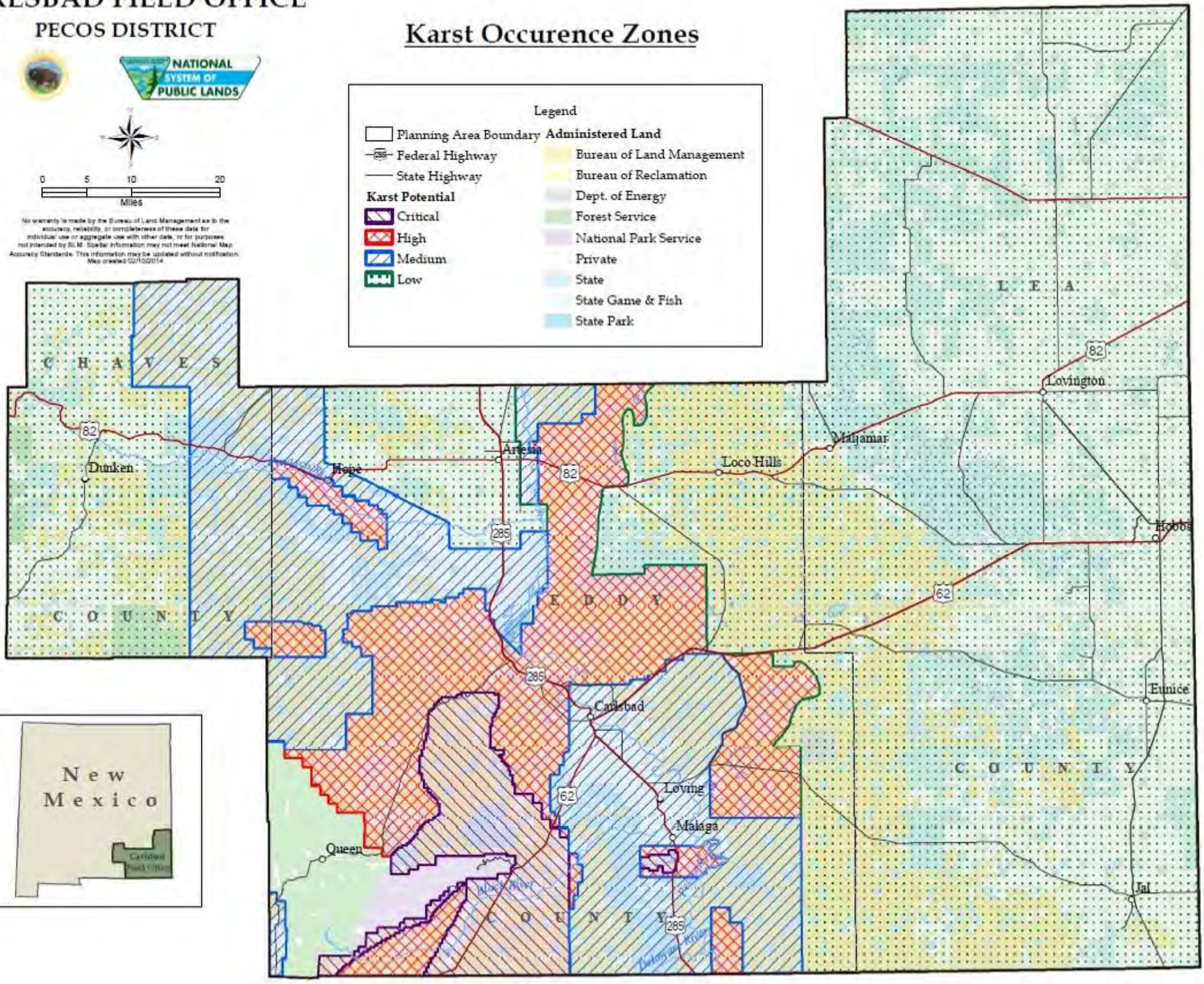


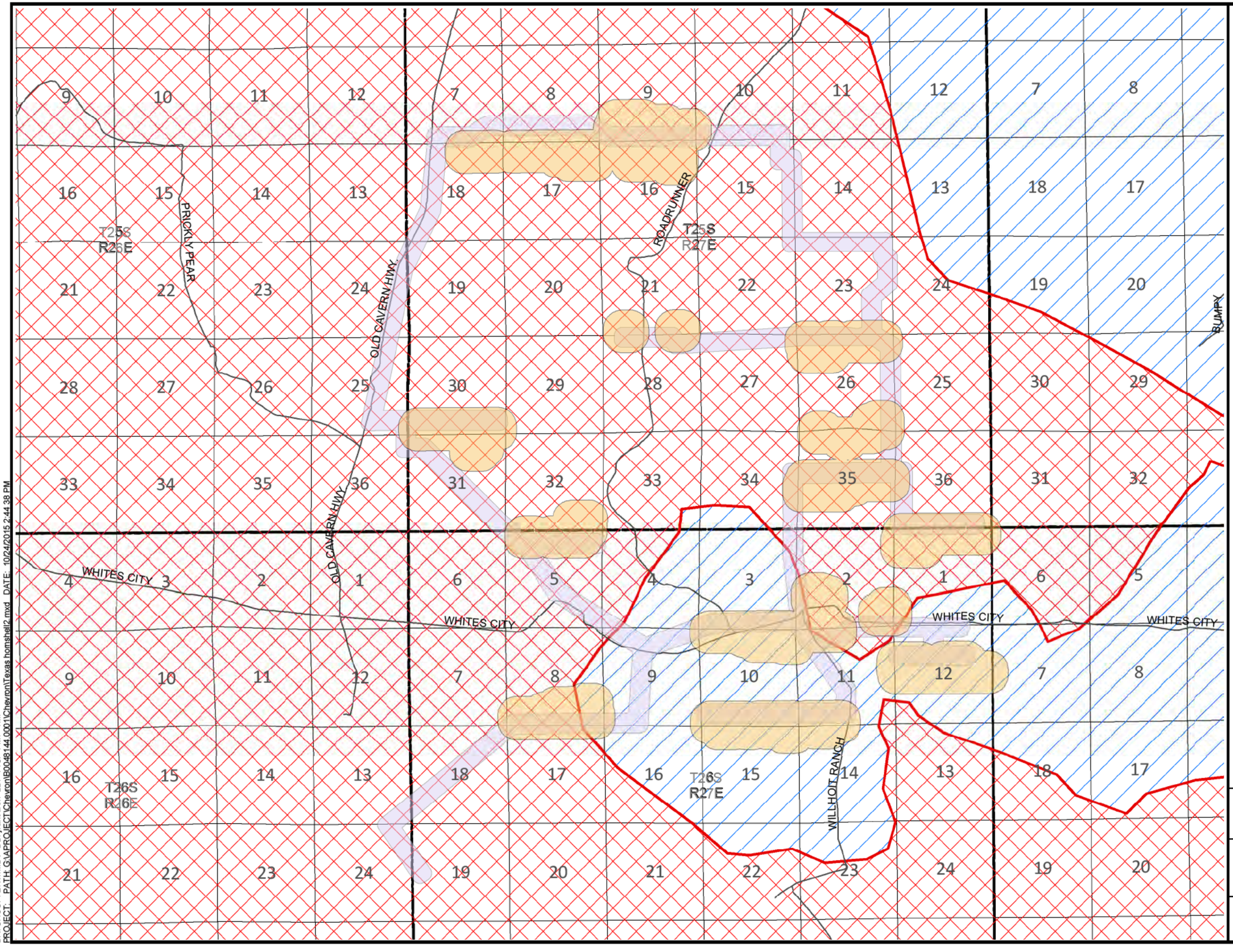
Note: There are no PFYC 1 or 5 areas located in the CFO Planning Area

CARLSBAD FIELD OFFICE

PECOS DISTRICT

Karst Occurence Zones





LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- High Potenital Karst
- Medium Potenitial Karst

0 1 2

Miles

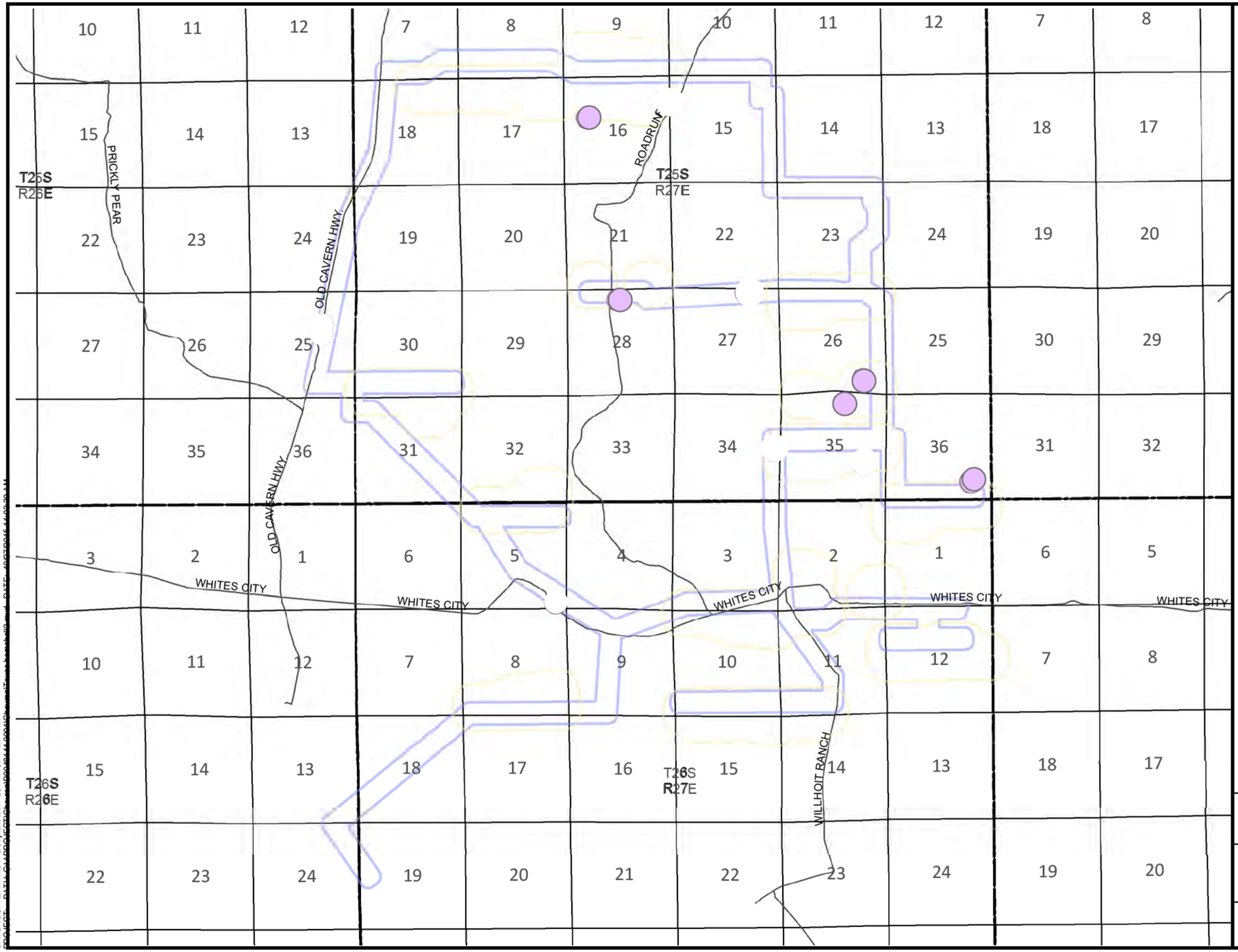
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

KARST POTENTIAL ZONES

ARCADIS

FIGURE
19

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT: PATH: G:\APROJECT\Chevron\B0048144.0001\Chevron\Texas hornshell2.mxd DATE: 10/24/2015 2:44:38 PM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- 200 m Buffer Sinkholes

0 1 2

Miles

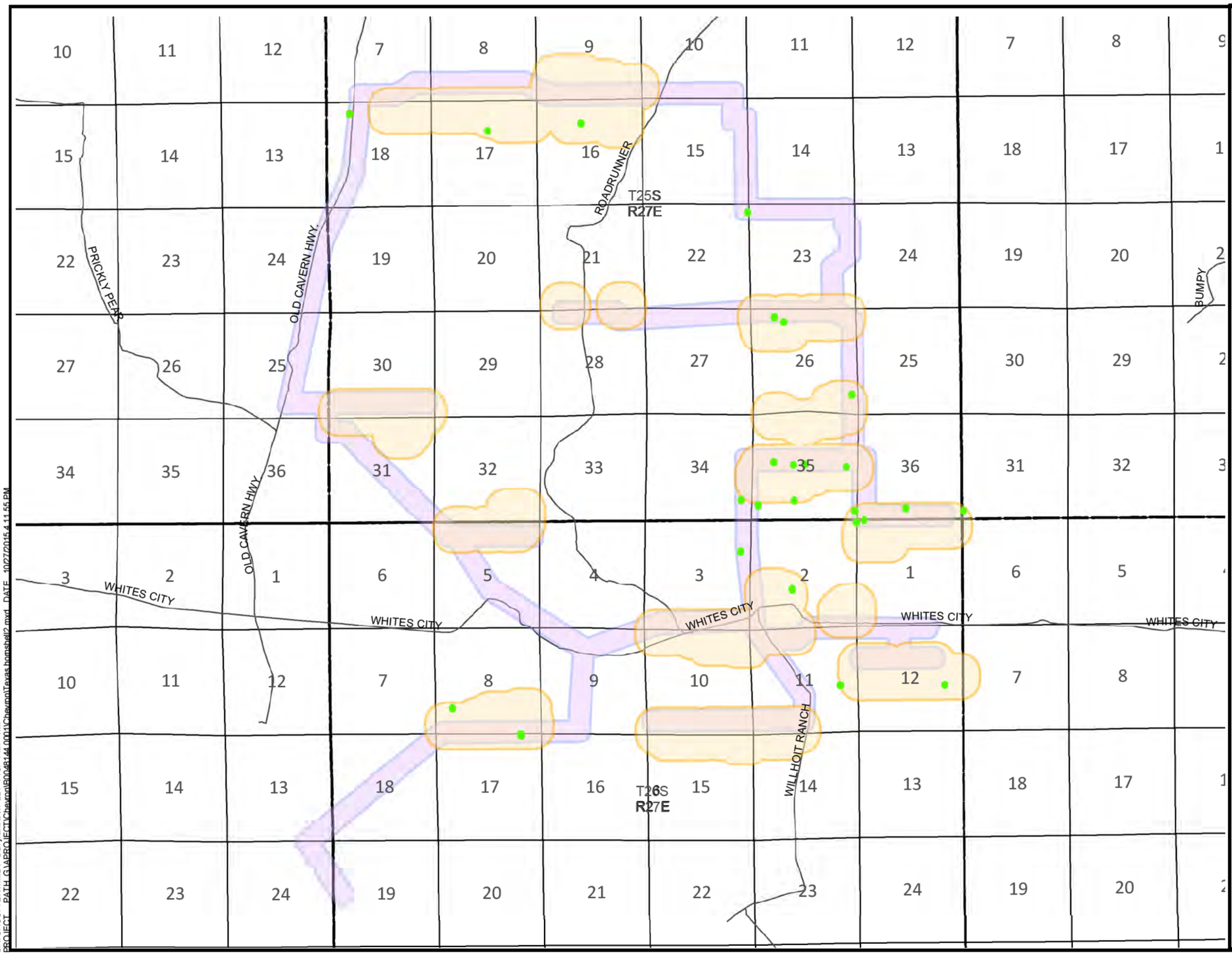
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

COLLAPSED SINKHOLES

ARCADIS

FIGURE
20

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- 50 m Buffer Closed Depressions

0 1 2

Miles

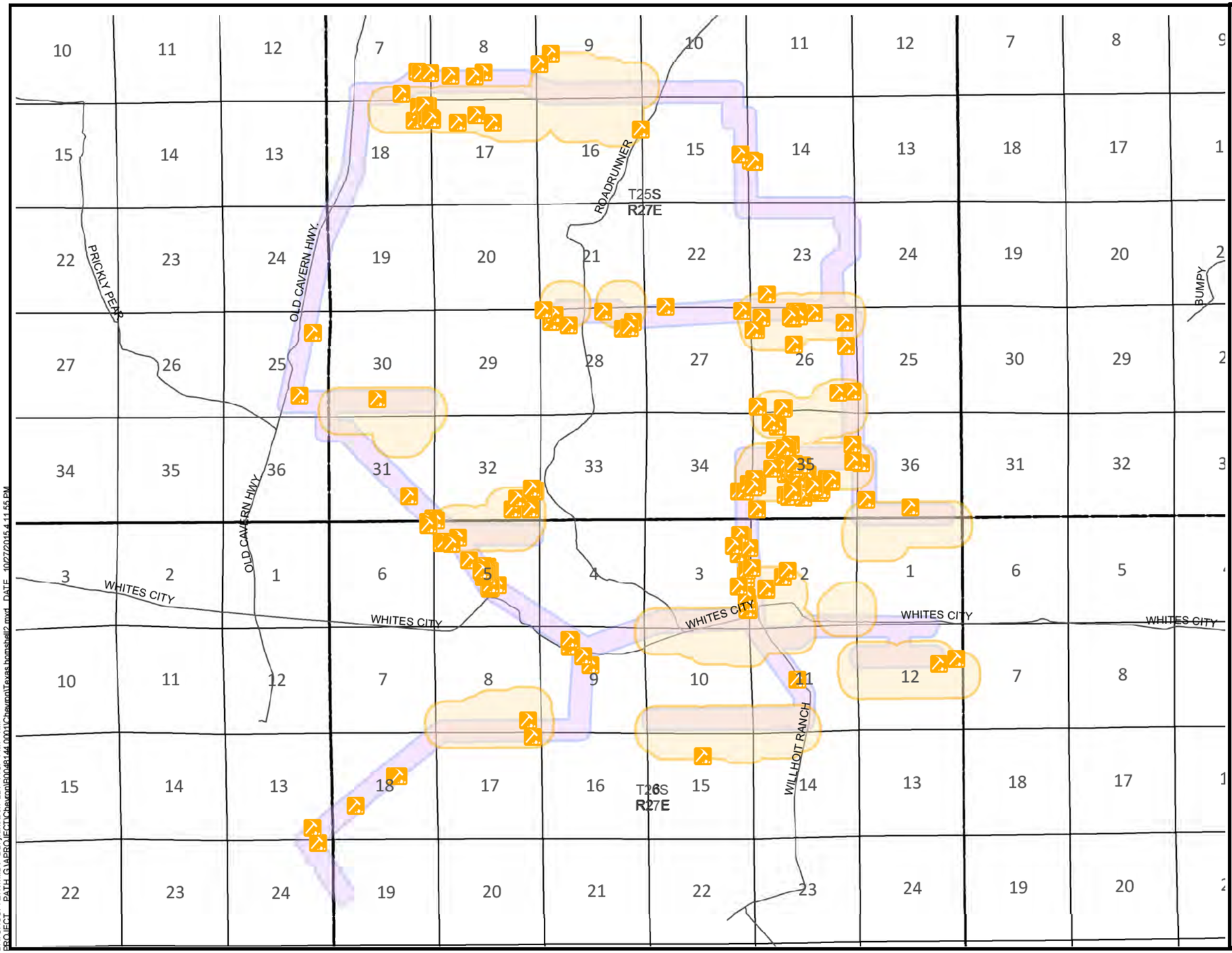
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

DEPRESSIONS / FISSURES

ARCADIS

FIGURE
21

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH: G:\ABR\PROJECT\Chevron\B0008144.0001\Chevron\Texas hornshell2.mxd DATE 10/27/2015 4:11:55 PM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- Outcropping

0 1 2

Miles

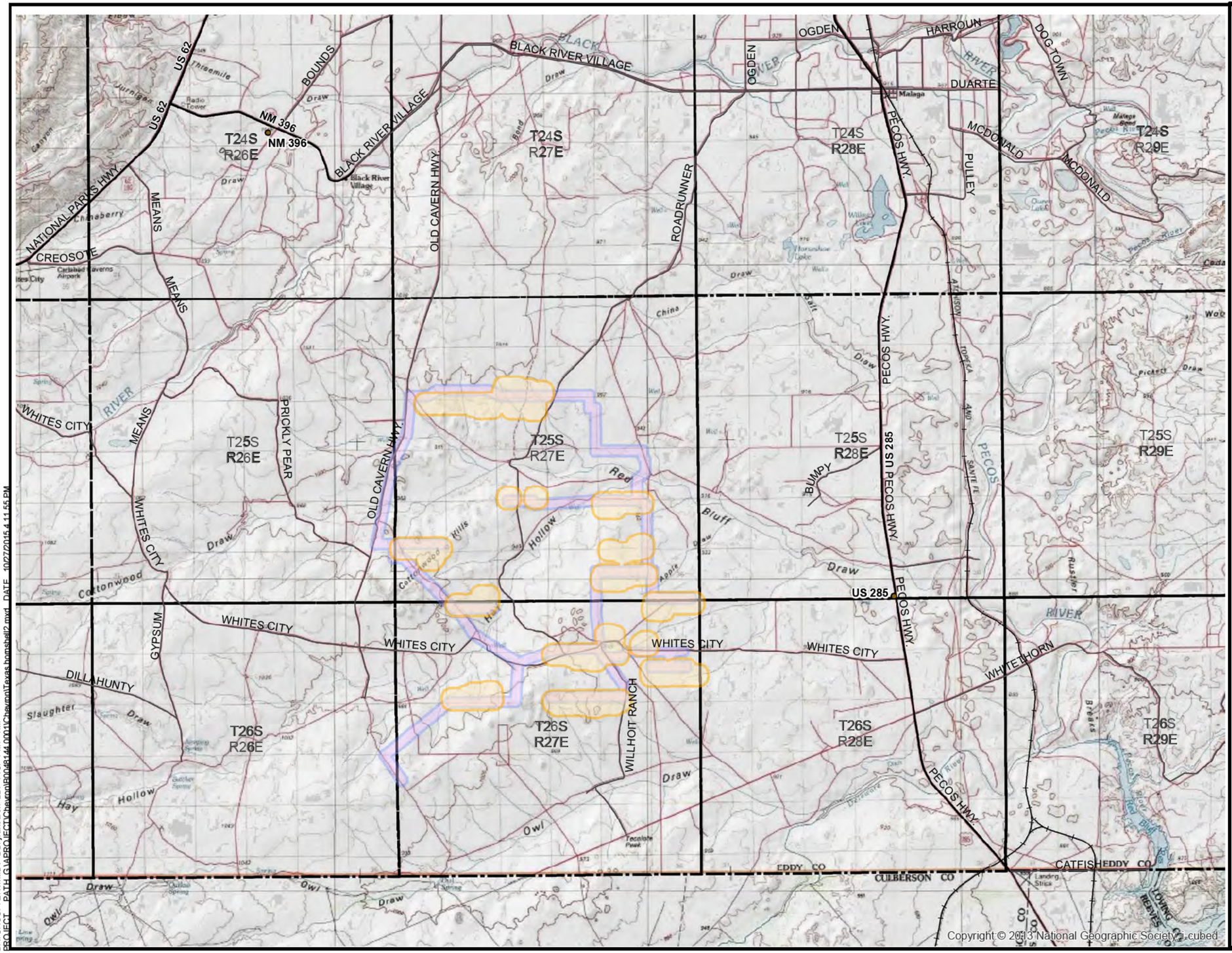
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

ROCK OR GYP OUTCROPPINGS

ARCADIS

FIGURE
22

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH: G:\APROJECT\Chevron\B0048144.0001\ChevronTexas.hornshell2.mxd DATE: 10/27/2015 4:11:55 PM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Townships

0 2 4
Miles

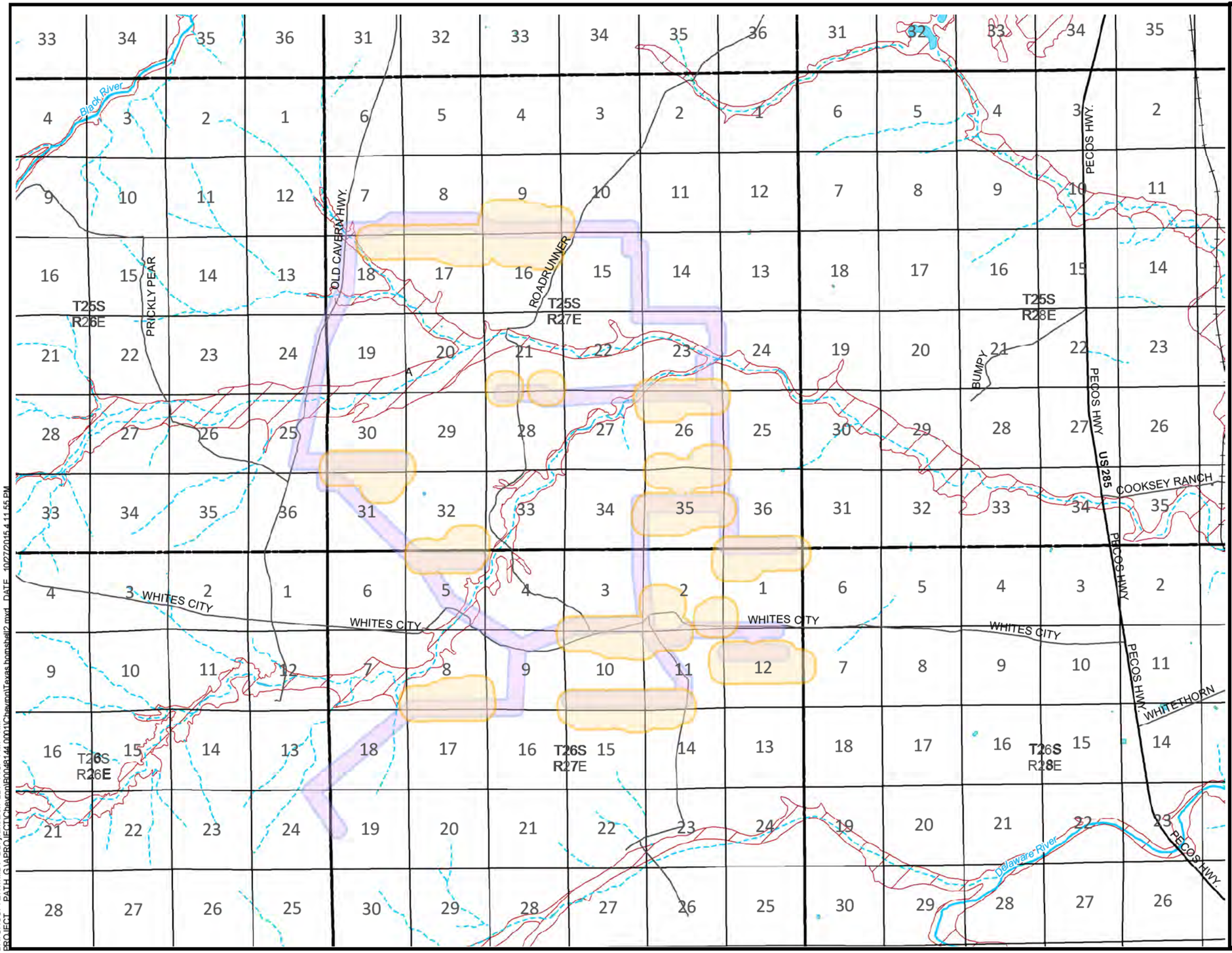
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

SURFACE HYDROLOGY TOPOGRAPHIC MAP

ARCADIS

FIGURE 23

DIV/GROUP: ENV/IMDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH: G:\APROJECT\Chevron\B0048144.0001\Chevron\Texas homshell2.mxd DATE 10/27/2015 4:11:55 PM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- FEMA Flood Zone
- River
- Stream/River: Hydrographic Category = Intermittent
- Stream/River: Hydrographic Category = Perennial
- LakePond

0 1 2

Miles

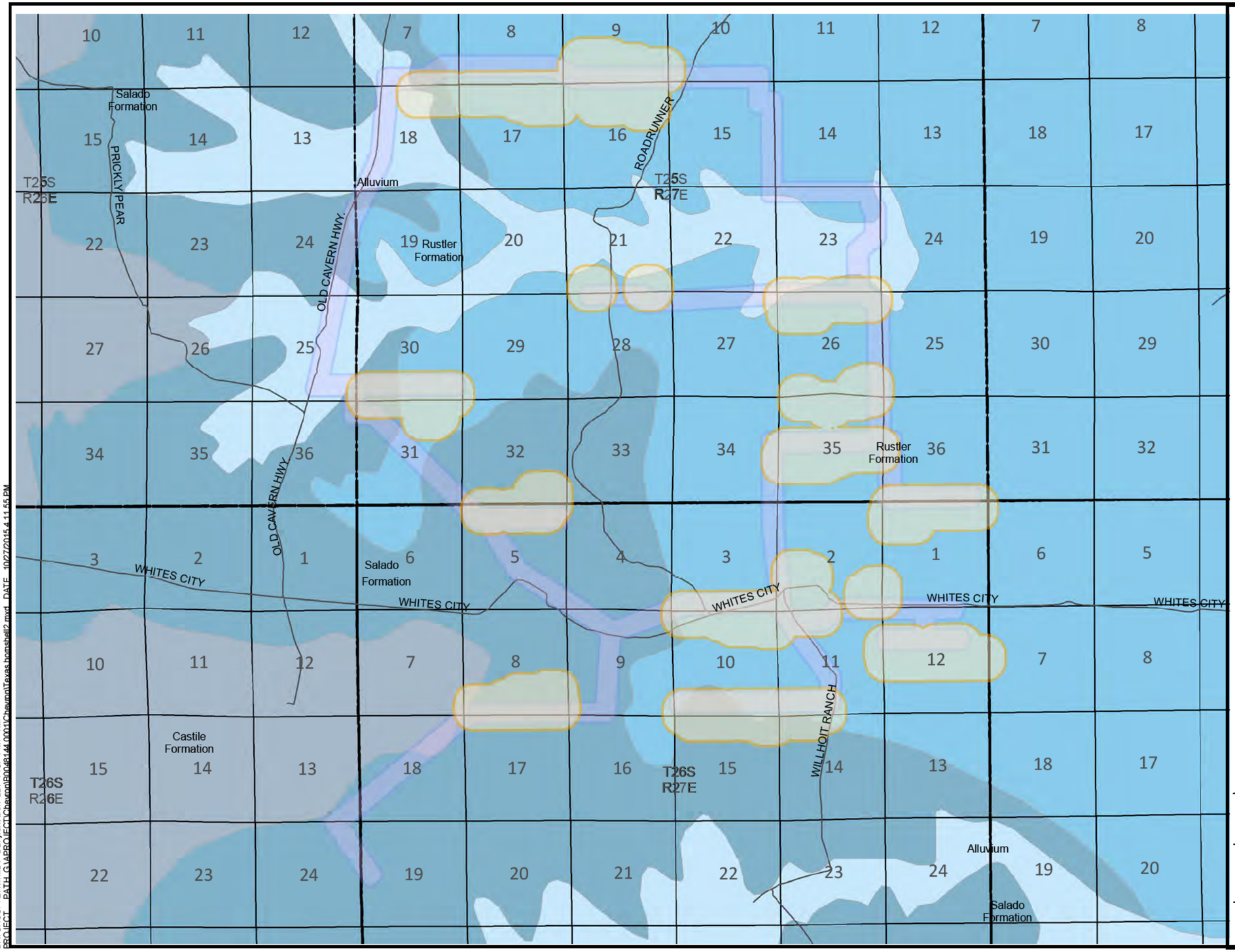
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

SURFACE HYDROLOGY

ARCADIS

FIGURE 24

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH: G:\AB\PROJECT\Chevron\B0048144.0001\Chevron\Texas.bonnshell2.mxd DATE: 10/27/2015 4:11:55 PM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- Castile
- Rustler
- Salado
- Alluvium

0 1 2

Miles

CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

GEOLOGIC RESOURCES

ARCADIS

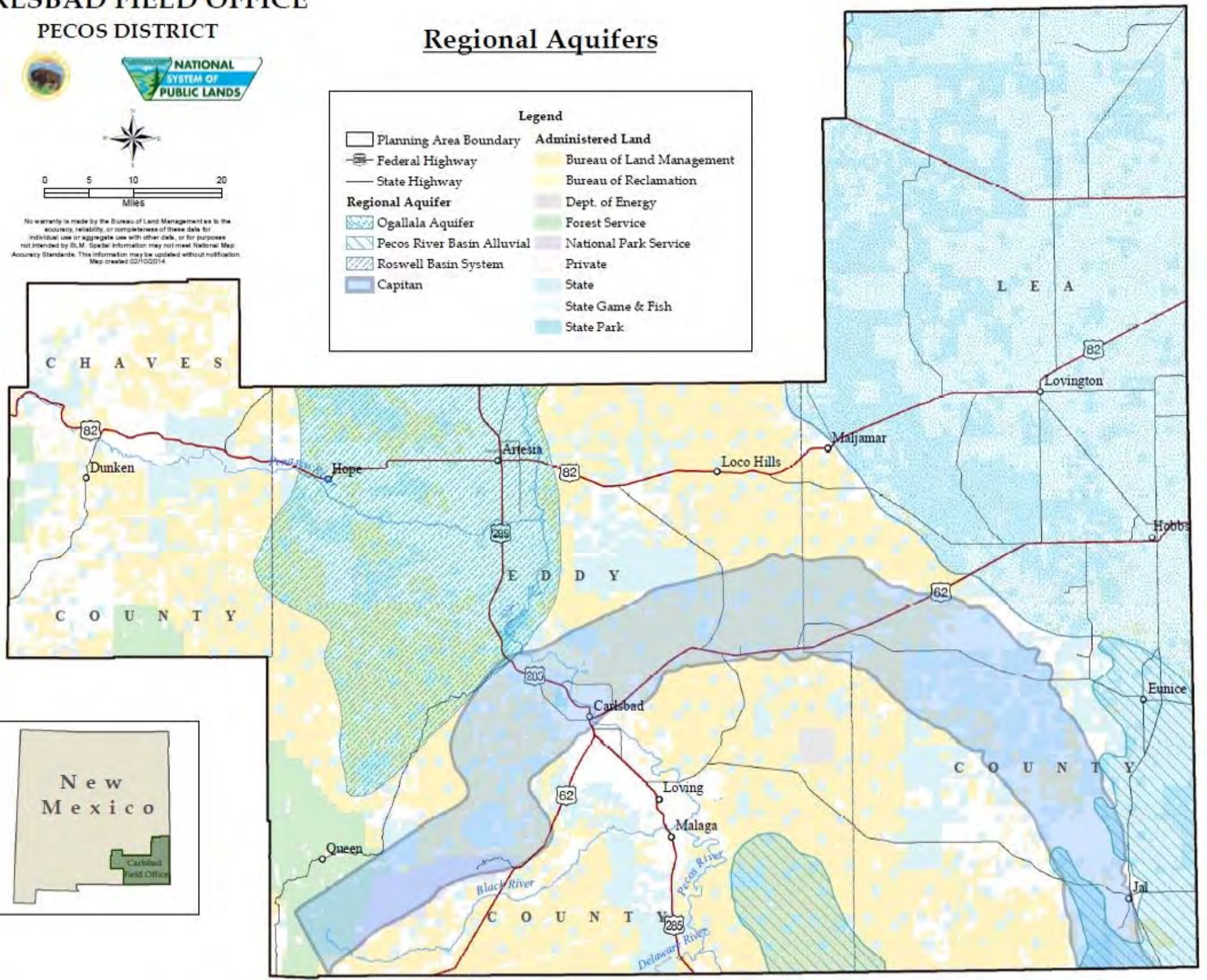
FIGURE **25**

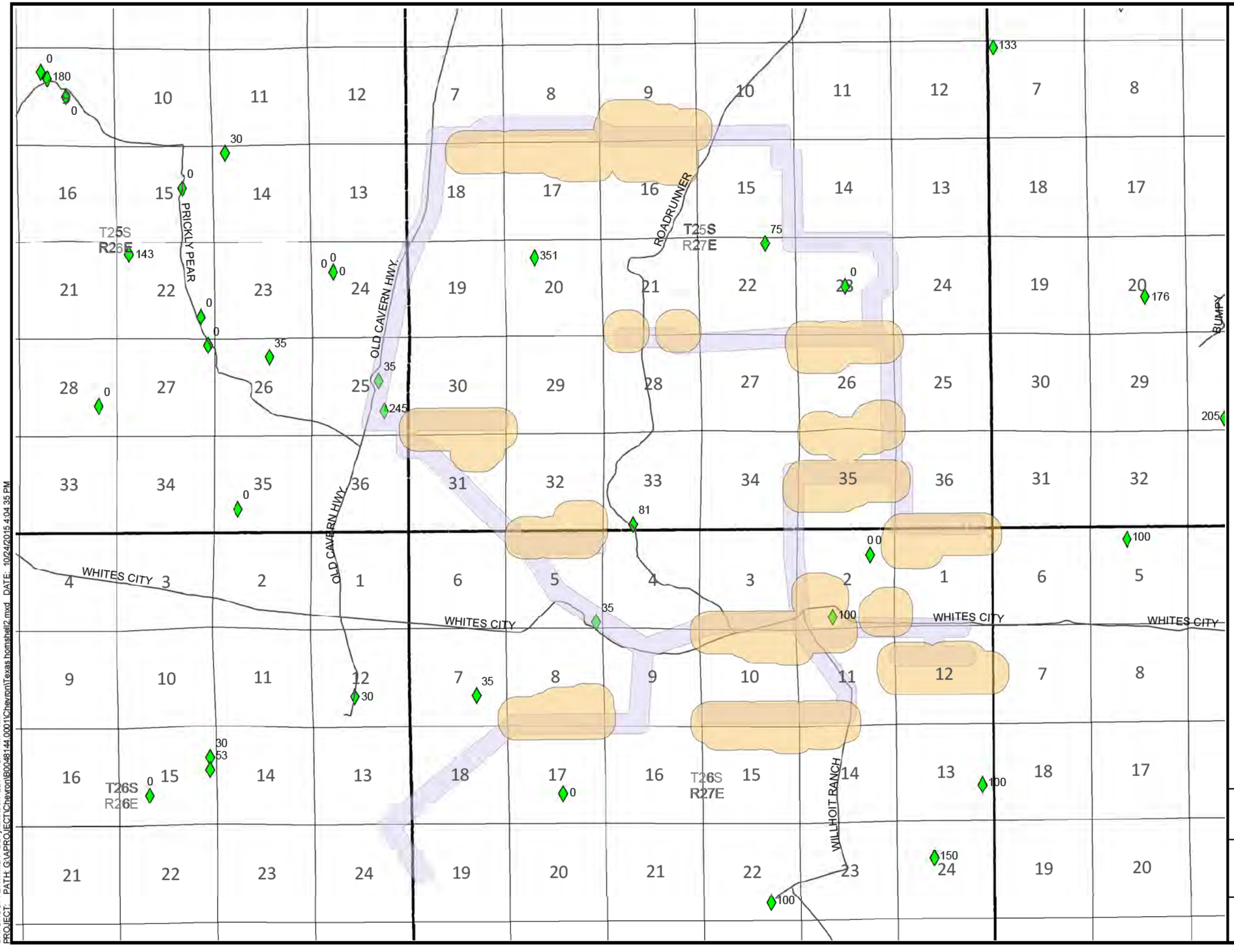
DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT PATH: G:\ARPROJECT\Chevron\B0048144.0001\Chevron\Texas hornshell2.mxd DATE 10/27/2015 4:11:55 PM

CARLSBAD FIELD OFFICE

PECOS DISTRICT

Regional Aquifers





LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- Groundwater Wells (OSE)

0 1 2

Miles

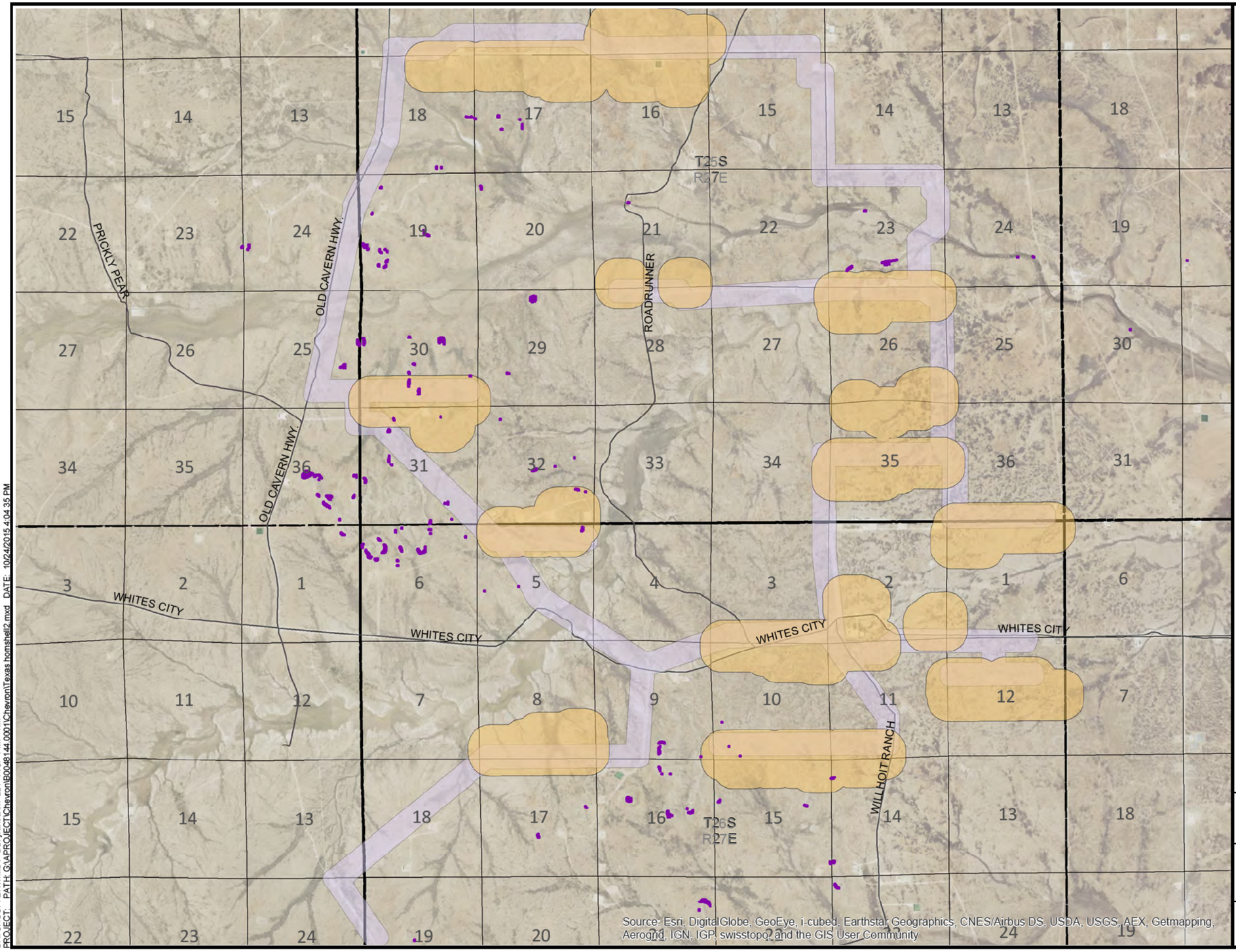
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

GROUNDWATER WELLS

ARCADIS

FIGURE 27

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT: PATH: G:\APROJECT\Chevron\B0048144.0001\Chevron\Texas homshell2.mxd DATE: 10/24/2015 4:04:35 PM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- Slope > 30%

0 1 2

Miles

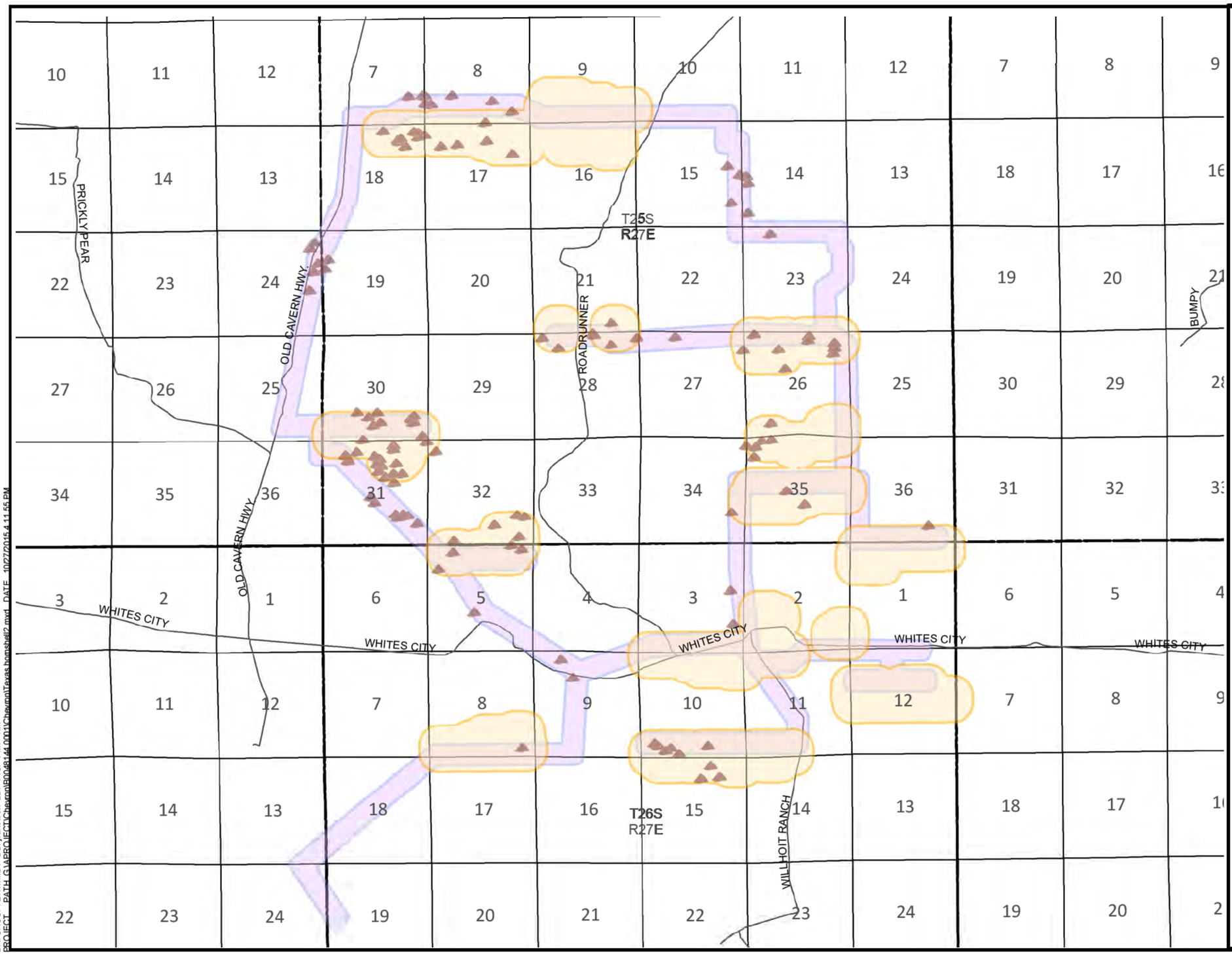
CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

SLOPE CONSTRAINTS

ARCADIS

FIGURE
28

DIV/GROUP: ENV/MDV DB: jvancuren LD: PIC: PM: TM:
PROJECT: PATH: G:\APROJECT\Chevron\B0048144.0001\Chevron1Texas homshell2.mxd DATE: 10/24/2015 4:04:35 PM



LEGEND

- 1000 ft Feature Buffer
- 400 ft ROW Buffer
- Eddy County Roads
- Sections
- Townships
- Hill

0 1 2

Miles

CHEVRON U.S.A.
ENVIRONMENTAL FIELD SURVEY
HAYHURST DEVELOPMENT AREA
EDDY COUNTY, NEW MEXICO

HILLTOPS OR STEEP SLOPES

ARCADIS

FIGURE
29

DIV/GROUP: ENV/MDV DB: jvarcuren LD: PIC: PM: TM:
PROJECT PATH: G:\APROJECT\Chevron\EP009144.0001\Chevron\Texas hornshell2.mxd DATE: 10/27/2015 4:11:55 PM

APPENDIX A

Visual Contrast Rating

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date: 10/02/2015
District: Pecos Valley
Resource Area: Carlsbad Field Office
Activity (program): Oil & Gas Development

SECTION A. PROJECT INFORMATION

1. Project Name: Hayhurst Development Area
2. Key Observation Point: White City
3. VRM Class: Class IV
4. Location: Township T25S,T26S; Range R27E; Section
5. Location Sketch: Exhibit#2 Location Verification Map

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LANDWATER	2. VEGETATION	3. STRUCTURES
FORM	Flat to rolling terrain	Steep / moderate / gentle	Contrasting / compatible
LINE	Horizontal & Diagonal	Undulating / flowing	Cylindrical
COLOR	Dark greens, browns, and tans	Hues- yellow, brown, green	Shale green / tan / black
TEXTURE	Smooth / rough	Smooth / rough / Dense / sparse	Scattered

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LANDWATER	2. VEGETATION	3. STRUCTURES
FORM	Flat (pad) Rolling (roads and ROW)	Bold / definite / transparent	Cylindrical, geometric & angular
LINE	Horizontal (pad) Curved (road)	Regular / irregular	Vertical, horizontal & angular
COLOR	Tan	Light to medium green	Shale green
TEXTURE	Smooth	Patchy	Glossy / matte

SECTION D. CONTRAST RATING ☐ SHORT TERM ☐ LONG TERM

1. DEGREE OF CONSTRAST

ELEMENTS	FEATURES: LANDWATER BODY (1)				VEGETATION (2)				STRUCTURES (3)			
	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None
Form			✓				✓			✓		
Line			✓				✓			✓		
Color			✓				✓				✓	
Texture			✓				✓			✓		

2. Does project design meet visual resource Management objectives? ☒ Yes ☐ No (Explain on reverse side)

3. Additional mitigating measures recommended? ☐ Yes ☒ No (Explain on reverse side)

Evaluator's Names: Jennifer Van Curen
Date: 10/02/2015

SECTION D. (Continued)

Comments from item 2.

The project, as modified by successful implementation of mitigation measures, should result in a moderate level of change to the characteristic landscape. Management activities may attract attention and may dominate the view of the casual observer, but is still mitigated. The project will meet VRM Class IV objectives.

Additional Mitigating Measures (See item 3)

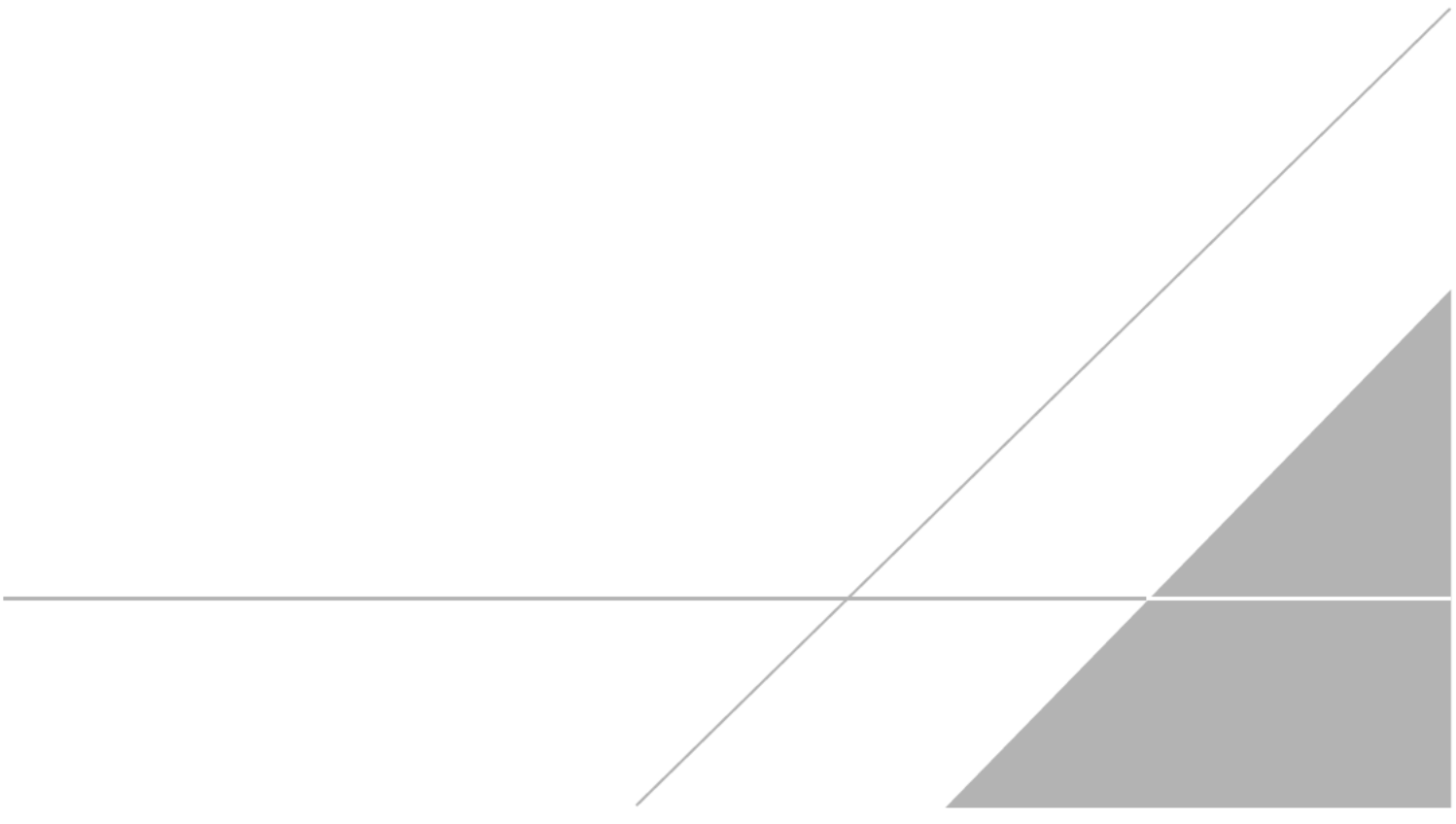
Per EA#:

Lease #: Leases entered here in table- COA stipulations document

U.S. GOVERNMENT PRINTING OFFICE: 1985-461-988/33094

APPENDIX B

Glossary



GLOSSARY

ACQUIRED LANDS. Lands in Federal ownership which were obtained by the government through purchase, condemnation, gift, or exchange.

ACRE-FOOT (AC-FT). Volume of water that will cover one acre of land to a depth of one foot; equals 43,560 cubic feet or 325,851 gallons.

AERIAL PHOTOGRAPHY. Photographs taken of the earth's surface from an aircraft. Both color and infra-red aerial photos can be produced which show surface features. Photographs can indicate vegetation changes and water content associated with fractures where caves may be located.

AGGREGATE. Any of several hard, inert materials, such as sand, gravel, slag, or crushed stone, used for mixing with a cementing or bituminous material to form concrete, mortar, or plaster, or used alone, as in railroad ballast or graded fill.

AIR POLLUTION. The general term alluding to the undesirable addition of substances (gases, liquids, or solid particles) to the atmosphere that are foreign to the natural atmosphere or are present in quantities exceeding natural concentrations.

ALLOTMENT. An area of land designated and managed for grazing of livestock.

ALLOTMENT MANAGEMENT PLAN (AMP). A livestock grazing activity plan for a specific allotment based on multiple-use resource management objectives. The AMP considers livestock grazing in relation to other uses of the rangelands and in relation to renewable resources (i.e., watershed, vegetation and wildlife). An AMP includes the seasons of use, number of livestock permitted on the allotment, grazing system, and the rangeland developments needed. AMPs are prepared in consultation, cooperation and coordination with the permittee(s), lessee(s) or other involved affected parties.

ANIMAL UNIT MONTH (AUM). The amount of forage necessary for the sustenance of one cow with a nursing calf or its equivalent for a period of one month.

ANNUAL WATER YIELD. The total stream flow volume that passes a specified point in a watershed during a year. It generally equals total precipitation and irrigation, less evapotranspiration losses and deep seepage losses.

AREAS OF CRITICAL ENVIRONMENTAL CONCERN (ACEC). Areas within the public land where special management attention is needed to protect and prevent irreparable damage to important historical, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and provide safety from natural hazards.

AVOIDANCE AREA. An environmentally sensitive area where rights-of-way would be granted only in cases where there is a prevailing need and no practical alternative location exists, and then only with appropriate provisions to protect the sensitive environmental components.

BERM. An embankment or mound of earth or other material. Examples of the use of a berm include use around a tank battery in an oil field to contain spilled fluids or as a barrier across a road or trail to prohibit travel by motor vehicles.

BEST MANAGEMENT PRACTICE (BMP). Methods, measures, or practices selected on the basis of site specific conditions to ensure environmental quality will be maintained or restored to its highest practicable level. BMPs include, but are not limited to structural and nonstructural controls, operations, and maintenance procedures. BMPs can be applied before, during, or after activities to reduce or eliminate impacts to soil, air, water, or vegetation resources.

BIODIVERSITY. Refers to the variety of life and its processes and includes the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur.

CALICHE. A brown or white material commonly found as a subsoil deposit in and or semi-arid climates which is composed largely of calcium carbonate.

CAVE. Any naturally occurring void, cavity, recess, or system of interconnected passages which occurs beneath the surface of the earth or within a cliff or ledge (including any cave resource therein, but not including any vug, mine, tunnel, aqueduct, or other manmade excavation) and which is large enough to permit an individual to enter, whether or not the entrance is naturally formed or manmade. The term "cave" includes any natural pit, sinkhole, or other feature which is an extension of the entrance. Refer also to "Significant Cave."

CAVE EXPLORATION. The act of entering a naturally occurring void, cavity, recess or system of interconnected passages which occurs beneath the surface of the earth, ledge, or cliff to investigate, study or analyze contents, hazards and extent; to travel into new territories for adventure or discovery.

CLASSIFICATION OF LANDS. The process of determining whether the lands are more valuable or suitable for transfer or use under particular or various public land laws than for retention in federal ownership for management purposes.

COMMUNITY. A group of plants and animals living together in a common area having close interactions.

COMMUNITY PIT. A site from which nonexclusive disposals of mineral materials can be made.

CONDITION OF APPROVAL (COA). A requirement appended to a use authorization that must be met in order to be in conformance with the authorization. Conditions of approval may be standard practices that are routinely applied or may be special requirements developed through the NEPA process. Conditions of approval usually are applied to mitigate the impacts of an action. Conditions of approval do not modify any rights granted by a lease (e.g., an oil and gas lease).

CONSERVATION (ARCHAEOLOGY). A level of management applied to cultural resources exhibiting uniqueness or relative scarcity of similar cultural properties; research potential that surpasses current state of the art; or singular historic importance or architectural interest.

COORDINATED RESOURCE MANAGEMENT PLAN. A plan for management of one or more grazing allotments that involve all the affected resources, e.g., range, wildlife, watershed, minerals, and recreation.

CORRIDOR. A linear strip of land forming a passageway between two points in which transportation and/or utility systems exist or may be located. A designated corridor is the preferred location for existing and future rights-of-way grants that have been identified by law, by secretarial order, through land use planning, or by other management decision.

CRITICAL HABITAT. Any air, land, or water area, including elements thereof, which have been determined (and published in the *Federal Register*) to be essential to the survival of wild populations of an endangered or threatened species or to be necessary for their recovery to a point at which the measures provided pursuant to the ESA are no longer necessary.

CULTURAL RESOURCE. The fragile and nonrenewable remains of human activity, occupation, or endeavor reflected in districts, sites, structures, buildings, objects, artifacts, ruins, works of art, architecture, and natural features that were of importance in human events. These resources consist of physical remains, areas where significant human events occurred even though evidence of the event no longer remains, and the environment immediately surrounding the actual resource and oral history or ethnographic accounts of life ways and customs.

DESIGNATION. The official identification and naming of a general area or site on public land. Lands may be designated when they are either (1) withdrawn, (2) given special status by act of Congress, or (3) established by an approved land use plan.

DESIGNATED USES. Surface water uses specified by the Water Quality Control Commission for which water quality standards have been established. Designated uses apply whether or not they are being attained.

DESIRED PLANT COMMUNITY (DPC). The plant community which provides the vegetation attributes required for meeting or exceeding RMP vegetation objectives. The DPC must be within an ecological site's capability to produce these attributes through natural succession, management action, or both. A specific description of the vegetation needed to meet the vegetation objectives of a detailed activity plan or implementing action can be described as a desired plant community. Seeding mixtures under DPC would emphasize the use of native species and avoid noxious weeds and exotic species.

DISTRICT. The specific area of public land administered by a District Manager.

DIVERSION. A man-made construction that diverts water from its natural source to be put to beneficial use.

DIVERSITY. The relative degree of abundance of wildlife species, plant species, communities, habitats, or habitat features per unit area.

DRAINAGE. A term used in oil and natural gas extraction meaning the pool of either resource is “drained” or removed either through existing pressure or pumping. These pools may extend beyond the surface ownership boundaries and a well drilled on one surface owner may drain the resource underneath an adjacent surface owner.

ECOSYSTEM. A complex self-sustaining natural system which includes living and nonliving components of the environment and the circulation of matter and energy between organisms and their environment.

ENDANGERED SPECIES (FEDERAL). An animal or plant species whose prospects of survival and reproduction are in immediate jeopardy and in danger of extinction throughout all or a significant portion of its range, as defined by the USFWS under the authority of the Endangered Species Act of 1973, as amended. Whether a species is threatened or endangered is determined by the following factors: (1) present or threatened destruction, modification, or curtailment of its habitat or range; (2) over utilization for commercial, sporting, scientific, or educational purposes; (3) disease or predation; (4) inadequacy of existing regulatory mechanisms; or (5) other natural or human-made factors. Also, see "Threatened Species (Federal)" in the Glossary.

ENDANGERED SPECIES (STATE). Any species or subspecies whose prospects of survival or recruitment in New Mexico are in jeopardy. Also, see "Threatened Species (State)" in the Glossary.

ENVIRONMENTAL ASSESSMENT (EA). The procedure for analyzing the impacts of some proposed action on a given environment and the documentation of that analysis. An EA is similar to an environmental impact statement (EIS) but is generally smaller in scope. An EA may be preliminary to an EIS.

ENVIRONMENTAL IMPACT STATEMENT (EIS). The procedure for analyzing the impacts (both beneficial and adverse) of a proposed action on a given environment, and the documentation of that analysis.

EXCEPTION. Case-by-case exemption from a lease stipulation. The stipulation continues to apply to all other sites within the leasehold to which the restrictive criteria apply.

EXCHANGE. A trading of public land (surface or subsurface estates) that usually does not have high public value, for lands in other ownerships which do have value for public use, management and enjoyment. The exchange may be for the benefit of other Federal agencies as well as the BLM.

EXCLUSION AREAS. Areas where future rights-of-way may be granted only when mandated by law.

EXTENSIVE RECREATION MANAGEMENT AREA (ERMA). Areas where recreation is unstructured and dispersed and where minimal recreation-related investments are required. ERMAs provide recreation visitors the freedom of choice with minimal regulatory constraint. These areas consist of the remainder of land areas not included in Special Recreation Management Areas within a District or Field Office area.

FEDERAL CAVE RESOURCES PROTECTION ACT (FCRPA) OF 1988. The purposes of this act are (1) to secure, protect, and preserve significant caves on Federal lands for the perpetual use, enjoyment, and benefit of all people; and (2) to foster increased cooperation and exchange of information between governmental authorities and those who utilize caves located on Federal lands for scientific, education, or recreational purposes.

FEDERAL LAND. Land owned by the United States and administered by the Federal government. Federal land includes public land (see Public Land in the Glossary).

FEDERAL LAND POLICY AND MANAGEMENT ACT (FLPMA) OF 1976. Public Law 94-579, gives the BLM legal authority to establish public land policy; to establish guidelines for administering such policy; and to provide for the management, protection, development, and enhancement of the public land. Often referred to and pronounced "flipma."

FEDERAL RESERVED WATER RIGHT. A water right which is reserved by the Federal government when land is withdrawn from the public domain for a particular purpose, such as National parks, forests, and monuments. The amount of water reserved is only that necessary to fulfill the intended purpose.

FIELD OFFICE. The smallest administrative subdivision of a BLM district. A Field Office is administered by a Field Manager and is the equivalent of a resource area.

FIRE MANAGEMENT UNIT (FMU). A land management area definable by objectives, management constraints, topographic features, access, values to be protected, political boundaries, fuel types, major fire regime groups, etc.

that set it apart from the characteristics of an adjacent FMU. The FMU may have dominant management objectives and pre-selected strategies assigned to accomplish these objectives.

FLOODPLAIN. See "One Hundred-Year Floodplain" in the Glossary.

FLOWLINE. The surface pipe through which oil, water, or gas travels from a well to processing equipment or to storage.

FRAGILE SOIL. A soil that is easily damaged by use or disturbance. Examples include soils that are susceptible to compaction or other mechanic damage to their structure, or soils that are highly erodible when disturbed.

GEOGRAPHIC INFORMATION SYSTEM (GIS). Through the use of computer technology, GIS allows the input, storage, analysis, and display of a great volume and variety of physically locatable data (i.e., data which is known to exist at some specific place or area on the ground).

GRANT. A gift of public land either in quantity or in place. Also, the document or the action which conveys land or an interest in land.

GRAZING CAPACITY. The maximum livestock stocking rate possible without inducing damage to vegetation or related resources such as watershed. This incorporates factors such as suitability of the rangeland for grazing a well as the proper use which can be made on all of the plants within the area. Normally expressed in terms of acres per animal unit month (AC/AUM) or sometimes referred to as the total AUMs that are available in any given area, such as an allotment. Areas that are unsuitable for livestock use are not computed in the grazing capacity. Grazing capacity may or may not be the same as the stocking rate.

GRAZING DISTRICT. Means the specific area within which the public land are administered under Section 3 of the Taylor Grazing Act. Public land outside grazing district boundaries is administered under Section 15 of the Taylor Grazing Act.

GROUND WATER. Subsurface water contained in interconnected pores between soil or rock particles in a zone of saturation. Groundwater includes underground lakes and streams in karst areas.

HABITAT. The place where an animal or plant normally lives during its life cycle often characterized by dominant food, cover, water, and space (e.g., the stream habitat, the forest habitat).

HABITAT MANAGEMENT PLAN (HMP). A written and officially approved plan for a specific geographical area of public land which identifies wildlife habitat and related objectives, establishes the sequence of actions for achieving objectives, and outlines procedures for evaluating accomplishments.

HAZARDOUS MATERIAL. Any substance posing a threat to the health or safety of persons or the environment. These includes but is not limited to RCRA hazardous wastes, CERCLA and CWA hazardous substances, DOT hazardous materials, OSHA hazardous chemicals, SRA Title III toxics and extremely hazardous substances, and biological and disease-causing agents.

HISTORICAL USE. The average of the highest two use seasons in the preceding five-year period.

INFORMATION (ARCHAEOLOGY). A level of management applied to cultural resources. Most sites fall into this category and would be studied for the information that could be retrieved from them. The process of extracting information often destroys the site. These sites could be lithic scatters, campsites and other types of sites.

INTERMITTENT STREAM. A stream that does not flow year round but has some association with ground water for surface or subsurface flows.

KARST. A landform where the topography has been formed chiefly by the dissolving of rock. In some cases, the dissolving of rock may be extensive enough to form passages through which an individual could pass. Surface expressions include sinking streams, swalletts, springs and resurgences, and the presence of sinkholes and caves. Surface streams are few, with most of the drainage being underground. These features are important for groundwater recharge of karst systems.

LEASABLE MINERALS. See Mineral Materials.

LEASE. An authorization to possess and use public land for a fixed period of time (usually long-term). Also, any contract, profit-share arrangement, joint venture, or other agreement issued or approved by the United States Government under a mineral leasing law that authorizes exploration for, extraction of, or removal of oil and gas resources.

LEASE NOTICE. An attachment to an oil and gas lease that transmits information at the time of lease issuance to assist a lessee in submitting acceptable plans of operation, or to assist in administration of leases. A Lease Notice is used to disclose a situation or condition known to exist that could affect lease operations. Lease Notices are not a basis for denial of lease operations.

LEGAL ACCESS. In the context of access to public land, especially public land tracts that may be adjacent to or surrounded by land of other ownerships, legal access exists when a person can reach a given public land tract without trespassing, such as from a public road or highway, or from another tract of public land. (See "Physical Access.")

LENTIC. Pertaining to static, calm, or slow moving water or aquatic habitats, such as a marsh.

LOCATABLE MINERALS. Minerals subject to disposal and development through the Mining Law of 1872 (as amended). Includes all "valuable mineral deposits" including metallic and nonmetallic minerals such as gold, lead, barite, fluorspar or high calcium limestone. It also includes uncommon varieties of sand, stone, gravel, cinders, pumice, pumicite and clay. Also included are all valuable minerals that are not excluded under the leasable and salable minerals.

MANAGEMENT FRAMEWORK PLAN (MFP). A planning decision document now replaced by RMPs that establishes for a given planning area land use allocations, coordination guidelines for multiple use, and management objectives to be achieved for each class of land use or protection.

MINERAL MATERIALS. Minerals such as common varieties of sand, stone, gravel, pumice, pumicite and clay which are not obtainable under the mining or leasing laws but which can be obtained under the Materials Act of 1947, as amended. Also known as saleable minerals.

MODIFICATION. A fundamental change in the provisions of a lease stipulation, either temporarily or for the term of the lease. A modification may, therefore, include an exemption from or an alteration to a stipulated requirement. Depending on the specific modification, the stipulation may or may not apply to all other sites within the leasehold to which the restrictive stipulation applies.

NATIONAL REGISTER OF HISTORIC PLACES. A list of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, and culture.

NONCOMMERCIAL USE. A recreational activity on public land or related waters where actual expenses are shared equally among all members or participants. Any person, group, or organization seeking to qualify as noncommercial must establish to the satisfaction of BLM that no financial or business gain will be derived from the proposed use. Fund raising, for any purpose, renders an activity a commercial use.

NONPOINT SOURCE POLLUTION (NPS). The alteration of waters by activities not regulated as point sources, which degrade the quality or adversely affect the biological community inhabiting the waters.

NO SURFACE OCCUPANCY (NSO). A condition of surface use attached to a lease or other authorization applied to minerals exploration and development which prohibits occupancy of only the land surface or to protect other identified resource values.

NOXIOUS WEED. A plant that causes disease or has other adverse effects on the human environment and is, therefore, detrimental to the agriculture and commerce of the United States and public health. Generally, noxious weeds possess one or more of the characteristics of being aggressive and difficult to manage, parasitic, a carrier or host of harmful insects or disease, and being either native, new to, or not common in, the United States. In most cases, however noxious weeds are normative species. Noxious weeds are designated and regulated by various state and Federal laws.

OCCUPIED RAPTOR NEST. An occupied raptor nest is defined as a large stick nest with the observation of one or more raptors within the nest or within the immediate vicinity of the nest and/or evidence of raptor occupation (e.g. recent nest material, prey remains) during the breeding season (March – June).

ONE HUNDRED-YEAR FLOOD. The flood that will be equaled or exceeded an average of once every 100 years; i.e. the flood that has a one percent chance of being equaled or exceeded in any given year.

ONE HUNDRED-YEAR FLOODPLAIN. The area adjacent to a stream or body of water that would be inundated at the peak of the one hundred-year flood. The floodplain delineated on Flood Insurance Rate Maps (FIRMS) or Flood Hazard Boundary Maps (FHBMS) published by the Federal Emergency Management Agency will be used for management purposes. When a FIRM or FHBM map is not available for the area of interest, the best available information will be used.

OPERATING PLAN. An applicant's/permittee's plan to conduct their activity or event on public lands or related waters in conjunction with a Special Recreation Permit. An operating plan will describe at a minimum how services will be delivered, how an event will be conducted, and describes measures that will be implemented to protect resources and provide for public health and safety.

PERENNIAL STREAM. Surface water normally flows throughout the year except during infrequent years of drought.

PERMIT (GRAZING). A document authorizing use of the public land within grazing districts under Section 3 of the Taylor Grazing Act for the purpose of grazing livestock.

PERMIT. An authorization, revocable by or at the discretion of BLM, to utilize public lands for a fixed period of time. A permit conveys no possessory interest in the land.

PERMITTEE. An individual, group or organization who has fulfilled all the requirements for and has been awarded a permit.

PETROGLYPH. A form of rock art manufactured by incising, scratching, or pecking designs into rock surfaces.

PHYSICAL ACCESS. In the context of access to public land, especially public land tracts that may be adjacent to or surrounded by land of other ownerships, physical access exists when a person can physically reach a given public land tract. The existence of physical access does not always mean that legal access exists. In some cases, taking advantage of physical access may involve trespass. (See "Legal Access.")

PIPELINE. A system of connected lengths of steel or plastic pipe, laid either in the earth or on the surface that is used for transporting petroleum, petroleum products, chemicals, natural gas, or other fluids.

PLAYA. A shallow, nearly level, often saline, dry lake bed. Playas vary considerably in materials, salinity, and hydrologic regime. In general, playas: (1) collect surface runoff in closed basins; (2) are poorly vegetated; (3) are ephemerally flooded; and (4) have a thin surface of non-gravelly, fine-textured sediment.

PRECIPITATION. Any or all forms of water particles, liquid or solid, which fall from the atmosphere and reach the ground.

PRESCRIBED FIRE. Any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan must exist, and NEPA requirements (where applicable) must be met, prior to ignition.

PUBLIC LAND. Any land and interest in land owned by the United States within the several states and administered by the Secretary of the Interior through the Bureau of the Land Management, without regard to how the United States acquired ownership, except (1) land located on the Outer Continental Shelf; and (2) land held for the benefit of Indians, Aleuts, and Eskimos.

PUBLIC VALUES AND INTERPRETATION (ARCHAEOLOGY). A level of management of cultural sites which contribute to the belief systems and folkways of a cultural group such as locations having religious significance. Public interpretive sites would have qualities that would lend themselves to being utilized as recreation, education, and interpretive areas.

RANGE IMPROVEMENT. An authorized activity or program on or relating to rangelands which is designed to improve production of forage; range vegetative composition; control patterns of use; provide water; stabilize soil and water conditions; and provide habitat for livestock, wild horses or burros, and wildlife. The term includes, but is not limited to structures, treatment projects, and use of mechanical means to accomplish the desired results.

RANGELAND. Land used for grazing by livestock and big game animals on which the vegetation is dominated by grasses, grass-like plants, forbs, or shrubs.

RAPTOR. A bird of prey, such as an eagle, hawk, or owl.

RECLAMATION. The reconstruction of disturbance by returning the land to a condition approximate or equal to that which existed prior to disturbance, or to a stable and productive condition compatible with the land use plan. The immediate goal of reclamation is to stabilize disturbed areas and protect both disturbed and adjacent undisturbed areas from unnecessary degradation.

RECREATION AREA/SITE. An area of recreation may be a site, complex of sites, or a high impact recreation area that, at a minimum, meets all of the conditions in REA Chapter 3(f)(4)(A-D). Further Definition: High-Impact Recreation Area, Geographic area, or Waterway Corridor: A high impact recreation area or geographic area or waterway corridor of concentrated recreation use which includes a variety of developed sites providing a similar recreation opportunity. High-impact recreation areas incur significant expenditures for restoration, public safety, sanitation facilities,

education, maintenance, and other activities necessary to protect the health and safety of visitors, cultural resources and the natural environment. They may contain sub-areas of little development and use which results in environmental impacts such as noticeable litter, vandalism, soil compaction, or erosion. These areas require intensive management to enhance visitor experiences, address environmental impacts, and manage conflicting uses. An area of high recreation impact is not an administrative unit such as a National Forest, BLM Field Office, or Reclamation Project.

In addition, it is contiguous areas directly associated with a clearly identified special, natural, or cultural features, place or activity that is the focal point of recreation use and have clearly defined access points and clearly described area boundaries.

Typically, a high impact recreation area is comprised of a complex of individual sites and displays one or more of the following characteristics:

(1) Has a population of one million or more within two hours of driving time;

(2) Contains rivers, streams, lakes or interpreted scenic byways corridors;

(3) Designed and conducted to maintain or enhance the recreational opportunities through Natural Resource Management Activities;

(4) Has regionally or nationally recognized recreation resources; and

(5) Is regionally or locally marketed for its tourism value.

RELATED WATERS. Waters which lie directly over or adjacent to public lands and require some management control to protect federally administered resources or to provide for enhanced visitor safety.

RESOURCE MANAGEMENT PLAN (RMP). A written land use plan that outlines BLM's decisions and strategies for management of the resources in a particular area. The RMP has been used by the BLM since 1980.

RESTRICTED AREAS. Areas where mitigation such as seasonal restrictions is required to protect resource values.

RURAL (R). Areas with recreation opportunities to experience affiliation with individuals and groups are prevalent as is the convenience of sites and opportunities. These factors are generally more important than the natural setting. Opportunities for wild land challenges, risk taking, and testing of outdoor skills are unimportant, except in activities involving challenge and risk.

RIGHT-OF-WAY (ROW). The legal right for use, occupancy, or access across land or water areas for a specified purpose or purposes. Also, the lands covered by such a right. Examples are roads, power lines, pipelines, water wells, and communication sites. It does not grant an estate of any kind.

RIPARIAN AREAS. Riparian areas are a form of wetland transition between permanently saturated wetlands and upland areas. These areas exhibit vegetation or physical characteristics reflective of permanent surface or subsurface water influence. Lands along, adjacent to, or contiguous with perennially and intermittently flowing rivers, and streams, glacial potholes, and the shores of lakes and reservoirs with stable water levels are typical riparian areas. Excluded are such sites as ephemeral streams or washes that do not exhibit the presence of vegetation dependent upon free water in the soil.

RIPARIAN AREA. A riparian area is an area of land occurring adjacent to streams, rivers, and other water bodies that is directly influenced by water. A riparian community is characterized by certain types of vegetation, soils, hydrology, and fauna and requires free or unbound water or conditions more moist than normally found in the area. Excluded are such sites as ephemeral streams or washes that do no exhibit the presence of vegetation dependent on free water in the soil.

SEDIMENT YIELD. A quantitative measure of the total sediment outflow from a watershed over a given period of time at a specified point in the channel. Sediment yield is the difference between the total erosion from slopes, channels, and mass wasting, and the amount of sediment deposited before reaching the specified point in the channel.

SEEPS. Is where ground water percolates to the surface and forms a saturated area.

SIGNIFICANT CAVE. A cave located on federal lands that possesses one or more of the following features, characteristics, or values (1) Biota; (2) Cultural; (3) Geologic / Mineralogic / Paleontologic; (4) Hydrologic; (5) Recreational; (6) Educational or Scientific.

SIGNIFICANT KARST. An area in which sinkholes or other features, such as lineaments, provide points of recharge to an aquifer that is the source of water for human, livestock, or wildlife use, or which provides a primary recharge zone for cave-related hydrologic systems.

SINKHOLE. A closed depression formed when the ground surface collapses above voids created by the solution of carbonate or evaporate rocks. Water levels typically fluctuate rapidly in sinkholes because of their close connection to groundwater.

SLOPE. The inclination of the land surface to the horizontal. When expressed as a percent, slope equals the change in elevation divided by the horizontal distance, with the result multiplied by 100 percent. Thus, a slope of 20 percent is a change in elevation of 20 feet for every 100 feet horizontally.

SPECIAL AREAS. Designated by statute, Executive, or Secretarial order, State Director special rule making authority, or an area covered by joint agreement between BLM and a State under Title II of the Sikes Act (16 U.S.C. 670a et seq.).

SPECIAL HABITAT FEATURE. A specific component of a habitat site requiring individual consideration, including geological anomalies (cliffs), aquatic situations (seeps), or manmade structures (windmill). A feature may be present in the habitat site because of animal use (booming grounds). Special habitat features may affect wildlife positively or negatively.

SPECIAL MANAGEMENT AREAS. An area containing one or a combination of unique resources or values that receive more intensive management (e.g., ACECS, WSAS, and SRMAS.)

SPECIAL STATUS SPECIES. Wildlife and plant species either Federally-listed or proposed for listing (candidates) as endangered or threatened, State-listed species, or BLM determined priority species (sensitive species).

SPRING. Where water is discharged from a fixed point and the flow usually forms a small channel.

SOLID LEASABLE MINERALS. The chlorides, sulfates, carbonates, borates, silicates or nitrates of potassium or sodium and related products; Sulphur in the States of Louisiana and New Mexico and on all acquired lands; phosphate, including associated and related minerals; asphalt in certain lands in Oklahoma; and gilsonite (including all vein-type solid hydrocarbons).

STATE APPROPRIATIVE WATER RIGHT. A water right licensed by the New Mexico State Engineer once proof of beneficial use is established.

STATE HISTORIC PRESERVATION OFFICER (SHPO). A position within State governments responsible for coordinating State participation in the implementation of the National Historic Preservation Act. This officer serves as an assistant and consultant when identifying cultural properties, assessing effects to them, and considering alternatives to avoid or reduce those effects.

STIPULATION. A requirement, usually dealing with protection of the environment that is made a part of a lease, grant, or other authorizing document. In the case of oil and gas leases, a provision that modifies standard lease rights and is attached to and made a part of the lease. Also, refer to "CONDITION OF APPROVAL" in the Glossary.

The following represent the major stipulations on BLM land:

No Surface Occupancy Stipulation (NSO): A stipulation in which use or occupancy of the land surface for fluid mineral exploration or development is prohibited to protect identified resource values.

Timing Limitation Stipulation: A stipulation which prohibits surface use during specified time periods to protect identified resource values. This stipulation does not apply to the operation and maintenance of production facilities unless the findings of analysis demonstrate the continued need for such mitigation and that less stringent, project specific mitigation measures would be insufficient.

SUITABILITY. The adaptability of an area to grazing by livestock or wildlife.

SUITABLE RANGE. Rangeland that is accessible to livestock, which can be grazed on a sustained yield basis without damaging the resource.

SURFACE DISTURBANCE. Any action that removal of soil or vegetation and expose the mineral soil to erosive processes. Used in the literal context of actual, physical disturbance and movement or removal of the land surface and vegetation.

SURFACE USE PLAN OF OPERATIONS (SUPO). The purpose of a Surface Use Plan of Operations (SUPO) is to manage development so that impacts to special status species habitat are minimized or eliminated. A SUPO would incorporate applicable best management practices and disclose all future well locations; the location and arrangement of well infrastructure (e. g., tank batteries, compressors, power lines and poles); road locations; and rights-of-way. Surface Use Plan of Operations (SUPO) contain proprietary information and therefore are not subject to disclosure under the Freedom of Information Act.

SURFACE WATER. All water located at the surface of the land, such as streams, rivers, and lakes.

THREATENED SPECIES (Federal). Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Whether a species is threatened or endangered is determined by the following factors: (1) present or threatened destruction, modification, or curtailment of its habitat or range; (2) over utilization for commercial, sporting, scientific, or educational purposes; (3) disease or predation; (4) inadequacy of existing regulatory mechanisms; or (5) other natural or human-made factors. Also, see "Endangered Species (Federal)" in the Glossary.

THREATENED SPECIES (State). Any species or subspecies that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range in New Mexico. Also, see "Endangered Species (State)" in the Glossary.

VALUE. As used in the RMP/EIS, a value refers to a natural resource or characteristic of a natural resource that is not usually a commodity or is difficult to quantify in terms of a unit of measurement. Examples of values in this context are listed in FLPMA and include scientific, scenic, air and atmospheric, historical, archeological and ecological resources.

VEGETATION TREATMENTS. Methods used to manage the growth and spread of vegetation. A vegetative management practice can either be a direct management of the vegetation itself, for example prescribed fire or indirect management like a change in the number of livestock utilizing the vegetation, or a change in the time frames when livestock are utilizing the vegetation.

VISUAL RESOURCES MANAGEMENT (VRM). The inventory and planning actions taken to identify visual values and to establish objectives for managing those values; and the management actions taken to achieve the visual management objectives.

VISUAL RESOURCE MANAGEMENT (VRM) CLASSES. VRM classes are based on relative visual ratings of inventoried lands. Each class describes the different degree of modification allowed to the basic elements of the landscape. The following are the minimum management objective for each class:

Class 1: Natural ecological changes and very limited management activity are allowed. Any contrast created within the characteristic landscape must not attract attention. This classification is applied to

Visual Areas of Critical Environmental Concern, wilderness areas, wild and scenic rivers, and other similar situations.

Class II: Changes in any of the basic elements (form, line, color, texture) caused by a management activity should not be evident in the landscape. A contrast may be seen but should not attract attention.

Class III: Contrasts to the basic elements caused by a management activity may be evident and begin to attract attention in the landscape. The changes, however, should remain subordinate in the existing landscape.

Class IV: Contrasts may attract attention and be a dominant feature in the landscape in terms of scale. However, the changes should repeat the basic elements of the landscape.

Rehabilitation Area: Change is needed or change may add acceptable visual variety to an area. This class applies to areas where the naturalistic character has been disturbed to a point where rehabilitation is needed to bring it back into character with the surrounding landscape. This class would apply to areas identified in the scenic evaluation where the quality class has been reduced because of unacceptable cultural modification. The contrast is inharmonious with the characteristic landscape. It may also be applied to areas that have the potential for enhancement; i.e., add acceptable visual variety to an area or site. It should be considered an interim or short term classification until one of the other VRM class objectives can be reached through rehabilitation or enhancement. The desired visual resource management class should be identified.

WATER QUALITY STANDARD. Regulations which specify designated uses for surface waters of the state, and water quality criteria to protect those uses. Standards are specified by the Water Quality Control Commission, in accordance with Section 303 of the Clean Water Act.

WETLANDS. Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support and which, under normal circumstances, do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include marshes, shallows, swamps, lake shores, bogs, muskegs, wet meadows, estuaries, and riparian areas.

WILDFIRE. An unplanned, unwanted wildland fire including unauthorized human caused fires, escaped wildland fire use events, escaped prescribed fire projects, and all other wildland fires where the objective is to put the fire out.

WILDFIRE SUPPRESSION. An appropriate management response to wildfire, escaped wildland fire use or prescribed fire that results in curtailment of fire spread and eliminates all identified threats from the particular fire.

WILDLAND FIRE. Any non-structure fire that occurs in the wildland. Three distinct types of wildland fire have been defined and include wildfire, wildland fire use, and prescribed fire.

WILDLIFE. Includes all species of animals, birds, mammals, mollusks, crustaceans, amphibians, fish, insects, reptiles, or their progeny or eggs which, whether raised in captivity or not, are normally found in a wild state.

WITHDRAWAL. Removal or withholding of public land, by statute or secretarial order, from operation of some or all of the public land laws. A mineral withdrawal is the closing of an area to mineral location and development activities. A mineral withdrawal includes public lands potentially valuable for solid leasable minerals, precluding the disposal of the lands except with a mineral reservation clause unless the lands are found not to contain a valuable deposit of minerals.

APPENDIX C

References

REFERENCES

Adams, J.W., J.W. Hawley, L. Pray, and D.W. Love. 1993. Second-day road log from Carlsbad to Whites City, Guadalupe Mountains National Park, Salt Flat, Washington Ranch and return to Carlsbad. New Mexico Geological Society, Field Conference Guidebook 44:43–67.

Bednarz, J. 1975. A Study of the Pecos Gambusia. Unpublished report for Endangered Species Program, New Mexico Department of Game and Fish, Santa Fe.

Brown, K.L., M. Graham, H.C. Higgins, T.G. McEnany, S. Owens, and M. Quirola. 2010. Permian Basin Project: Ethnographic and Archaeological Inventory with the Mescalero Apache Tribe of Potential Traditional Cultural Properties in the Vicinity of the Permian Basin MOA, BLM Pecos District, Eddy County, New Mexico.

Brown, M.E. (ed.). 2011. The Boot Hill Site (LA 32229): An Oasis in the Desert, Eddy County, New Mexico.

Bureau of Land Management (BLM). 1978. Wilderness Inventory Handbook: Policy, Direction, Procedures, and Guidance for Conducting Wilderness Inventory on Public Lands. Washington D.C: Bureau of Land Management.

BLM. 1986. Visual Resource Inventory Handbook: H-8410-1. Washington D.C: Bureau of Land Management.

BLM. 1988. Carlsbad Resource Management Plan. Roswell, New Mexico: Bureau of Land Management Roswell District.

BLM. 1997. Carlsbad Approved Resource Management Plan Amendment and Record of Decision. Carlsbad, New Mexico: Government Printing Office.

BLM. 2001a. New Mexico Standards for Public Land Health and Guidelines for Livestock Grazing Management, Record of Decision. January 2001, U.S. Department of the Interior, Bureau of Land Management.

BLM. 2001c. H-4180-1 – Rangeland Health Standards. Washington D.C: Bureau of Land Management.

BLM. 2010a. New Mexico's Permian Basin Cumulative Air Quality Impact Analysis--Draft Emissions inventory. Carlsbad, New Mexico: Bureau of Land Management.

BLM. 2010c. Carlsbad Field Office Allotment Master Report. Rangeland Administration System. Bureau of Land Management, June 2010. Available at: http://www.blm.gov/ras/.

BLM. 2012a. BLM Manual 6310—Conducting Wilderness Characteristics Inventory on BLM Lands (Public). Available at: http://www.blm.gov/pgdata/etc/medialib/blm/wo/Information_Resources_Management/policy/blm_manual.Par.38337.File.dat/6310.pdf.

Carmen, S.M. 2007. Texas Hornshell Popenaias popeii Recovery Plan. Santa Fe, New Mexico: New Mexico Department of Game and Fish, Conservation Services Division.

Federal Register/Volume 44 No. 217 Wednesday November 7, 1979, 64741. 50 CFR Part 17. Endangered and Threatened Wildlife and Plants: determination that Coryphantha sneedii is an Endangered Species.

Federal Register. Vol. 46, No.12. January 19, 1981. 50 CFR Part 17. Endangered and Threatened Wildlife and Plants: Determination of Two New Mexico Plants to be Endangered Species and Threatened Species, with Critical Habitat.

Federal Register/Volume 55 No. 60 Wednesday March 28, 1990, 11413. 50 CFR Part 17. Endangered and Threatened Wildlife and Plants: Finding on a Petition to List the Mexican Spotted Owl as Threatened or Endangered.

Federal Register/Volume 58 No. 49 March 16, 1993, 14248-14271. 50 CFR 17. Endangered and Threatened Wildlife and Plants: Final Rule to List the Mexican Spotted Owl as a Threatened Species.

Federal Register/Volume 60 No. 133 Wednesday July 12, 1995, 36000. 50 CFR 17. Endangered and Threatened Wildlife and Plants: Final Rule to Reclassify the Bald Eagle from Endangered to Threatened in All of the Lower 48 States.

Federal Register/Volume 71 No. 143 Wednesday July 26, 2006, 42298. 50 CFR Part 17. Endangered and Threatened Wildlife and Plants: Establishment of a Nonessential Experimental population of Northern Aplomado Falcons in New Mexico and Arizona.

Hill, C.A., 1996, Geology of the Delaware Basin, Guadalupe, Apache and Glass Mountains: New Mexico and West Texas: Permian Basin Section: Midland, Texas, SEPM, 480 p.

King, P.B. 1949. Regional Geologic Map of Parts of Culberson and Hudspeth Counties, Texas. United States Geological Survey Oil and Gas Investigations Preliminary Map 90. 1 sheet. Scale 1:50,000.

Knight, P.J. 1993. A Status Review of Gypsum Wild Buckwheat. Submitted to U.S. Fish and Wildlife Service, Region 2, Albuquerque.

Morgan, J.A., D.G. Milchunas, D.R. LeCain, M. West, and A.R. Mosier. 2007. Carbon dioxide enrichment alters plant community structure and accelerates shrub growth in the shortgrass steppe. Proceedings of the National Academy of Sciences (USA) 104:14724–14729.

New Mexico Bureau of Geology and Mineral Resources (NMBGMR). 2003. Geologic Map of New Mexico. Scale 1:500,000.

New Mexico Department of Agriculture (NMDA). 2009. 2009 New Mexico Noxious Weed List Update. Memorandum to the general public. from I. Gonzales. April 1, 2009. Available at http://www.nmda.nmsu.edu/wp-content/uploads/2012/01/weed_memo_list.pdf. Accessed October 19, 2015.

New Mexico Department of Game and Fish (NMDGF). 2004. 2004. Threatened and Endangered Species of New Mexico. 2004 Biennial Review. Santa Fe, New Mexico: New Mexico Department of Game and Fish Conservation Services Division.

Palmer, A.N., and Palmer, M.V. 2009. Caves and Karst of the USA. Huntsville: National Speleological Society, Inc.

U.S. Fish and Wildlife Service. 1984. Gypsum Wild Buckwheat (Eriogonum gypsophilum) Recovery Plan. Albuquerque: U.S. Fish and Wildlife Service, New Mexico Ecological Services Field Office.

U.S. Fish and Wildlife Service. 2007. Gypsum Wild Buckwheat (Eriogonum gypsophilum) 5-Year Review: Summary and Evaluation. Albuquerque: New Mexico Ecological Services Field Office, Region 2.

Vine, J.D. 1963. Surface Geology of the Nash Draw Quadrangle, Eddy County, New Mexico. United States Geological Survey Bulletin 1141-B. 46 pages.

Walter, J.C. 1953. Paleontology of Rustler Formation, Culberson County, Texas. Journal of Paleontology. Vol. 27, No. 5. Pp. 679-702.

APPENDIX D

Resumes

ARCADIS

Education
MS, University of Minnesota, Water Resources Management, 2000
BS, Colorado State University, Natural Resource Management, 1995

Years of Experience
Total - 19
With ARCADIS –2

Ethan Jahnke

Energy Project Manager

Mr. Jahnke has more than 19 years of experience in oil and gas project management, federal regulatory permitting and compliance, NEPA, hydrologic modeling, water sampling and GIS analysis. His project management experience includes coordinating over 80 Federal Plans of Developments/Master Development Plans for large and small oil and gas firms, managing and permitting water resources projects, running his own company for several years and managing numerous oil and gas projects. As a project manager, his duties have included coordinating activities of over twenty personnel and contractors, maintaining project timelines within multi-million dollar budget constraints, overseeing negotiations with federal, state and local governments, and managing data and documentation submittals.

His technical experience includes writing Environmental Assessments (EAs), Master Surface Use Plans and Water Management Plans for federal energy projects, writing Water Resource and Visual Resource sections for EAs and FERC reports, Phase 1 environmental site assessments, permitting oil and gas wells at the state and federal level, NPDES permitting, GIS database creation and management, surface and ground water quality sampling and modeling, beta-testing surface water hydrology models, reservoir impoundment design and baseline data investigations for Environmental Impact Statements (EIS) and EAs. He has worked with large multi-national corporations, small businesses, municipalities, local and state agencies and federal agencies including the BLM, USFS, EPA, USFWS and the DOE.

Category of Experience

Environmental Assessments for Oil and Gas Development in the Rockies

As a Project Manager, he has written or co-written numerous EAs for oil and gas development in Wyoming, Utah and New Mexico. Ethan has worked on a variety of EAs, ranging from projects with high resources value (historic and wildlife) near Adobe Town in southwest Wyoming to tribal land (Navajo) near the Four Corners in Utah to several EAs in southeast New Mexico with issues relating to wildlife and karst.

Federal Permitting Coordinator for Coal-bed Natural Gas Plans of Development in Northeast Wyoming

As an in-house contractor for over five years, he coordinated the federal permitting of over 80 Plans of Developments (precursor of Master Development Plans) entailing over 3,000 well APDs. His duties included coordinating permitting process with the BLM (POD submittal, on-

sites, final submittals and Conditions of Approvals), coordinated with internal operations managers, petroleum engineers, GIS contractors, internal regulatory staff, contract civil engineers, surveyors, archeologists, wildlife biologists, several different federal agencies and other stakeholders from project conception to approval. He also coordinated multiple process and software changes that allowed for better quality control and for more APDs to be submitted in a shorter timeframe. He was actively involved in the creation of a GIS database that is used in the operator's field offices in the United States. He was actively involved with biological and endangered species issues, such as the Greater sage-grouse, and coordinated Conditions of Approval with regulatory agencies.

Environmental, Health and Safety Support to Oil and Gas Operator in Wyoming

As contract manager for the project, he helped coordinate environmental, health and safety services to a small independent oil and gas company operating a producing field in Carbon County, Wyoming. He and staff were integrated into the company and served as their environmental, health and safety department. The work included creation of Bureau of Land Management (BLM) Plans of Developments for numerous federal oil and gas wells, conducting storm water audits, evaluating compliance of air quality program, creating site-specific reclamation plans, creation of water management plan, overseeing wildlife issues, such as sage grouse and raptor surveys, and GIS mapping and database creation of project areas.

Environmental Coordinator for In-Situ Coals Gasification Project

Coordinated the surveying and engineering designs of coal-bed natural gas wells for pilot testing of an in-situ coal gasification project in Northeast Wyoming. He used resources from several field offices to work on multiple aspects of the project, including: surveying, engineering designs, permitting, EHS audits and wildlife surveys. All of this was done under a tight deadline in order to all drilling to occur between timing stipulation periods.

Federal Permitting Coordinator in Coal-Bed Natural Gas Field for a Small Operator

Coordinated the federal permitting a coal-bed natural gas field in Northeast Wyoming consisting of over 90 wells. For the small operator, he permitted and negotiated with the BLM the design and layout of the project. He wrote the Master Surface Use Plan in conjunction with the proposed operator, coordinated the surveying, civil engineering, wildlife surveys. He also worked on the Watershed Management Plan, which included the designing and permitting of stock reservoirs and NPDES discharge permits.

El Creston Molybdenum Mexican Environmental Impact Statement

Wrote water resource section and created GIS maps for a Mexican Environmental Impact Statement of a proposed molybdenum and copper mine near Opodepe, Sonora, Mexico. As well as being the author of the two sections, he was tasked with coordinating the hydrological, technical and geographical data transfer with local consultants and other members of the team located in both Central America and South America. The EIS was eventually put on

hold due to low commodity prices.

Federal Permitting Coordinator and Hydrologist for Coal-Bed Natural Gas Operator

Worked to negotiate with the BLM on the approval of over 500 coal-bed natural gas wells in Northeast Wyoming for a major independent oil and gas firm. He wrote Water Management Plans for federal Plans of Development and coordinated the mapping, field layout, stock reservoir designs, state and federal permitting of stock reservoirs and discharge points through the BLM, COE, State of Wyoming, WDEQ and WSEO. Helped create an Access database for water quality that allowed the user to more closely monitor areas that were near or of non-compliance. This Access information was then placed into a GIS for all users to view and was also used for placement into the biannual Discharge Monitoring Reports required for all discharge permits. As part of the NPDES permitting process, he created a model that predicts the distance discharged water will travel based infiltration, evaporation, soil type and soil saturation.

Hydrological Evaluation and Impact of Coal-Bed Natural Gas on Ford Ranch

Evaluated the potential impact of natural gas wells to natural springs on a large ranch in Northeast Wyoming. A Coal-Bed Natural Gas development of over 40 wells was proposed on a historical ranch that would have added numerous reservoirs and possibly impacted the existing springs and, therefore, how the ranch operates. He proposed an alternative solution to water storage and treatment that was eventually used and became advantageous for the operator and landowner.

Coal-Bed Natural Gas Project Management and Plan on Developments for Small Operator

Oversaw the development of multiple Plans of Developments located in Northeast Wyoming. He managed the federal permitting, which included attaining approved well permits, coordinating wildlife surveys, well surveys, civil engineers, archeologist, reservoir permits, Water Management Plans and Master Surface Use Plans. He also managed the biannual Discharge Monitoring Reports for all of their discharge points.

Federal Energy Resource Commission (FERC) Report for Pipeline

Worked as the lead investigator on ground water and surface water for a FERC report on a gas pipeline in Southwest Wyoming. He was required to gather all necessary hydrological data for area the pipeline was to impact and to write his findings into the technical document. He was also the lead GIS Specialist on this project.

Visual Resources and GIS Mapping Sections for Mid-America Pipeline Company, LLC (MAPL) Western Expansion Project Environmental Assessment

Evaluated and wrote the visual impacts sections of a major pipeline Environmental Assessment traveling through New Mexico, Colorado, Utah and Wyoming. As the lead GIS Specialist on this project, he used GIS tools to analyze both the hydrologic and visual impacts

this major pipeline would bring to arid and semi-arid ecosystems.

Water Resources Section of a Pipeline Environmental Assessment

Evaluated and wrote the hydrologic sections of a pipeline Environmental Assessment located in Southwest Wyoming. He researched existing information for this area and used GIS tools to analyze the hydrology impacts. He was also the lead GIS Specialist on this project.

Hydrologic Modeling the Impact of Urban Development on a Trout System

Analyzed the potential impacts of urban development on a trout stream in Eastern Minnesota using hydrologic models and GIS. He used a beta model that combined ArcView and Soil and Water Assessment Tool (SWAT) and analyzed multiple urban densities and the associated runoff's impact to the existing trout stream. The township used this model to plan for impacts of certain urban density within the watershed of the stream.

Lawn Runoff Study in the Twin Cities, MN

Worked as part of a study that evaluated the relationship of phosphorus fertilizer within storm runoff and the quality of nearby lakes that are used as storage for storm water runoff. He coordinated with over 30 homeowners to allow the placement of sampling units within their yards and the sample pickup after storm events. He also was responsible for sampling nearby lakes and streams and analyzing the samples in a water quality laboratory. This study is now used as an example across many State and local governments to determine the types of fertilizer allowed within their region.

GIS Mapping and Database Creation for Wind Company

Created GIS maps for a start-up wind company in Denver. By collecting and researching through multiple existing GIS layers, he generated maps showing optimal sites for wind farms throughout the Rocky Mountain Region. These layers were based on wildlife habitat, average wind speed, proximity to transmission lines, surface ownership and access.

Lead GIS Specialist for Seismic Environmental Assessments

Worked on multiple Seismic Environmental Assessments for oil and gas projects in the Rocky Mountains as the lead GIS Specialist. His duties included the gathering of layers and shapefiles from multiple sources, the creation of maps and geodatabases and coordinating with multiple project managers.

GIS Environmental Atlas

Managed the creation of a GIS environmental atlas for a major energy firm in the Rocky Mountains. He coordinated with multiple State and Federal agencies to obtain approval on access to certain GIS layers and then created a geodatabase for the firm. This allowed quick access to information, such as sage grouse habitat or raptor nests, that is important to the viability of a federal project.

JENNIFER E VAN CUREN

ENVIRONMENTAL PROJECT SCIENTIST

Education
BBA, Management, New Mexico State University, 2003

Years of Experience
Total - 13
With ARCADIS –1.5

Professional Qualifications
Upstream, Midstream, and Downstream Oil & Gas Regulations for Federal & State
Auditing for Upstream and Midstream Facilities
Oil & Gas Well Permitting
Oil & Gas Federal Compliance
NEPA / EA
Undesirable Event & First Responder
SPCC Plans
Visual Resource Management
Production Allocation Mgt.

Jennifer Van Curen is an Environmental Project Scientist focused on Oil & Gas drill permitting and compliance at the ARCADIS Midland, Texas office. Miss Van Curen has thirteen years' experience working on various planning, permitting, and compliance projects throughout the oil and gas community. Miss Van Curen specializes in Permitting and Compliance. She is versed in Federal regulations and requirements: BMP's, RMP's, policies, Acts, Onshore Orders, CFR's, NEPA, EPA, FLPMA, and LUP. Most recently, Miss Van Curen has been working on permitting oil and gas drill locations, surface use permits, emergency response and spill control, NEPA evaluations, environmental site assessments, right of ways, due diligence, and compliance in all stages of oil and gas production from planning to plugging.

NEPA / PERMITTING

Complete NEPA reviews and prepared environmental assessments in accordance to federal regulations for permitting and surface plan uses.

Very familiar with BLM expectations with preparing Permits to drill and sundry notices

Implement procedures to protect the biological needs of plant and animal life through mitigating measures during the life of the well.

Prepare Spill Prevention Control and Countermeasure plan (SPCC), Contingency plans, and Undesirable Incident reports.

FEDERAL AND STATE INTERPRETATION

Interpret Federal regulations, laws, policies, Acts, and Best Management Practices.

Perform annual reviews of facilities for safety, compliance, and inspecting for any hazards to environment or wildlife.

Review air quality permits, SPCC plans, and contingency plans for correctness and up to date information.

AUDITING

Research production accountability issues identified through audit and non-compliance incidents and resolve.

Investigate the mishandling of Federal mineral resources.

Review and analyze oil and gas condensate theft, spill reports and monthly reports of Operations to identify any anomalies or trends

Investigate illegal dumping of contaminated materials

INTERIM AND ABANDONMENT RECLAMATION

Perform rangeland monitoring studies for legacy leases on a wide range of environmental concerns ranging from vegetation availability to wildlife sustenance.

Analyze data for allowance of roadways, disturbances, wildlife projects, and grazing capabilities of rangeland.

Construct transects in order to complete studies and track wildlife populations, relative humidity of grass and shrub, and inspecting foliage types for invasive or poisonous varieties.

Professional work experience and knowledge of soils, biology and agriculture, rangeland ecosystems and soil properties for surface reclamation, geology and hydrology, riparian and threatened or endangered species and resources in SENM

MONITORING

Monitor activities during all phases of oil and gas operations: construction, drilling, completion, production, interim reclamation, undesirable events, abandonment and reclamation. Ensuring that all activities are completed as approved with safety the highest priority.

Confidential Client –

- Complete on-sites and NEPA reviews
- Write Environmental Assessments (EA's)
- Assist with compliance of construction
- Oversee reclamation for IR and submit to BLM
- Review Application to Drill permits for completeness

Confidential Client –

- Complete on-sites and NEPA reviews
- Write Environmental Assessments (EA's)
- Revamped permitting process for a bottleneck free process from planning to permit approval
- Improved mapping and SUP for a better understanding and clear picture of actions proposed
- Improved commingling permit approval process via meetings with BLM to ensure necessary information is included with correct format.
- Project Lead and Surface Management Expert (SME) for Plan of Developments (PODs) for better planning and surface management of planned (present and future) oil and gas activities
- Review Application to Drill permits for completeness

Confidential Client –

- Completed phase I ESA projects with report and cost estimate to bring into compliance
    - Reeves and Pecos ESA
    - Nadel and Gussman ESA
    - Geronimo ESA
    - Endeavor ESA
    - Trinity River ESA

Confidential Client –

- Completed phase I ESA for three Galvanizing Plants

Confidential Client –

- Emergency response team member
- First responder to make initial contact
- Meet with residents, collect information, and complete reports
- Collect water samples
- Work with the outreach team

Confidential Client –

- Review and update compressor station air quality requirements for EPA regulations

Confidential Client –

- Complete SPCC reviews for all facilities
- Make recommendations for updating facilities to meet present regulations
- Review Air Permits and NOI's
- Review regulatory records

AARON SIDES

Staff Scientist

CORE SKILLS

1. SWPPP
2. SPCC
3. Wildlife Surveys
4. Radio Telementry
5. Spatial Modeling

QUALIFICATIONS

- B.S. Biology
- Certified Associate Wildlife Biologist

Project Experience

Inventory of terrestrial mammals

2000 - 2006

Catalogued mammals with various techniques: live trapping, calling, road spot-lighting, aerial transects, camera traps, track stations, and acoustical monitoring.

Gene Howe Wildlife Management Area

Diamond Y Spring Preserve

Davis Mountains Preserve

Amistad National Recreation Area

Rio Grande Wild and Scenic River North of Mexico

Chihuahuan Desert Research Institute

Dolan Falls Preserve

Assistant museum curator

2000 - 2005

Prepared and catalogues vertebrate specimens and tissue samples for inclusion in the Texas Tech Museum of Natural History.
Prepared and catalogued vertebrate specimens for inclusion in the James F. Scudday Vertebrate Museum, Sul Ross State University.

Montezuma Quail
2006 - 2007

Assisted in the capture, radio-fitting, and monitoring of Montezuma Quail for activity patterns, habitat use, and survival rates.

Sierra del Carmen, Chihuahua Mexico

Davis Mountains, Texas

Sul Ross Campus, Texas

Elk home range and habitat use
2006 -2007

Assisted in the capture (helicopter net gun), radio-fitting, and monitoring of Elk for activity patterns, habitat use, and survival rates.

Glass Mountains, Texas

Rangeland restoration and erosion control
2006 - 2007

Installed erosion control devices and accessed effectiveness through the conductance of vegetation surveys. Applied herbicides and accessed effectiveness at controlling juniper and mesquite. Performed controlled burns to restore and maintain ranch grasslands.

Brewster County, Texas

Oak Motte Characteristics
2006

Surveyed oak motte characteristics and distribution at Independence Creek.

Independence Creek, Texas

Fish Surveys
2000 - 2006

Catalogued fishes through electro-fishing, seining, and cast netting.

Independence Creek, Texas

Rio Grande River, Big Bend National Park, Texas

Phantom Cave, Texas

Balmoreah Lake, Texas

Pronghorn Demographics
2006-2007

Utilized Landsat Thematic Mapper imagery to develop vegetation change models for Trans-Pecos, Texas using ArcMap, ArcView, and Erdas Imagine software. Utilized NOAA climatic data to generate drought indices for Trans-Pecos, Texas. Developed predictive pronghorn demographic models with historic Texas Parks and Wildlife pronghorn census data, vegetation models, and drought indices.

Trans-Pecos, Texas

Mule Deer Demographics
2006

Assisted with the utilization of Landsat Thematic Mapper imagery to develop vegetation change models for Trans-Pecos, Texas using ArcMap, ArcView, and Erdas Imagine software.

Trans-Pecos, Texas

Gray Fox
2006

Assisted with the capture and radio fitting of gray fox. Specific duty was the release of incidental skunk captures.

Brewster County, Texas

Mule Deer Demographics
2006

Assisted with the utilization of Landsat Thematic Mapper imagery to develop vegetation change models for Trans-Pecos, Texas using ArcMap, ArcView, and Erdas Imagine software.

Trans-Pecos, Texas

Horned Lizard
2006

Density estimation (Distance sampling), radio fitting, and monitoring of daily activity patterns in Texas Horned Lizards

Big Bend National Park, Texas

Diamond Y Spring Preserve, Texas

Remedial Construction Site
2007 - 2011

Performed site Phase II. Installed wildlife exclusionary devices. Managed the site SWPPP. Reclaimed manmade wetlands impacted by heavy metals. Recovered chemicals from plant process equipment for recycling. Remediated soils and performed sampling seeking closure under TRRP. Designed and implemented final reclaimed site surface.

North East, Texas

Groundwater Remediation System Installation
2007-2011

Field supervision of the installation of BioSparge, Air-sparge, Multi-phase extraction, injection, and ET-DSP® systems

Enid, Oklahoma

Hawthorne, California

Grants, New Mexico

Remediation System Operation and Maintenance
2011 - Present

Operation and maintenance of groundwater remediation systems including EDR, oil-water separation, evaporation ponds.

Mitchell County, Texas

Ector County, Texas

Monitored Natural Attenuation
2011 - Present

Groundwater sampling, data analysis, and reporting under monitored natural attenuation remedies.

Eddy County, New Mexico

Gaines County, Texas

Hockley County, Texas

Phase I ESAs
2011 - Present

Performed Phase I ESAs:

Over 300 oil and gas production facilities, lay down yards, field offices, and maintenance yards. Potential gas plant construction sites. Pipeline ROWs, including bird nest surveys.

West Texas

Southern Oklahoma

Eddy and Lea Counties, New Mexico

Field Investigations for SPCC determinations and planning
2011 - Present

Field investigation of oil and gas production facilities and construction sites for determination and development of SPCC plans.

West Texas

ARCADIS

Education
MS, Geological Sciences, University of Colorado, 2008
BS, Earth Sciences, Montana State University, 2003

Years of Experience
Total - 8
With ARCADIS - 6

Professional Registrations
Professional Geologist WY-#3826

Professional Associations
Geological Society of Nevada
Society of Vertebrate Paleontology

Jason S. Adams, PG

Staff Geologist

Mr. Adams is the ARCADIS soils, geology, and paleontology technical lead for environmental impact analyses in western North America. He has a wide range of experience in the field of geological and hydrological sciences in western North America, Central America, and Eastern Europe. His work has commonly involved a variety of disciplines including: soil science; hydrology; exploration geology; sedimentology; stratigraphy; paleontology; and geochemistry.

Relevant Project Experience

Application for Permit-to-Drill EAs
Lea and Eddy Counties, New Mexico
Assessed paleontological resources and potential impacts to resources for multiple oil and gas APDs in eastern New Mexico. Reviewed Potential Fossil Yield Classification, surficial and bedrock geologic mapping, and known paleontological resources within general geographic area and specific geologic formations.

Eagle Prospect EIS
Plains Exploration and Production Company, Wyoming
Assessed groundwater, surface water, soil, geological and paleontological resources and potential impacts to resources for exploration and development phases of proposed oil and gas activity. Authored Erosion and Sediment Transport Modeling technical support document which incorporated SWAT and KINEROS2 soil erosion models. Coordinated development of multi-stakeholder Surface Water and Groundwater Monitoring and Mitigation Plan and was lead author of Water Monitoring Framework.

Shadura Natural Gas Development Project EIS
USFWS and NordAq, Alaska
Assessed potential impacts to surface water, groundwater, soil, geological, and paleontological resources for oil and gas development on the Kenai National Wildlife Refuge northeast of Kenai, Alaska. Included assessment of potential wetland drainage and impacts to shallow groundwater flow through subsurface peat pipes.

Lesser Prairie-Chicken Stakeholder Conservation Plan EIS
American Habitat Center, Colorado, Kansas, Nebraska, New Mexico, Oklahoma, Texas
Assistant project manager for preparation of the Draft EIS for a Habitat Conservation Plan as part of an Incidental Take Permit for the lesser prairie-chicken. Worked with USFWS to define study

area, impact thresholds, and develop alternatives based on major issues identified during scoping. Coordinated EIS technical team and provided technical oversight, served as primary ARCADIS point of contact for project applicant and USFWS, and managed project budget.

Jonah 3D Seismic EA

Global Geophysical Services, Wyoming

Coordinated document preparation for an Environmental Assessment of a proposed surface geophysical survey in Wyoming in accordance with NEPA requirements, including coordination with client and BLM resource specialists. Assessed visual, soil, hydrological, geological, paleontological, air, range management, and recreation resources and impacts to resources. Project-specific mitigation strategies for each impacted resource were also developed.

BLM Consultations and Permitting Review

Lea and Eddy Counties, New Mexico

Reviewed environmental constraints and permitting pathways for proposed 80-mile water pipelines, electrical substations, and high-yield water wells to support oil and gas drilling in eastern New Mexico. Conducted pre-application review with BLM Carlsbad Field Office staff to identify staff concerns and inform project design alternatives.

Blackfoot Bridge EIS

Monsanto, Idaho

Assessed the soil, geological and paleontological resources and potential impacts to resources for a proposed phosphate mine to satisfy NEPA requirements in this EIS in cooperation with client and BLM resource specialists. Investigated methods and limitations of various cover system designs and materials based on review of technical and industry literature, with a focus on geosynthetic clay laminated liners and potential impacts to hydrology and water chemistry.

South Dakota Resource Management Plan (RMP) and EIS

BLM, South Dakota

Developed a comprehensive, written analysis of impacts to soils and surface and ground water from management actions proposed for the revised South Dakota Field Office RMP. Analysis included evaluation of impacts from oil and gas development, livestock management, renewable energy development, transportation management, and other resource uses and management.

Mine Plan of Operation Amendments and Updates

Multiple Clients, Nevada and New Mexico

Authored site characterization (mineralogy, geology, hydrogeology) sections for multiple potash mine plan updates to include recent regional and site-specific research. Incorporated client, BLM and state comments on proposed mine plan updates for final approval by BLM.

ARCADIS

Education

Graduate Studies, Contaminant Hydrogeology and Geochemistry, Syracuse University, Syracuse, NY, 1994

Graduate Studies, Advanced Hydrogeology, Syracuse University, Syracuse, NY, 1993

BS, Geology, State University of New York, College at Cortland, 1986

Years of Experience

Total - 26

With ARCADIS - 17

Professional Registrations

Professional Geologist, PA

Professional Geologist, IL

Certified Professional Geologist: American Institute of Professional Geologists

Professional Qualifications

American Institute of Professional Geologists

Association of Environmental and Engineering Geologists

Central New York Association of Professional Geologists

National Ground Water Association

National Speleological Society

Keith A. White, CPG, PG

Principal Geologist

Mr. White has over 26 years of progressive experience as an environmental scientist, hydrogeologist, and technical expert. He has designed and managed various hazardous waste (RCRA and CERCLA), solid waste (6NYCRR), and water-resource investigations for industrial, state, and federal clients; served as lead hydrogeologist for multiple Remedial Design/Remedial Action (RD/RA) projects at the state and federal level; provided expert field oversight and critically reviewed remedial investigation/feasibility study (RI/FS) reports as a contractor to the U.S. Environmental Protection Agency (USEPA); co-authored and delivered presentations at multiple conferences and symposia; designed, conducted, and interpreted results of numerous geophysical surveys; prepared groundwater flow models (areal and vertical) using various numerical and analytical codes; and served as the technical lead for multiple sites involving contaminant transport in karst aquifers.

Mr. White currently leads the Company's *Karst Hydrogeology Center of Practice*. Mr. White is a member of the Geological Society of America's (GSA's) new Karst Division, and has served as co-chair for a Topical Session entitled *Contaminant Hydrogeology of Karst—Characterization, Modeling, and Remediation* at the GSA's 2010 Annual Meeting in Denver, CO. Mr. White and a colleague periodically co-instruct one-day and two-day short courses on Karst Contaminant Hydrogeology for the National Ground Water Association and have also taught the 8-hour course, by request, to staff of the Alabama Department of Environmental Management. Mr. White has also presented on the topic of karst remediation at the USEPA Region III Petroleum UST Workshop held in Rehoboth Beach, Delaware (September 2011) and at the 12th Annual Alabama Groundwater Conference in Montgomery, Alabama (June 2012). In addition, Mr. White recently co-chaired a session on Karst Remediation at Battelle's *Ninth International Conference on Remediation of Chlorinated and Recalcitrant Compounds* (May 19-22, Monterey, CA).

Experience

Operational Range Assessments – Fort McClellan, Anniston Army Depot, Redstone Arsenal, and Camp Crowder
Army National Guard and the United States Army – Anniston and Huntsville, Alabama; and Neosho, Missouri
2011
Projects involve evaluating whether the ongoing or historical use of operational firing ranges has affected the quality of groundwater and surface water leaving the ranges. Responsibilities include developing: 1) an updated site conceptual model for karstification and groundwater flow, and 2) a strategic approach for assessing groundwater, spring-water, and surface-water quality of the surrounding karst aquifers.

Hydrogeologic Investigation – Oak Grove Village Well CERCLA Site
Confidential Client, Sullivan, MO

Served as senior karst expert for a deep drilling and sampling program in Operable Unit 2 to further characterize geology and groundwater conditions. At this site, a municipal supply well has been impacted by chlorinated solvents; however, the source of the solvents is still being investigated in this complicated karst terrane. Reviewed and revised scopes of work, designated and oversaw work performed by an ARCADIS karst specialist, and performed high-level review of investigation results and site strategy.

CERCLA Remedial Investigation – Fort Detrick Area B
USACE, Baltimore District, Frederick, Maryland
Ongoing, Project Value: $2,500,000
Senior hydrogeologist and technical expert for this CERCLA project. Project involves completing a groundwater remedial investigation at Fort Detrick's Area B. The area is underlain by karstic carbonate bedrock of Triassic and Cambrian age. Responsible for implementing a work plan that includes well drilling, down-hole geophysical testing, dye tracing, and sampling of groundwater, surface water and spring water. Mr. White is also responsible for analyzing the collected data and updating the site's conceptual model for karstic groundwater movement and contaminant transport.

Risk Assessment and Closure Strategy – Former Manufacturing Facility
Confidential Client, Huntsville, Alabama
Ongoing
Project involves developing a risk assessment and closure strategy for a facility where chlorinated solvents were released to a karstic aquifer. Responsible for CSM development,

evaluating contaminant transport, and developing a karst-specific closure strategy. Developed a unique, karst-specific approach for predicting groundwater contaminant concentrations at hypothetical, offsite domestic supply wells. Project requires working closely with representatives of the Alabama Department of Environmental Management (ADEM). ADEM approved ARCADIS' closure approach and have indicated that the site is on track to become the first such karst site in the state to attain "No Further Action" status.

RCRA Facility Investigation/Interim Measures
Beazer East, Inc., Guthrie, Kentucky
2005, Project Value: $1,800,000
Lead hydrogeologist for a site occupied by an active wood-treating facility that uses coal-tar creosote as the treating fluid. Duties included revising the conceptual model for groundwater flow and DNAPL transport in the karstic bedrock aquifer, optimizing bedrock DNAPL-collection systems (which have collectively removed more than 48,000 gallons of DNAPL), and assisting development and conduct of a dye trace study. That study, which focused on an area where DNAPL had migrated offsite, identified the spring that discharges groundwater from the area, and demonstrated that the site is located in a different drainage basin than the spring that formerly supplied the City of Guthrie with drinking water. The site's DNAPL-collection program includes a passive DNAPL barrier designed to prevent coal-tar creosote from discharging to a nearby stream without pumping or treating groundwater. Mr. White served on the design team for that system component.

CERCLA Remedial Investigation – Former Ramey Air Force Base
USACE, Huntsville District, Aguadilla, Puerto Rico
Ongoing
Senior hydrogeologist and technical expert for this CERCLA project. Project involves characterizing the nature and extent of impacts to a coastal karst aquifer relative to two former landfills. Scope of investigation includes sampling of pore water in residuum beneath the landfills, conducting a study of VOC vapors in the underlying epikarst, designing and implementing a tracer study to evaluate the effectiveness of the existing groundwater-monitoring network, and developing a karst-specific conceptual site model for groundwater (and contaminant) occurrence and movement.

Remediation Program
Confidential Client, Russellville, Kentucky
Ongoing
Lead hydrogeologist for a project that involves the release of PCB DNAPL to a karstic aquifer. Responsible for all aspects of site hydrogeology including developing a groundwater-flow and DNAPL transport conceptual model, developing a long-term groundwater monitoring and

DNAPL-recovery program as part of a Corrective Action Plan for the site, evaluating the effectiveness of a bedrock groundwater-interceptor trench, supervising a dye-trace study, and developing a final groundwater remedy. Was also an integral member of a team tasked with fast-tracking a design for an innovative remedial measure to keep DNAPL and PCB-contaminated groundwater from discharging from the bedrock into a local urban stream.

Tracer Study – Highway Extension
Tennessee Department of Transportation, Knoxville, Tennessee
2009, Project Value: $100,000
This project was performed to support an Environmental Impact Statement being prepared for a new highway extension planned in karst terrane near Knoxville, TN. The terrane contains a cave system that is home to a threatened species of salamander. The objectives of the work were to 1. Develop a karst-specific conceptual site model, and 2. Determine which sinkholes in the proposed highway corridors drained to the salamander's cave system. Mr. White served as the principal hydrogeologist for this project. The work conclusively determined which sinkholes drained to the cave system and which did not. The study also identified a sinkhole that, despite being located outside the local surface-water drainage basin, actually drained to that basin.

Karst Conceptual Model and Sinkhole Vulnerability Assessment
Confidential Client, Narrows, Virginia
2011
Developed a site-specific conceptual model for karstification and assessed the vulnerability of closed process sludge and flyash landfills, as well as a new active sanitary landfill to sinkhole formation. Work entailed performing a comprehensive literature review, analyzing results of geophysical and drilling investigations conducted at the site, reviewing historical maps and aerial photographs, and performing a topographic slope analysis.

Voluntary Site Investigation – Former Wood-Treating Site
Confidential Client, Indiana
Ongoing, Project Cost to Date: >$300,000
Lead hydrogeologist for an investigation that involves characterizing the nature and extent of impacts related to a former creosoting facility. Creosote DNAPL has migrated offsite within the karstic bedrock and into a nearby stream. Currently responsible for all hydrogeologic aspects of the project, including refining the site conceptual model for groundwater and DNAPL movement, overseeing and interpreting results of two dye-trace studies, and developing a scope-of-work to complete the ongoing site characterization , and helping develop a preliminary, karst-specific remedial approach and closure strategy for the site.

Chlorinated-Solvent-in-Groundwater Investigation
Confidential Client, Tennessee
2003, Project Cost: $70,000
Project manager and technical lead for an investigation conducted in a mature karst aquifer. The site houses a large industrial manufacturing facility. Work performed included revising the conceptual site model from a "fractured-rock" to a karst-based model, assisting design and conduct of a spring survey, and a dye-trace study. The study identified several springs that discharge groundwater from the site, some more than 3.5 miles away. Groundwater velocities were calculated to be in excess of 2,500 feet per day.

Karst Conceptual Model and Sinkhole Vulnerability Assessment
Confidential Client, Ohio
2011
Developed a site-specific conceptual model for karstification and evaluated the potential for sinkhole formation related to the design of a 700-million gallon primary drinking water reservoir. Work entailed performing a comprehensive literature review, analyzing results of geophysical and drilling investigations conducted at the site, reviewing historical maps and aerial photographs, and interviewing a member of the Ohio Geological Survey's karst mapping project team.

Karst Aquifer LNAPL Remediation
Confidential Client, Indiana
Ongoing
Karst technical lead for a project involving the delineation and remediation of PCB-containing LNAPL in a mature karst aquifer. Work entails conducting a karst reconnaissance/spring survey, LNAPL bail-down testing, borehole televiewing, and preparing a conceptual model for LNAPL storage and transport in the karst aquifer. Ongoing work will be used to develop and deliver a remedial solution to address the LNAPL.

RCRA Facility Investigation
Beazer East, Inc., Roanoke, Virginia
2004
Lead hydrogeologist for an RCRA Facility Investigation conducted at an active wood-treating facility. The investigation includes characterizing groundwater and contaminant transport (including DNAPL) in a karstic aquifer. Duties included supervising a dye-trace study at the site that included two new backup drinking-water supply wells for the City of Salem, Virginia. The State-approved Corrective Measures Study for the site includes a combination of sentinel-well monitoring and periodic tracer studies to evaluate the effectiveness of the groundwater remedy, which is Monitored Natural Attenuation (MNA).

Selected Publications

Ewers, R.O., K. A. White, and J. F. Fuller. 2012. Contaminant plumes and psuedoplumes in karst aquifers. Carbonates and Evaporites, vol. 27, no. 2, p. 153-159.

Ewers, R.O., K.A. White, K. Paschl, and M.B. Hanish. 2005. "Problems with Applying Traditional Characterization and Monitoring Approaches to Karst Aquifers: A Case History." In *Sinkholes and the Engineering and Environmental Impacts of Karst: Proceedings of the 10th Multidisciplinary Conference*, ed. B. F. Beck. American Society of Civil Engineers: Reston, VA., p. 365-379.

Costa, H.C., K.A. White, and J. Ruspantini. 2004. Distinguishing PAH background and MGP residues in sediments of a freshwater creek. Environmental Forensics 5(3), p. 171-182.

Presentations

White, K. A. 2012. "Remediating and Managing Karst Sites". Presented at the 12th Annual Alabama Groundwater Conference, Montgomery, AL. June 6, 2012.

White, K.A. and D.S. Lipson. 2012. "Remediating groundwater in karst terranes: state of the industry". Presented at the Eight International Conference on Remediation of Chlorinated and Recalcitrant Compounds, 21-24 May, Monterey, California.

White, K. A. 2011. "Remediation and Management of Karst Sites". Presented at the USEPA Region 3 States LUST Technical Workshop, Rehoboth Beach, DE. September 28-30, 2011.

Cobb, M.K., K A. White, P. N. Milionis, and B. Hartley. 2010. "The role of saturated epikarst in solute transport: an example from the Lehigh valley, Pennsylvania". Presented at the Geologic Society of America Annual Meeting, October 31 to November 3, 2010, Denver, CO.

White, K.A., and P. J. Kurzanski. 2010. "Special considerations for remediating a former wood-treating facility in karst terrane." Presented at the Railroad Environmental Conference, University of Illinois at Urbana-Champaign, October 26-27, 2010.

White, K. A., M. Gefell, and M. Thurman, 2010. "Remedy for PCB DNAPL seeps in a fractured bedrock creek bed." Presented at the Seventh International Conference on Remediation of Chlorinated and Recalcitrant Compounds, 24-27 May, Monterey, California.

White, K. A. and R. O. Ewers. 2007. "Problems with Applying Traditional Characterization and Monitoring Approaches to Karst Aquifers: A Case History." In Proceedings of the 2007 U.S. EPA/ NGWA Fractured Rock Conference: State of the Science and Measuring Success in Remediation, USEPA/NGWA. 24-26 September, Portland, Maine.

White, K.A., B.H. Kueper, and M.J. Gefell 2007. “Passive DNAPL Barriers - Concepts, General Design Requirements, and Performance.” Presented at the EPRI MGP 2007 Symposium - Advances in MGP Site Remediation, 8-11 January, Atlanta, Georgia.

White, K.A., B.H. Kueper, M.J. Gefell, and T.L. Blazicek 2006. “Passive DNAPL Barriers - Concepts and Case Histories.” Presented at: Natural Gas Technologies 2006 -Energy and the Environment, 22-25 October, Orlando, Florida.

White, K.A., M.O. Gravelding, M.J. Gefell, D.G. Bessingpas, and M. Slenska. 2006. "Design, Installation, and Operation of a Passive DNAPL Barrier at a Former Wood-Treating Site." Presented at the Fifth International Conference on Remediation of Chlorinated and Recalcitrant Compounds, 22-25 May, Monterey, California.

Ewers, R.O., K.A. White, and K. Paschl. 2005. "Shallow Groundwater and DNAPL Movement within Slightly Dipping Limestone, Southwestern Kentucky." Presented at the 10th Multidisciplinary Conference on Sinkholes and the Engineering and Environmental Impacts of Karst, 24-28 September, San Antonio, Texas.

White, K.A., K. Paschl, and D.S. Lipson. 2004. "Characterization of a DNAPL Site in Karst Terrane: Implications for Remediation." Presented at the 2004 EPA/NGWA Fractured Rock Conference: State of the Science and Measuring Success in Remediation, 13-15 September, Portland, Maine.

White, K.A., M.J. Gefell, P. Alessio, and A. Ferro. 2004. "Stream Re-Routing, DNAPL Containment, and Phytoremediation to Address DNAPL at a Major Wood-Treating Site." Presented at the Fourth Conference on Remediation of Chlorinated and Recalcitrant Compounds, 24-27 May, Monterey, California.

White, K.A., S.T. Saroff, and M.J. Gefell. 1999. “Groundwater Flow Modeling at the Port Washington L-4 Landfill Superfund Site.” Presented at the Sixth Annual Conference on Geology of Long Island and Metropolitan New York, SUNY Stony Brook, April, Stony Brook, New York.

Erica Serna

Geologist 1

Ms. Serna recently joined ARCADIS in December 2014. Prior joining ARCADIS, she attended East Carolina University and Indiana University. During the spring of 2012, Ms. Serna volunteered with the USGS- Hawaiian Volcano Observatory (HVO) where she was in charge of measuring sulfur dioxide emission rates from the Kilauea volcano. Since joining ARCADIS, Ms. Serna has gained experience with installation of soil borings and groundwater monitoring wells. Soil characterization and sampling, groundwater sampling (bailer and low flow techniques), sampling and monitoring of sub-slab vapor ports, indoor air surveying, and vapor intrusion sampling. Ms. Serna has also gained experience with geophysical surveying using a ground penetrating radar.

Category of Experience

Groundwater Sampling
Various Confidential Clients, Indiana
Ongoing
Performed groundwater sampling activities at several active and inactive retail gas stations, automotive facilities and railroad facilities. Work included: health and safety management, monitoring well installation (direct push), drilling subcontractor coordination and oversight, vertical aquifer profile testing, communication with analytical laboratories, and soil and groundwater sample collection. Shipped and transported samples.

DNAPL Recovery
Various clients, Indiana
Ongoing
Recovered DNAPL using advanced techniques developed by ARCADIS. Performed subsequent inspections at a PCB impacted site.

Vapor Intrusion and Soil Gas Sampling
Various clients, Indiana
Ongoing
Conducted indoor air, sub-slab vapor, and soil and gas sampling in residential neighborhoods to determine the proper placement of sub-slab sampling ports, indoor air, crawl spaces, and ambient sample media. Performed subsequent inspections to verify proper system operation.

Education

MS, Geology, East Carolina University, North Carolina, 2014

BS, Geology, Indiana University, Bloomington, Indiana, 2011

Professional Registrations

40-Hour OSHA Hazardous Waste Operations (HAZWOPER) Safety Training, 2014

DOT HazMat, 2014

MARBOP, 2015

CSX FRA Roadway Worker Training, 2015

E-RAILSAFE System Training, 2014

RCRA Training, 2015

CPR/First Aid/AED, 2015

Professional Associations

Geological Society of America

Kristen Audette

Principal Environmental Scientist

Kristen Audette joined the ARCADIS team in July 2015. Prior to joining ARCADIS, she attended Roger Williams University. During her undergraduate career, Ms. Audette presented research on the bioremediation of heavy metals in the Narragansett Bay at the 2015 American Chemical Society National Conference. Ms. Audette also served as an intern for the Blackstone Water Treatment Plant in Massachusetts, focusing on water treatment system design and water sampling/testing. Past project work also includes GIS map creation for the DPW for the City of Pawtucket, RI and the construction of an Osprey Platform for wildlife conservation. Since joining ARCADIS, Ms. Audette has gained experience with Phase 1 report writing, soil characterization/ treatment/sampling and tracking, air emission calculations, groundwater and well sampling and report writing.

Education

BS, Environmental Science, Minor, Environmental Engineering, Roger Williams University, Rhode Island, 2015

Professional Registrations

40-Hour OSHA Hazardous Waste Operations (HAZWOPER) Safety Training, 2015

Chevron 101, 2015

Professional Associations

America Water Works Association

American Chemical Society

Society of Women Engineers

Experience

Well Sampling
Midland, Texas
Ongoing
Performed in home and well sampling activities at residential sites. Work included: health and safety management, shower filtration installation, communication with residents. Shipped and transported samples.

Emission Calculations
RI
Ongoing
Collected generator data from various clients to generate monthly air calculation reports in accordance with EPA standards. Collected chemical concentration levels in treated and contaminated soils to calculate air emissions. Verification air emissions complied with RIDEM permitting thresholds.

Soil Treatment and Tracking
Chevron, RI
Ongoing
Completed treated soil sampling for East Providence Rhode Island gas terminal. Collected samples and sample volume and weight. Created monthly tracking tables and reports for RIDEM.

Phase 1 Report Writing
Rhode Island
July 2015

Completed Phase 1 Site Assessment Report for residential property.
Reviewed environmental databases, conducted questionnaire and initial site assessment. Completed written report.

Odor Map Creation
Chevron, RI
August 2015
Researched surrounding polluters for East Providence Rhode Island Chevron (EPRI) Terminal to create odor map with polluter terminal locations and schedule times of shipping/loading information of sea vessels.

East Providence Bike Path Closure
Chevron, RI
Ongoing
Researched proper contact information/permits/notifications needed to conduct construction work on Providence public bike path. Organized meeting for RIDEM and responsible subcontractors/related parties. Report writing.

Kaylyn Marsano

Environmental Compliance Specialist

Education

Marine and Atmospheric Science, Stony Brook University, M.S., 2013

Marine Sciences, University of Maine, B.S., 2010

1 Year of Experience

Ms. Kaylyn Marsano is an Environmental Compliance Specialist in ARCADIS Environmental Business Consulting group in Houston, Texas. She has experience in the oil and gas upstream and midstream industry in environmental compliance including, preparing applications for U.S. Army Corps of Engineers (USACE) Nationwide Permit's (NWP), stormwater permitting, preparing resource reports for Federal Energy Regulatory Commission (FERC) applications for natural gas projects, preparing state applications for crude oil projects, and conducting environmental constraints analyses for proposed oil and natural gas projects.

Category of Experience

U.S. Army Corps of Engineers (USACE) Nationwide Permit's (NWP)

Supported multiple oil and gas clients in preparing their applications for USACE NWP's for their proposed pipeline projects. Support includes, but is not limited to the following:

- *Desktop analysis of the environmental features within the Project area.*
- *Environmental field surveys using methodology approved by the 1987 USACE Wetlands Delineation Manual and Regional Supplements*
- *Preparation of environmental site assessments that highlight environmental permitting requirements.*
- *Preparation permit matrices that clearly define the permitting process for the client.*
- *Preparation of a pre-construction notification (PCN) for authorization under USACE Section 404 Nationwide Permits.*

Stormwater Permitting

Supported multiple oil and gas clients with their stormwater permits. Support includes, but is not limited to the following:

- *Preparation Stormwater Pollution Protection Plans (SWPPP) in accordance to with the U.S. Environmental Protection Agency (EPA) General Construction Permit for Stormwater Discharges During construction for crude oil pipelines.*
- *Preparation Stormwater Pollution Protection Plans (SWPPP) in accordance to with state stormwater permitting agencies general permits for product pipelines.*
- *Preparation of a Notice of Intent (NOI) if required for the project.*

FERC 7(C) Applications

Supported multiple oil and gas clients in preparing their FERC 7(C) Applications for a Certificate of Public Convenience and Necessity for their proposed natural gas transmission or facility based projects. Support provided includes, but is not limited to, the following:

- *Desktop analysis of the environmental features within the Project area.*
- *Consultation with state and local agencies to verify and define environmental permitting requirements and/or authorizations required.*
- *Preparation and revision of the resource reports included the application.*
- *Interpretation of field and other resource data to include within the resource reports.*
- *Completion of formatting and quality checks of the application materials prior to filing with FERC.*
- *Preparation of monthly reports of the project's progress to be filed to the FERC docket on the client's behalf.*
- *Responding to FERC data requests on the client's behalf throughout the FERC application process.*

Environmental Constraints Analyses

Identified the potential environmental constraints that could result in excessive schedule delays, and/or costs such that the oil or natural gas project would not be profitable. Identified authorizations, documentation, and notifications required by governing agencies with estimated cost and schedule for preparation, process and approval. Prepared a final document that provided an assessment of the risk for environmental constraints of the following areas: Water Use and Quality; Geological and Soil Resources; Wildlife, Vegetation, and Threatened and Endangered Species; Public Lands; Cultural Resources; and Air Quality and Noise.

Journal Publications

Becker (*Marsano*), K. N. Warren, J.D. 2015. *Material Properties of Pacific Hake, Humboldt squid, and two species of myctophids in the California Current*. Journal of the Acoustical Society of America.

Becker (*Marsano*), K.N. Warren, J.D. 2014. *Material Properties of Northeast Pacific Zooplankton.* ICES Journal of Marine Science.

Arcadis U.S., Inc.

2929 Briarpark Drive

Suite 300

Houston, Texas 77042

Tel 713 953 4800

Fax 713 977 4620

www.arcadis.com

From: Spotts, Richard
To: Phil Hanceford; nada_culver@tws.org; megan_dickie@tws.org; Kieran Suckling; RRomero@biologicaldiversity.org; rspivak@biologicaldiversity.org; Greta Anderson; Sandy Bahr; alicyn.gitlin@sierraclub.org; Roger Clark; eaumack@grandcanyontrust.org; kim@grandcanyonwildlands.org; kelly@grandcanyonwildlands.org; Katie Davis; Samantha Hammer; admin@sonorandesert.org; kim@wildlandsnetwork.org; Northern Jaguar Project
Subject: FYI - Public Lands: BLM proposal allows target shooting in Ariz. monument
Date: Friday, December 16, 2016 4:56:24 PM

FYI - If you have not already seen it, you may find the article below of interest. RS

PUBLIC LANDS

BLM proposal allows target shooting in Ariz. monument

Scott Streater, E&E News reporter

Published: Friday, December 16, 2016

The Bureau of Land Management is proposing a plan to allow recreational target shooting throughout all but the most heavily visited sections of an Arizona national monument.

The issue of target shooting at the Sonoran Desert National Monument has sparked a federal lawsuit and an ongoing battle of words between gun rights advocates and conservation groups.

A federal judge last year threw out a section of a 2012 resource management plan (RMP) that opened the national monument to target shooting. U.S. District Judge David Campbell ordered BLM to go back to the drawing board and address shortcomings in the RMP that addressed target shooting (*Greenwire*, April 1, 2015).

BLM today issued a proposed RMP amendment and accompanying draft environmental impact statement (EIS) that would allow recreational target shooting on 433,600 acres of the nearly half-million-acre monument, within the so-called Desert Back Country recreation management zone (RMZ).

The proposal would restrict target shooting only within the 52,800-acre Juan Bautista de Anza National Historic Trail recreation management zone, on the northeast side of the monument.

The restricted area "is the most heavily visited area" in the national monument. "As such, restricting recreational target shooting in this area would also address visitor safety concerns," the draft EIS says.

The proposal to allow target shooting on 433,600 acres is listed as the "preferred alternative" in the draft EIS, which was published this week in the *Federal Register*. The proposed RMP and draft EIS are now open for public comment through March 15, 2017.

BLM plans to hold three public informational meetings, starting next month.

"Public input is very important to our decision making process," David Scarbrough, Sonoran Desert National Monument manager, said in a statement. "New information, suggestions for improved or new alternatives, and comments pertaining to the accuracy of assumptions and information presented in the draft planning amendment and environmental impact statement are especially helpful."

Environmental groups that have followed the issue say they need more time to evaluate the proposed plan.

Phil Hanceford, assistant director of the Wilderness Society's BLM Action Center, said he'll be looking for stipulations that "protect the fundamental purposes of the monument."

"Any use that potentially harms the saguaro, ancient petroglyphs or threatens visitor safety to one of our prized national monuments is illegal," Hanceford said.

He added: "The BLM has more work to do to satisfy this obligation, including analyzing alternatives of where the use is actually occurring, as well as where other uses may take priority in the monument. Much of this has already been done by the agency in its original draft plan and EIS, but was ignored by the BLM in its final decision, which is why the court is making the agency go back and look at this again."

The issue of target shooting at the site southwest of Phoenix has been a source of controversy since President Clinton signed a proclamation designating it a national monument in January 2001. The intent of the designation, according to the proclamation, was to preserve "a magnificent example of untrammeled Sonoran desert landscape."

In late 2011, BLM proposed to ban target shooting at the monument, which the agency argued had raised concerns over noise, public safety and resource impacts. That proposal was roundly criticized by sportsmen's and gun rights groups.

Under pressure from the National Rifle Association and a sportsmen's advisory council, the agency reversed course in May 2012, reopening the lands to recreational shooting (*E&E News PM*, May 11, 2012).

An RMP for the national monument was finalized in September 2012.

But a coalition of groups — Archaeology Southwest, the Wilderness Society and the National Trust for Historic Preservation — in September 2013 filed the lawsuit in the U.S. District Court for the District of Arizona, claiming BLM had violated the National Environmental Policy Act (NEPA), the Federal Land Policy and Management Act (FLPMA), and other laws in allowing the target shooting throughout the monument.

The groups argued that the abrupt 2012 decision reversing course and issuing a final EIS authorizing target shooting was wrong, saying it could threaten monument visitors as well as the plants and resources it was designated to protect.

Judge Campbell agreed with the conservation groups, and he remanded the target shooting plan to BLM for further review. BLM began the latest EIS in January.

Under the proposed RMP amendment, BLM would closely monitor the areas where target shooting will be allowed and apply mitigation measures "to protect Monument objects," the

draft EIS says.

"Recreational target shooting is compatible with recreation management and objectives in this RMZ because it is a dispersed activity, primarily limited to areas near roads, and does not prevent opportunities to engage in the RMZ's other road-dependent recreation activity — four-wheel-drive touring," the document says.

Click here to read the draft RMP and draft EIS.

Email: sstreater@eenews.net

From: Nada Culver
To: James Stovall; Cody Layton
Cc: Judy Calman
Subject: Request for State Director Review being filed
Date: Friday, December 23, 2016 10:54:27 AM
Attachments: Hayhurst MDP SDR--12-22-16-final.pdf

Hi Jim and Cody – As we discussed last week, we are filing our request for state director review today just so we don't miss any deadlines. We are hopeful that we can resolve everything in our ongoing conversations and so wanted to make sure you knew that and also had a copy of the document in case it's helpful to review. We look forward to the continuing discussions next week. Merry Christmas (even though this isn't really a great Christmas card).

Nada Culver

Senior Counsel and Director, BLM Action Center

The Wilderness Society

1660 Wynkoop, #850

Denver, CO 80202

Main: 303-650-5818

Direct: 303-225-4635

Nada_Culver@tws.org <mailto:Nada_Culver@tws.org>

NEW MEXICO WILDERNESS ALLIANCE * NATIONAL PARKS CONSERVATION ASSOCIATION * THE WILDERNESS SOCIETY

December 22, 2016

Via Overnight Mail

Ms. Amy Lueders, State Director
New Mexico BLM State Office
301 Dinosaur Trail
Santa Fe, NM 87508

Re: Request for State Director Review of the Hayhurst Master Development Plan and Stay of Operations Pending Final Decision. Oral Presentation Requested.

Dear Ms. Lueders:

The New Mexico Wilderness Alliance (NMWA), National Parks Conservation Association (NPCA), and The Wilderness Society (TWS) hereby request your review of the decision by the Carlsbad Field Office of the Bureau of Land Management (BLM) that approved the above oil and natural gas development project, which includes the Hayhurst Master Development Plan (MDP) and twelve applications for permit to drill (APD). We make this request pursuant to the provisions at 43 C.F.R. § 3165.3(b); and also request a stay of the operations approved by the Hayhurst MDP, based on meeting the criteria set out at 43 C.F.R. § 3165.3(c). We are bringing this request for state director review of the Hayhurst MDP based on the order the Interior Board of Land Appeals (IBLA) issued on December 2, 2016 dismissing our appeal challenging the project and remanding it for your review. As mentioned above, we also request an oral presentation, as provided for by 43 C.F.R. § 3165.3(b).

Overview of Concerns Regarding the Hayhurst MDP

There are a number of aspects of the approved Hayhurst MDP and the supporting environmental analysis that should be modified. These include:

1. Concerns regarding the conditions of approval (COA) that would accompany development pursuant to the MDP, including the twelve applications APDs that were approved with the project: The COAs should be clearly incorporated into the MDP and made part of it so there is a clear roadmap of mitigation measures that can be followed by the operator, the BLM, and the public. The COAs are not currently clearly made part of the MDP. Other concerns include:

    - There is a need for COAs that provide for protection of areas of critical environmental concern (ACEC) in the area, protection of lands with wilderness characteristics (LWC), and protection of values and resources in the nearby Carlsbad Caverns National Park. These COAs must be explicitly incorporated into the MDP. The absence of these COAs in an explicit fashion in the MDP contributes to the failures to provide adequate public notice and information about this project.
    - In addition to being added explicitly to the MDP, the COAs should also be made part of any APDs that are approved for this project, and these APDs should be publicly available.[1]
    - While COAs may be site-specific, the BLM nevertheless can provide information about what conditions will apply under various circumstances.
    - There is a need to ensure the mitigation provided by the COAs is effective. There is a need to protect resources and ensure mitigation succeeds. Currently the Hayhurst environmental assessment (EA) as well as the Decision Record and

[1] While Appendix A in the Hayhurst Environmental Assessment addresses the twelve APDs that were filed, COAs are not shown there, either.

Finding of No Significant Impact (FONSI) for this project do not explain how mitigation will succeed if certain conditions are met.

- Incorporating COAs into the MDP would track the model the BLM has been using for other master development plans, such as the Bull Mountain Master Development Plan in Colorado[2], and for Master Leasing Plans, such as the just-approved Moab MLP in Utah[3].

2. There is a need to address the effects of MDP decisions on alternatives that might be considered in the pending revision of the Carlsbad Field Office Resource Management Plan (RMP). Particularly, MDP decisions could negatively impact consideration and designation of potential and existing ACECs under the revised RMP, as well as management of wilderness characteristics in LWC.
3. Under the BLM Manual (BLM Manual 1613), there is a requirement to provide interim protective measures to protect the relevant and important values that make areas qualified for consideration as ACECs pending the development of a revised RMP. Currently no interim protective management is specified for the potential ACECs BLM has acknowledged as meeting relevant criteria in the MDP area.
4. The BLM has only prepared an EA evaluating the environmental impacts of the Hayhurst MDP but there is a need to develop an environmental impact statement (EIS) that more fully considers these impacts. Needs in this regard include:

[2] https://www.blm.gov/style/medialib/blm/co/information/nepa/uncompahgre_field/fy2015_nepa_docs.Par.34704.File.dat/Bull_Mtn_Final_EIS_July_2016_Vol_II_508_reduced.pdf

[3] https://eplanning.blm.gov/epl-front-office/projects/lup/68430/92959/111979/09_Moab_MLP_ROD_Appendix-B_Best_Management_Practices_Web.pdf

- The evaluation under the National Environmental Policy Act (NEPA) needs to explicitly address how the COAs that will be required for the MDP and APDs approved under it will mitigate environmental impacts. In particular, there is a need for greater consideration of concerns and issues related to impacts on potential and existing ACECs in the area and to impacts to Carlsbad Caverns National Park.
- There is a need for enhanced and improved opportunities for informed public participation in these NEPA analyses.

5. In 2011, the BLM entered into a memorandum of understanding (MOU) with the Environmental Protection Agency (EPA) as well as the National Park Service (NPS) regarding NEPA analysis requirements for oil and gas projects with respect to impacts on air quality. The BLM needs to ensure more complete and thorough compliance with this MOU than has been evident to date. It is available at https://www.epa.gov/sites/production/files/2014-08/documents/air-quality-analyses-mou-2011.pdf.
6. The BLM needs to commit to providing notice to interested stakeholders and parties regarding this MDP before more actions are taken that permit development, including providing documents on its websites in a timely and reliable manner.
    - In addition, there is a specific need to take further actions to engage the NPS with sufficient time for review and concurrence before actions are approved.

Background

The Hayhurst MDP would be a significant oil and natural gas development project located in Eddy County, New Mexico. The project is proposed by Chevron U.S.A., Inc. It is

located in the BLM Carlsbad Field Office. It would encompass 8,866 acres and permit drilling of 436 wells on 109 well pads. Twelve APDs were also approved when this MDP was adopted.

The decision approving this project was signed on October 7, 2016, by George MacDonnell, Field Manager BLM Carlsbad Field Office (CFO). In this decision, the BLM issued a Decision Record and FONSI regarding the Hayhurst MDP (DOI-BLM-NM-P020-2016-1434-EA). The Chevron U.S.A., Inc. Hayhurst Master Development Plan EA was also prepared as part of the review of this project.

Significant environmental impacts could accompany development at this magnitude, and thus we request your review of this project to ensure the requirements of NEPA and the Federal Land Policy and Management Act (FLPMA) have been met. As discussed in the above section, we do not believe this has occurred.

There are several significant environmental impacts relative to this project which we do not believe have been adequately reviewed under NEPA and FLPMA. Two potential ACECs are found in the MDP project area—the Carlsbad Chihuahuan Desert Rivers ACEC and the Gypsum Soils ACEC – as well as two existing ACECs – Chosa Draw and Yeso-Hills. The relevant and important and important values of these areas making them eligible for ACEC designation have not been adequately protected under the Hayhurst EA, Decision Record, or FONSI.

Moreover, this project is located near Carlsbad Caverns National Park. The potential for significant impacts to the Park have been documented by the NPS and include increased air pollution and impacts to dark, nighttime skies due to lighting in the MDP area. The BLM has also failed to comply with the existing MOU with the EPA and the NPS relative to NEPA compliance for air pollution resulting from oil and gas development projects.

A proposed LWC unit is also found in this project area and would be inadequately protected under the decision for this project.

These issues were raised in the appeal we filed with the IBLA, as was the basis for a stay of implementing the CFO's approval of the Hayhurst MDP and APDs (although IBLA dismissed the appeal because it did not view this matter as subject to its review prior to completion of state director review). We have enclosed a copy of that appeal, including the numerous exhibits, and ask that they be fully considered and made part of this request for state director review. In particular, we direct your attention to the in-depth discussion of the harm that will occur to our interests and the affected natural and cultural resources from the commitments made in the MDP if it is implemented. These harms and the interests of all parties justify a stay pursuant to regulatory standards; the discussion in the attached Petition for Stay and in this filing also justify a stay in operations under the MDP pending the completion of this state director review process.

We will also discuss the flaws in BLM's analysis below, along with proposed remedies.

Environmental Impacts of the Hayhurst MDP

The Chihuahuan Desert Rivers ACEC

In 2010, as part of the scoping process for the revision of the Carlsbad Field Office RMP, NMWA submitted a nomination for the "Chihuahuan Desert Rivers Area of Critical Environmental Concern." It proposed consideration of approximately 137,000 acres to be managed specifically with protection of the area's rivers in mind. The ACEC nomination contains two pristine rivers in the middle of the desert (the Delaware and the Black) and is immediately adjacent to a third, the Pecos. The Delaware is home to at least 20 BLM sensitive species as well as several endangered plants and invertebrates. It has been designated an Important Birding Area by the Audubon Society because of its importance as a rest stop for

migrating birds, and is truly an oasis in an otherwise industrial zone. The area is also home to numerous archeological and paleontological sites, including the site of the discovery of a mammoth tusk in 1999, stops on the Butterfield Stagecoach Trail, and sites from Captain John Pope's excursion to find a route for the transcontinental railroad. The Delaware River area has been nominated for the National Register of Historic Places. In its nomination of the ACEC, NMWA notified the CFO of its responsibility to use interim management for potential ACECs to protect the area's relevant and important values until a planning process is completed.

As part of the nomination process, NMWA had at least ten in-person meetings with CFO, which encouraged NMWA to expand and alter the proposal in various ways. As part of its February 2012 Special Designations, Travel Management, and Visual Resource Management Public Workshops, BLM announced that the proposed Carlsbad Chihuahuan Desert Rivers ACEC met the required relevance and importance criteria and would be carried forward into analysis in the Draft RMP. The proposed Carlsbad Chihuahuan Desert Rivers ACEC is within the Hayhurst MDP project area and the EA area of analysis. Hayhurst EA, Figure 3.15-1, p. 3-77.

The potential impacts from the activities proposed in the Hayhurst MDP and authorized for the twelve approved APDs are very important in the context of the relevant and important values identified in the proposed Chihuahuan Desert Rivers ACEC. The impacts of the proposed development are of high intensity/severity due to the large number of new wells and well pads being authorized and the area's unique natural characteristics. By approving the MDP and APDs without specific conditions of approval or placeholders for future conditions, BLM is relinquishing the opportunity to evaluate and impose COAs in these APDs or possibly on future APDs, foreclosing alternatives that would protect the ACEC values.

The Gypsum Soils ACEC

The second ACEC found in the Hayhurst MDP area is the Gypsum Soils proposed ACEC, which BLM internally nominated.

> . . . due to the presence of fragile microbiotic soil crust, high erosion potential when the crust is disturbed, and poor revegetation potential. These soils tend to be located along the banks and sidewalls of draws and in drainage bottoms. The BLM CFO has identified the Southern Gypsum Soil Area. This 62,800-acre area is characterized by gypsum soils with low organic matter content, sparse vegetation, rapid to very rapid runoff, very low to low water-holding capacity, and high salinity that limits plant rooting. These soils are also subject to severe erosion if the vegetative cover is lost (BLM 2014a). **Within this area, some off-road travel activities are restricted, but no specific management designations have been prescribed** (BLM 1988).

Hayhurst EA, p. 3-26 (emphasis added).

As part of its February 2012 Special Designations, Travel Management, and Visual Resource Management Public Workshops, BLM announced that the Gypsum Soils ACEC met the required relevance and importance criteria and would be carried forward into analysis in the Draft RMP. The proposed Gypsum Soils ACEC is within the Hayhurst MDP project area and the Hayhurst EA area of analysis. Hayhurst EA, Figure 3.15-1, p. 3-77.

The potential impacts from the activities proposed in the Hayhurst MDP and authorized for the twelve approved APDs are significant in the context of the relevant and important values identified in the proposed Gypsum Soils ACEC. The impacts of the proposed development are of high intensity/severity due to the large number of new wells and well pads being authorized and the area's unique natural characteristics, including fragile soils.

The EA confirms that these resources are at risk from development of the MDP if it is completed. For instance, with respect to soil, the Hayhurst EA states on page 3-26 that:

> Soil map units CR, GC, and RG constitute the nominated Gypsum Soils Area of Critical Environmental Concern (ACEC) due to the presence of fragile microbiotic soil crust, high erosion potential when the crust is disturbed, and poor revegetation potential. These soils tend to be located along the banks and sidewalls of draws and in drainage bottoms. The BLM CFO has identified the Southern Gypsum Soil Area. This 62,800-acre area is

> characterized by gypsum soils with low organic matter content, sparse vegetation, rapid to very rapid runoff, very low to low water-holding capacity, and high salinity that limits plant rooting. These soils are also subject to severe erosion if the vegetative cover is lost . . . . Construction-related impacts to soil resources may include compaction and degradation of factors necessary to support vegetation. There is a potential for wind and water erosion due to the erosive nature of some project area soils once the cover is lost, particularly within gypsum type soils. Based on the layout of project components presented in the MDP and APDs, approximately 530 acres of short-term impacts are expected in soils within the Nominated Gypsum Soils ACEC, particularly the Reeves-Gypsum land complex. Approximately 63 acres of short-term disturbance would be in soils with a severe water erosion hazard (i.e., Gypsum land-Cottonwood complex). Long-term impacts due to soil erosion could occur in areas where reclamation is difficult and where establishment of vegetation takes longer than expected.

The EA also notes (on the same page) that these soils can take up to 250 years to recover.

Impact to Carlsbad Caverns National Park

The NPS submitted comments to CFO on August 29, 2016, opposing the approval of the Hayhurst MDP. NPS highlighted a number of concerns, especially related to air quality and impacts to night skies, due to the proximity of the project to the boundary of the National Park. Carlsbad Caverns National Park is a Class I airshed under the Clean Air Act. Notably, NPS concluded: "we do not believe the project impacts are congruent with the issuance of a Finding of No Significant Impact."

NPS identified "significant adverse impacts to the desert ecosystems in Carlsbad Caverns NP due to excess nitrogen deposition" and "significant concerns regarding the cumulative impacts to night skies." NPS also cited broader concerns with impacts to visibility and that "very little information regarding the visibility analysis methods for the Hayhurst project is provided in the EA."

Further, NPS pointed out the failure of the BLM to follow the collaborative process outlined in the 2011 Air Quality MOU between BLM, the NPS, and the EPA. This MOU specifically applies to NEPA analyses and mitigation for oil and gas decisions. While NPS noted

that BLM's "recent efforts are consistent with the goals of the MOU," it also pointed out the MOU commitments to convene a technical workgroup and engage in a collaborative process to analyze and mitigate impacts "early in the planning process."

In this context, CFO did not collaborate with NPS early in the process and did not fulfill the other commitments for evaluating air quality impacts or designing mitigation measures. CFO declined to prepare an EIS (over the objection of NPS) and apparently also declined to even consider taking any of the actions identified in the MOU, such as developing and applying mitigation measures and design features to "eliminate or reduce adverse impacts."

The NPS comments conclude by reiterating the agency's key concerns: "As stated previously, we do not believe the air resource impacts from the proposed project are congruent with the issuance of a FONSI. We also have significant concerns regarding the cumulative impacts to night skies." In the approved EA, there is no mention of NPS concerns or actions taken to address them; for example, in the discussion of night skies, the EA only discusses the manner in which the cumulative impacts to night skies are consistent with BLM's Class IV visual resource management classification. *See*, Hayhurst EA, p. 3-74.

The NPS concerns remained after the Hayhurst EA was completed and the MDP was approved. In a second comment letter sent to the BLM on November 1, 2016, after the MDP was approved, the NPS stated, "The mitigations described in the response to comments document . . . are not incorporated as COAs into the Decision Record/Finding of No Significant Impact (FONSI)." And while COAs were developed to reduce nitrogen deposition issues, the NPS still "recommend[s] that a few changes to the COAs would ensure their effectiveness in addressing any potential adverse effects on park resources from excessive nitrogen deposition."[4] This was

[4] The COAs relative to air quality that BLM specifies follow below.

because "nitrogen deposition in the park is predicted to exceed the NPS Deposition Analysis Threshold . . . ." Therefore, the NPS recommended several revisions to the nitrogen oxide (NO_X) emissions caps for drilling and completion engines, and the emissions tracking mechanism expressed in the COAs that had been adopted. A copy of this November 1, 2016, letter is attached. Based on our review of the APDs approved with the MDP, it is clear that these additional needed changes have not been adopted by the BLM, even though BLM claimed that it was incorporating additional protections in its response to the NPS comments (Appendix F, pp. 3-7).

By approving the MDP, BLM has foreclosed opportunities to require phased development in the context of protecting the resources of Carlsbad Caverns National Park, as

---

In order to ensure that the proponent's impacts are consistent with the operating parameters considered in the air quality analysis, Conditions of Approval (COA) will be applied to Applications for Permit to Drill requested under the Hayhurst Master Development Plan. These COAs are:

- All project activities including equipment emissions shall meet or exceed all state and federal standards for air quality as regulated by the New Mexico Environment Department Air Quality Bureau and the U.S. Environmental Protection Agency.
- The operator will implement a drill and completion rig schedule where Tier 4 (or equivalent) drill and completion rigs are phased in. The operator will not exceed four drill rigs at one time and will be 100% compliant with Tier 4 (or equivalent) standards in 2020.
- During the drilling phase, the operator will emit NOx emissions of 262.95 tons per year (tpy) or less from nonroad (mobile sources) between Year 1 and Year 3 and 220.7 tpy or less from nonroad (mobile sources) for the remainder of the drilling phase.
- The operator will emit 213.6 tpy or less of NOx emissions during production operations, as defined in the emission inventory analyzed in the Environmental Assessment. The operator will submit emissions and/or parameters with an Application for Permit to Drill or annual emissions inventory that show the NOx emissions are within the limits of the air quality analysis within the Environmental Assessment.

They say nothing about Carlsbad Caverns National Park resources at all and appear to be standard Pecos District COAs that do not include avoidance and just provide some mitigation to limit harm. In the COAs we have seen for this project shown in the APDs, the only COAs are the standard Pecos District COAs and the COAs for air quality just presented. They do not include the changes the NPS recommended.

proposed by the NPS. Similarly, approval of the MDP and APDs prevents BLM from evaluating alternatives that would address cumulative impacts to night skies and desert ecosystems in the Park. Accurately analyzing the impacts to Carlsbad Caverns National Park and developing measures to limit harm to park resources is squarely in the public interest. The concerns expressed by the NPS are concerns that we share.

Lands with Wilderness Characteristics

The identification and consideration for protection of LWC is one of the issues being addressed in the Carlsbad Field Office RMP revision. LWC are roadless, generally 5,000 acres or more, and exhibit naturalness and outstanding opportunities for solitude or primitive, unconfined recreation. NMWA inventoried and identified lands with wilderness characteristics in the Hayhurst MDP area; NMWA submitted this information to the CFO and it includes one LWC unit within the MDP (the Delaware River unit, 6,276 acres). The map attached as Exhibit F in the IBLA appeal shows LWC identified by NMWA and submitted to CFO. While wilderness characteristics would clearly be impacted by the approved APDs and the other activities contemplated by the MDP, this resource is not acknowledged nor are potential impacts analyzed in the Hayhurst EA. Furthermore, while BLM notes in the Response to Comments that it decided this unit does not have wilderness characteristics (Exhibit F, p. 7), the public has never been given the opportunity to review BLM's LWC inventory or comment on its conclusions.

Lack of Compliance with NEPA and FLPMA

National Environmental Policy Act

NEPA requires agencies to take a "hard look" at the environmental impacts of proposed projects and also requires that a reasonable range of alternatives be considered to achieve the purposes of a project and the policies of NEPA. Where an EA rather than an environmental impact statement (EIS) is used to consider impacts, the EA must "provide sufficient evidence and analysis" to determine whether an EIS should be prepared or that a FONSI is appropriate, and the EA must consider the environmental impacts of the proposed action and alternatives to it. 40 C.F.R. § 1508.9. A FONSI is only appropriate if a project "will not" have significant environmental effects, and there are lengthy provisions governing how significance is to be determined. 40 C.F.R. §§ 1508.13 and 1508.27. The Hayhurst MDP EA, Decision Record, and FONSI have not met these requirements.

There would clearly be irreversible and irretrievable commitments of resources if the Hayhurst MDP and the twelve APDs were developed. Under these circumstances there must be adequate environmental review before a project can be approved. These potential impacts, which were not fully considered in the Hayhurst EA, were mentioned above relative to the Chihuahuan Desert Rivers ACEC, Gypsum Soils ACEC, Carlsbad Caverns National Park, and Land with Wilderness Characteristics. The need to fully consider irreversible and irretrievable commitments of resources when oil and gas resources are developed was made clear in *New Mexico ex rel. Bill Richardson v. BLM*, 565 F.3d 683 (10th Cir. 2009) where the court required supplemental NEPA analysis that considered closing a Chihuahuan Desert area to oil and gas development.

NEPA and BLM guidance documents require adequate analysis of site-specific impacts as soon as potential impacts are "reasonably foreseeable." *See* 40 C.F.R.§ 1502.22 (discussing situations where there is incomplete or unavailable information). NEPA analyses must be completed "at the earliest practicable point" and "before any irretrievable commitment of resources" 42 U.S.C. § 4332(2)(C)(v); *Pennaco Energy, Inc. v. U.S. Dep't of Interior*, 377 F.3d 1147, 1160 (10th Cir. 2004). The Tenth Circuit established that issuing a lease without a No Surface Occupancy (NSO) stipulation, for example, constitutes an irretrievable commitment of resources, and this necessitates preparation of an EIS. *New Mexico,* 565 F.3d. at 718. In this instance, the CFO has approved twelve APDs, giving the MDP proponent the right to drill twelve wells without adequately addressing the significant impacts to resources we and the NPS have repeatedly identified; these APDs are a similarly irretrievable commitment of resources. As noted by the NPS in its comments, "mitigation measures implemented to avoid significant impacts are implemented at Conditions of Approval (COAs) through this EA and in subsequent application for permits to drill (APDs)." The twelve APDs approved by CFO do not have the mitigation measures proposed by the NPS and BLM cannot impose them now. Further, by approving the MDP, BLM has foreclosed opportunities to require phased development in the context of protecting the resources of Carlsbad Caverns National Park, as proposed by the NPS.

As discussed in our respective comment letters to CFO, an EIS is the only way CFO can ensure an appropriate level of analysis and consider alternatives to minimize and mitigate impacts to public lands resources. NEPA requires preparation of an EIS to evaluate the environmental consequences of a proposed action when that action *may* significantly impact the environment. 40 C.F.R. § 1501.4. The definition of "significantly" (set out at 40 C.F.R. § 1508.27) unquestionably requires preparation of an EIS when considering development of

hundreds of new oil and gas wells in a potential ACEC and that would harm the resources of a nearby national park. In addition, the development of hundreds of new wells in a small area governed by an RMP that the BLM has acknowledged is out of date would still warrant an EIS according to NEPA, making the preparation of an EIS even more critical in this instance. *See New Mexico,* 565 F.3d at 694-95 (requiring preparation of a supplemental EIS where a single oil and gas lease parcel was sold in a Chihuahuan Desert grassland under a plan that did not comply with NEPA).

The potential impacts from the activities proposed in the Hayhurst MDP and authorized for the twelve approved APDs are very important in the context of the relevant and important values identified in the proposed Gypsum Soils ACEC and the proposed Chihuahuan Desert Rivers ACEC. The impacts of the proposed development are of high intensity/severity due to the large number of new wells and well pads being authorized and the areas' unique natural characteristics. Additionally, authorizing hundreds of new oil and gas wells is highly controversial, as evidenced by the public comment and concern that has been generated around oil and gas leasing and development on public lands. Further, BLM's sister agency, the NPS, has explicitly concluded that the impacts to the resources of Carlsbad Caverns National Park are "significant," as explicitly stated and repeated in the NPS comment letters.

We believe several critical factors require a much deeper analysis than what was present in the Hayhurst EA. These include:

- Impacts to the ecosystem night skies, and viewshed of Carlsbad Caverns National Park,
- Potential impacts to karst resources within the project area, especially to any groundwater,
- Impacts to threatened and endangered species, including impacts to the adjacent riparian areas,
- Impacts to all identified lands with wilderness characteristics,

- Impacts to the Delaware River area, which has been nominated for the National Register of Historic Places, and
- Impacts to ACEC resources especially the relevant and important values found in these areas.

Moreover, an EIS is required in order to provide a current analysis of environmental consequences and potential mitigation measures. The Hayhurst EA states that it is in conformance with the 1997 Carlsbad RMP Amendment. But that plan does not reflect information that has come to light or changes on the ground in the past two decades, including scientific research, U.S. government commitments, and new policies regarding climate change, which is partly why the RMP is currently being revised. An EIS would entail a more thorough analysis of the potential environmental consequences of development in the Hay Hollow area based on newly-discovered information as well as suitable mitigation measures. There is a wealth of new information and changed circumstances regarding both oil and gas development and protection of other resources both in the project area and affecting CFO's management decisions in the context of the broader RMP revision that require the preparation of an EIS.

Council on Environmental Quality (CEQ) guidance states that an EA should generally be in the 10-15 page range, and that a lengthy EA, while occasionally appropriate, generally means that an EIS is needed. We would note that the CEQ regulations are to receive "substantial deference" and even the Forty Most Asked Questions guidance is "persuasive authority." *New Mexico,* 565 F.3d at 703, 705. Here, the Hayhurst EA is 634 pages, far beyond what we believe is an appropriate stretch of the guidelines. Additionally, we found many examples of EISs being prepared for MDPs which are much smaller than the Hayhurst MDP project and which do not have active conservation proposals on them[5], indicating it is common practice to prepare EISs

[5] *See* Bull Mountain Unit MDP EIS (146 wells, July 2016, Uncompahgre Field Office in Colorado, available at https://www.blm.gov/co/st/eonn/BLM_Information/nepa/ufo/Bull_Mountain_EIS.html). See also Eagle Prospect and Noble Basin MDP (133 wells, 2010, Bridger-Teton National Forest in Wyoming).

for similar, and even much smaller projects.

The Bull Mountain MDP EIS provides important insight about what should be included in a Hayhurst MDP EIS. The BLM originally prepared an EA for Bull Mountain but then decided to prepare an EIS.[6] And since this EIS was evaluating both the MDP and an APD, BLM included complete APD packages in the EIS so as to inform the public.[7] The Bull Mountain EIS set out required conditions for drilling approval, such as we are requesting, and it specified detailed "design features" and "mitigation measures" for future development, and it required closed loop drilling.[8] Appendix C in the Bull Mountain EIS provides for Design Features, Mitigation Measures, and Conditions of Approval.

In its FONSI, CFO stated its reason for not producing an EIS was that, "BLM determined through the analysis presented in the Environmental Assessment that the proposed action would not result in significant impacts; therefore, preparation of an Environmental Impact Statement is not required." But the Hayhurst EA itself acknowledges significant impacts, the NPS also concluded there were significant impacts, and there was new information presented to CFO in 2010. CFO should have prepared an EIS to fully evaluate the environmental consequences of the Hayhurst MDP and twelve APDs, as well as to consider appropriate mitigation measures, such as those proposed by the NPS.

Approval of the MDP and APDs prevents BLM from evaluating and imposing COAs on development of the leases managed by the MDP, foreclosing alternatives that would protect the

---

[6]See Bull Mountain Draft EIS, p. ES-10. https://www.blm.gov/style/medialib/blm/co/information/nepa/uncompahgre_field/13-22_bull_mountain.Par.23863.File.dat/ Bull_Mtn_DEIS_Jan2015_508_reduced.pdf.

[7] Bull Mountain Final EIS, p. ES-5. https://www.blm.gov/style/medialib/blm/co/information/nepa/uncompahgre_field/fy2015_nepa_docs.Par.39131.File.dat/Bull_Mtn_Final_EIS_July_2016_Vol_I_508_reduced.pdf.

[8] Bull Mountain EIS Table ES-2, p. ES-9; p. ES-11.

ACEC values. Similarly, approval of the MDP and APDs prevents BLM from evaluating alternatives that would address cumulative impacts to night skies and desert ecosystems in Carlsbad Caverns National Park. As discussed above, BLM cannot require phased drilling in the area around the park in a manner that will affect the MDP and APDs. Thus, in addition to not properly determining the significance of the impacts from this project, the Hayhurst MDP decision document was also approved without considering a reasonable range of alternatives. There is a need to discuss the effect of this MDP on the reasonable alternatives that will be available in the RMP revision for the Carlsbad Field Office. The requirements of NEPA have clearly not been met for the Hayhurst MDP project.

Federal Land Policy and Management Act

FLPMA is BLM's organic act that specifies provisions for all aspects of BLM land management. There are a number of relevant provisions in FLPMA that are applicable to the Hayhurst MDP and the ongoing Carlsbad Field Office RMP revision. For example, the public lands must be managed in a way that protects them, and in some cases, preserves them. 43 U.S.C. § 1701(a)(8). They must be managed under principles of multiple use, which among other things requires harmonious and coordinated management "without permanent impairment." *Id.* §§ 1702(c), 1732(a). Priority is to be given to designating ACECs. *Id.* § 1712(c)(3). BLM is to "provide for compliance with applicable pollution control laws, including State and Federal air, water, noise, or other pollution standards or implementation plans . . . ." *Id.* § 1712(c)(8). And BLM must prevent unnecessary or undue degradation of the lands it manages. *Id.* § 1732(b). There are a number of requirements in BLM's planning regulations that require protection of lands in the interim during RMP revisions so that a reasonable range of land management options can be considered. We would note that BLM's FLPMA land use planning regulations

have just been revised and establish new requirements for RMP revisions. 81 Fed. Reg. 89,580 (Dec. 12, 2016).

To meet FLPMA requirements, the BLM must complete the Carlsbad Field Office RMP revision before it approves the Hayhurst MDP. CFO states on its RMP revision website that revision is needed in part because, "[c]hanges in population, types of uses, technologies, user interests, and public understanding of resource availability, capabilities, and constraints, have made the existing RMP and its amendment decisions less effective in allocating use. It has become more difficult to find public land parcels with non-conflicting uses in the planning area."

BLM's interest in promoting mineral production from the public lands and generating royalties is contingent on first performing adequate analysis and land use planning to assure that the development is environmentally and socially sound, as required under FLPMA and NEPA. *See* 43 U.S.C. § 1701(a)(8) & (12) (BLM must manage the public lands for multiple use "in a manner which recognizes the Nation's need for domestic sources of minerals . . . in a manner that will protect the quality of . . . ecological, environmental values."); 43 C.F.R. 1610.6-3(a) and (b) (resource management actions must conform to the new RMP and BLM must make activities under the plan conform with the plan).

In addition, where BLM has been presented with information that was not considered during preparation of the original RMP and, therefore, is not reflected in the existing NEPA analysis, then the information must be considered prior to making management decisions. *See, e.g.*, *Southern Utah Wilderness Alliance v. Norton*, 457 F. Supp. 2d 1253 (D. Utah 2006) (information not considered in NEPA analysis in existing land use plan meant that the existing plan could not support leasing; new information must be considered).

Here, new information was presented to CFO in 2010 in the form of an ACEC nomination from NMWA and its own ACEC nomination, as well as through inventory of LWC both from BLM and NMWA. In addition, the CFO's own stated reasons for revising the Carlsbad RMP acknowledge that a revision "is necessary because a number of changes have occurred, both on the landscape and in the resource use and protection arenas." It then identifies some of these changes to include:

- "continuing fluid and solid mineral extraction and energy development in the area and new technologies being used to extract those resources";
- "Updated or new wildlife and special status species stipulations, Conditions of Approval (COAs), and Best Management Practices (BMPs) are needed for oil and gas development. Special designations such as Areas of Critical Environmental Concern (ACECs) need to be reexamined, especially for several cultural areas"; and
- "opportunities to update recreation decisions in the plan revision to capitalize on community interest and needs, as well as surrounding tourism destinations."

By approving a Master Development Plan and twelve associated APDs in the midst of an RMP revision, BLM is limiting the choices it can make for future management of the Field Office. BLM acknowledged the relevant and important values of the proposed Chihuahuan Desert Rivers ACEC, as well as the Gypsum Soils ACEC, and according to recent meetings with CFO, is considering designation of the ACECs in at least one of the alternatives in the revised RMP, along with how drilling would be managed in proximity to desert riparian areas and in the presence of fragile soils. As noted above, approval of the MDP and APDs could foreclose alternatives that would protect the ACEC values. Similarly, approval of the MDP and APDs prevents BLM from evaluating alternatives that would avoid or minimize cumulative impacts to night skies and desert ecosystems in Carlsbad Caverns National Park, including phased development.

During a plan revision, BLM has a responsibility not to authorize actions which could preclude a choice among reasonable alternatives. According to the agency's Land Use Planning Handbook:

> During the amendment or revision process, the BLM should review all proposed implementation actions through the NEPA process to determine whether approval of a proposed action would harm resource values so as to limit the choice of reasonable alternative actions relative to the land use plan decisions being reexamined. *Even though the current land use plan may allow an action, the BLM manager has the discretion to defer or modify proposed implementation-level actions*.

Handbook 1601-1, Section VII(E) (emphasis added).

The BLM's guidance is supported by applicable NEPA regulations. 40 C.F.R. § 1506.1(a) states that, "[u]ntil an agency issues a record of decision…no action concerning the proposal shall be taken which would: 1. Have an adverse environmental impact; or 2. Limit the choice of reasonable alternatives". Similarly, 40 C.F.R. § 1506.1(c) states that:

> [w]hile work on a required program environmental impact statement is in progress and the action is not covered by an existing program statement, agencies shall not undertake in the interim any major Federal action covered by the program which may significantly affect the quality of the human environment unless such action: 1. Is justified independently of the program; 2. *Is itself accompanied by an adequate environmental impact statement;* and 3. *Will not prejudice the ultimate decision on the program.* Interim action prejudices the ultimate decision on the program when it tends to determine subsequent development or limit alternatives.

Additionally, BLM Instruction Memorandum 2010-117, which is binding national policy, confirms that "there is no presumed preference for oil and gas development over other uses"; this policy applies even when areas are open to leasing under applicable land use plans and especially when those plans have been found out of date by BLM. In evaluating the proposed MDP and twelve APDs, BLM should have assessed proposed oil and gas development in regard to how it would impact the management of other resources and uses already under consideration through the RMP revision. In the context of the Hayhurst MDP and the twelve APDs, BLM's actions

were not justified by an adequate EIS (as discussed above) and would also foreclose important alternatives under consideration. BLM should have deferred approval of the MDP until the RMP revision was completed.

FLPMA obligates BLM to "give priority to the designation and protection of areas of critical environmental concern." 43 U.S.C. § 1712(c)(3). BLM's ACEC manual requires that all areas which meet the relevance and importance criteria must be "fully considered" for designation in resource management planning. BLM Manual 1613 at .21. The manual states at section .21(E) that

> If an area is identified for consideration as an ACEC and a planning effort is not underway or imminent, the District Manager or Area Manager must make a preliminary evaluation on a timely basis to determine if the relevance and importance criteria are met. If so the District Manager must initiate either a plan amendment to further evaluate the potential ACEC, or provide temporary management until an evaluation is completed through resource management planning. **Temporary management includes those reasonable measures necessary to protect** human life and safety or **significant resource values from degradation until the area is fully evaluated through the resource management planning process** (emphasis added).

In this case, the area in question was nominated for ACEC designation six years ago in 2010, before planning formally began. In NMWA's nomination, it pointed to this clause of the ACEC manual and asked CFO to use interim management to protect the resource values. In accordance with the passage above, CFO determined that the relevance and importance criteria were met. It was required at that point to protect those values until a determination was made about ACEC designation in the plan. Further, once CFO was considering an MDP and approval of twelve APDs, it had an immediate obligation to put interim management in place to protect ACEC values and an important opportunity to design the MDP to incorporate such protections through an EIS. BLM did not take any of the required actions and so has failed to comply with its guidance as well as FLPMA's mandate that the agency give priority to the designation and

protection of ACECs. 43 U.S.C. § 1712(c)(3). In reviewing the response to comments in the Hayhurst EA it is not apparent to us that BLM responded to the need for ACEC interim management at all. And while the BLM seems to acknowledge it can eventually manage the proposed ACECs as ACECs, it needs to do a more thorough analysis of the relevance and importance values in these areas, which we discussed above, and how they can be protected.

Public Involvement and Comment Issues

As discussed in detail in our IBLA appeal, the approval of the Hayhurst MDP was notable for the near secrecy that accompanied it. We were not notified of this project despite being parties which would have an obvious interest due to the ACEC and LWC proposals, and only were able to comment after receiving an anonymous tip. We were not notified that the FONSI had been signed and only learned about it through the NPS. And even then, the FONSI and other documents were not even posted on the BLM website until well after they were signed, because we requested it numerous times through email. The procedures used by the CFO nearly defeated public participation, and would have defeated it had we not objected. This secrecy was despite the fact NMWA and TWS have continued to have regular contact and meetings with CFO over the past five years; in-person, over the phone, and by email. These procedures are further evidence of a failure to comply with NEPA.

NEPA requires that major federal actions be reviewed by the public, that agencies respond to the public's concerns when making decisions about proposed actions, and that NEPA determinations are not made before public comments are considered. *See, e.g.*, 40 C.F.R. §§ 1500.1(b) and 1503.4. The purpose of providing a comment period on an EA is "to allow the public an opportunity to comment on the agency's determination." BLM National Environmental Policy Act Handbook, H-1790-1, Section IV(B)(4)(a). The regulations require that agencies

"make diligent efforts to involve the public in preparing and implementing their NEPA procedures." 40 CFR § 1506.6(a). According to the handbook, the primary goal of public involvement is to ensure that all interested and affected parties are aware of the proposed action.

The Handbook states that BLM should reach out to potentially interested community organizations. BLM is told, "[b]efore and during the preparation of the EA, be very thoughtful about the level of public involvement that may be necessary with respect both to the decision to be made and the analysis of the environmental consequences of that decision." BLM Manual 1790-1, section 8.2. Separately, in CEQ's NEPA's Forty Most-Asked Questions, agencies are told that, "[a] combination of methods may be used to give notice, and the methods should be tailored to the needs of particular cases…[t]he objective, however, is to notify all interested or affected parties."

Clearly BLM's failure to adequately inform the parties to this matter about the Hayhurst MDP violated the public involvement provisions of NEPA. This is yet another reason why an EIS should be prepared for the Hayhurst project—so that the public can be adequately engaged. This also emphasizes the need to adopt the solutions to the problems in this MDP and the Hayhurst EA that we have identified in these comments.

Our interests are clear: our members visit the disputed lands and public lands in the vicinity of the MDP project area for a variety of aesthetic and recreational pursuits, they live and work in neighboring communities, and have been involved in CFO decisions for many years. We could be harmed by the immediate development of twelve wells and the planned development of over 400 wells on over 100 well pads. These will result in irreversible and irretrievable environmental damage and alteration of the existing resources, as well as impacts to the range of alternatives available for the ongoing RMP revision, including the ACEC we have nominated.

The NPSs interests are also clear. They have emphasized and documented in detail these concerns in two comment letters, the first on August 29, 2016 and the second on November 1, 2016. These letters were discussed above. Clearly the BLM must ensure full transparency relevant to this project so that the concerns of the NPS can be fully addressed, as well as the concerns of the public.

In this case, BLM's approval of the Hayhurst MDP and twelve APDs authorizes drilling which will immediately destroy natural values and harm soils and riparian areas, as well as any user's enjoyment of those resources. BLM's decision will impact lands undergoing an RMP revision, harm resources on the affected area and in the adjacent Carlsbad Caverns National Park, could preclude designation of an ACEC, and could lead to other sensitive areas in CFO's jurisdiction, such as LWC, being impacted before the RMP revision is finished. Consequently, Appellants will be irreparably harmed. This emphasizes the inappropriate level of public involvement in this matter, and the need to correct that through development of an EIS.

Restatement of Concerns Regarding the Hayhurst MDP

As we indicated in the first section of this request for State Director review, we believe there are two principal ways the BLM can resolve the problems evident in the Hayhurst MDP. First, it should develop an EIS for this project and not rely on a faulty EA. Second, it should not approve the Hayhurst MDP during the pendency of the Carlsbad Field Office RMP revision.

These two changes are needed in order for the Hayhurst MDP to comply with the requirements of NEPA and FLPMA. In addition, the BLM should put in place interim management requirements that protect the relevant and important values of the ACECs proposed in the MDP area before the MDP is approved. Moreover, development of an EIS would allow the

BLM to ensure full compliance with the air quality oil and gas project NEPA MOU that it has entered into with the NPS and EPA.

The State Director should reverse the Hayhurst MDP Decision Record and FONSI pending completion of an updated EIS and development of the Carlsbad RMP. The State Director should also require the development of interim management plans for the ACECs in the MDP area.

Conclusion

We appreciate your consideration of this Request for State Director Review, and the opportunity to present an oral presentation to you regarding our concerns. The solutions to the issues we have identified—preparation of an EIS for the Hayhurst MDP project, not approving the project until the Carlsbad Field Office RMP has been revised, putting in place interim management requirements to protect the ACECs that are under consideration, and improved compliance with the air quality MOU—are well within your authority to direct. Taking these actions will help ensure this project complies with NEPA and FLPMA, and will make it unnecessary for us to refile our appeal with the IBLA.

We look forward to the opportunity to present these issues in more detail at an oral presentation; we are also available to answer questions or provide additional information prior to that meeting. In the interim, we request a stay of operations approved in the MDP and related APDs based on meeting the criteria for a stay set out in the applicable regulations.

Sincerely,

Judy Calman, Staff Attorney
New Mexico Wilderness Alliance
142 Truman St. NE #B-1
Albuquerque, NM 87108
505-843-8696
judy@nmwild.org

Nada Culver, Senior Counsel and Director
BLM Action Center
The Wilderness Society
1660 Wynkoop Street, #850
Denver, CO 80202
303-225-4635
Nada_culver@tws.org

David Nimkin, Southwest Regional Director
National Parks Conservation Association
307 West 200 South, Suite 5000
Salt Lake City, UT 84101
801.521.0785
dnimkin@npca.org

From: Nada Culver
To: Neil Kornze
Subject: TWS BLM Action Center"s annual awards recognizing BLM"s great work
Date: Wednesday, January 4, 2017 5:11:04 PM
Attachments: 2016 CAPE Awards.pdf

Hi Neil – It's that time of year. We wanted to share our annual CAPE awards recognizing so much amazing work this year, and thank you for all the support you gave to these transformative initiatives this year and every year in your work at BLM. We're not doing press releases but are sending these to the many folks who contributed to these accomplishments.

All the best,

Nada Culver

Senior Counsel and Director, BLM Action Center

The Wilderness Society

1660 Wynkoop, #850

Denver, CO 80202

Main: 303-650-5818

Direct: 303-225-4635

Nada_Culver@tws.org

The 2016 CAPE Awards

Celebrating Milestones in Conservation for our Public Lands

The Interior Department hit its stride in 2016, and rolled out some inspired final decisions to cap off the Obama administration's tenure. We were delighted to see years of effort culminate in major progress for stewardship of wilderness quality lands, more balanced oil and gas management, and smart from the start renewable energy planning. And, how we could not spotlight right off the bat finalization of the BLM's new planning rule?! Way to go, BLM, it's been quite a ride.

Unfortunately, there have also been isolated affronts towards our western public lands and the civil servants that steward them for all Americans. In these challenging times, as in years past, we'd like to start our annual year-end celebratory awards to first recognize and appreciate all BLM employees and their commitment to managing our vast shared real estate for the benefit of us all. In coming years, we hope the agency maintains pride in its mission, continues its exciting trajectory towards landscape-level planning and managing for the greatest threat of the future – climate change – and keeps the faith that the American public overwhelmingly supports public lands.

The Comparative Analysis of Particular Excellence (CAPE) rating system, inspired by the superhero-like character of the BLM Action Center team (able to leap tall stacks of RMPs in a single bound!), ranges from one CAPE on the low end (worth a pat on the back) to five CAPEs on the high end (HUGE PROGRESS!!! WAY TO GO!!!).

1. New Rule to Update Planning for Public Lands – 5 CAPEs

Acknowledging that the BLM's land use planning rule has not been substantially updated since the Internet was invented in 1983, the agency finalized updates to the rule this year to help bring planning for our public lands into the 21st century. The rule is part of the BLM's "Planning 2.0" initiative to make planning more cooperative, transparent and efficient. Under the new rule, the public has new and improved opportunities to make their voices heard in management decisions affecting our public lands. The rule also encourages planning at a landscape-scale rather than by political boundaries to better address issues such as wildlife movement corridors and planning for energy development while protecting valuable lands for conservation.

The rule has broad public support, including from many local governments, who appreciate the agency's commitment to expand public participation in land use planning decisions, utilize modern science in assessing land conditions and planning for the future, and strive to make our public lands more resilient

and adaptable. Through this rule, the BLM will be better equipped to design land management plans that truly reflect the needs and desires of the public.

We congratulate the BLM on getting this important and essential rule over the finish line and look forward to seeing it implemented. We are also looking forward to seeing the Planning 2.0 initiative come to completion with the issuance of an updated land use planning handbook to help guide implementation.

2. Wilderness Quality Lands Get the Love They Deserve – 5 CAPEs

In 2016, the BLM continued to make significant progress in its efforts to conduct and maintain inventories of lands with wilderness characteristics. Lands with wilderness characteristics are an important resource that the BLM is obligated to identify under the Federal Land Policy and Management Act of 1976. In the last few years, we've seen the BLM improve its inventory methods while extending the agency's commitments to funding and executing on-the-ground inventory work. The BLM has or is currently updating inventories in planning areas around the country—including the Colorado River Valley and San Luis Valley field offices in Colorado, as well as the Basin and Range National Monument in Nevada.

Basin and Range National Monument, by Bob Wick

In addition to improving inventory methods and conducting field inventories, the BLM is also clarifying its obligations to address wilderness resources in a more consistent manner. This year, the BLM developed statewide guidance in Colorado and Utah to provide more detail on conducting inventories, responding to citizens' inventories, and considering lands with wilderness characteristics in planning efforts, including at the project level. This guidance helps to provide uniformity in how individual field offices meet their obligations to identify and consider lands with wilderness characteristics.

The BLM further committed to stewarding wilderness resources this year through requiring compensatory mitigation for impacts to lands with wilderness characteristics from development. Mitigation is an important tool because it ensures that the public receives compensation for the loss of wilderness quality lands due to projects such as energy development. In the case of the recently approved TransWest Express and Gateway South transmission lines, the BLM will offset impacts to lands with wilderness characteristics by protecting wilderness-quality lands elsewhere.

The BLM has been ushering in a renewed dedication to assessing and protecting wilderness quality public lands over the past few years, and the momentum continued in 2016 thanks to extensive inventory work, state-specific guidance and compensatory mitigation commitments. We expect the BLM will continue with this important work in coming years to meet the agency's obligations under FLPMA.

3. Employing a Commonsense Approach to Oil and Gas Development – 5 CAPEs

For far too long, the oil and gas industry has run the roost on our public lands. The BLM has prioritized oil and gas leasing and drilling at the expense of wildlands, wildlife, clean air and water, recreation and numerous other values of our shared western landscapes. This year, the BLM took the reins and implemented commonsense decisions and reforms to ensure oil and gas has just one seat at the table – along with all other multiple uses. Two of the most impactful decisions were to cancel oil and gas leases in Colorado's Thompson Divide and Montana's Badger-Two Medicine area. In both cases, the BLM responded to strong local support – including ranchers in the Thompson Divide and the Blackfeet Nation in Badger-Two – to rectify a historic wrong and dispose of improperly-issued leases. These landscapes are truly too wild to drill, and we are elated that the BLM has finally taken strong action to protect them for future generations.

The BLM also adopted other commonsense reforms for oil and gas development this year. Chief among them is the "methane rule," which aims to cut natural gas waste and methane pollution from oil and gas operations on public lands. The methane rule will help move us toward agreements to cut U.S. methane emissions by 40 to 45 percent by 2025, building on 2015 U.S. commitments in Paris to reduce emissions and slow global warming. The BLM also finalized Onshore Orders 3, 4 and 5 to accurately measure and report oil and gas produced from federal lands and ensure companies pay full royalties.

Lease cancellations in the Thompson Divide and Badger-Two Medicine areas are landmark victories for nationally important landscapes that should never have been leased in the first place. We are thrilled to see the BLM take a proactive approach to oil and gas management on our public lands by protecting special lands and adopting rules to make drilling safer and smarter, for the climate and for taxpayers.

4. California Desert Plan Protects 4.2 Million Acres – 5 CAPEs

In September, the California BLM released its highly anticipated Record of Decision (ROD) for the Desert Renewable Energy Conservation Plan (DRECP) – a land use planning effort designed to balance smart renewable energy development with land conservation in the California Desert. The signing of the DRECP ROD not only marks the end of the first phase of a broader plan, but also affirms that developing clean energy and protecting wildlife, plants, cultural resources, and recreation opportunities are not mutually exclusive.

The DRECP ROD will protect 4.2 million acres of wild and vulnerable public land, including permanently protecting almost 3 million acres of newly designated California Desert National Conservation Lands. The BLM has already initiated the mineral withdrawal procedures for over 1.3 million acres of these new conservation lands as required by the DRECP ROD. This early action will not only reinforce their designation as protected conservation areas, but help drive DRECP implementation forward. The DRECP ROD also designates carefully selected low-conflict areas dedicated to renewable energy production, including locations that are already adjacent to existing infrastructure like transmission lines and roads. This decision will help elevate and streamline renewable energy production in locations that are attractive to developers and pose limited risk to other resources.

California's Silurian Valley, by Mason Cummings

With the ROD, the plan has set a high bar for future collaborative, multi-agency planning initiatives unfolding across the West. While the work in the California Desert is just beginning, signing the DRECP ROD for Phase I is an important achievement and an essential building block for what is to come from implementation and Phase II.

We enthusiastically support the DRECP ROD, which will protect over 4.2 million of acres of delicate desert resources and pristine landscapes for future generations while helping California meet its renewable energy and climate goals. In a time of serious climate uncertainty, forward-thinking planning measures like the DRECP will help reduce stress and impacts to a vulnerable landscape. Moving forward, the BLM needs to tackle the implementation of the DRECP Phase I head-on, beginning with the recently initiated mineral withdrawal procedures on over 1.3 million acres of designated conservation lands and to diligently assess the landscape for disturbances, as well as helping renewables projects succeed in designated low-conflict areas.

5. BLM Codifies "Smart from the Start" Renewable Energy Program – 5 CAPEs

The BLM has made great strides in advancing responsible renewable energy in the last five years. This includes permitting the first-ever solar projects on public lands, establishing landscape-scale plans to guide development to low-conflict zones across the southwest, and approving over 15,000 megawatts of wind, solar and geothermal development – enough to power over five million homes. In finalizing the Wind and Solar Leasing Rule this year, BLM ensured that smart approaches advanced in recent years will become standard practice going forward. By prioritizing development in designated low-conflict areas, the rule will make the permitting process more efficient in appropriate areas while protecting wildlands and wildlife habitat from development, as demonstrated by the success at the Dry Lake Solar Energy Zone (SEZ) outside Las Vegas. It will also assure taxpayers fair compensation by implementing a competitive leasing process. The rule enjoys wide, bi-partisan support and will facilitate responsible renewables development, helping us protect our natural heritage, tackle the threat of climate change, and benefit western economies.

BLM also continues to make renewable energy zones more attractive to developers and ensure that unavoidable impacts from development are offset through mitigation. The agency finalized two Solar Regional Mitigation Strategies (SRMSs) this year, one for the Dry Lake Valley North (DLVN) SEZ in eastern Nevada and one for Arizona's three SEZs. These build off BLM's pilot SRMS for the Dry Lake SEZ, which proved to be a key element of the agency's success in providing an efficient permitting process for projects in that zone and giving predictability to developers on their mitigation obligations, while investing mitigation resources in strategic conservation actions in the region. BLM has continued to refine its approach to SRMSs, and the DLVN and Arizona SRMSs included improvements such as better addressing uncertainty on mitigation outcomes in fee calculations. We expect that the completion of

these SRMSs will increase the attractiveness of these SEZs for responsible development when market conditions are right.

We applaud the BLM in creating a robust renewable energy program from scratch, culminating with the finalization of the Wind and Solar Leasing Rule this year. We look forward to working with the BLM, project developers, and other stakeholders to put the rule to work, including establishing implementation guidance, helping projects succeed in zones, designating new zones in appropriate areas, and protecting wildlands and wildlife habitat from development. We also look forward to engaging with BLM as it finalizes the SRMSs underway in Colorado, New Mexico, and Utah to facilitate responsible solar development and mitigation in those regions. We hope BLM will continue to refine its approach to SRMSs, including elevating the potential for addressing mitigation obligations by adding or strengthening protections for other public lands in SEZ regions.

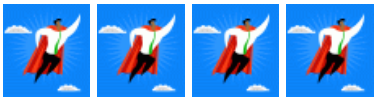
6. Natural Heritage Protected in the Arctic – 5 CAPEs

Hot off the presses, this week the BLM finalized a plan for 6.5 million acres of extremely wild public lands in Alaska's Eastern Interior planning area. The public lands managed by the BLM here include some traditional land of twelve federally recognized tribes, several of which have worked throughout the planning process to ensure their cultural heritage and identities, realized through subsistence lifestyles, are protected. Moose, caribou, grizzly bear, wolverine, and eagles are among the many species that make their home in the Eastern Interior along with dozens of fish species that depend on vast and complex river systems, including the mighty Yukon. The public lands in Alaska's interior also provide outstanding opportunities for hunting, fishing, rafting, and cross-country skiing to winter huts. The final Eastern Interior plan strikes a good balance for conserving important fish and wildlife habitat, providing quality backcountry recreation experiences, and protecting traditional uses. It also identifies and includes measures to protect 3 million acres of lands with wilderness characteristics, and substantially restricts new mining.

This year, the Department of the Interior also decided to protect the Arctic Ocean from oil and gas leasing for the next five years in the Bureau of Ocean Energy Management's 2017-2022 program for offshore oil and gas leasing. The Arctic Ocean provides habitat for numerous species of whales, polar bears, seals, walruses and many populations of fish and birds, and has supported the lives and cultures of Alaska Natives for thousands of years. These places would be gravely threatened by oil and gas leasing, and we are relieved that the Arctic Ocean will be spared for the near future.

We are inspired by the BLM's commitment to protect Alaska's indigenous people and their subsistence cultures, as well as critically important wildlife habitat and epically vast wilderness-quality lands, from destructive mining and development in the Eastern Interior. We are also grateful that the Department of the Interior recognized the Arctic Ocean is not appropriate for oil and gas leasing due to its extraordinarily vulnerable environment and important natural resources.

7. BLM Finalizes Strong Mitigation Manual and Handbook – 4 CAPEs



BLM has demonstrated great leadership in recent years in modernizing its approach to "mitigation", the practice of avoiding and offsetting damage caused to public lands from development. Federal regulations require agencies to follow a five-step hierarchy to address impacts – avoid, minimize, rectify, reduce/eliminate, and compensate – which can be summarized as avoidance, minimization and compensation. Historically, work to mitigate the negative impacts of development such as oil and gas drilling and transmission lines was implemented on a project-by-project basis, which was insufficient to protect our resources and inefficient for permitting projects.

The new policies from BLM and other federal agencies provide guidelines for a broad, landscape-scale approach to balancing development and conservation on public lands. If the policies are used properly, future development projects will avoid impacts to sensitive resources while benefitting from more predictable and efficient permitting processes, and federal agencies will require conservation gains to address and overcome any loss of resources that does occur. Key concepts emphasized in the manual and handbook include a focus on the mitigation hierarchy; use of a landscape-scale approach; setting a no net loss or net benefit outcome for resources that are considered important, scarce, sensitive, or have a protective legal mandate; use of mitigation strategies and plans to establish mitigation standards in advance of development; and emphasizing BLM's preference for achieving compensatory mitigation outcomes in advance of impacts.

The handbook also provides important details on tools BLM can use to durably protect mitigation sites on public lands such as identification of a protective land use plan allocation for the site (e.g. an Area of Critical Environmental Concern) or issuance of a lease or easement to a member of the public to conserve the site (via the authority granted in FLPMA Title III and/or Title V).

As described elsewhere in these awards, we've seen the value of BLM's smarter approach to mitigation in Solar Regional Mitigation Strategies, transmission line project approvals and other contexts. With the manual and handbook now finalized, we look forward to continuing to work with BLM to advance these important mitigation guidelines through land use planning and project permitting. Used properly, they will better balance conservation and development on our public lands while increasing permitting predictability and efficiency.

8. Coal Gets a Reboot – 4 CAPEs

On January 15, 2016, Interior Secretary Sally Jewell signed Secretarial Order 3338 directing the BLM to prepare a Programmatic Environmental Impact Statement (PEIS) to analyze potential leasing and management reforms to the federal coal program. The BLM held six public meetings across the county and solicited comment from stakeholders to gather information on policies and practices that need to be updated. The PEIS seeks to address how, when and where to lease public lands for future coal development, as well as how to secure a fair return to taxpayers from royalties, address climate impacts, and address our domestic energy needs. BLM also implemented a temporary pause on significant new coal leasing while it completes the process.

Colorado's North Fork Valley, by Jim Ramey

The coal program has not been reassessed in almost thirty years and significant changes are necessary to bring the program in line with 21st century energy demands and public expectations for our shared public lands. An updated coal program should also seek ways to assist coal dependent communities in this time of transition – like Colorado's North Fork Valley. We commend BLM's extensive public outreach process and we hope the scoping report due to be released in early January will provide the agency and the public with information to move forward with smart reforms.

While we realize the incoming administration may not agree with all the steps taken to date, we believe that the incredible amount of time, energy, and analysis that has gone into the process thus far should not be wasted. International and domestic market factors point to a decline in coal production and use regardless of a shift in federal energy policy. We hope that smart and sensible reforms are pursued to ensure that the American taxpayer is not being shortchanged and that American coal workers and coal dependent communities are not forgotten amid this transition. We applaud the BLM for initiating this monumental undertaking.

9. Planning for Oil and Gas at a Landscape Level – 3 CAPEs

In 2016 BLM made headway towards smart and balanced landscape level planning for energy development on public lands. This was highlighted by the agency's work on several Master Leasing Plans (MLPs) across the West. The Moab MLP, finalized on December 15th, illustrates how effective this tool can be. The final plan protects Canyonlands and Arches National Parks from nearby development and ensures the region's economy will continue to thrive by managing lands to support recreation, tourism and cultural sites. Also in Utah, the BLM released preliminary alternatives for the San Rafael Desert MLP. The planning area contains valuable wilderness quality lands and endemic bee habitat, and abuts Canyonlands National Park. The preliminary alternatives contain measures that emphasize the importance of protecting these other resources while maintaining ample opportunity for responsible oil and gas development.

In Colorado, the BLM made notable progress on the South Park MLP this year. There, elected officials, sportsmen, the state wildlife agency, local residents and municipal service providers like Denver Water have come together to ensure oil and gas drilling does not harm wildlife habitat, Gold Medal fishing streams, South Park's scenic wildlands, or vitally important drinking water sources for Colorado's front range. And just before the holidays, BLM Colorado announced that the Tres Rios Field Office will be moving forward with the Southwest Colorado MLP. This plan has been largely driven forward by support from the local community who highlighted the need to establish protections for agriculture, Mesa Verde National Park and the renowned mountain biking area Phil's World.

Finally, in the greater Chaco landscape in northwest New Mexico, tribal leaders, industry and conservation groups have encouraged the BLM to establish a workable process to help preserve unique cultural values in an energy-rich region. The BLM is embarking on a joint planning process with the Bureau of Indian Affairs to ensure everyone has a seat at the table in planning for the future of oil and gas development in the Chaco region.

W*e are encouraged by the leaps forward the BLM has taken in the last year to ensure true multiple-use management of our public lands and smart planning for oil and gas development. We hope the BLM will continue to use Master Leasing Plans and other tools for smart from the start oil and gas planning to manage our public lands in a way that balances community needs and other resource values with energy development.*

Chaco Culture National Historical Park, by Ti Hays

10. Greater Sage-grouse Conservation Plan Implementation Moving Forward – 2 CAPEs

Since completion of the range-wide conservation plans last year, BLM has been moving to implement their commitments. Initial guidance has been issued, through seven instruction memoranda, regarding oil and gas leasing and development, grazing permit review priorities, grazing management thresholds and responses, adaptive management triggers, disturbance tracking, effectiveness monitoring, and habitat assessment framework. These memoranda provide key direction for implementing various aspects of managing resources uses and evaluating how the plans are meeting their goals. BLM has also issued a Draft Environmental Impact Statement setting out the results of its analysis of potential mineral withdrawals, following on the recommendations for withdrawal in the conservation plans and developing alternatives based on input from states and other stakeholders.

Additional direction, such as specific mitigation strategies, and implementation, such as through travel planning, is still needed to ensure the success of the conservation plans. Similarly, BLM must move forward on the mineral withdrawals that were recommended as part of conserving the greater sage-grouse and its habitat, and supported the U.S. Fish and Wildlife Service's conclusion that this species no longer warrants protection under the Endangered Species Act.

11. Opportunity Abounds to Protect the North Fork Valley – 1 CAPE

This year, the BLM released its draft plan for the Uncompahgre area in western Colorado, and included an alternative to largely protect the North Fork Valley from oil and gas development. The North Fork Valley, surrounding the North Fork of the Gunnison River, is Colorado's farm-to-table capital and is home to idyllic vineyards and one of the largest concentrations of organic farming in the state, not to mention outstanding hiking, biking, and hunting. The local community rose in opposition to the BLM's plan to issue oil and gas leases in the area in 2012, and came together to develop the "North Fork Alternative Plan," a proposal to the BLM for managing oil and gas development in the scenic valley. The BLM's draft plan would adopt this community vision in one alternative – but not the agency's preferred alternative.

We greatly appreciate that the BLM included the local community's North Fork Alternative Plan in the draft RMP, making room for the agency to ultimately adopt the community vision in the final plan. The BLM must seize this opportunity to develop a final plan for the North Fork Valley that protects agriculture, recreation, the Gunnison River and the livelihoods of the locals from oil and gas development.

Honorable Mention

With transition to new ePlanning system, the BLM aims to increase transparency

Over the past year, the BLM has been transitioning its online National Environmental Policy Act (NEPA) Registers to a new ePlanning system. As a central database for the agency, ePlanning will house land use planning information and NEPA documents across all BLM planning areas. We appreciate that the BLM has invested resources in improving the functionality and accessibility of online information for the general public. From approving the construction of new roads and transmission lines to authorizing off-road vehicle races, the NEPA Registers are the fundamental tool for the public to understand and engage in decisions affecting our public lands. Allowing users to search based on location, filter based on BLM program, and readily view projects that have an open opportunity for public comment are a few of the ePlanning features that improve usability. As the BLM further develops ePlanning webpages, we hope to see relevant mapping information and data for all projects readily available and greater collaboration with stakeholders to explore ways that ePlanning might further support public participation.

Regional Review of West-wide Energy Corridors moves forward in Arizona, California, and Nevada

BLM initiated its first Regional Review of West-wide Energy Corridors this fall for energy corridors in the California desert, western Arizona, and southern Nevada. These Regional Reviews allow BLM to take a second look at existing energy corridors on our public lands and make sure they are helping promote responsible development. To be effective, energy corridors must be functional and attractive for developers, and avoid sensitive resources such as lands with wilderness characteristics and wildlife habitat. Corridors should also help facilitate renewable energy for our nation's energy grid.

As the first Regional Review out the door, there is a tremendous opportunity for BLM to begin engraining a 'smart-from-the-start' approach to planning for transmission lines and other energy infrastructure. In fact, recommendations in Region 1 have the immediate potential to improve ongoing projects and planning, such as the proposed Ten West Link transmission project between Arizona and California, and corridors in the ongoing Las Vegas-Pahrump Resource Management Plan revision. For all corridors in review, BLM should analyze the full range of resources on public lands and put forward recommendations that address serious environmental concerns. Overall, we have welcomed the emphasis BLM has placed on public and stakeholder participation in the process, including the creation of the interactive Energy Corridor Mapping Tool and multiple stakeholder meetings. We look forward to continued work with BLM and other federal agencies in Region 1 and setting a strong example for future Regional Reviews.

From: Nada Culver
To: llance@blm.gov
Subject: FW: TWS BLM Action Center"s annual awards recognizing BLM"s great work
Date: Wednesday, January 4, 2017 5:13:10 PM
Attachments: 2016 CAPE Awards.pdf

Dear Linda – We wanted to share our annual CAPE awards recognizing so much amazing work this year, and thank you for all the support you gave to these transformative initiatives– from Planning 2.0 to coal reform to the place-based support. We're not doing press releases but are sending these to the many folks who contributed to these accomplishments.

All the best,

Nada Culver

Senior Counsel and Director, BLM Action Center

The Wilderness Society

1660 Wynkoop, #850

Denver, CO 80202

Main: 303-650-5818

Direct: 303-225-4635

Nada_Culver@tws.org

The 2016 CAPE Awards

Celebrating Milestones in Conservation for our Public Lands

The Interior Department hit its stride in 2016, and rolled out some inspired final decisions to cap off the Obama administration's tenure. We were delighted to see years of effort culminate in major progress for stewardship of wilderness quality lands, more balanced oil and gas management, and smart from the start renewable energy planning. And, how we could not spotlight right off the bat finalization of the BLM's new planning rule?! Way to go, BLM, it's been quite a ride.

Unfortunately, there have also been isolated affronts towards our western public lands and the civil servants that steward them for all Americans. In these challenging times, as in years past, we'd like to start our annual year-end celebratory awards to first recognize and appreciate all BLM employees and their commitment to managing our vast shared real estate for the benefit of us all. In coming years, we hope the agency maintains pride in its mission, continues its exciting trajectory towards landscape-level planning and managing for the greatest threat of the future – climate change – and keeps the faith that the American public overwhelmingly supports public lands.

The Comparative Analysis of Particular Excellence (CAPE) rating system, inspired by the superhero-like character of the BLM Action Center team (able to leap tall stacks of RMPs in a single bound!), ranges from one CAPE on the low end (worth a pat on the back) to five CAPEs on the high end (HUGE PROGRESS!!! WAY TO GO!!!).

1. New Rule to Update Planning for Public Lands – 5 CAPEs

Acknowledging that the BLM's land use planning rule has not been substantially updated since the Internet was invented in 1983, the agency finalized updates to the rule this year to help bring planning for our public lands into the 21st century. The rule is part of the BLM's "Planning 2.0" initiative to make planning more cooperative, transparent and efficient. Under the new rule, the public has new and improved opportunities to make their voices heard in management decisions affecting our public lands. The rule also encourages planning at a landscape-scale rather than by political boundaries to better address issues such as wildlife movement corridors and planning for energy development while protecting valuable lands for conservation.

The rule has broad public support, including from many local governments, who appreciate the agency's commitment to expand public participation in land use planning decisions, utilize modern science in assessing land conditions and planning for the future, and strive to make our public lands more resilient

and adaptable. Through this rule, the BLM will be better equipped to design land management plans that truly reflect the needs and desires of the public.

We congratulate the BLM on getting this important and essential rule over the finish line and look forward to seeing it implemented. We are also looking forward to seeing the Planning 2.0 initiative come to completion with the issuance of an updated land use planning handbook to help guide implementation.

2. Wilderness Quality Lands Get the Love They Deserve – 5 CAPEs

In 2016, the BLM continued to make significant progress in its efforts to conduct and maintain inventories of lands with wilderness characteristics. Lands with wilderness characteristics are an important resource that the BLM is obligated to identify under the Federal Land Policy and Management Act of 1976. In the last few years, we've seen the BLM improve its inventory methods while extending the agency's commitments to funding and executing on-the-ground inventory work. The BLM has or is currently updating inventories in planning areas around the country—including the Colorado River Valley and San Luis Valley field offices in Colorado, as well as the Basin and Range National Monument in Nevada.

Basin and Range National Monument, by Bob Wick

In addition to improving inventory methods and conducting field inventories, the BLM is also clarifying its obligations to address wilderness resources in a more consistent manner. This year, the BLM developed statewide guidance in Colorado and Utah to provide more detail on conducting inventories, responding to citizens' inventories, and considering lands with wilderness characteristics in planning efforts, including at the project level. This guidance helps to provide uniformity in how individual field offices meet their obligations to identify and consider lands with wilderness characteristics.

The BLM further committed to stewarding wilderness resources this year through requiring compensatory mitigation for impacts to lands with wilderness characteristics from development. Mitigation is an important tool because it ensures that the public receives compensation for the loss of wilderness quality lands due to projects such as energy development. In the case of the recently approved TransWest Express and Gateway South transmission lines, the BLM will offset impacts to lands with wilderness characteristics by protecting wilderness-quality lands elsewhere.

The BLM has been ushering in a renewed dedication to assessing and protecting wilderness quality public lands over the past few years, and the momentum continued in 2016 thanks to extensive inventory work, state-specific guidance and compensatory mitigation commitments. We expect the BLM will continue with this important work in coming years to meet the agency's obligations under FLPMA.

3. Employing a Commonsense Approach to Oil and Gas Development – 5 CAPEs

For far too long, the oil and gas industry has run the roost on our public lands. The BLM has prioritized oil and gas leasing and drilling at the expense of wildlands, wildlife, clean air and water, recreation and numerous other values of our shared western landscapes. This year, the BLM took the reins and implemented commonsense decisions and reforms to ensure oil and gas has just one seat at the table – along with all other multiple uses. Two of the most impactful decisions were to cancel oil and gas leases in Colorado's Thompson Divide and Montana's Badger-Two Medicine area. In both cases, the BLM responded to strong local support – including ranchers in the Thompson Divide and the Blackfeet Nation in Badger-Two – to rectify a historic wrong and dispose of improperly-issued leases. These landscapes are truly too wild to drill, and we are elated that the BLM has finally taken strong action to protect them for future generations.

The BLM also adopted other commonsense reforms for oil and gas development this year. Chief among them is the "methane rule," which aims to cut natural gas waste and methane pollution from oil and gas operations on public lands. The methane rule will help move us toward agreements to cut U.S. methane emissions by 40 to 45 percent by 2025, building on 2015 U.S. commitments in Paris to reduce emissions and slow global warming. The BLM also finalized Onshore Orders 3, 4 and 5 to accurately measure and report oil and gas produced from federal lands and ensure companies pay full royalties.

Lease cancellations in the Thompson Divide and Badger-Two Medicine areas are landmark victories for nationally important landscapes that should never have been leased in the first place. We are thrilled to see the BLM take a proactive approach to oil and gas management on our public lands by protecting special lands and adopting rules to make drilling safer and smarter, for the climate and for taxpayers.

4. California Desert Plan Protects 4.2 Million Acres – 5 CAPEs

In September, the California BLM released its highly anticipated Record of Decision (ROD) for the Desert Renewable Energy Conservation Plan (DRECP) – a land use planning effort designed to balance smart renewable energy development with land conservation in the California Desert. The signing of the DRECP ROD not only marks the end of the first phase of a broader plan, but also affirms that developing clean energy and protecting wildlife, plants, cultural resources, and recreation opportunities are not mutually exclusive.

The DRECP ROD will protect 4.2 million acres of wild and vulnerable public land, including permanently protecting almost 3 million acres of newly designated California Desert National Conservation Lands. The BLM has already initiated the mineral withdrawal procedures for over 1.3 million acres of these new conservation lands as required by the DRECP ROD. This early action will not only reinforce their designation as protected conservation areas, but help drive DRECP implementation forward. The DRECP ROD also designates carefully selected low-conflict areas dedicated to renewable energy production, including locations that are already adjacent to existing infrastructure like transmission lines and roads. This decision will help elevate and streamline renewable energy production in locations that are attractive to developers and pose limited risk to other resources.

California's Silurian Valley, by Mason Cummings

With the ROD, the plan has set a high bar for future collaborative, multi-agency planning initiatives unfolding across the West. While the work in the California Desert is just beginning, signing the DRECP ROD for Phase I is an important achievement and an essential building block for what is to come from implementation and Phase II.

We enthusiastically support the DRECP ROD, which will protect over 4.2 million of acres of delicate desert resources and pristine landscapes for future generations while helping California meet its renewable energy and climate goals. In a time of serious climate uncertainty, forward-thinking planning measures like the DRECP will help reduce stress and impacts to a vulnerable landscape. Moving forward, the BLM needs to tackle the implementation of the DRECP Phase I head-on, beginning with the recently initiated mineral withdrawal procedures on over 1.3 million acres of designated conservation lands and to diligently assess the landscape for disturbances, as well as helping renewables projects succeed in designated low-conflict areas.

5. BLM Codifies "Smart from the Start" Renewable Energy Program – 5 CAPEs

The BLM has made great strides in advancing responsible renewable energy in the last five years. This includes permitting the first-ever solar projects on public lands, establishing landscape-scale plans to guide development to low-conflict zones across the southwest, and approving over 15,000 megawatts of wind, solar and geothermal development – enough to power over five million homes. In finalizing the Wind and Solar Leasing Rule this year, BLM ensured that smart approaches advanced in recent years will become standard practice going forward. By prioritizing development in designated low-conflict areas, the rule will make the permitting process more efficient in appropriate areas while protecting wildlands and wildlife habitat from development, as demonstrated by the success at the Dry Lake Solar Energy Zone (SEZ) outside Las Vegas. It will also assure taxpayers fair compensation by implementing a competitive leasing process. The rule enjoys wide, bi-partisan support and will facilitate responsible renewables development, helping us protect our natural heritage, tackle the threat of climate change, and benefit western economies.

BLM also continues to make renewable energy zones more attractive to developers and ensure that unavoidable impacts from development are offset through mitigation. The agency finalized two Solar Regional Mitigation Strategies (SRMSs) this year, one for the Dry Lake Valley North (DLVN) SEZ in eastern Nevada and one for Arizona's three SEZs. These build off BLM's pilot SRMS for the Dry Lake SEZ, which proved to be a key element of the agency's success in providing an efficient permitting process for projects in that zone and giving predictability to developers on their mitigation obligations, while investing mitigation resources in strategic conservation actions in the region. BLM has continued to refine its approach to SRMSs, and the DLVN and Arizona SRMSs included improvements such as better addressing uncertainty on mitigation outcomes in fee calculations. We expect that the completion of

these SRMSs will increase the attractiveness of these SEZs for responsible development when market conditions are right.

We applaud the BLM in creating a robust renewable energy program from scratch, culminating with the finalization of the Wind and Solar Leasing Rule this year. We look forward to working with the BLM, project developers, and other stakeholders to put the rule to work, including establishing implementation guidance, helping projects succeed in zones, designating new zones in appropriate areas, and protecting wildlands and wildlife habitat from development. We also look forward to engaging with BLM as it finalizes the SRMSs underway in Colorado, New Mexico, and Utah to facilitate responsible solar development and mitigation in those regions. We hope BLM will continue to refine its approach to SRMSs, including elevating the potential for addressing mitigation obligations by adding or strengthening protections for other public lands in SEZ regions.

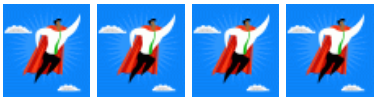
6. Natural Heritage Protected in the Arctic – 5 CAPEs

Hot off the presses, this week the BLM finalized a plan for 6.5 million acres of extremely wild public lands in Alaska's Eastern Interior planning area. The public lands managed by the BLM here include some traditional land of twelve federally recognized tribes, several of which have worked throughout the planning process to ensure their cultural heritage and identities, realized through subsistence lifestyles, are protected. Moose, caribou, grizzly bear, wolverine, and eagles are among the many species that make their home in the Eastern Interior along with dozens of fish species that depend on vast and complex river systems, including the mighty Yukon. The public lands in Alaska's interior also provide outstanding opportunities for hunting, fishing, rafting, and cross-country skiing to winter huts. The final Eastern Interior plan strikes a good balance for conserving important fish and wildlife habitat, providing quality backcountry recreation experiences, and protecting traditional uses. It also identifies and includes measures to protect 3 million acres of lands with wilderness characteristics, and substantially restricts new mining.

This year, the Department of the Interior also decided to protect the Arctic Ocean from oil and gas leasing for the next five years in the Bureau of Ocean Energy Management's 2017-2022 program for offshore oil and gas leasing. The Arctic Ocean provides habitat for numerous species of whales, polar bears, seals, walruses and many populations of fish and birds, and has supported the lives and cultures of Alaska Natives for thousands of years. These places would be gravely threatened by oil and gas leasing, and we are relieved that the Arctic Ocean will be spared for the near future.

We are inspired by the BLM's commitment to protect Alaska's indigenous people and their subsistence cultures, as well as critically important wildlife habitat and epically vast wilderness-quality lands, from destructive mining and development in the Eastern Interior. We are also grateful that the Department of the Interior recognized the Arctic Ocean is not appropriate for oil and gas leasing due to its extraordinarily vulnerable environment and important natural resources.

7. BLM Finalizes Strong Mitigation Manual and Handbook – 4 CAPEs



BLM has demonstrated great leadership in recent years in modernizing its approach to "mitigation", the practice of avoiding and offsetting damage caused to public lands from development. Federal regulations require agencies to follow a five-step hierarchy to address impacts – avoid, minimize, rectify, reduce/eliminate, and compensate – which can be summarized as avoidance, minimization and compensation. Historically, work to mitigate the negative impacts of development such as oil and gas drilling and transmission lines was implemented on a project-by-project basis, which was insufficient to protect our resources and inefficient for permitting projects.

The new policies from BLM and other federal agencies provide guidelines for a broad, landscape-scale approach to balancing development and conservation on public lands. If the policies are used properly, future development projects will avoid impacts to sensitive resources while benefitting from more predictable and efficient permitting processes, and federal agencies will require conservation gains to address and overcome any loss of resources that does occur. Key concepts emphasized in the manual and handbook include a focus on the mitigation hierarchy; use of a landscape-scale approach; setting a no net loss or net benefit outcome for resources that are considered important, scarce, sensitive, or have a protective legal mandate; use of mitigation strategies and plans to establish mitigation standards in advance of development; and emphasizing BLM's preference for achieving compensatory mitigation outcomes in advance of impacts.

The handbook also provides important details on tools BLM can use to durably protect mitigation sites on public lands such as identification of a protective land use plan allocation for the site (e.g. an Area of Critical Environmental Concern) or issuance of a lease or easement to a member of the public to conserve the site (via the authority granted in FLPMA Title III and/or Title V).

As described elsewhere in these awards, we've seen the value of BLM's smarter approach to mitigation in Solar Regional Mitigation Strategies, transmission line project approvals and other contexts. With the manual and handbook now finalized, we look forward to continuing to work with BLM to advance these important mitigation guidelines through land use planning and project permitting. Used properly, they will better balance conservation and development on our public lands while increasing permitting predictability and efficiency.

8. Coal Gets a Reboot – 4 CAPEs

On January 15, 2016, Interior Secretary Sally Jewell signed Secretarial Order 3338 directing the BLM to prepare a Programmatic Environmental Impact Statement (PEIS) to analyze potential leasing and management reforms to the federal coal program. The BLM held six public meetings across the county and solicited comment from stakeholders to gather information on policies and practices that need to be updated. The PEIS seeks to address how, when and where to lease public lands for future coal development, as well as how to secure a fair return to taxpayers from royalties, address climate impacts, and address our domestic energy needs. BLM also implemented a temporary pause on significant new coal leasing while it completes the process.

Colorado's North Fork Valley, by Jim Ramey

The coal program has not been reassessed in almost thirty years and significant changes are necessary to bring the program in line with 21st century energy demands and public expectations for our shared public lands. An updated coal program should also seek ways to assist coal dependent communities in this time of transition – like Colorado's North Fork Valley. We commend BLM's extensive public outreach process and we hope the scoping report due to be released in early January will provide the agency and the public with information to move forward with smart reforms.

While we realize the incoming administration may not agree with all the steps taken to date, we believe that the incredible amount of time, energy, and analysis that has gone into the process thus far should not be wasted. International and domestic market factors point to a decline in coal production and use regardless of a shift in federal energy policy. We hope that smart and sensible reforms are pursued to ensure that the American taxpayer is not being shortchanged and that American coal workers and coal dependent communities are not forgotten amid this transition. We applaud the BLM for initiating this monumental undertaking.

9. Planning for Oil and Gas at a Landscape Level – 3 CAPEs

In 2016 BLM made headway towards smart and balanced landscape level planning for energy development on public lands. This was highlighted by the agency's work on several Master Leasing Plans (MLPs) across the West. The Moab MLP, finalized on December 15th, illustrates how effective this tool can be. The final plan protects Canyonlands and Arches National Parks from nearby development and ensures the region's economy will continue to thrive by managing lands to support recreation, tourism and cultural sites. Also in Utah, the BLM released preliminary alternatives for the San Rafael Desert MLP. The planning area contains valuable wilderness quality lands and endemic bee habitat, and abuts Canyonlands National Park. The preliminary alternatives contain measures that emphasize the importance of protecting these other resources while maintaining ample opportunity for responsible oil and gas development.

In Colorado, the BLM made notable progress on the South Park MLP this year. There, elected officials, sportsmen, the state wildlife agency, local residents and municipal service providers like Denver Water have come together to ensure oil and gas drilling does not harm wildlife habitat, Gold Medal fishing streams, South Park's scenic wildlands, or vitally important drinking water sources for Colorado's front range. And just before the holidays, BLM Colorado announced that the Tres Rios Field Office will be moving forward with the Southwest Colorado MLP. This plan has been largely driven forward by support from the local community who highlighted the need to establish protections for agriculture, Mesa Verde National Park and the renowned mountain biking area Phil's World.

Finally, in the greater Chaco landscape in northwest New Mexico, tribal leaders, industry and conservation groups have encouraged the BLM to establish a workable process to help preserve unique cultural values in an energy-rich region. The BLM is embarking on a joint planning process with the Bureau of Indian Affairs to ensure everyone has a seat at the table in planning for the future of oil and gas development in the Chaco region.

W*e are encouraged by the leaps forward the BLM has taken in the last year to ensure true multiple-use management of our public lands and smart planning for oil and gas development. We hope the BLM will continue to use Master Leasing Plans and other tools for smart from the start oil and gas planning to manage our public lands in a way that balances community needs and other resource values with energy development.*

Chaco Culture National Historical Park, by Ti Hays

10. Greater Sage-grouse Conservation Plan Implementation Moving Forward – 2 CAPEs

Since completion of the range-wide conservation plans last year, BLM has been moving to implement their commitments. Initial guidance has been issued, through seven instruction memoranda, regarding oil and gas leasing and development, grazing permit review priorities, grazing management thresholds and responses, adaptive management triggers, disturbance tracking, effectiveness monitoring, and habitat assessment framework. These memoranda provide key direction for implementing various aspects of managing resources uses and evaluating how the plans are meeting their goals. BLM has also issued a Draft Environmental Impact Statement setting out the results of its analysis of potential mineral withdrawals, following on the recommendations for withdrawal in the conservation plans and developing alternatives based on input from states and other stakeholders.

Additional direction, such as specific mitigation strategies, and implementation, such as through travel planning, is still needed to ensure the success of the conservation plans. Similarly, BLM must move forward on the mineral withdrawals that were recommended as part of conserving the greater sage-grouse and its habitat, and supported the U.S. Fish and Wildlife Service's conclusion that this species no longer warrants protection under the Endangered Species Act.

11. Opportunity Abounds to Protect the North Fork Valley – 1 CAPE

This year, the BLM released its draft plan for the Uncompahgre area in western Colorado, and included an alternative to largely protect the North Fork Valley from oil and gas development. The North Fork Valley, surrounding the North Fork of the Gunnison River, is Colorado's farm-to-table capital and is home to idyllic vineyards and one of the largest concentrations of organic farming in the state, not to mention outstanding hiking, biking, and hunting. The local community rose in opposition to the BLM's plan to issue oil and gas leases in the area in 2012, and came together to develop the "North Fork Alternative Plan," a proposal to the BLM for managing oil and gas development in the scenic valley. The BLM's draft plan would adopt this community vision in one alternative – but not the agency's preferred alternative.

We greatly appreciate that the BLM included the local community's North Fork Alternative Plan in the draft RMP, making room for the agency to ultimately adopt the community vision in the final plan. The BLM must seize this opportunity to develop a final plan for the North Fork Valley that protects agriculture, recreation, the Gunnison River and the livelihoods of the locals from oil and gas development.

Honorable Mention

With transition to new ePlanning system, the BLM aims to increase transparency

Over the past year, the BLM has been transitioning its online National Environmental Policy Act (NEPA) Registers to a new ePlanning system. As a central database for the agency, ePlanning will house land use planning information and NEPA documents across all BLM planning areas. We appreciate that the BLM has invested resources in improving the functionality and accessibility of online information for the general public. From approving the construction of new roads and transmission lines to authorizing off-road vehicle races, the NEPA Registers are the fundamental tool for the public to understand and engage in decisions affecting our public lands. Allowing users to search based on location, filter based on BLM program, and readily view projects that have an open opportunity for public comment are a few of the ePlanning features that improve usability. As the BLM further develops ePlanning webpages, we hope to see relevant mapping information and data for all projects readily available and greater collaboration with stakeholders to explore ways that ePlanning might further support public participation.

Regional Review of West-wide Energy Corridors moves forward in Arizona, California, and Nevada

BLM initiated its first Regional Review of West-wide Energy Corridors this fall for energy corridors in the California desert, western Arizona, and southern Nevada. These Regional Reviews allow BLM to take a second look at existing energy corridors on our public lands and make sure they are helping promote responsible development. To be effective, energy corridors must be functional and attractive for developers, and avoid sensitive resources such as lands with wilderness characteristics and wildlife habitat. Corridors should also help facilitate renewable energy for our nation's energy grid.

As the first Regional Review out the door, there is a tremendous opportunity for BLM to begin engraining a 'smart-from-the-start' approach to planning for transmission lines and other energy infrastructure. In fact, recommendations in Region 1 have the immediate potential to improve ongoing projects and planning, such as the proposed Ten West Link transmission project between Arizona and California, and corridors in the ongoing Las Vegas-Pahrump Resource Management Plan revision. For all corridors in review, BLM should analyze the full range of resources on public lands and put forward recommendations that address serious environmental concerns. Overall, we have welcomed the emphasis BLM has placed on public and stakeholder participation in the process, including the creation of the interactive Energy Corridor Mapping Tool and multiple stakeholder meetings. We look forward to continued work with BLM and other federal agencies in Region 1 and setting a strong example for future Regional Reviews.

From: Nada Culver
To: "bamme@blm.gov"
Subject: TWS BLM Action Center"s annual awards recognizing BLM"s great work
Date: Wednesday, January 4, 2017 5:19:07 PM
Attachments: 2016 CAPE Awards.pdf

Hi Brian – I wanted to forward our annual awards to you, personally, since we wanted to thank you for all your hard work on Planning 2.0. Look forward to working with you further in Nevada.

Nada Culver

Senior Counsel and Director, BLM Action Center

The Wilderness Society

1660 Wynkoop, #850

Denver, CO 80202

Main: 303-650-5818

Direct: 303-225-4635

Nada_Culver@tws.org

The 2016 CAPE Awards

Celebrating Milestones in Conservation for our Public Lands

The Interior Department hit its stride in 2016, and rolled out some inspired final decisions to cap off the Obama administration's tenure. We were delighted to see years of effort culminate in major progress for stewardship of wilderness quality lands, more balanced oil and gas management, and smart from the start renewable energy planning. And, how we could not spotlight right off the bat finalization of the BLM's new planning rule?! Way to go, BLM, it's been quite a ride.

Unfortunately, there have also been isolated affronts towards our western public lands and the civil servants that steward them for all Americans. In these challenging times, as in years past, we'd like to start our annual year-end celebratory awards to first recognize and appreciate all BLM employees and their commitment to managing our vast shared real estate for the benefit of us all. In coming years, we hope the agency maintains pride in its mission, continues its exciting trajectory towards landscape-level planning and managing for the greatest threat of the future – climate change – and keeps the faith that the American public overwhelmingly supports public lands.

The Comparative Analysis of Particular Excellence (CAPE) rating system, inspired by the superhero-like character of the BLM Action Center team (able to leap tall stacks of RMPs in a single bound!), ranges from one CAPE on the low end (worth a pat on the back) to five CAPEs on the high end (HUGE PROGRESS!!! WAY TO GO!!!).

1. New Rule to Update Planning for Public Lands – 5 CAPEs

Acknowledging that the BLM's land use planning rule has not been substantially updated since the Internet was invented in 1983, the agency finalized updates to the rule this year to help bring planning for our public lands into the 21st century. The rule is part of the BLM's "Planning 2.0" initiative to make planning more cooperative, transparent and efficient. Under the new rule, the public has new and improved opportunities to make their voices heard in management decisions affecting our public lands. The rule also encourages planning at a landscape-scale rather than by political boundaries to better address issues such as wildlife movement corridors and planning for energy development while protecting valuable lands for conservation.

The rule has broad public support, including from many local governments, who appreciate the agency's commitment to expand public participation in land use planning decisions, utilize modern science in assessing land conditions and planning for the future, and strive to make our public lands more resilient

and adaptable. Through this rule, the BLM will be better equipped to design land management plans that truly reflect the needs and desires of the public.

We congratulate the BLM on getting this important and essential rule over the finish line and look forward to seeing it implemented. We are also looking forward to seeing the Planning 2.0 initiative come to completion with the issuance of an updated land use planning handbook to help guide implementation.

2. Wilderness Quality Lands Get the Love They Deserve – 5 CAPEs

In 2016, the BLM continued to make significant progress in its efforts to conduct and maintain inventories of lands with wilderness characteristics. Lands with wilderness characteristics are an important resource that the BLM is obligated to identify under the Federal Land Policy and Management Act of 1976. In the last few years, we've seen the BLM improve its inventory methods while extending the agency's commitments to funding and executing on-the-ground inventory work. The BLM has or is currently updating inventories in planning areas around the country—including the Colorado River Valley and San Luis Valley field offices in Colorado, as well as the Basin and Range National Monument in Nevada.

Basin and Range National Monument, by Bob Wick

In addition to improving inventory methods and conducting field inventories, the BLM is also clarifying its obligations to address wilderness resources in a more consistent manner. This year, the BLM developed statewide guidance in Colorado and Utah to provide more detail on conducting inventories, responding to citizens' inventories, and considering lands with wilderness characteristics in planning efforts, including at the project level. This guidance helps to provide uniformity in how individual field offices meet their obligations to identify and consider lands with wilderness characteristics.

The BLM further committed to stewarding wilderness resources this year through requiring compensatory mitigation for impacts to lands with wilderness characteristics from development. Mitigation is an important tool because it ensures that the public receives compensation for the loss of wilderness quality lands due to projects such as energy development. In the case of the recently approved TransWest Express and Gateway South transmission lines, the BLM will offset impacts to lands with wilderness characteristics by protecting wilderness-quality lands elsewhere.

The BLM has been ushering in a renewed dedication to assessing and protecting wilderness quality public lands over the past few years, and the momentum continued in 2016 thanks to extensive inventory work, state-specific guidance and compensatory mitigation commitments. We expect the BLM will continue with this important work in coming years to meet the agency's obligations under FLPMA.

3. Employing a Commonsense Approach to Oil and Gas Development – 5 CAPEs

For far too long, the oil and gas industry has run the roost on our public lands. The BLM has prioritized oil and gas leasing and drilling at the expense of wildlands, wildlife, clean air and water, recreation and numerous other values of our shared western landscapes. This year, the BLM took the reins and implemented commonsense decisions and reforms to ensure oil and gas has just one seat at the table – along with all other multiple uses. Two of the most impactful decisions were to cancel oil and gas leases in Colorado's Thompson Divide and Montana's Badger-Two Medicine area. In both cases, the BLM responded to strong local support – including ranchers in the Thompson Divide and the Blackfeet Nation in Badger-Two – to rectify a historic wrong and dispose of improperly-issued leases. These landscapes are truly too wild to drill, and we are elated that the BLM has finally taken strong action to protect them for future generations.

The BLM also adopted other commonsense reforms for oil and gas development this year. Chief among them is the "methane rule," which aims to cut natural gas waste and methane pollution from oil and gas operations on public lands. The methane rule will help move us toward agreements to cut U.S. methane emissions by 40 to 45 percent by 2025, building on 2015 U.S. commitments in Paris to reduce emissions and slow global warming. The BLM also finalized Onshore Orders 3, 4 and 5 to accurately measure and report oil and gas produced from federal lands and ensure companies pay full royalties.

Lease cancellations in the Thompson Divide and Badger-Two Medicine areas are landmark victories for nationally important landscapes that should never have been leased in the first place. We are thrilled to see the BLM take a proactive approach to oil and gas management on our public lands by protecting special lands and adopting rules to make drilling safer and smarter, for the climate and for taxpayers.

4. California Desert Plan Protects 4.2 Million Acres – 5 CAPEs

In September, the California BLM released its highly anticipated Record of Decision (ROD) for the Desert Renewable Energy Conservation Plan (DRECP) – a land use planning effort designed to balance smart renewable energy development with land conservation in the California Desert. The signing of the DRECP ROD not only marks the end of the first phase of a broader plan, but also affirms that developing clean energy and protecting wildlife, plants, cultural resources, and recreation opportunities are not mutually exclusive.

The DRECP ROD will protect 4.2 million acres of wild and vulnerable public land, including permanently protecting almost 3 million acres of newly designated California Desert National Conservation Lands. The BLM has already initiated the mineral withdrawal procedures for over 1.3 million acres of these new conservation lands as required by the DRECP ROD. This early action will not only reinforce their designation as protected conservation areas, but help drive DRECP implementation forward. The DRECP ROD also designates carefully selected low-conflict areas dedicated to renewable energy production, including locations that are already adjacent to existing infrastructure like transmission lines and roads. This decision will help elevate and streamline renewable energy production in locations that are attractive to developers and pose limited risk to other resources.

California's Silurian Valley, by Mason Cummings

With the ROD, the plan has set a high bar for future collaborative, multi-agency planning initiatives unfolding across the West. While the work in the California Desert is just beginning, signing the DRECP ROD for Phase I is an important achievement and an essential building block for what is to come from implementation and Phase II.

We enthusiastically support the DRECP ROD, which will protect over 4.2 million of acres of delicate desert resources and pristine landscapes for future generations while helping California meet its renewable energy and climate goals. In a time of serious climate uncertainty, forward-thinking planning measures like the DRECP will help reduce stress and impacts to a vulnerable landscape. Moving forward, the BLM needs to tackle the implementation of the DRECP Phase I head-on, beginning with the recently initiated mineral withdrawal procedures on over 1.3 million acres of designated conservation lands and to diligently assess the landscape for disturbances, as well as helping renewables projects succeed in designated low-conflict areas.

5. BLM Codifies "Smart from the Start" Renewable Energy Program – 5 CAPEs

The BLM has made great strides in advancing responsible renewable energy in the last five years. This includes permitting the first-ever solar projects on public lands, establishing landscape-scale plans to guide development to low-conflict zones across the southwest, and approving over 15,000 megawatts of wind, solar and geothermal development – enough to power over five million homes. In finalizing the Wind and Solar Leasing Rule this year, BLM ensured that smart approaches advanced in recent years will become standard practice going forward. By prioritizing development in designated low-conflict areas, the rule will make the permitting process more efficient in appropriate areas while protecting wildlands and wildlife habitat from development, as demonstrated by the success at the Dry Lake Solar Energy Zone (SEZ) outside Las Vegas. It will also assure taxpayers fair compensation by implementing a competitive leasing process. The rule enjoys wide, bi-partisan support and will facilitate responsible renewables development, helping us protect our natural heritage, tackle the threat of climate change, and benefit western economies.

BLM also continues to make renewable energy zones more attractive to developers and ensure that unavoidable impacts from development are offset through mitigation. The agency finalized two Solar Regional Mitigation Strategies (SRMSs) this year, one for the Dry Lake Valley North (DLVN) SEZ in eastern Nevada and one for Arizona's three SEZs. These build off BLM's pilot SRMS for the Dry Lake SEZ, which proved to be a key element of the agency's success in providing an efficient permitting process for projects in that zone and giving predictability to developers on their mitigation obligations, while investing mitigation resources in strategic conservation actions in the region. BLM has continued to refine its approach to SRMSs, and the DLVN and Arizona SRMSs included improvements such as better addressing uncertainty on mitigation outcomes in fee calculations. We expect that the completion of

these SRMSs will increase the attractiveness of these SEZs for responsible development when market conditions are right.

We applaud the BLM in creating a robust renewable energy program from scratch, culminating with the finalization of the Wind and Solar Leasing Rule this year. We look forward to working with the BLM, project developers, and other stakeholders to put the rule to work, including establishing implementation guidance, helping projects succeed in zones, designating new zones in appropriate areas, and protecting wildlands and wildlife habitat from development. We also look forward to engaging with BLM as it finalizes the SRMSs underway in Colorado, New Mexico, and Utah to facilitate responsible solar development and mitigation in those regions. We hope BLM will continue to refine its approach to SRMSs, including elevating the potential for addressing mitigation obligations by adding or strengthening protections for other public lands in SEZ regions.

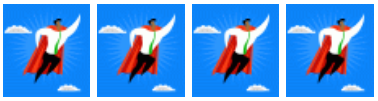
6. Natural Heritage Protected in the Arctic – 5 CAPEs

Hot off the presses, this week the BLM finalized a plan for 6.5 million acres of extremely wild public lands in Alaska's Eastern Interior planning area. The public lands managed by the BLM here include some traditional land of twelve federally recognized tribes, several of which have worked throughout the planning process to ensure their cultural heritage and identities, realized through subsistence lifestyles, are protected. Moose, caribou, grizzly bear, wolverine, and eagles are among the many species that make their home in the Eastern Interior along with dozens of fish species that depend on vast and complex river systems, including the mighty Yukon. The public lands in Alaska's interior also provide outstanding opportunities for hunting, fishing, rafting, and cross-country skiing to winter huts. The final Eastern Interior plan strikes a good balance for conserving important fish and wildlife habitat, providing quality backcountry recreation experiences, and protecting traditional uses. It also identifies and includes measures to protect 3 million acres of lands with wilderness characteristics, and substantially restricts new mining.

This year, the Department of the Interior also decided to protect the Arctic Ocean from oil and gas leasing for the next five years in the Bureau of Ocean Energy Management's 2017-2022 program for offshore oil and gas leasing. The Arctic Ocean provides habitat for numerous species of whales, polar bears, seals, walruses and many populations of fish and birds, and has supported the lives and cultures of Alaska Natives for thousands of years. These places would be gravely threatened by oil and gas leasing, and we are relieved that the Arctic Ocean will be spared for the near future.

We are inspired by the BLM's commitment to protect Alaska's indigenous people and their subsistence cultures, as well as critically important wildlife habitat and epically vast wilderness-quality lands, from destructive mining and development in the Eastern Interior. We are also grateful that the Department of the Interior recognized the Arctic Ocean is not appropriate for oil and gas leasing due to its extraordinarily vulnerable environment and important natural resources.

7. BLM Finalizes Strong Mitigation Manual and Handbook – 4 CAPEs



BLM has demonstrated great leadership in recent years in modernizing its approach to "mitigation", the practice of avoiding and offsetting damage caused to public lands from development. Federal regulations require agencies to follow a five-step hierarchy to address impacts – avoid, minimize, rectify, reduce/eliminate, and compensate – which can be summarized as avoidance, minimization and compensation. Historically, work to mitigate the negative impacts of development such as oil and gas drilling and transmission lines was implemented on a project-by-project basis, which was insufficient to protect our resources and inefficient for permitting projects.

The new policies from BLM and other federal agencies provide guidelines for a broad, landscape-scale approach to balancing development and conservation on public lands. If the policies are used properly, future development projects will avoid impacts to sensitive resources while benefitting from more predictable and efficient permitting processes, and federal agencies will require conservation gains to address and overcome any loss of resources that does occur. Key concepts emphasized in the manual and handbook include a focus on the mitigation hierarchy; use of a landscape-scale approach; setting a no net loss or net benefit outcome for resources that are considered important, scarce, sensitive, or have a protective legal mandate; use of mitigation strategies and plans to establish mitigation standards in advance of development; and emphasizing BLM's preference for achieving compensatory mitigation outcomes in advance of impacts.

The handbook also provides important details on tools BLM can use to durably protect mitigation sites on public lands such as identification of a protective land use plan allocation for the site (e.g. an Area of Critical Environmental Concern) or issuance of a lease or easement to a member of the public to conserve the site (via the authority granted in FLPMA Title III and/or Title V).

As described elsewhere in these awards, we've seen the value of BLM's smarter approach to mitigation in Solar Regional Mitigation Strategies, transmission line project approvals and other contexts. With the manual and handbook now finalized, we look forward to continuing to work with BLM to advance these important mitigation guidelines through land use planning and project permitting. Used properly, they will better balance conservation and development on our public lands while increasing permitting predictability and efficiency.

8. Coal Gets a Reboot – 4 CAPEs

On January 15, 2016, Interior Secretary Sally Jewell signed Secretarial Order 3338 directing the BLM to prepare a Programmatic Environmental Impact Statement (PEIS) to analyze potential leasing and management reforms to the federal coal program. The BLM held six public meetings across the county and solicited comment from stakeholders to gather information on policies and practices that need to be updated. The PEIS seeks to address how, when and where to lease public lands for future coal development, as well as how to secure a fair return to taxpayers from royalties, address climate impacts, and address our domestic energy needs. BLM also implemented a temporary pause on significant new coal leasing while it completes the process.

Colorado's North Fork Valley, by Jim Ramey

The coal program has not been reassessed in almost thirty years and significant changes are necessary to bring the program in line with 21st century energy demands and public expectations for our shared public lands. An updated coal program should also seek ways to assist coal dependent communities in this time of transition – like Colorado's North Fork Valley. We commend BLM's extensive public outreach process and we hope the scoping report due to be released in early January will provide the agency and the public with information to move forward with smart reforms.

While we realize the incoming administration may not agree with all the steps taken to date, we believe that the incredible amount of time, energy, and analysis that has gone into the process thus far should not be wasted. International and domestic market factors point to a decline in coal production and use regardless of a shift in federal energy policy. We hope that smart and sensible reforms are pursued to ensure that the American taxpayer is not being shortchanged and that American coal workers and coal dependent communities are not forgotten amid this transition. We applaud the BLM for initiating this monumental undertaking.

9. Planning for Oil and Gas at a Landscape Level – 3 CAPEs

In 2016 BLM made headway towards smart and balanced landscape level planning for energy development on public lands. This was highlighted by the agency's work on several Master Leasing Plans (MLPs) across the West. The Moab MLP, finalized on December 15th, illustrates how effective this tool can be. The final plan protects Canyonlands and Arches National Parks from nearby development and ensures the region's economy will continue to thrive by managing lands to support recreation, tourism and cultural sites. Also in Utah, the BLM released preliminary alternatives for the San Rafael Desert MLP. The planning area contains valuable wilderness quality lands and endemic bee habitat, and abuts Canyonlands National Park. The preliminary alternatives contain measures that emphasize the importance of protecting these other resources while maintaining ample opportunity for responsible oil and gas development.

In Colorado, the BLM made notable progress on the South Park MLP this year. There, elected officials, sportsmen, the state wildlife agency, local residents and municipal service providers like Denver Water have come together to ensure oil and gas drilling does not harm wildlife habitat, Gold Medal fishing streams, South Park's scenic wildlands, or vitally important drinking water sources for Colorado's front range. And just before the holidays, BLM Colorado announced that the Tres Rios Field Office will be moving forward with the Southwest Colorado MLP. This plan has been largely driven forward by support from the local community who highlighted the need to establish protections for agriculture, Mesa Verde National Park and the renowned mountain biking area Phil's World.

Finally, in the greater Chaco landscape in northwest New Mexico, tribal leaders, industry and conservation groups have encouraged the BLM to establish a workable process to help preserve unique cultural values in an energy-rich region. The BLM is embarking on a joint planning process with the Bureau of Indian Affairs to ensure everyone has a seat at the table in planning for the future of oil and gas development in the Chaco region.

W*e are encouraged by the leaps forward the BLM has taken in the last year to ensure true multiple-use management of our public lands and smart planning for oil and gas development. We hope the BLM will continue to use Master Leasing Plans and other tools for smart from the start oil and gas planning to manage our public lands in a way that balances community needs and other resource values with energy development.*

Chaco Culture National Historical Park, by Ti Hays

10. Greater Sage-grouse Conservation Plan Implementation Moving Forward – 2 CAPEs

Since completion of the range-wide conservation plans last year, BLM has been moving to implement their commitments. Initial guidance has been issued, through seven instruction memoranda, regarding oil and gas leasing and development, grazing permit review priorities, grazing management thresholds and responses, adaptive management triggers, disturbance tracking, effectiveness monitoring, and habitat assessment framework. These memoranda provide key direction for implementing various aspects of managing resources uses and evaluating how the plans are meeting their goals. BLM has also issued a Draft Environmental Impact Statement setting out the results of its analysis of potential mineral withdrawals, following on the recommendations for withdrawal in the conservation plans and developing alternatives based on input from states and other stakeholders.

Additional direction, such as specific mitigation strategies, and implementation, such as through travel planning, is still needed to ensure the success of the conservation plans. Similarly, BLM must move forward on the mineral withdrawals that were recommended as part of conserving the greater sage-grouse and its habitat, and supported the U.S. Fish and Wildlife Service's conclusion that this species no longer warrants protection under the Endangered Species Act.

11. Opportunity Abounds to Protect the North Fork Valley – 1 CAPE

This year, the BLM released its draft plan for the Uncompahgre area in western Colorado, and included an alternative to largely protect the North Fork Valley from oil and gas development. The North Fork Valley, surrounding the North Fork of the Gunnison River, is Colorado's farm-to-table capital and is home to idyllic vineyards and one of the largest concentrations of organic farming in the state, not to mention outstanding hiking, biking, and hunting. The local community rose in opposition to the BLM's plan to issue oil and gas leases in the area in 2012, and came together to develop the "North Fork Alternative Plan," a proposal to the BLM for managing oil and gas development in the scenic valley. The BLM's draft plan would adopt this community vision in one alternative – but not the agency's preferred alternative.

We greatly appreciate that the BLM included the local community's North Fork Alternative Plan in the draft RMP, making room for the agency to ultimately adopt the community vision in the final plan. The BLM must seize this opportunity to develop a final plan for the North Fork Valley that protects agriculture, recreation, the Gunnison River and the livelihoods of the locals from oil and gas development.

Honorable Mention

With transition to new ePlanning system, the BLM aims to increase transparency

Over the past year, the BLM has been transitioning its online National Environmental Policy Act (NEPA) Registers to a new ePlanning system. As a central database for the agency, ePlanning will house land use planning information and NEPA documents across all BLM planning areas. We appreciate that the BLM has invested resources in improving the functionality and accessibility of online information for the general public. From approving the construction of new roads and transmission lines to authorizing off-road vehicle races, the NEPA Registers are the fundamental tool for the public to understand and engage in decisions affecting our public lands. Allowing users to search based on location, filter based on BLM program, and readily view projects that have an open opportunity for public comment are a few of the ePlanning features that improve usability. As the BLM further develops ePlanning webpages, we hope to see relevant mapping information and data for all projects readily available and greater collaboration with stakeholders to explore ways that ePlanning might further support public participation.

Regional Review of West-wide Energy Corridors moves forward in Arizona, California, and Nevada

BLM initiated its first Regional Review of West-wide Energy Corridors this fall for energy corridors in the California desert, western Arizona, and southern Nevada. These Regional Reviews allow BLM to take a second look at existing energy corridors on our public lands and make sure they are helping promote responsible development. To be effective, energy corridors must be functional and attractive for developers, and avoid sensitive resources such as lands with wilderness characteristics and wildlife habitat. Corridors should also help facilitate renewable energy for our nation's energy grid.

As the first Regional Review out the door, there is a tremendous opportunity for BLM to begin engraining a 'smart-from-the-start' approach to planning for transmission lines and other energy infrastructure. In fact, recommendations in Region 1 have the immediate potential to improve ongoing projects and planning, such as the proposed Ten West Link transmission project between Arizona and California, and corridors in the ongoing Las Vegas-Pahrump Resource Management Plan revision. For all corridors in review, BLM should analyze the full range of resources on public lands and put forward recommendations that address serious environmental concerns. Overall, we have welcomed the emphasis BLM has placed on public and stakeholder participation in the process, including the creation of the interactive Energy Corridor Mapping Tool and multiple stakeholder meetings. We look forward to continued work with BLM and other federal agencies in Region 1 and setting a strong example for future Regional Reviews.

From: Nada Culver
To: j2stout@blm.gov
Subject: TWS BLM Action Center"s annual awards recognizing BLM"s great work
Date: Wednesday, January 4, 2017 5:20:14 PM
Attachments: 2016 CAPE Awards.pdf

Hi Joe– I wanted to forward our annual awards to you, personally, since we wanted to thank you for all your hard work on Planning 2.0. Look forward to working with you further in California.

Nada Culver

Senior Counsel and Director, BLM Action Center

The Wilderness Society

1660 Wynkoop, #850

Denver, CO 80202

Main: 303-650-5818

Direct: 303-225-4635

Nada_Culver@tws.org

The 2016 CAPE Awards

Celebrating Milestones in Conservation for our Public Lands

The Interior Department hit its stride in 2016, and rolled out some inspired final decisions to cap off the Obama administration's tenure. We were delighted to see years of effort culminate in major progress for stewardship of wilderness quality lands, more balanced oil and gas management, and smart from the start renewable energy planning. And, how we could not spotlight right off the bat finalization of the BLM's new planning rule?! Way to go, BLM, it's been quite a ride.

Unfortunately, there have also been isolated affronts towards our western public lands and the civil servants that steward them for all Americans. In these challenging times, as in years past, we'd like to start our annual year-end celebratory awards to first recognize and appreciate all BLM employees and their commitment to managing our vast shared real estate for the benefit of us all. In coming years, we hope the agency maintains pride in its mission, continues its exciting trajectory towards landscape-level planning and managing for the greatest threat of the future – climate change – and keeps the faith that the American public overwhelmingly supports public lands.

The Comparative Analysis of Particular Excellence (CAPE) rating system, inspired by the superhero-like character of the BLM Action Center team (able to leap tall stacks of RMPs in a single bound!), ranges from one CAPE on the low end (worth a pat on the back) to five CAPEs on the high end (HUGE PROGRESS!!! WAY TO GO!!!).

1. New Rule to Update Planning for Public Lands – 5 CAPEs

Acknowledging that the BLM's land use planning rule has not been substantially updated since the Internet was invented in 1983, the agency finalized updates to the rule this year to help bring planning for our public lands into the 21st century. The rule is part of the BLM's "Planning 2.0" initiative to make planning more cooperative, transparent and efficient. Under the new rule, the public has new and improved opportunities to make their voices heard in management decisions affecting our public lands. The rule also encourages planning at a landscape-scale rather than by political boundaries to better address issues such as wildlife movement corridors and planning for energy development while protecting valuable lands for conservation.

The rule has broad public support, including from many local governments, who appreciate the agency's commitment to expand public participation in land use planning decisions, utilize modern science in assessing land conditions and planning for the future, and strive to make our public lands more resilient

and adaptable. Through this rule, the BLM will be better equipped to design land management plans that truly reflect the needs and desires of the public.

We congratulate the BLM on getting this important and essential rule over the finish line and look forward to seeing it implemented. We are also looking forward to seeing the Planning 2.0 initiative come to completion with the issuance of an updated land use planning handbook to help guide implementation.

2. Wilderness Quality Lands Get the Love They Deserve – 5 CAPEs

In 2016, the BLM continued to make significant progress in its efforts to conduct and maintain inventories of lands with wilderness characteristics. Lands with wilderness characteristics are an important resource that the BLM is obligated to identify under the Federal Land Policy and Management Act of 1976. In the last few years, we've seen the BLM improve its inventory methods while extending the agency's commitments to funding and executing on-the-ground inventory work. The BLM has or is currently updating inventories in planning areas around the country—including the Colorado River Valley and San Luis Valley field offices in Colorado, as well as the Basin and Range National Monument in Nevada.

Basin and Range National Monument, by Bob Wick

In addition to improving inventory methods and conducting field inventories, the BLM is also clarifying its obligations to address wilderness resources in a more consistent manner. This year, the BLM developed statewide guidance in Colorado and Utah to provide more detail on conducting inventories, responding to citizens' inventories, and considering lands with wilderness characteristics in planning efforts, including at the project level. This guidance helps to provide uniformity in how individual field offices meet their obligations to identify and consider lands with wilderness characteristics.

The BLM further committed to stewarding wilderness resources this year through requiring compensatory mitigation for impacts to lands with wilderness characteristics from development. Mitigation is an important tool because it ensures that the public receives compensation for the loss of wilderness quality lands due to projects such as energy development. In the case of the recently approved TransWest Express and Gateway South transmission lines, the BLM will offset impacts to lands with wilderness characteristics by protecting wilderness-quality lands elsewhere.

The BLM has been ushering in a renewed dedication to assessing and protecting wilderness quality public lands over the past few years, and the momentum continued in 2016 thanks to extensive inventory work, state-specific guidance and compensatory mitigation commitments. We expect the BLM will continue with this important work in coming years to meet the agency's obligations under FLPMA.

3. Employing a Commonsense Approach to Oil and Gas Development – 5 CAPEs

For far too long, the oil and gas industry has run the roost on our public lands. The BLM has prioritized oil and gas leasing and drilling at the expense of wildlands, wildlife, clean air and water, recreation and numerous other values of our shared western landscapes. This year, the BLM took the reins and implemented commonsense decisions and reforms to ensure oil and gas has just one seat at the table – along with all other multiple uses. Two of the most impactful decisions were to cancel oil and gas leases in Colorado's Thompson Divide and Montana's Badger-Two Medicine area. In both cases, the BLM responded to strong local support – including ranchers in the Thompson Divide and the Blackfeet Nation in Badger-Two – to rectify a historic wrong and dispose of improperly-issued leases. These landscapes are truly too wild to drill, and we are elated that the BLM has finally taken strong action to protect them for future generations.

The BLM also adopted other commonsense reforms for oil and gas development this year. Chief among them is the "methane rule," which aims to cut natural gas waste and methane pollution from oil and gas operations on public lands. The methane rule will help move us toward agreements to cut U.S. methane emissions by 40 to 45 percent by 2025, building on 2015 U.S. commitments in Paris to reduce emissions and slow global warming. The BLM also finalized Onshore Orders 3, 4 and 5 to accurately measure and report oil and gas produced from federal lands and ensure companies pay full royalties.

Lease cancellations in the Thompson Divide and Badger-Two Medicine areas are landmark victories for nationally important landscapes that should never have been leased in the first place. We are thrilled to see the BLM take a proactive approach to oil and gas management on our public lands by protecting special lands and adopting rules to make drilling safer and smarter, for the climate and for taxpayers.

4. California Desert Plan Protects 4.2 Million Acres – 5 CAPEs

In September, the California BLM released its highly anticipated Record of Decision (ROD) for the Desert Renewable Energy Conservation Plan (DRECP) – a land use planning effort designed to balance smart renewable energy development with land conservation in the California Desert. The signing of the DRECP ROD not only marks the end of the first phase of a broader plan, but also affirms that developing clean energy and protecting wildlife, plants, cultural resources, and recreation opportunities are not mutually exclusive.

The DRECP ROD will protect 4.2 million acres of wild and vulnerable public land, including permanently protecting almost 3 million acres of newly designated California Desert National Conservation Lands. The BLM has already initiated the mineral withdrawal procedures for over 1.3 million acres of these new conservation lands as required by the DRECP ROD. This early action will not only reinforce their designation as protected conservation areas, but help drive DRECP implementation forward. The DRECP ROD also designates carefully selected low-conflict areas dedicated to renewable energy production, including locations that are already adjacent to existing infrastructure like transmission lines and roads. This decision will help elevate and streamline renewable energy production in locations that are attractive to developers and pose limited risk to other resources.

California's Silurian Valley, by Mason Cummings

With the ROD, the plan has set a high bar for future collaborative, multi-agency planning initiatives unfolding across the West. While the work in the California Desert is just beginning, signing the DRECP ROD for Phase I is an important achievement and an essential building block for what is to come from implementation and Phase II.

We enthusiastically support the DRECP ROD, which will protect over 4.2 million of acres of delicate desert resources and pristine landscapes for future generations while helping California meet its renewable energy and climate goals. In a time of serious climate uncertainty, forward-thinking planning measures like the DRECP will help reduce stress and impacts to a vulnerable landscape. Moving forward, the BLM needs to tackle the implementation of the DRECP Phase I head-on, beginning with the recently initiated mineral withdrawal procedures on over 1.3 million acres of designated conservation lands and to diligently assess the landscape for disturbances, as well as helping renewables projects succeed in designated low-conflict areas.

5. BLM Codifies "Smart from the Start" Renewable Energy Program – 5 CAPEs

The BLM has made great strides in advancing responsible renewable energy in the last five years. This includes permitting the first-ever solar projects on public lands, establishing landscape-scale plans to guide development to low-conflict zones across the southwest, and approving over 15,000 megawatts of wind, solar and geothermal development – enough to power over five million homes. In finalizing the Wind and Solar Leasing Rule this year, BLM ensured that smart approaches advanced in recent years will become standard practice going forward. By prioritizing development in designated low-conflict areas, the rule will make the permitting process more efficient in appropriate areas while protecting wildlands and wildlife habitat from development, as demonstrated by the success at the Dry Lake Solar Energy Zone (SEZ) outside Las Vegas. It will also assure taxpayers fair compensation by implementing a competitive leasing process. The rule enjoys wide, bi-partisan support and will facilitate responsible renewables development, helping us protect our natural heritage, tackle the threat of climate change, and benefit western economies.

BLM also continues to make renewable energy zones more attractive to developers and ensure that unavoidable impacts from development are offset through mitigation. The agency finalized two Solar Regional Mitigation Strategies (SRMSs) this year, one for the Dry Lake Valley North (DLVN) SEZ in eastern Nevada and one for Arizona's three SEZs. These build off BLM's pilot SRMS for the Dry Lake SEZ, which proved to be a key element of the agency's success in providing an efficient permitting process for projects in that zone and giving predictability to developers on their mitigation obligations, while investing mitigation resources in strategic conservation actions in the region. BLM has continued to refine its approach to SRMSs, and the DLVN and Arizona SRMSs included improvements such as better addressing uncertainty on mitigation outcomes in fee calculations. We expect that the completion of

these SRMSs will increase the attractiveness of these SEZs for responsible development when market conditions are right.

We applaud the BLM in creating a robust renewable energy program from scratch, culminating with the finalization of the Wind and Solar Leasing Rule this year. We look forward to working with the BLM, project developers, and other stakeholders to put the rule to work, including establishing implementation guidance, helping projects succeed in zones, designating new zones in appropriate areas, and protecting wildlands and wildlife habitat from development. We also look forward to engaging with BLM as it finalizes the SRMSs underway in Colorado, New Mexico, and Utah to facilitate responsible solar development and mitigation in those regions. We hope BLM will continue to refine its approach to SRMSs, including elevating the potential for addressing mitigation obligations by adding or strengthening protections for other public lands in SEZ regions.

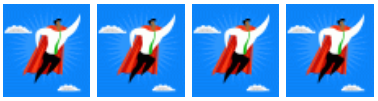
6. Natural Heritage Protected in the Arctic – 5 CAPEs

Hot off the presses, this week the BLM finalized a plan for 6.5 million acres of extremely wild public lands in Alaska's Eastern Interior planning area. The public lands managed by the BLM here include some traditional land of twelve federally recognized tribes, several of which have worked throughout the planning process to ensure their cultural heritage and identities, realized through subsistence lifestyles, are protected. Moose, caribou, grizzly bear, wolverine, and eagles are among the many species that make their home in the Eastern Interior along with dozens of fish species that depend on vast and complex river systems, including the mighty Yukon. The public lands in Alaska's interior also provide outstanding opportunities for hunting, fishing, rafting, and cross-country skiing to winter huts. The final Eastern Interior plan strikes a good balance for conserving important fish and wildlife habitat, providing quality backcountry recreation experiences, and protecting traditional uses. It also identifies and includes measures to protect 3 million acres of lands with wilderness characteristics, and substantially restricts new mining.

This year, the Department of the Interior also decided to protect the Arctic Ocean from oil and gas leasing for the next five years in the Bureau of Ocean Energy Management's 2017-2022 program for offshore oil and gas leasing. The Arctic Ocean provides habitat for numerous species of whales, polar bears, seals, walruses and many populations of fish and birds, and has supported the lives and cultures of Alaska Natives for thousands of years. These places would be gravely threatened by oil and gas leasing, and we are relieved that the Arctic Ocean will be spared for the near future.

We are inspired by the BLM's commitment to protect Alaska's indigenous people and their subsistence cultures, as well as critically important wildlife habitat and epically vast wilderness-quality lands, from destructive mining and development in the Eastern Interior. We are also grateful that the Department of the Interior recognized the Arctic Ocean is not appropriate for oil and gas leasing due to its extraordinarily vulnerable environment and important natural resources.

7. BLM Finalizes Strong Mitigation Manual and Handbook – 4 CAPEs



BLM has demonstrated great leadership in recent years in modernizing its approach to "mitigation", the practice of avoiding and offsetting damage caused to public lands from development. Federal regulations require agencies to follow a five-step hierarchy to address impacts – avoid, minimize, rectify, reduce/eliminate, and compensate – which can be summarized as avoidance, minimization and compensation. Historically, work to mitigate the negative impacts of development such as oil and gas drilling and transmission lines was implemented on a project-by-project basis, which was insufficient to protect our resources and inefficient for permitting projects.

The new policies from BLM and other federal agencies provide guidelines for a broad, landscape-scale approach to balancing development and conservation on public lands. If the policies are used properly, future development projects will avoid impacts to sensitive resources while benefitting from more predictable and efficient permitting processes, and federal agencies will require conservation gains to address and overcome any loss of resources that does occur. Key concepts emphasized in the manual and handbook include a focus on the mitigation hierarchy; use of a landscape-scale approach; setting a no net loss or net benefit outcome for resources that are considered important, scarce, sensitive, or have a protective legal mandate; use of mitigation strategies and plans to establish mitigation standards in advance of development; and emphasizing BLM's preference for achieving compensatory mitigation outcomes in advance of impacts.

The handbook also provides important details on tools BLM can use to durably protect mitigation sites on public lands such as identification of a protective land use plan allocation for the site (e.g. an Area of Critical Environmental Concern) or issuance of a lease or easement to a member of the public to conserve the site (via the authority granted in FLPMA Title III and/or Title V).

As described elsewhere in these awards, we've seen the value of BLM's smarter approach to mitigation in Solar Regional Mitigation Strategies, transmission line project approvals and other contexts. With the manual and handbook now finalized, we look forward to continuing to work with BLM to advance these important mitigation guidelines through land use planning and project permitting. Used properly, they will better balance conservation and development on our public lands while increasing permitting predictability and efficiency.

8. Coal Gets a Reboot – 4 CAPEs

On January 15, 2016, Interior Secretary Sally Jewell signed Secretarial Order 3338 directing the BLM to prepare a Programmatic Environmental Impact Statement (PEIS) to analyze potential leasing and management reforms to the federal coal program. The BLM held six public meetings across the county and solicited comment from stakeholders to gather information on policies and practices that need to be updated. The PEIS seeks to address how, when and where to lease public lands for future coal development, as well as how to secure a fair return to taxpayers from royalties, address climate impacts, and address our domestic energy needs. BLM also implemented a temporary pause on significant new coal leasing while it completes the process.

Colorado's North Fork Valley, by Jim Ramey

The coal program has not been reassessed in almost thirty years and significant changes are necessary to bring the program in line with 21st century energy demands and public expectations for our shared public lands. An updated coal program should also seek ways to assist coal dependent communities in this time of transition – like Colorado's North Fork Valley. We commend BLM's extensive public outreach process and we hope the scoping report due to be released in early January will provide the agency and the public with information to move forward with smart reforms.

While we realize the incoming administration may not agree with all the steps taken to date, we believe that the incredible amount of time, energy, and analysis that has gone into the process thus far should not be wasted. International and domestic market factors point to a decline in coal production and use regardless of a shift in federal energy policy. We hope that smart and sensible reforms are pursued to ensure that the American taxpayer is not being shortchanged and that American coal workers and coal dependent communities are not forgotten amid this transition. We applaud the BLM for initiating this monumental undertaking.

9. Planning for Oil and Gas at a Landscape Level – 3 CAPEs

In 2016 BLM made headway towards smart and balanced landscape level planning for energy development on public lands. This was highlighted by the agency's work on several Master Leasing Plans (MLPs) across the West. The Moab MLP, finalized on December 15th, illustrates how effective this tool can be. The final plan protects Canyonlands and Arches National Parks from nearby development and ensures the region's economy will continue to thrive by managing lands to support recreation, tourism and cultural sites. Also in Utah, the BLM released preliminary alternatives for the San Rafael Desert MLP. The planning area contains valuable wilderness quality lands and endemic bee habitat, and abuts Canyonlands National Park. The preliminary alternatives contain measures that emphasize the importance of protecting these other resources while maintaining ample opportunity for responsible oil and gas development.

In Colorado, the BLM made notable progress on the South Park MLP this year. There, elected officials, sportsmen, the state wildlife agency, local residents and municipal service providers like Denver Water have come together to ensure oil and gas drilling does not harm wildlife habitat, Gold Medal fishing streams, South Park's scenic wildlands, or vitally important drinking water sources for Colorado's front range. And just before the holidays, BLM Colorado announced that the Tres Rios Field Office will be moving forward with the Southwest Colorado MLP. This plan has been largely driven forward by support from the local community who highlighted the need to establish protections for agriculture, Mesa Verde National Park and the renowned mountain biking area Phil's World.

Finally, in the greater Chaco landscape in northwest New Mexico, tribal leaders, industry and conservation groups have encouraged the BLM to establish a workable process to help preserve unique cultural values in an energy-rich region. The BLM is embarking on a joint planning process with the Bureau of Indian Affairs to ensure everyone has a seat at the table in planning for the future of oil and gas development in the Chaco region.

W*e are encouraged by the leaps forward the BLM has taken in the last year to ensure true multiple-use management of our public lands and smart planning for oil and gas development. We hope the BLM will continue to use Master Leasing Plans and other tools for smart from the start oil and gas planning to manage our public lands in a way that balances community needs and other resource values with energy development.*

Chaco Culture National Historical Park, by Ti Hays

10. Greater Sage-grouse Conservation Plan Implementation Moving Forward – 2 CAPEs

Since completion of the range-wide conservation plans last year, BLM has been moving to implement their commitments. Initial guidance has been issued, through seven instruction memoranda, regarding oil and gas leasing and development, grazing permit review priorities, grazing management thresholds and responses, adaptive management triggers, disturbance tracking, effectiveness monitoring, and habitat assessment framework. These memoranda provide key direction for implementing various aspects of managing resources uses and evaluating how the plans are meeting their goals. BLM has also issued a Draft Environmental Impact Statement setting out the results of its analysis of potential mineral withdrawals, following on the recommendations for withdrawal in the conservation plans and developing alternatives based on input from states and other stakeholders.

Additional direction, such as specific mitigation strategies, and implementation, such as through travel planning, is still needed to ensure the success of the conservation plans. Similarly, BLM must move forward on the mineral withdrawals that were recommended as part of conserving the greater sage-grouse and its habitat, and supported the U.S. Fish and Wildlife Service's conclusion that this species no longer warrants protection under the Endangered Species Act.

11. Opportunity Abounds to Protect the North Fork Valley – 1 CAPE

This year, the BLM released its draft plan for the Uncompahgre area in western Colorado, and included an alternative to largely protect the North Fork Valley from oil and gas development. The North Fork Valley, surrounding the North Fork of the Gunnison River, is Colorado's farm-to-table capital and is home to idyllic vineyards and one of the largest concentrations of organic farming in the state, not to mention outstanding hiking, biking, and hunting. The local community rose in opposition to the BLM's plan to issue oil and gas leases in the area in 2012, and came together to develop the "North Fork Alternative Plan," a proposal to the BLM for managing oil and gas development in the scenic valley. The BLM's draft plan would adopt this community vision in one alternative – but not the agency's preferred alternative.

We greatly appreciate that the BLM included the local community's North Fork Alternative Plan in the draft RMP, making room for the agency to ultimately adopt the community vision in the final plan. The BLM must seize this opportunity to develop a final plan for the North Fork Valley that protects agriculture, recreation, the Gunnison River and the livelihoods of the locals from oil and gas development.

Honorable Mention

With transition to new ePlanning system, the BLM aims to increase transparency

Over the past year, the BLM has been transitioning its online National Environmental Policy Act (NEPA) Registers to a new ePlanning system. As a central database for the agency, ePlanning will house land use planning information and NEPA documents across all BLM planning areas. We appreciate that the BLM has invested resources in improving the functionality and accessibility of online information for the general public. From approving the construction of new roads and transmission lines to authorizing off-road vehicle races, the NEPA Registers are the fundamental tool for the public to understand and engage in decisions affecting our public lands. Allowing users to search based on location, filter based on BLM program, and readily view projects that have an open opportunity for public comment are a few of the ePlanning features that improve usability. As the BLM further develops ePlanning webpages, we hope to see relevant mapping information and data for all projects readily available and greater collaboration with stakeholders to explore ways that ePlanning might further support public participation.

Regional Review of West-wide Energy Corridors moves forward in Arizona, California, and Nevada

BLM initiated its first Regional Review of West-wide Energy Corridors this fall for energy corridors in the California desert, western Arizona, and southern Nevada. These Regional Reviews allow BLM to take a second look at existing energy corridors on our public lands and make sure they are helping promote responsible development. To be effective, energy corridors must be functional and attractive for developers, and avoid sensitive resources such as lands with wilderness characteristics and wildlife habitat. Corridors should also help facilitate renewable energy for our nation's energy grid.

As the first Regional Review out the door, there is a tremendous opportunity for BLM to begin engraining a 'smart-from-the-start' approach to planning for transmission lines and other energy infrastructure. In fact, recommendations in Region 1 have the immediate potential to improve ongoing projects and planning, such as the proposed Ten West Link transmission project between Arizona and California, and corridors in the ongoing Las Vegas-Pahrump Resource Management Plan revision. For all corridors in review, BLM should analyze the full range of resources on public lands and put forward recommendations that address serious environmental concerns. Overall, we have welcomed the emphasis BLM has placed on public and stakeholder participation in the process, including the creation of the interactive Energy Corridor Mapping Tool and multiple stakeholder meetings. We look forward to continued work with BLM and other federal agencies in Region 1 and setting a strong example for future Regional Reviews.

From: Nada Culver
To: Whitlock, Jenna
Subject: TWS BLM Action Center"s annual awards recognizing BLM"s great work
Date: Wednesday, January 4, 2017 5:22:58 PM
Attachments: 2016 CAPE Awards.pdf

Hi Jenna– I wanted to forward our annual awards to you, personally, since we wanted to thank you for all your work on the lands with wilderness characteristics guidance and the master leasing plans in Utah. Thanks so much.

Nada Culver

Senior Counsel and Director, BLM Action Center

The Wilderness Society

1660 Wynkoop, #850

Denver, CO 80202

Main: 303-650-5818

Direct: 303-225-4635

Nada_Culver@tws.org

The 2016 CAPE Awards

Celebrating Milestones in Conservation for our Public Lands

The Interior Department hit its stride in 2016, and rolled out some inspired final decisions to cap off the Obama administration's tenure. We were delighted to see years of effort culminate in major progress for stewardship of wilderness quality lands, more balanced oil and gas management, and smart from the start renewable energy planning. And, how we could not spotlight right off the bat finalization of the BLM's new planning rule?! Way to go, BLM, it's been quite a ride.

Unfortunately, there have also been isolated affronts towards our western public lands and the civil servants that steward them for all Americans. In these challenging times, as in years past, we'd like to start our annual year-end celebratory awards to first recognize and appreciate all BLM employees and their commitment to managing our vast shared real estate for the benefit of us all. In coming years, we hope the agency maintains pride in its mission, continues its exciting trajectory towards landscape-level planning and managing for the greatest threat of the future – climate change – and keeps the faith that the American public overwhelmingly supports public lands.

The Comparative Analysis of Particular Excellence (CAPE) rating system, inspired by the superhero-like character of the BLM Action Center team (able to leap tall stacks of RMPs in a single bound!), ranges from one CAPE on the low end (worth a pat on the back) to five CAPEs on the high end (HUGE PROGRESS!!! WAY TO GO!!!).

1. New Rule to Update Planning for Public Lands – 5 CAPEs

Acknowledging that the BLM's land use planning rule has not been substantially updated since the Internet was invented in 1983, the agency finalized updates to the rule this year to help bring planning for our public lands into the 21st century. The rule is part of the BLM's "Planning 2.0" initiative to make planning more cooperative, transparent and efficient. Under the new rule, the public has new and improved opportunities to make their voices heard in management decisions affecting our public lands. The rule also encourages planning at a landscape-scale rather than by political boundaries to better address issues such as wildlife movement corridors and planning for energy development while protecting valuable lands for conservation.

The rule has broad public support, including from many local governments, who appreciate the agency's commitment to expand public participation in land use planning decisions, utilize modern science in assessing land conditions and planning for the future, and strive to make our public lands more resilient

and adaptable. Through this rule, the BLM will be better equipped to design land management plans that truly reflect the needs and desires of the public.

We congratulate the BLM on getting this important and essential rule over the finish line and look forward to seeing it implemented. We are also looking forward to seeing the Planning 2.0 initiative come to completion with the issuance of an updated land use planning handbook to help guide implementation.

2. Wilderness Quality Lands Get the Love They Deserve – 5 CAPEs

In 2016, the BLM continued to make significant progress in its efforts to conduct and maintain inventories of lands with wilderness characteristics. Lands with wilderness characteristics are an important resource that the BLM is obligated to identify under the Federal Land Policy and Management Act of 1976. In the last few years, we've seen the BLM improve its inventory methods while extending the agency's commitments to funding and executing on-the-ground inventory work. The BLM has or is currently updating inventories in planning areas around the country—including the Colorado River Valley and San Luis Valley field offices in Colorado, as well as the Basin and Range National Monument in Nevada.

Basin and Range National Monument, by Bob Wick

In addition to improving inventory methods and conducting field inventories, the BLM is also clarifying its obligations to address wilderness resources in a more consistent manner. This year, the BLM developed statewide guidance in Colorado and Utah to provide more detail on conducting inventories, responding to citizens' inventories, and considering lands with wilderness characteristics in planning efforts, including at the project level. This guidance helps to provide uniformity in how individual field offices meet their obligations to identify and consider lands with wilderness characteristics.

The BLM further committed to stewarding wilderness resources this year through requiring compensatory mitigation for impacts to lands with wilderness characteristics from development. Mitigation is an important tool because it ensures that the public receives compensation for the loss of wilderness quality lands due to projects such as energy development. In the case of the recently approved TransWest Express and Gateway South transmission lines, the BLM will offset impacts to lands with wilderness characteristics by protecting wilderness-quality lands elsewhere.

The BLM has been ushering in a renewed dedication to assessing and protecting wilderness quality public lands over the past few years, and the momentum continued in 2016 thanks to extensive inventory work, state-specific guidance and compensatory mitigation commitments. We expect the BLM will continue with this important work in coming years to meet the agency's obligations under FLPMA.

3. Employing a Commonsense Approach to Oil and Gas Development – 5 CAPEs

For far too long, the oil and gas industry has run the roost on our public lands. The BLM has prioritized oil and gas leasing and drilling at the expense of wildlands, wildlife, clean air and water, recreation and numerous other values of our shared western landscapes. This year, the BLM took the reins and implemented commonsense decisions and reforms to ensure oil and gas has just one seat at the table – along with all other multiple uses. Two of the most impactful decisions were to cancel oil and gas leases in Colorado's Thompson Divide and Montana's Badger-Two Medicine area. In both cases, the BLM responded to strong local support – including ranchers in the Thompson Divide and the Blackfeet Nation in Badger-Two – to rectify a historic wrong and dispose of improperly-issued leases. These landscapes are truly too wild to drill, and we are elated that the BLM has finally taken strong action to protect them for future generations.

The BLM also adopted other commonsense reforms for oil and gas development this year. Chief among them is the "methane rule," which aims to cut natural gas waste and methane pollution from oil and gas operations on public lands. The methane rule will help move us toward agreements to cut U.S. methane emissions by 40 to 45 percent by 2025, building on 2015 U.S. commitments in Paris to reduce emissions and slow global warming. The BLM also finalized Onshore Orders 3, 4 and 5 to accurately measure and report oil and gas produced from federal lands and ensure companies pay full royalties.

Lease cancellations in the Thompson Divide and Badger-Two Medicine areas are landmark victories for nationally important landscapes that should never have been leased in the first place. We are thrilled to see the BLM take a proactive approach to oil and gas management on our public lands by protecting special lands and adopting rules to make drilling safer and smarter, for the climate and for taxpayers.

4. California Desert Plan Protects 4.2 Million Acres – 5 CAPEs

In September, the California BLM released its highly anticipated Record of Decision (ROD) for the Desert Renewable Energy Conservation Plan (DRECP) – a land use planning effort designed to balance smart renewable energy development with land conservation in the California Desert. The signing of the DRECP ROD not only marks the end of the first phase of a broader plan, but also affirms that developing clean energy and protecting wildlife, plants, cultural resources, and recreation opportunities are not mutually exclusive.

The DRECP ROD will protect 4.2 million acres of wild and vulnerable public land, including permanently protecting almost 3 million acres of newly designated California Desert National Conservation Lands. The BLM has already initiated the mineral withdrawal procedures for over 1.3 million acres of these new conservation lands as required by the DRECP ROD. This early action will not only reinforce their designation as protected conservation areas, but help drive DRECP implementation forward. The DRECP ROD also designates carefully selected low-conflict areas dedicated to renewable energy production, including locations that are already adjacent to existing infrastructure like transmission lines and roads. This decision will help elevate and streamline renewable energy production in locations that are attractive to developers and pose limited risk to other resources.

California's Silurian Valley, by Mason Cummings

With the ROD, the plan has set a high bar for future collaborative, multi-agency planning initiatives unfolding across the West. While the work in the California Desert is just beginning, signing the DRECP ROD for Phase I is an important achievement and an essential building block for what is to come from implementation and Phase II.

We enthusiastically support the DRECP ROD, which will protect over 4.2 million of acres of delicate desert resources and pristine landscapes for future generations while helping California meet its renewable energy and climate goals. In a time of serious climate uncertainty, forward-thinking planning measures like the DRECP will help reduce stress and impacts to a vulnerable landscape. Moving forward, the BLM needs to tackle the implementation of the DRECP Phase I head-on, beginning with the recently initiated mineral withdrawal procedures on over 1.3 million acres of designated conservation lands and to diligently assess the landscape for disturbances, as well as helping renewables projects succeed in designated low-conflict areas.

5. BLM Codifies "Smart from the Start" Renewable Energy Program – 5 CAPEs

The BLM has made great strides in advancing responsible renewable energy in the last five years. This includes permitting the first-ever solar projects on public lands, establishing landscape-scale plans to guide development to low-conflict zones across the southwest, and approving over 15,000 megawatts of wind, solar and geothermal development – enough to power over five million homes. In finalizing the Wind and Solar Leasing Rule this year, BLM ensured that smart approaches advanced in recent years will become standard practice going forward. By prioritizing development in designated low-conflict areas, the rule will make the permitting process more efficient in appropriate areas while protecting wildlands and wildlife habitat from development, as demonstrated by the success at the Dry Lake Solar Energy Zone (SEZ) outside Las Vegas. It will also assure taxpayers fair compensation by implementing a competitive leasing process. The rule enjoys wide, bi-partisan support and will facilitate responsible renewables development, helping us protect our natural heritage, tackle the threat of climate change, and benefit western economies.

BLM also continues to make renewable energy zones more attractive to developers and ensure that unavoidable impacts from development are offset through mitigation. The agency finalized two Solar Regional Mitigation Strategies (SRMSs) this year, one for the Dry Lake Valley North (DLVN) SEZ in eastern Nevada and one for Arizona's three SEZs. These build off BLM's pilot SRMS for the Dry Lake SEZ, which proved to be a key element of the agency's success in providing an efficient permitting process for projects in that zone and giving predictability to developers on their mitigation obligations, while investing mitigation resources in strategic conservation actions in the region. BLM has continued to refine its approach to SRMSs, and the DLVN and Arizona SRMSs included improvements such as better addressing uncertainty on mitigation outcomes in fee calculations. We expect that the completion of

these SRMSs will increase the attractiveness of these SEZs for responsible development when market conditions are right.

We applaud the BLM in creating a robust renewable energy program from scratch, culminating with the finalization of the Wind and Solar Leasing Rule this year. We look forward to working with the BLM, project developers, and other stakeholders to put the rule to work, including establishing implementation guidance, helping projects succeed in zones, designating new zones in appropriate areas, and protecting wildlands and wildlife habitat from development. We also look forward to engaging with BLM as it finalizes the SRMSs underway in Colorado, New Mexico, and Utah to facilitate responsible solar development and mitigation in those regions. We hope BLM will continue to refine its approach to SRMSs, including elevating the potential for addressing mitigation obligations by adding or strengthening protections for other public lands in SEZ regions.

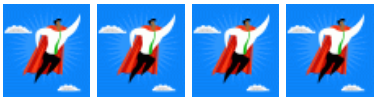
6. Natural Heritage Protected in the Arctic – 5 CAPEs

Hot off the presses, this week the BLM finalized a plan for 6.5 million acres of extremely wild public lands in Alaska's Eastern Interior planning area. The public lands managed by the BLM here include some traditional land of twelve federally recognized tribes, several of which have worked throughout the planning process to ensure their cultural heritage and identities, realized through subsistence lifestyles, are protected. Moose, caribou, grizzly bear, wolverine, and eagles are among the many species that make their home in the Eastern Interior along with dozens of fish species that depend on vast and complex river systems, including the mighty Yukon. The public lands in Alaska's interior also provide outstanding opportunities for hunting, fishing, rafting, and cross-country skiing to winter huts. The final Eastern Interior plan strikes a good balance for conserving important fish and wildlife habitat, providing quality backcountry recreation experiences, and protecting traditional uses. It also identifies and includes measures to protect 3 million acres of lands with wilderness characteristics, and substantially restricts new mining.

This year, the Department of the Interior also decided to protect the Arctic Ocean from oil and gas leasing for the next five years in the Bureau of Ocean Energy Management's 2017-2022 program for offshore oil and gas leasing. The Arctic Ocean provides habitat for numerous species of whales, polar bears, seals, walruses and many populations of fish and birds, and has supported the lives and cultures of Alaska Natives for thousands of years. These places would be gravely threatened by oil and gas leasing, and we are relieved that the Arctic Ocean will be spared for the near future.

We are inspired by the BLM's commitment to protect Alaska's indigenous people and their subsistence cultures, as well as critically important wildlife habitat and epically vast wilderness-quality lands, from destructive mining and development in the Eastern Interior. We are also grateful that the Department of the Interior recognized the Arctic Ocean is not appropriate for oil and gas leasing due to its extraordinarily vulnerable environment and important natural resources.

7. BLM Finalizes Strong Mitigation Manual and Handbook – 4 CAPEs



BLM has demonstrated great leadership in recent years in modernizing its approach to "mitigation", the practice of avoiding and offsetting damage caused to public lands from development. Federal regulations require agencies to follow a five-step hierarchy to address impacts – avoid, minimize, rectify, reduce/eliminate, and compensate – which can be summarized as avoidance, minimization and compensation. Historically, work to mitigate the negative impacts of development such as oil and gas drilling and transmission lines was implemented on a project-by-project basis, which was insufficient to protect our resources and inefficient for permitting projects.

The new policies from BLM and other federal agencies provide guidelines for a broad, landscape-scale approach to balancing development and conservation on public lands. If the policies are used properly, future development projects will avoid impacts to sensitive resources while benefitting from more predictable and efficient permitting processes, and federal agencies will require conservation gains to address and overcome any loss of resources that does occur. Key concepts emphasized in the manual and handbook include a focus on the mitigation hierarchy; use of a landscape-scale approach; setting a no net loss or net benefit outcome for resources that are considered important, scarce, sensitive, or have a protective legal mandate; use of mitigation strategies and plans to establish mitigation standards in advance of development; and emphasizing BLM's preference for achieving compensatory mitigation outcomes in advance of impacts.

The handbook also provides important details on tools BLM can use to durably protect mitigation sites on public lands such as identification of a protective land use plan allocation for the site (e.g. an Area of Critical Environmental Concern) or issuance of a lease or easement to a member of the public to conserve the site (via the authority granted in FLPMA Title III and/or Title V).

As described elsewhere in these awards, we've seen the value of BLM's smarter approach to mitigation in Solar Regional Mitigation Strategies, transmission line project approvals and other contexts. With the manual and handbook now finalized, we look forward to continuing to work with BLM to advance these important mitigation guidelines through land use planning and project permitting. Used properly, they will better balance conservation and development on our public lands while increasing permitting predictability and efficiency.

8. Coal Gets a Reboot – 4 CAPEs

On January 15, 2016, Interior Secretary Sally Jewell signed Secretarial Order 3338 directing the BLM to prepare a Programmatic Environmental Impact Statement (PEIS) to analyze potential leasing and management reforms to the federal coal program. The BLM held six public meetings across the county and solicited comment from stakeholders to gather information on policies and practices that need to be updated. The PEIS seeks to address how, when and where to lease public lands for future coal development, as well as how to secure a fair return to taxpayers from royalties, address climate impacts, and address our domestic energy needs. BLM also implemented a temporary pause on significant new coal leasing while it completes the process.

Colorado's North Fork Valley, by Jim Ramey

The coal program has not been reassessed in almost thirty years and significant changes are necessary to bring the program in line with 21st century energy demands and public expectations for our shared public lands. An updated coal program should also seek ways to assist coal dependent communities in this time of transition – like Colorado's North Fork Valley. We commend BLM's extensive public outreach process and we hope the scoping report due to be released in early January will provide the agency and the public with information to move forward with smart reforms.

While we realize the incoming administration may not agree with all the steps taken to date, we believe that the incredible amount of time, energy, and analysis that has gone into the process thus far should not be wasted. International and domestic market factors point to a decline in coal production and use regardless of a shift in federal energy policy. We hope that smart and sensible reforms are pursued to ensure that the American taxpayer is not being shortchanged and that American coal workers and coal dependent communities are not forgotten amid this transition. We applaud the BLM for initiating this monumental undertaking.

9. Planning for Oil and Gas at a Landscape Level – 3 CAPEs

In 2016 BLM made headway towards smart and balanced landscape level planning for energy development on public lands. This was highlighted by the agency's work on several Master Leasing Plans (MLPs) across the West. The Moab MLP, finalized on December 15th, illustrates how effective this tool can be. The final plan protects Canyonlands and Arches National Parks from nearby development and ensures the region's economy will continue to thrive by managing lands to support recreation, tourism and cultural sites. Also in Utah, the BLM released preliminary alternatives for the San Rafael Desert MLP. The planning area contains valuable wilderness quality lands and endemic bee habitat, and abuts Canyonlands National Park. The preliminary alternatives contain measures that emphasize the importance of protecting these other resources while maintaining ample opportunity for responsible oil and gas development.

In Colorado, the BLM made notable progress on the South Park MLP this year. There, elected officials, sportsmen, the state wildlife agency, local residents and municipal service providers like Denver Water have come together to ensure oil and gas drilling does not harm wildlife habitat, Gold Medal fishing streams, South Park's scenic wildlands, or vitally important drinking water sources for Colorado's front range. And just before the holidays, BLM Colorado announced that the Tres Rios Field Office will be moving forward with the Southwest Colorado MLP. This plan has been largely driven forward by support from the local community who highlighted the need to establish protections for agriculture, Mesa Verde National Park and the renowned mountain biking area Phil's World.

Finally, in the greater Chaco landscape in northwest New Mexico, tribal leaders, industry and conservation groups have encouraged the BLM to establish a workable process to help preserve unique cultural values in an energy-rich region. The BLM is embarking on a joint planning process with the Bureau of Indian Affairs to ensure everyone has a seat at the table in planning for the future of oil and gas development in the Chaco region.

W*e are encouraged by the leaps forward the BLM has taken in the last year to ensure true multiple-use management of our public lands and smart planning for oil and gas development. We hope the BLM will continue to use Master Leasing Plans and other tools for smart from the start oil and gas planning to manage our public lands in a way that balances community needs and other resource values with energy development.*

Chaco Culture National Historical Park, by Ti Hays

10. Greater Sage-grouse Conservation Plan Implementation Moving Forward – 2 CAPEs

Since completion of the range-wide conservation plans last year, BLM has been moving to implement their commitments. Initial guidance has been issued, through seven instruction memoranda, regarding oil and gas leasing and development, grazing permit review priorities, grazing management thresholds and responses, adaptive management triggers, disturbance tracking, effectiveness monitoring, and habitat assessment framework. These memoranda provide key direction for implementing various aspects of managing resources uses and evaluating how the plans are meeting their goals. BLM has also issued a Draft Environmental Impact Statement setting out the results of its analysis of potential mineral withdrawals, following on the recommendations for withdrawal in the conservation plans and developing alternatives based on input from states and other stakeholders.

Additional direction, such as specific mitigation strategies, and implementation, such as through travel planning, is still needed to ensure the success of the conservation plans. Similarly, BLM must move forward on the mineral withdrawals that were recommended as part of conserving the greater sage-grouse and its habitat, and supported the U.S. Fish and Wildlife Service's conclusion that this species no longer warrants protection under the Endangered Species Act.

11. Opportunity Abounds to Protect the North Fork Valley – 1 CAPE

This year, the BLM released its draft plan for the Uncompahgre area in western Colorado, and included an alternative to largely protect the North Fork Valley from oil and gas development. The North Fork Valley, surrounding the North Fork of the Gunnison River, is Colorado's farm-to-table capital and is home to idyllic vineyards and one of the largest concentrations of organic farming in the state, not to mention outstanding hiking, biking, and hunting. The local community rose in opposition to the BLM's plan to issue oil and gas leases in the area in 2012, and came together to develop the "North Fork Alternative Plan," a proposal to the BLM for managing oil and gas development in the scenic valley. The BLM's draft plan would adopt this community vision in one alternative – but not the agency's preferred alternative.

We greatly appreciate that the BLM included the local community's North Fork Alternative Plan in the draft RMP, making room for the agency to ultimately adopt the community vision in the final plan. The BLM must seize this opportunity to develop a final plan for the North Fork Valley that protects agriculture, recreation, the Gunnison River and the livelihoods of the locals from oil and gas development.

Honorable Mention

With transition to new ePlanning system, the BLM aims to increase transparency

Over the past year, the BLM has been transitioning its online National Environmental Policy Act (NEPA) Registers to a new ePlanning system. As a central database for the agency, ePlanning will house land use planning information and NEPA documents across all BLM planning areas. We appreciate that the BLM has invested resources in improving the functionality and accessibility of online information for the general public. From approving the construction of new roads and transmission lines to authorizing off-road vehicle races, the NEPA Registers are the fundamental tool for the public to understand and engage in decisions affecting our public lands. Allowing users to search based on location, filter based on BLM program, and readily view projects that have an open opportunity for public comment are a few of the ePlanning features that improve usability. As the BLM further develops ePlanning webpages, we hope to see relevant mapping information and data for all projects readily available and greater collaboration with stakeholders to explore ways that ePlanning might further support public participation.

Regional Review of West-wide Energy Corridors moves forward in Arizona, California, and Nevada

BLM initiated its first Regional Review of West-wide Energy Corridors this fall for energy corridors in the California desert, western Arizona, and southern Nevada. These Regional Reviews allow BLM to take a second look at existing energy corridors on our public lands and make sure they are helping promote responsible development. To be effective, energy corridors must be functional and attractive for developers, and avoid sensitive resources such as lands with wilderness characteristics and wildlife habitat. Corridors should also help facilitate renewable energy for our nation's energy grid.

As the first Regional Review out the door, there is a tremendous opportunity for BLM to begin engraining a 'smart-from-the-start' approach to planning for transmission lines and other energy infrastructure. In fact, recommendations in Region 1 have the immediate potential to improve ongoing projects and planning, such as the proposed Ten West Link transmission project between Arizona and California, and corridors in the ongoing Las Vegas-Pahrump Resource Management Plan revision. For all corridors in review, BLM should analyze the full range of resources on public lands and put forward recommendations that address serious environmental concerns. Overall, we have welcomed the emphasis BLM has placed on public and stakeholder participation in the process, including the creation of the interactive Energy Corridor Mapping Tool and multiple stakeholder meetings. We look forward to continued work with BLM and other federal agencies in Region 1 and setting a strong example for future Regional Reviews.

From: Nada Culver
To: Porter, Lance
Subject: TWS BLM Action Center"s annual awards recognizing BLM"s great work
Date: Wednesday, January 4, 2017 5:24:59 PM
Attachments: 2016 CAPE Awards.pdf

Hi Lance– I wanted to forward our annual awards to you, personally, since we wanted to thank you for all your work on the Moab MLP. Thanks so much.

Nada Culver

Senior Counsel and Director, BLM Action Center

The Wilderness Society

1660 Wynkoop, #850

Denver, CO 80202

Main: 303-650-5818

Direct: 303-225-4635

Nada_Culver@tws.org

The 2016 CAPE Awards

Celebrating Milestones in Conservation for our Public Lands

The Interior Department hit its stride in 2016, and rolled out some inspired final decisions to cap off the Obama administration's tenure. We were delighted to see years of effort culminate in major progress for stewardship of wilderness quality lands, more balanced oil and gas management, and smart from the start renewable energy planning. And, how we could not spotlight right off the bat finalization of the BLM's new planning rule?! Way to go, BLM, it's been quite a ride.

Unfortunately, there have also been isolated affronts towards our western public lands and the civil servants that steward them for all Americans. In these challenging times, as in years past, we'd like to start our annual year-end celebratory awards to first recognize and appreciate all BLM employees and their commitment to managing our vast shared real estate for the benefit of us all. In coming years, we hope the agency maintains pride in its mission, continues its exciting trajectory towards landscape-level planning and managing for the greatest threat of the future – climate change – and keeps the faith that the American public overwhelmingly supports public lands.

The Comparative Analysis of Particular Excellence (CAPE) rating system, inspired by the superhero-like character of the BLM Action Center team (able to leap tall stacks of RMPs in a single bound!), ranges from one CAPE on the low end (worth a pat on the back) to five CAPEs on the high end (HUGE PROGRESS!!! WAY TO GO!!!).

1. New Rule to Update Planning for Public Lands – 5 CAPEs

Acknowledging that the BLM's land use planning rule has not been substantially updated since the Internet was invented in 1983, the agency finalized updates to the rule this year to help bring planning for our public lands into the 21st century. The rule is part of the BLM's "Planning 2.0" initiative to make planning more cooperative, transparent and efficient. Under the new rule, the public has new and improved opportunities to make their voices heard in management decisions affecting our public lands. The rule also encourages planning at a landscape-scale rather than by political boundaries to better address issues such as wildlife movement corridors and planning for energy development while protecting valuable lands for conservation.

The rule has broad public support, including from many local governments, who appreciate the agency's commitment to expand public participation in land use planning decisions, utilize modern science in assessing land conditions and planning for the future, and strive to make our public lands more resilient

and adaptable. Through this rule, the BLM will be better equipped to design land management plans that truly reflect the needs and desires of the public.

We congratulate the BLM on getting this important and essential rule over the finish line and look forward to seeing it implemented. We are also looking forward to seeing the Planning 2.0 initiative come to completion with the issuance of an updated land use planning handbook to help guide implementation.

2. Wilderness Quality Lands Get the Love They Deserve – 5 CAPEs

In 2016, the BLM continued to make significant progress in its efforts to conduct and maintain inventories of lands with wilderness characteristics. Lands with wilderness characteristics are an important resource that the BLM is obligated to identify under the Federal Land Policy and Management Act of 1976. In the last few years, we've seen the BLM improve its inventory methods while extending the agency's commitments to funding and executing on-the-ground inventory work. The BLM has or is currently updating inventories in planning areas around the country—including the Colorado River Valley and San Luis Valley field offices in Colorado, as well as the Basin and Range National Monument in Nevada.

Basin and Range National Monument, by Bob Wick

In addition to improving inventory methods and conducting field inventories, the BLM is also clarifying its obligations to address wilderness resources in a more consistent manner. This year, the BLM developed statewide guidance in Colorado and Utah to provide more detail on conducting inventories, responding to citizens' inventories, and considering lands with wilderness characteristics in planning efforts, including at the project level. This guidance helps to provide uniformity in how individual field offices meet their obligations to identify and consider lands with wilderness characteristics.

The BLM further committed to stewarding wilderness resources this year through requiring compensatory mitigation for impacts to lands with wilderness characteristics from development. Mitigation is an important tool because it ensures that the public receives compensation for the loss of wilderness quality lands due to projects such as energy development. In the case of the recently approved TransWest Express and Gateway South transmission lines, the BLM will offset impacts to lands with wilderness characteristics by protecting wilderness-quality lands elsewhere.

The BLM has been ushering in a renewed dedication to assessing and protecting wilderness quality public lands over the past few years, and the momentum continued in 2016 thanks to extensive inventory work, state-specific guidance and compensatory mitigation commitments. We expect the BLM will continue with this important work in coming years to meet the agency's obligations under FLPMA.

3. Employing a Commonsense Approach to Oil and Gas Development – 5 CAPEs

For far too long, the oil and gas industry has run the roost on our public lands. The BLM has prioritized oil and gas leasing and drilling at the expense of wildlands, wildlife, clean air and water, recreation and numerous other values of our shared western landscapes. This year, the BLM took the reins and implemented commonsense decisions and reforms to ensure oil and gas has just one seat at the table – along with all other multiple uses. Two of the most impactful decisions were to cancel oil and gas leases in Colorado's Thompson Divide and Montana's Badger-Two Medicine area. In both cases, the BLM responded to strong local support – including ranchers in the Thompson Divide and the Blackfeet Nation in Badger-Two – to rectify a historic wrong and dispose of improperly-issued leases. These landscapes are truly too wild to drill, and we are elated that the BLM has finally taken strong action to protect them for future generations.

The BLM also adopted other commonsense reforms for oil and gas development this year. Chief among them is the "methane rule," which aims to cut natural gas waste and methane pollution from oil and gas operations on public lands. The methane rule will help move us toward agreements to cut U.S. methane emissions by 40 to 45 percent by 2025, building on 2015 U.S. commitments in Paris to reduce emissions and slow global warming. The BLM also finalized Onshore Orders 3, 4 and 5 to accurately measure and report oil and gas produced from federal lands and ensure companies pay full royalties.

Lease cancellations in the Thompson Divide and Badger-Two Medicine areas are landmark victories for nationally important landscapes that should never have been leased in the first place. We are thrilled to see the BLM take a proactive approach to oil and gas management on our public lands by protecting special lands and adopting rules to make drilling safer and smarter, for the climate and for taxpayers.

4. California Desert Plan Protects 4.2 Million Acres – 5 CAPEs

In September, the California BLM released its highly anticipated Record of Decision (ROD) for the Desert Renewable Energy Conservation Plan (DRECP) – a land use planning effort designed to balance smart renewable energy development with land conservation in the California Desert. The signing of the DRECP ROD not only marks the end of the first phase of a broader plan, but also affirms that developing clean energy and protecting wildlife, plants, cultural resources, and recreation opportunities are not mutually exclusive.

The DRECP ROD will protect 4.2 million acres of wild and vulnerable public land, including permanently protecting almost 3 million acres of newly designated California Desert National Conservation Lands. The BLM has already initiated the mineral withdrawal procedures for over 1.3 million acres of these new conservation lands as required by the DRECP ROD. This early action will not only reinforce their designation as protected conservation areas, but help drive DRECP implementation forward. The DRECP ROD also designates carefully selected low-conflict areas dedicated to renewable energy production, including locations that are already adjacent to existing infrastructure like transmission lines and roads. This decision will help elevate and streamline renewable energy production in locations that are attractive to developers and pose limited risk to other resources.

California's Silurian Valley, by Mason Cummings

With the ROD, the plan has set a high bar for future collaborative, multi-agency planning initiatives unfolding across the West. While the work in the California Desert is just beginning, signing the DRECP ROD for Phase I is an important achievement and an essential building block for what is to come from implementation and Phase II.

We enthusiastically support the DRECP ROD, which will protect over 4.2 million of acres of delicate desert resources and pristine landscapes for future generations while helping California meet its renewable energy and climate goals. In a time of serious climate uncertainty, forward-thinking planning measures like the DRECP will help reduce stress and impacts to a vulnerable landscape. Moving forward, the BLM needs to tackle the implementation of the DRECP Phase I head-on, beginning with the recently initiated mineral withdrawal procedures on over 1.3 million acres of designated conservation lands and to diligently assess the landscape for disturbances, as well as helping renewables projects succeed in designated low-conflict areas.

5. BLM Codifies "Smart from the Start" Renewable Energy Program – 5 CAPEs

The BLM has made great strides in advancing responsible renewable energy in the last five years. This includes permitting the first-ever solar projects on public lands, establishing landscape-scale plans to guide development to low-conflict zones across the southwest, and approving over 15,000 megawatts of wind, solar and geothermal development – enough to power over five million homes. In finalizing the Wind and Solar Leasing Rule this year, BLM ensured that smart approaches advanced in recent years will become standard practice going forward. By prioritizing development in designated low-conflict areas, the rule will make the permitting process more efficient in appropriate areas while protecting wildlands and wildlife habitat from development, as demonstrated by the success at the Dry Lake Solar Energy Zone (SEZ) outside Las Vegas. It will also assure taxpayers fair compensation by implementing a competitive leasing process. The rule enjoys wide, bi-partisan support and will facilitate responsible renewables development, helping us protect our natural heritage, tackle the threat of climate change, and benefit western economies.

BLM also continues to make renewable energy zones more attractive to developers and ensure that unavoidable impacts from development are offset through mitigation. The agency finalized two Solar Regional Mitigation Strategies (SRMSs) this year, one for the Dry Lake Valley North (DLVN) SEZ in eastern Nevada and one for Arizona's three SEZs. These build off BLM's pilot SRMS for the Dry Lake SEZ, which proved to be a key element of the agency's success in providing an efficient permitting process for projects in that zone and giving predictability to developers on their mitigation obligations, while investing mitigation resources in strategic conservation actions in the region. BLM has continued to refine its approach to SRMSs, and the DLVN and Arizona SRMSs included improvements such as better addressing uncertainty on mitigation outcomes in fee calculations. We expect that the completion of

these SRMSs will increase the attractiveness of these SEZs for responsible development when market conditions are right.

We applaud the BLM in creating a robust renewable energy program from scratch, culminating with the finalization of the Wind and Solar Leasing Rule this year. We look forward to working with the BLM, project developers, and other stakeholders to put the rule to work, including establishing implementation guidance, helping projects succeed in zones, designating new zones in appropriate areas, and protecting wildlands and wildlife habitat from development. We also look forward to engaging with BLM as it finalizes the SRMSs underway in Colorado, New Mexico, and Utah to facilitate responsible solar development and mitigation in those regions. We hope BLM will continue to refine its approach to SRMSs, including elevating the potential for addressing mitigation obligations by adding or strengthening protections for other public lands in SEZ regions.

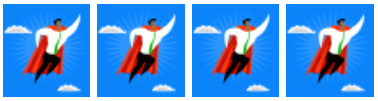
6. Natural Heritage Protected in the Arctic – 5 CAPEs

Hot off the presses, this week the BLM finalized a plan for 6.5 million acres of extremely wild public lands in Alaska's Eastern Interior planning area. The public lands managed by the BLM here include some traditional land of twelve federally recognized tribes, several of which have worked throughout the planning process to ensure their cultural heritage and identities, realized through subsistence lifestyles, are protected. Moose, caribou, grizzly bear, wolverine, and eagles are among the many species that make their home in the Eastern Interior along with dozens of fish species that depend on vast and complex river systems, including the mighty Yukon. The public lands in Alaska's interior also provide outstanding opportunities for hunting, fishing, rafting, and cross-country skiing to winter huts. The final Eastern Interior plan strikes a good balance for conserving important fish and wildlife habitat, providing quality backcountry recreation experiences, and protecting traditional uses. It also identifies and includes measures to protect 3 million acres of lands with wilderness characteristics, and substantially restricts new mining.

This year, the Department of the Interior also decided to protect the Arctic Ocean from oil and gas leasing for the next five years in the Bureau of Ocean Energy Management's 2017-2022 program for offshore oil and gas leasing. The Arctic Ocean provides habitat for numerous species of whales, polar bears, seals, walruses and many populations of fish and birds, and has supported the lives and cultures of Alaska Natives for thousands of years. These places would be gravely threatened by oil and gas leasing, and we are relieved that the Arctic Ocean will be spared for the near future.

We are inspired by the BLM's commitment to protect Alaska's indigenous people and their subsistence cultures, as well as critically important wildlife habitat and epically vast wilderness-quality lands, from destructive mining and development in the Eastern Interior. We are also grateful that the Department of the Interior recognized the Arctic Ocean is not appropriate for oil and gas leasing due to its extraordinarily vulnerable environment and important natural resources.

7. BLM Finalizes Strong Mitigation Manual and Handbook – 4 CAPEs



BLM has demonstrated great leadership in recent years in modernizing its approach to "mitigation", the practice of avoiding and offsetting damage caused to public lands from development. Federal regulations require agencies to follow a five-step hierarchy to address impacts – avoid, minimize, rectify, reduce/eliminate, and compensate – which can be summarized as avoidance, minimization and compensation. Historically, work to mitigate the negative impacts of development such as oil and gas drilling and transmission lines was implemented on a project-by-project basis, which was insufficient to protect our resources and inefficient for permitting projects.

The new policies from BLM and other federal agencies provide guidelines for a broad, landscape-scale approach to balancing development and conservation on public lands. If the policies are used properly, future development projects will avoid impacts to sensitive resources while benefitting from more predictable and efficient permitting processes, and federal agencies will require conservation gains to address and overcome any loss of resources that does occur. Key concepts emphasized in the manual and handbook include a focus on the mitigation hierarchy; use of a landscape-scale approach; setting a no net loss or net benefit outcome for resources that are considered important, scarce, sensitive, or have a protective legal mandate; use of mitigation strategies and plans to establish mitigation standards in advance of development; and emphasizing BLM's preference for achieving compensatory mitigation outcomes in advance of impacts.

The handbook also provides important details on tools BLM can use to durably protect mitigation sites on public lands such as identification of a protective land use plan allocation for the site (e.g. an Area of Critical Environmental Concern) or issuance of a lease or easement to a member of the public to conserve the site (via the authority granted in FLPMA Title III and/or Title V).

As described elsewhere in these awards, we've seen the value of BLM's smarter approach to mitigation in Solar Regional Mitigation Strategies, transmission line project approvals and other contexts. With the manual and handbook now finalized, we look forward to continuing to work with BLM to advance these important mitigation guidelines through land use planning and project permitting. Used properly, they will better balance conservation and development on our public lands while increasing permitting predictability and efficiency.

8. Coal Gets a Reboot – 4 CAPEs

On January 15, 2016, Interior Secretary Sally Jewell signed Secretarial Order 3338 directing the BLM to prepare a Programmatic Environmental Impact Statement (PEIS) to analyze potential leasing and management reforms to the federal coal program. The BLM held six public meetings across the county and solicited comment from stakeholders to gather information on policies and practices that need to be updated. The PEIS seeks to address how, when and where to lease public lands for future coal development, as well as how to secure a fair return to taxpayers from royalties, address climate impacts, and address our domestic energy needs. BLM also implemented a temporary pause on significant new coal leasing while it completes the process.

Colorado's North Fork Valley, by Jim Ramey

The coal program has not been reassessed in almost thirty years and significant changes are necessary to bring the program in line with 21st century energy demands and public expectations for our shared public lands. An updated coal program should also seek ways to assist coal dependent communities in this time of transition – like Colorado's North Fork Valley. We commend BLM's extensive public outreach process and we hope the scoping report due to be released in early January will provide the agency and the public with information to move forward with smart reforms.

While we realize the incoming administration may not agree with all the steps taken to date, we believe that the incredible amount of time, energy, and analysis that has gone into the process thus far should not be wasted. International and domestic market factors point to a decline in coal production and use regardless of a shift in federal energy policy. We hope that smart and sensible reforms are pursued to ensure that the American taxpayer is not being shortchanged and that American coal workers and coal dependent communities are not forgotten amid this transition. We applaud the BLM for initiating this monumental undertaking.

9. Planning for Oil and Gas at a Landscape Level – 3 CAPEs

In 2016 BLM made headway towards smart and balanced landscape level planning for energy development on public lands. This was highlighted by the agency's work on several Master Leasing Plans (MLPs) across the West. The Moab MLP, finalized on December 15th, illustrates how effective this tool can be. The final plan protects Canyonlands and Arches National Parks from nearby development and ensures the region's economy will continue to thrive by managing lands to support recreation, tourism and cultural sites. Also in Utah, the BLM released preliminary alternatives for the San Rafael Desert MLP. The planning area contains valuable wilderness quality lands and endemic bee habitat, and abuts Canyonlands National Park. The preliminary alternatives contain measures that emphasize the importance of protecting these other resources while maintaining ample opportunity for responsible oil and gas development.

In Colorado, the BLM made notable progress on the South Park MLP this year. There, elected officials, sportsmen, the state wildlife agency, local residents and municipal service providers like Denver Water have come together to ensure oil and gas drilling does not harm wildlife habitat, Gold Medal fishing streams, South Park's scenic wildlands, or vitally important drinking water sources for Colorado's front range. And just before the holidays, BLM Colorado announced that the Tres Rios Field Office will be moving forward with the Southwest Colorado MLP. This plan has been largely driven forward by support from the local community who highlighted the need to establish protections for agriculture, Mesa Verde National Park and the renowned mountain biking area Phil's World.

Finally, in the greater Chaco landscape in northwest New Mexico, tribal leaders, industry and conservation groups have encouraged the BLM to establish a workable process to help preserve unique cultural values in an energy-rich region. The BLM is embarking on a joint planning process with the Bureau of Indian Affairs to ensure everyone has a seat at the table in planning for the future of oil and gas development in the Chaco region.

W*e are encouraged by the leaps forward the BLM has taken in the last year to ensure true multiple-use management of our public lands and smart planning for oil and gas development. We hope the BLM will continue to use Master Leasing Plans and other tools for smart from the start oil and gas planning to manage our public lands in a way that balances community needs and other resource values with energy development.*

Chaco Culture National Historical Park, by Ti Hays

10. Greater Sage-grouse Conservation Plan Implementation Moving Forward – 2 CAPEs

Since completion of the range-wide conservation plans last year, BLM has been moving to implement their commitments. Initial guidance has been issued, through seven instruction memoranda, regarding oil and gas leasing and development, grazing permit review priorities, grazing management thresholds and responses, adaptive management triggers, disturbance tracking, effectiveness monitoring, and habitat assessment framework. These memoranda provide key direction for implementing various aspects of managing resources uses and evaluating how the plans are meeting their goals. BLM has also issued a Draft Environmental Impact Statement setting out the results of its analysis of potential mineral withdrawals, following on the recommendations for withdrawal in the conservation plans and developing alternatives based on input from states and other stakeholders.

Additional direction, such as specific mitigation strategies, and implementation, such as through travel planning, is still needed to ensure the success of the conservation plans. Similarly, BLM must move forward on the mineral withdrawals that were recommended as part of conserving the greater sage-grouse and its habitat, and supported the U.S. Fish and Wildlife Service's conclusion that this species no longer warrants protection under the Endangered Species Act.

11. Opportunity Abounds to Protect the North Fork Valley – 1 CAPE

This year, the BLM released its draft plan for the Uncompahgre area in western Colorado, and included an alternative to largely protect the North Fork Valley from oil and gas development. The North Fork Valley, surrounding the North Fork of the Gunnison River, is Colorado's farm-to-table capital and is home to idyllic vineyards and one of the largest concentrations of organic farming in the state, not to mention outstanding hiking, biking, and hunting. The local community rose in opposition to the BLM's plan to issue oil and gas leases in the area in 2012, and came together to develop the "North Fork Alternative Plan," a proposal to the BLM for managing oil and gas development in the scenic valley. The BLM's draft plan would adopt this community vision in one alternative – but not the agency's preferred alternative.

We greatly appreciate that the BLM included the local community's North Fork Alternative Plan in the draft RMP, making room for the agency to ultimately adopt the community vision in the final plan. The BLM must seize this opportunity to develop a final plan for the North Fork Valley that protects agriculture, recreation, the Gunnison River and the livelihoods of the locals from oil and gas development.

Honorable Mention

With transition to new ePlanning system, the BLM aims to increase transparency

Over the past year, the BLM has been transitioning its online National Environmental Policy Act (NEPA) Registers to a new ePlanning system. As a central database for the agency, ePlanning will house land use planning information and NEPA documents across all BLM planning areas. We appreciate that the BLM has invested resources in improving the functionality and accessibility of online information for the general public. From approving the construction of new roads and transmission lines to authorizing off-road vehicle races, the NEPA Registers are the fundamental tool for the public to understand and engage in decisions affecting our public lands. Allowing users to search based on location, filter based on BLM program, and readily view projects that have an open opportunity for public comment are a few of the ePlanning features that improve usability. As the BLM further develops ePlanning webpages, we hope to see relevant mapping information and data for all projects readily available and greater collaboration with stakeholders to explore ways that ePlanning might further support public participation.

Regional Review of West-wide Energy Corridors moves forward in Arizona, California, and Nevada

BLM initiated its first Regional Review of West-wide Energy Corridors this fall for energy corridors in the California desert, western Arizona, and southern Nevada. These Regional Reviews allow BLM to take a second look at existing energy corridors on our public lands and make sure they are helping promote responsible development. To be effective, energy corridors must be functional and attractive for developers, and avoid sensitive resources such as lands with wilderness characteristics and wildlife habitat. Corridors should also help facilitate renewable energy for our nation's energy grid.

As the first Regional Review out the door, there is a tremendous opportunity for BLM to begin engraining a 'smart-from-the-start' approach to planning for transmission lines and other energy infrastructure. In fact, recommendations in Region 1 have the immediate potential to improve ongoing projects and planning, such as the proposed Ten West Link transmission project between Arizona and California, and corridors in the ongoing Las Vegas-Pahrump Resource Management Plan revision. For all corridors in review, BLM should analyze the full range of resources on public lands and put forward recommendations that address serious environmental concerns. Overall, we have welcomed the emphasis BLM has placed on public and stakeholder participation in the process, including the creation of the interactive Energy Corridor Mapping Tool and multiple stakeholder meetings. We look forward to continued work with BLM and other federal agencies in Region 1 and setting a strong example for future Regional Reviews.

From: Nada Culver
To: lmermejo@blm.gov
Subject: TWS BLM Action Center"s annual awards recognizing BLM"s great work
Date: Wednesday, January 4, 2017 5:31:01 PM
Attachments: 2016 CAPE Awards.pdf

Hi Lauren– I wanted to forward our annual awards to you, personally, since we wanted to thank you for all your work on implementing the sage-grouse plans. Thanks so much and hope all is well with you.

Nada Culver

Senior Counsel and Director, BLM Action Center

The Wilderness Society

1660 Wynkoop, #850

Denver, CO 80202

Main: 303-650-5818

Direct: 303-225-4635

Nada_Culver@tws.org

The 2016 CAPE Awards

Celebrating Milestones in Conservation for our Public Lands

The Interior Department hit its stride in 2016, and rolled out some inspired final decisions to cap off the Obama administration's tenure. We were delighted to see years of effort culminate in major progress for stewardship of wilderness quality lands, more balanced oil and gas management, and smart from the start renewable energy planning. And, how we could not spotlight right off the bat finalization of the BLM's new planning rule?! Way to go, BLM, it's been quite a ride.

Unfortunately, there have also been isolated affronts towards our western public lands and the civil servants that steward them for all Americans. In these challenging times, as in years past, we'd like to start our annual year-end celebratory awards to first recognize and appreciate all BLM employees and their commitment to managing our vast shared real estate for the benefit of us all. In coming years, we hope the agency maintains pride in its mission, continues its exciting trajectory towards landscape-level planning and managing for the greatest threat of the future – climate change – and keeps the faith that the American public overwhelmingly supports public lands.

The Comparative Analysis of Particular Excellence (CAPE) rating system, inspired by the superhero-like character of the BLM Action Center team (able to leap tall stacks of RMPs in a single bound!), ranges from one CAPE on the low end (worth a pat on the back) to five CAPEs on the high end (HUGE PROGRESS!!! WAY TO GO!!!).

1. New Rule to Update Planning for Public Lands – 5 CAPEs

Acknowledging that the BLM's land use planning rule has not been substantially updated since the Internet was invented in 1983, the agency finalized updates to the rule this year to help bring planning for our public lands into the 21st century. The rule is part of the BLM's "Planning 2.0" initiative to make planning more cooperative, transparent and efficient. Under the new rule, the public has new and improved opportunities to make their voices heard in management decisions affecting our public lands. The rule also encourages planning at a landscape-scale rather than by political boundaries to better address issues such as wildlife movement corridors and planning for energy development while protecting valuable lands for conservation.

The rule has broad public support, including from many local governments, who appreciate the agency's commitment to expand public participation in land use planning decisions, utilize modern science in assessing land conditions and planning for the future, and strive to make our public lands more resilient

and adaptable. Through this rule, the BLM will be better equipped to design land management plans that truly reflect the needs and desires of the public.

We congratulate the BLM on getting this important and essential rule over the finish line and look forward to seeing it implemented. We are also looking forward to seeing the Planning 2.0 initiative come to completion with the issuance of an updated land use planning handbook to help guide implementation.

2. Wilderness Quality Lands Get the Love They Deserve – 5 CAPEs

In 2016, the BLM continued to make significant progress in its efforts to conduct and maintain inventories of lands with wilderness characteristics. Lands with wilderness characteristics are an important resource that the BLM is obligated to identify under the Federal Land Policy and Management Act of 1976. In the last few years, we've seen the BLM improve its inventory methods while extending the agency's commitments to funding and executing on-the-ground inventory work. The BLM has or is currently updating inventories in planning areas around the country—including the Colorado River Valley and San Luis Valley field offices in Colorado, as well as the Basin and Range National Monument in Nevada.

Basin and Range National Monument, by Bob Wick

In addition to improving inventory methods and conducting field inventories, the BLM is also clarifying its obligations to address wilderness resources in a more consistent manner. This year, the BLM developed statewide guidance in Colorado and Utah to provide more detail on conducting inventories, responding to citizens' inventories, and considering lands with wilderness characteristics in planning efforts, including at the project level. This guidance helps to provide uniformity in how individual field offices meet their obligations to identify and consider lands with wilderness characteristics.

The BLM further committed to stewarding wilderness resources this year through requiring compensatory mitigation for impacts to lands with wilderness characteristics from development. Mitigation is an important tool because it ensures that the public receives compensation for the loss of wilderness quality lands due to projects such as energy development. In the case of the recently approved TransWest Express and Gateway South transmission lines, the BLM will offset impacts to lands with wilderness characteristics by protecting wilderness-quality lands elsewhere.

The BLM has been ushering in a renewed dedication to assessing and protecting wilderness quality public lands over the past few years, and the momentum continued in 2016 thanks to extensive inventory work, state-specific guidance and compensatory mitigation commitments. We expect the BLM will continue with this important work in coming years to meet the agency's obligations under FLPMA.

3. Employing a Commonsense Approach to Oil and Gas Development – 5 CAPEs

For far too long, the oil and gas industry has run the roost on our public lands. The BLM has prioritized oil and gas leasing and drilling at the expense of wildlands, wildlife, clean air and water, recreation and numerous other values of our shared western landscapes. This year, the BLM took the reins and implemented commonsense decisions and reforms to ensure oil and gas has just one seat at the table – along with all other multiple uses. Two of the most impactful decisions were to cancel oil and gas leases in Colorado's Thompson Divide and Montana's Badger-Two Medicine area. In both cases, the BLM responded to strong local support – including ranchers in the Thompson Divide and the Blackfeet Nation in Badger-Two – to rectify a historic wrong and dispose of improperly-issued leases. These landscapes are truly too wild to drill, and we are elated that the BLM has finally taken strong action to protect them for future generations.

The BLM also adopted other commonsense reforms for oil and gas development this year. Chief among them is the "methane rule," which aims to cut natural gas waste and methane pollution from oil and gas operations on public lands. The methane rule will help move us toward agreements to cut U.S. methane emissions by 40 to 45 percent by 2025, building on 2015 U.S. commitments in Paris to reduce emissions and slow global warming. The BLM also finalized Onshore Orders 3, 4 and 5 to accurately measure and report oil and gas produced from federal lands and ensure companies pay full royalties.

Lease cancellations in the Thompson Divide and Badger-Two Medicine areas are landmark victories for nationally important landscapes that should never have been leased in the first place. We are thrilled to see the BLM take a proactive approach to oil and gas management on our public lands by protecting special lands and adopting rules to make drilling safer and smarter, for the climate and for taxpayers.

4. California Desert Plan Protects 4.2 Million Acres – 5 CAPEs

In September, the California BLM released its highly anticipated Record of Decision (ROD) for the Desert Renewable Energy Conservation Plan (DRECP) – a land use planning effort designed to balance smart renewable energy development with land conservation in the California Desert. The signing of the DRECP ROD not only marks the end of the first phase of a broader plan, but also affirms that developing clean energy and protecting wildlife, plants, cultural resources, and recreation opportunities are not mutually exclusive.

The DRECP ROD will protect 4.2 million acres of wild and vulnerable public land, including permanently protecting almost 3 million acres of newly designated California Desert National Conservation Lands. The BLM has already initiated the mineral withdrawal procedures for over 1.3 million acres of these new conservation lands as required by the DRECP ROD. This early action will not only reinforce their designation as protected conservation areas, but help drive DRECP implementation forward. The DRECP ROD also designates carefully selected low-conflict areas dedicated to renewable energy production, including locations that are already adjacent to existing infrastructure like transmission lines and roads. This decision will help elevate and streamline renewable energy production in locations that are attractive to developers and pose limited risk to other resources.

California's Silurian Valley, by Mason Cummings

With the ROD, the plan has set a high bar for future collaborative, multi-agency planning initiatives unfolding across the West. While the work in the California Desert is just beginning, signing the DRECP ROD for Phase I is an important achievement and an essential building block for what is to come from implementation and Phase II.

We enthusiastically support the DRECP ROD, which will protect over 4.2 million of acres of delicate desert resources and pristine landscapes for future generations while helping California meet its renewable energy and climate goals. In a time of serious climate uncertainty, forward-thinking planning measures like the DRECP will help reduce stress and impacts to a vulnerable landscape. Moving forward, the BLM needs to tackle the implementation of the DRECP Phase I head-on, beginning with the recently initiated mineral withdrawal procedures on over 1.3 million acres of designated conservation lands and to diligently assess the landscape for disturbances, as well as helping renewables projects succeed in designated low-conflict areas.

5. BLM Codifies "Smart from the Start" Renewable Energy Program – 5 CAPEs

The BLM has made great strides in advancing responsible renewable energy in the last five years. This includes permitting the first-ever solar projects on public lands, establishing landscape-scale plans to guide development to low-conflict zones across the southwest, and approving over 15,000 megawatts of wind, solar and geothermal development – enough to power over five million homes. In finalizing the Wind and Solar Leasing Rule this year, BLM ensured that smart approaches advanced in recent years will become standard practice going forward. By prioritizing development in designated low-conflict areas, the rule will make the permitting process more efficient in appropriate areas while protecting wildlands and wildlife habitat from development, as demonstrated by the success at the Dry Lake Solar Energy Zone (SEZ) outside Las Vegas. It will also assure taxpayers fair compensation by implementing a competitive leasing process. The rule enjoys wide, bi-partisan support and will facilitate responsible renewables development, helping us protect our natural heritage, tackle the threat of climate change, and benefit western economies.

BLM also continues to make renewable energy zones more attractive to developers and ensure that unavoidable impacts from development are offset through mitigation. The agency finalized two Solar Regional Mitigation Strategies (SRMSs) this year, one for the Dry Lake Valley North (DLVN) SEZ in eastern Nevada and one for Arizona's three SEZs. These build off BLM's pilot SRMS for the Dry Lake SEZ, which proved to be a key element of the agency's success in providing an efficient permitting process for projects in that zone and giving predictability to developers on their mitigation obligations, while investing mitigation resources in strategic conservation actions in the region. BLM has continued to refine its approach to SRMSs, and the DLVN and Arizona SRMSs included improvements such as better addressing uncertainty on mitigation outcomes in fee calculations. We expect that the completion of

these SRMSs will increase the attractiveness of these SEZs for responsible development when market conditions are right.

We applaud the BLM in creating a robust renewable energy program from scratch, culminating with the finalization of the Wind and Solar Leasing Rule this year. We look forward to working with the BLM, project developers, and other stakeholders to put the rule to work, including establishing implementation guidance, helping projects succeed in zones, designating new zones in appropriate areas, and protecting wildlands and wildlife habitat from development. We also look forward to engaging with BLM as it finalizes the SRMSs underway in Colorado, New Mexico, and Utah to facilitate responsible solar development and mitigation in those regions. We hope BLM will continue to refine its approach to SRMSs, including elevating the potential for addressing mitigation obligations by adding or strengthening protections for other public lands in SEZ regions.

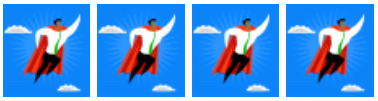
6. Natural Heritage Protected in the Arctic – 5 CAPEs

Hot off the presses, this week the BLM finalized a plan for 6.5 million acres of extremely wild public lands in Alaska's Eastern Interior planning area. The public lands managed by the BLM here include some traditional land of twelve federally recognized tribes, several of which have worked throughout the planning process to ensure their cultural heritage and identities, realized through subsistence lifestyles, are protected. Moose, caribou, grizzly bear, wolverine, and eagles are among the many species that make their home in the Eastern Interior along with dozens of fish species that depend on vast and complex river systems, including the mighty Yukon. The public lands in Alaska's interior also provide outstanding opportunities for hunting, fishing, rafting, and cross-country skiing to winter huts. The final Eastern Interior plan strikes a good balance for conserving important fish and wildlife habitat, providing quality backcountry recreation experiences, and protecting traditional uses. It also identifies and includes measures to protect 3 million acres of lands with wilderness characteristics, and substantially restricts new mining.

This year, the Department of the Interior also decided to protect the Arctic Ocean from oil and gas leasing for the next five years in the Bureau of Ocean Energy Management's 2017-2022 program for offshore oil and gas leasing. The Arctic Ocean provides habitat for numerous species of whales, polar bears, seals, walruses and many populations of fish and birds, and has supported the lives and cultures of Alaska Natives for thousands of years. These places would be gravely threatened by oil and gas leasing, and we are relieved that the Arctic Ocean will be spared for the near future.

We are inspired by the BLM's commitment to protect Alaska's indigenous people and their subsistence cultures, as well as critically important wildlife habitat and epically vast wilderness-quality lands, from destructive mining and development in the Eastern Interior. We are also grateful that the Department of the Interior recognized the Arctic Ocean is not appropriate for oil and gas leasing due to its extraordinarily vulnerable environment and important natural resources.

7. BLM Finalizes Strong Mitigation Manual and Handbook – 4 CAPEs



BLM has demonstrated great leadership in recent years in modernizing its approach to "mitigation", the practice of avoiding and offsetting damage caused to public lands from development. Federal regulations require agencies to follow a five-step hierarchy to address impacts – avoid, minimize, rectify, reduce/eliminate, and compensate – which can be summarized as avoidance, minimization and compensation. Historically, work to mitigate the negative impacts of development such as oil and gas drilling and transmission lines was implemented on a project-by-project basis, which was insufficient to protect our resources and inefficient for permitting projects.

The new policies from BLM and other federal agencies provide guidelines for a broad, landscape-scale approach to balancing development and conservation on public lands. If the policies are used properly, future development projects will avoid impacts to sensitive resources while benefitting from more predictable and efficient permitting processes, and federal agencies will require conservation gains to address and overcome any loss of resources that does occur. Key concepts emphasized in the manual and handbook include a focus on the mitigation hierarchy; use of a landscape-scale approach; setting a no net loss or net benefit outcome for resources that are considered important, scarce, sensitive, or have a protective legal mandate; use of mitigation strategies and plans to establish mitigation standards in advance of development; and emphasizing BLM's preference for achieving compensatory mitigation outcomes in advance of impacts.

The handbook also provides important details on tools BLM can use to durably protect mitigation sites on public lands such as identification of a protective land use plan allocation for the site (e.g. an Area of Critical Environmental Concern) or issuance of a lease or easement to a member of the public to conserve the site (via the authority granted in FLPMA Title III and/or Title V).

As described elsewhere in these awards, we've seen the value of BLM's smarter approach to mitigation in Solar Regional Mitigation Strategies, transmission line project approvals and other contexts. With the manual and handbook now finalized, we look forward to continuing to work with BLM to advance these important mitigation guidelines through land use planning and project permitting. Used properly, they will better balance conservation and development on our public lands while increasing permitting predictability and efficiency.

8. Coal Gets a Reboot – 4 CAPEs

On January 15, 2016, Interior Secretary Sally Jewell signed Secretarial Order 3338 directing the BLM to prepare a Programmatic Environmental Impact Statement (PEIS) to analyze potential leasing and management reforms to the federal coal program. The BLM held six public meetings across the county and solicited comment from stakeholders to gather information on policies and practices that need to be updated. The PEIS seeks to address how, when and where to lease public lands for future coal development, as well as how to secure a fair return to taxpayers from royalties, address climate impacts, and address our domestic energy needs. BLM also implemented a temporary pause on significant new coal leasing while it completes the process.

Colorado's North Fork Valley, by Jim Ramey

The coal program has not been reassessed in almost thirty years and significant changes are necessary to bring the program in line with 21st century energy demands and public expectations for our shared public lands. An updated coal program should also seek ways to assist coal dependent communities in this time of transition – like Colorado's North Fork Valley. We commend BLM's extensive public outreach process and we hope the scoping report due to be released in early January will provide the agency and the public with information to move forward with smart reforms.

While we realize the incoming administration may not agree with all the steps taken to date, we believe that the incredible amount of time, energy, and analysis that has gone into the process thus far should not be wasted. International and domestic market factors point to a decline in coal production and use regardless of a shift in federal energy policy. We hope that smart and sensible reforms are pursued to ensure that the American taxpayer is not being shortchanged and that American coal workers and coal dependent communities are not forgotten amid this transition. We applaud the BLM for initiating this monumental undertaking.

9. Planning for Oil and Gas at a Landscape Level – 3 CAPEs

In 2016 BLM made headway towards smart and balanced landscape level planning for energy development on public lands. This was highlighted by the agency's work on several Master Leasing Plans (MLPs) across the West. The Moab MLP, finalized on December 15th, illustrates how effective this tool can be. The final plan protects Canyonlands and Arches National Parks from nearby development and ensures the region's economy will continue to thrive by managing lands to support recreation, tourism and cultural sites. Also in Utah, the BLM released preliminary alternatives for the San Rafael Desert MLP. The planning area contains valuable wilderness quality lands and endemic bee habitat, and abuts Canyonlands National Park. The preliminary alternatives contain measures that emphasize the importance of protecting these other resources while maintaining ample opportunity for responsible oil and gas development.

In Colorado, the BLM made notable progress on the South Park MLP this year. There, elected officials, sportsmen, the state wildlife agency, local residents and municipal service providers like Denver Water have come together to ensure oil and gas drilling does not harm wildlife habitat, Gold Medal fishing streams, South Park's scenic wildlands, or vitally important drinking water sources for Colorado's front range. And just before the holidays, BLM Colorado announced that the Tres Rios Field Office will be moving forward with the Southwest Colorado MLP. This plan has been largely driven forward by support from the local community who highlighted the need to establish protections for agriculture, Mesa Verde National Park and the renowned mountain biking area Phil's World.

Finally, in the greater Chaco landscape in northwest New Mexico, tribal leaders, industry and conservation groups have encouraged the BLM to establish a workable process to help preserve unique cultural values in an energy-rich region. The BLM is embarking on a joint planning process with the Bureau of Indian Affairs to ensure everyone has a seat at the table in planning for the future of oil and gas development in the Chaco region.

W*e are encouraged by the leaps forward the BLM has taken in the last year to ensure true multiple-use management of our public lands and smart planning for oil and gas development. We hope the BLM will continue to use Master Leasing Plans and other tools for smart from the start oil and gas planning to manage our public lands in a way that balances community needs and other resource values with energy development.*

Chaco Culture National Historical Park, by Ti Hays

10. Greater Sage-grouse Conservation Plan Implementation Moving Forward – 2 CAPEs

Since completion of the range-wide conservation plans last year, BLM has been moving to implement their commitments. Initial guidance has been issued, through seven instruction memoranda, regarding oil and gas leasing and development, grazing permit review priorities, grazing management thresholds and responses, adaptive management triggers, disturbance tracking, effectiveness monitoring, and habitat assessment framework. These memoranda provide key direction for implementing various aspects of managing resources uses and evaluating how the plans are meeting their goals. BLM has also issued a Draft Environmental Impact Statement setting out the results of its analysis of potential mineral withdrawals, following on the recommendations for withdrawal in the conservation plans and developing alternatives based on input from states and other stakeholders.

Additional direction, such as specific mitigation strategies, and implementation, such as through travel planning, is still needed to ensure the success of the conservation plans. Similarly, BLM must move forward on the mineral withdrawals that were recommended as part of conserving the greater sage-grouse and its habitat, and supported the U.S. Fish and Wildlife Service's conclusion that this species no longer warrants protection under the Endangered Species Act.

11. Opportunity Abounds to Protect the North Fork Valley – 1 CAPE

This year, the BLM released its draft plan for the Uncompahgre area in western Colorado, and included an alternative to largely protect the North Fork Valley from oil and gas development. The North Fork Valley, surrounding the North Fork of the Gunnison River, is Colorado's farm-to-table capital and is home to idyllic vineyards and one of the largest concentrations of organic farming in the state, not to mention outstanding hiking, biking, and hunting. The local community rose in opposition to the BLM's plan to issue oil and gas leases in the area in 2012, and came together to develop the "North Fork Alternative Plan," a proposal to the BLM for managing oil and gas development in the scenic valley. The BLM's draft plan would adopt this community vision in one alternative – but not the agency's preferred alternative.

We greatly appreciate that the BLM included the local community's North Fork Alternative Plan in the draft RMP, making room for the agency to ultimately adopt the community vision in the final plan. The BLM must seize this opportunity to develop a final plan for the North Fork Valley that protects agriculture, recreation, the Gunnison River and the livelihoods of the locals from oil and gas development.

Honorable Mention

With transition to new ePlanning system, the BLM aims to increase transparency

Over the past year, the BLM has been transitioning its online National Environmental Policy Act (NEPA) Registers to a new ePlanning system. As a central database for the agency, ePlanning will house land use planning information and NEPA documents across all BLM planning areas. We appreciate that the BLM has invested resources in improving the functionality and accessibility of online information for the general public. From approving the construction of new roads and transmission lines to authorizing off-road vehicle races, the NEPA Registers are the fundamental tool for the public to understand and engage in decisions affecting our public lands. Allowing users to search based on location, filter based on BLM program, and readily view projects that have an open opportunity for public comment are a few of the ePlanning features that improve usability. As the BLM further develops ePlanning webpages, we hope to see relevant mapping information and data for all projects readily available and greater collaboration with stakeholders to explore ways that ePlanning might further support public participation.

Regional Review of West-wide Energy Corridors moves forward in Arizona, California, and Nevada

BLM initiated its first Regional Review of West-wide Energy Corridors this fall for energy corridors in the California desert, western Arizona, and southern Nevada. These Regional Reviews allow BLM to take a second look at existing energy corridors on our public lands and make sure they are helping promote responsible development. To be effective, energy corridors must be functional and attractive for developers, and avoid sensitive resources such as lands with wilderness characteristics and wildlife habitat. Corridors should also help facilitate renewable energy for our nation's energy grid.

As the first Regional Review out the door, there is a tremendous opportunity for BLM to begin engraining a 'smart-from-the-start' approach to planning for transmission lines and other energy infrastructure. In fact, recommendations in Region 1 have the immediate potential to improve ongoing projects and planning, such as the proposed Ten West Link transmission project between Arizona and California, and corridors in the ongoing Las Vegas-Pahrump Resource Management Plan revision. For all corridors in review, BLM should analyze the full range of resources on public lands and put forward recommendations that address serious environmental concerns. Overall, we have welcomed the emphasis BLM has placed on public and stakeholder participation in the process, including the creation of the interactive Energy Corridor Mapping Tool and multiple stakeholder meetings. We look forward to continued work with BLM and other federal agencies in Region 1 and setting a strong example for future Regional Reviews.

From:	Nada Culver
To:	"creed@blm.gov"; Shannon Stewart
Cc:	Pam Eaton
Subject:	TWS BLM Action Center"s annual awards recognizing BLM"s great work
Date:	Wednesday, January 4, 2017 5:39:07 PM
Attachments:	2016 CAPE Awards.pdf

Hi Shannon and Christina – I'm attaching our annual CAPE awards, which highlight BLM's accomplishments from the previous year. We wanted to forward to you, personally, since we wanted to thank you for all your work on the Coal PEIS. Thanks so much and hope all is well with you both.

Nada Culver

Senior Counsel and Director, BLM Action Center

The Wilderness Society

1660 Wynkoop, #850

Denver, CO 80202

Main: 303-650-5818

Direct: 303-225-4635

Nada_Culver@tws.org

The 2016 CAPE Awards

Celebrating Milestones in Conservation for our Public Lands

The Interior Department hit its stride in 2016, and rolled out some inspired final decisions to cap off the Obama administration's tenure. We were delighted to see years of effort culminate in major progress for stewardship of wilderness quality lands, more balanced oil and gas management, and smart from the start renewable energy planning. And, how we could not spotlight right off the bat finalization of the BLM's new planning rule?! Way to go, BLM, it's been quite a ride.

Unfortunately, there have also been isolated affronts towards our western public lands and the civil servants that steward them for all Americans. In these challenging times, as in years past, we'd like to start our annual year-end celebratory awards to first recognize and appreciate all BLM employees and their commitment to managing our vast shared real estate for the benefit of us all. In coming years, we hope the agency maintains pride in its mission, continues its exciting trajectory towards landscape-level planning and managing for the greatest threat of the future – climate change – and keeps the faith that the American public overwhelmingly supports public lands.

The Comparative Analysis of Particular Excellence (CAPE) rating system, inspired by the superhero-like character of the BLM Action Center team (able to leap tall stacks of RMPs in a single bound!), ranges from one CAPE on the low end (worth a pat on the back) to five CAPEs on the high end (HUGE PROGRESS!!! WAY TO GO!!!).

1. New Rule to Update Planning for Public Lands – 5 CAPEs

Acknowledging that the BLM's land use planning rule has not been substantially updated since the Internet was invented in 1983, the agency finalized updates to the rule this year to help bring planning for our public lands into the 21st century. The rule is part of the BLM's "Planning 2.0" initiative to make planning more cooperative, transparent and efficient. Under the new rule, the public has new and improved opportunities to make their voices heard in management decisions affecting our public lands. The rule also encourages planning at a landscape-scale rather than by political boundaries to better address issues such as wildlife movement corridors and planning for energy development while protecting valuable lands for conservation.

The rule has broad public support, including from many local governments, who appreciate the agency's commitment to expand public participation in land use planning decisions, utilize modern science in assessing land conditions and planning for the future, and strive to make our public lands more resilient

and adaptable. Through this rule, the BLM will be better equipped to design land management plans that truly reflect the needs and desires of the public.

We congratulate the BLM on getting this important and essential rule over the finish line and look forward to seeing it implemented. We are also looking forward to seeing the Planning 2.0 initiative come to completion with the issuance of an updated land use planning handbook to help guide implementation.

2. Wilderness Quality Lands Get the Love They Deserve – 5 CAPEs

In 2016, the BLM continued to make significant progress in its efforts to conduct and maintain inventories of lands with wilderness characteristics. Lands with wilderness characteristics are an important resource that the BLM is obligated to identify under the Federal Land Policy and Management Act of 1976. In the last few years, we've seen the BLM improve its inventory methods while extending the agency's commitments to funding and executing on-the-ground inventory work. The BLM has or is currently updating inventories in planning areas around the country—including the Colorado River Valley and San Luis Valley field offices in Colorado, as well as the Basin and Range National Monument in Nevada.

Basin and Range National Monument, by Bob Wick

In addition to improving inventory methods and conducting field inventories, the BLM is also clarifying its obligations to address wilderness resources in a more consistent manner. This year, the BLM developed statewide guidance in Colorado and Utah to provide more detail on conducting inventories, responding to citizens' inventories, and considering lands with wilderness characteristics in planning efforts, including at the project level. This guidance helps to provide uniformity in how individual field offices meet their obligations to identify and consider lands with wilderness characteristics.

The BLM further committed to stewarding wilderness resources this year through requiring compensatory mitigation for impacts to lands with wilderness characteristics from development. Mitigation is an important tool because it ensures that the public receives compensation for the loss of wilderness quality lands due to projects such as energy development. In the case of the recently approved TransWest Express and Gateway South transmission lines, the BLM will offset impacts to lands with wilderness characteristics by protecting wilderness-quality lands elsewhere.

The BLM has been ushering in a renewed dedication to assessing and protecting wilderness quality public lands over the past few years, and the momentum continued in 2016 thanks to extensive inventory work, state-specific guidance and compensatory mitigation commitments. We expect the BLM will continue with this important work in coming years to meet the agency's obligations under FLPMA.

3. Employing a Commonsense Approach to Oil and Gas Development – 5 CAPEs

For far too long, the oil and gas industry has run the roost on our public lands. The BLM has prioritized oil and gas leasing and drilling at the expense of wildlands, wildlife, clean air and water, recreation and numerous other values of our shared western landscapes. This year, the BLM took the reins and implemented commonsense decisions and reforms to ensure oil and gas has just one seat at the table – along with all other multiple uses. Two of the most impactful decisions were to cancel oil and gas leases in Colorado's Thompson Divide and Montana's Badger-Two Medicine area. In both cases, the BLM responded to strong local support – including ranchers in the Thompson Divide and the Blackfeet Nation in Badger-Two – to rectify a historic wrong and dispose of improperly-issued leases. These landscapes are truly too wild to drill, and we are elated that the BLM has finally taken strong action to protect them for future generations.

The BLM also adopted other commonsense reforms for oil and gas development this year. Chief among them is the "methane rule," which aims to cut natural gas waste and methane pollution from oil and gas operations on public lands. The methane rule will help move us toward agreements to cut U.S. methane emissions by 40 to 45 percent by 2025, building on 2015 U.S. commitments in Paris to reduce emissions and slow global warming. The BLM also finalized Onshore Orders 3, 4 and 5 to accurately measure and report oil and gas produced from federal lands and ensure companies pay full royalties.

Lease cancellations in the Thompson Divide and Badger-Two Medicine areas are landmark victories for nationally important landscapes that should never have been leased in the first place. We are thrilled to see the BLM take a proactive approach to oil and gas management on our public lands by protecting special lands and adopting rules to make drilling safer and smarter, for the climate and for taxpayers.

4. California Desert Plan Protects 4.2 Million Acres – 5 CAPEs

In September, the California BLM released its highly anticipated Record of Decision (ROD) for the Desert Renewable Energy Conservation Plan (DRECP) – a land use planning effort designed to balance smart renewable energy development with land conservation in the California Desert. The signing of the DRECP ROD not only marks the end of the first phase of a broader plan, but also affirms that developing clean energy and protecting wildlife, plants, cultural resources, and recreation opportunities are not mutually exclusive.

The DRECP ROD will protect 4.2 million acres of wild and vulnerable public land, including permanently protecting almost 3 million acres of newly designated California Desert National Conservation Lands. The BLM has already initiated the mineral withdrawal procedures for over 1.3 million acres of these new conservation lands as required by the DRECP ROD. This early action will not only reinforce their designation as protected conservation areas, but help drive DRECP implementation forward. The DRECP ROD also designates carefully selected low-conflict areas dedicated to renewable energy production, including locations that are already adjacent to existing infrastructure like transmission lines and roads. This decision will help elevate and streamline renewable energy production in locations that are attractive to developers and pose limited risk to other resources.

California's Silurian Valley, by Mason Cummings

With the ROD, the plan has set a high bar for future collaborative, multi-agency planning initiatives unfolding across the West. While the work in the California Desert is just beginning, signing the DRECP ROD for Phase I is an important achievement and an essential building block for what is to come from implementation and Phase II.

We enthusiastically support the DRECP ROD, which will protect over 4.2 million of acres of delicate desert resources and pristine landscapes for future generations while helping California meet its renewable energy and climate goals. In a time of serious climate uncertainty, forward-thinking planning measures like the DRECP will help reduce stress and impacts to a vulnerable landscape. Moving forward, the BLM needs to tackle the implementation of the DRECP Phase I head-on, beginning with the recently initiated mineral withdrawal procedures on over 1.3 million acres of designated conservation lands and to diligently assess the landscape for disturbances, as well as helping renewables projects succeed in designated low-conflict areas.

5. BLM Codifies "Smart from the Start" Renewable Energy Program – 5 CAPEs

The BLM has made great strides in advancing responsible renewable energy in the last five years. This includes permitting the first-ever solar projects on public lands, establishing landscape-scale plans to guide development to low-conflict zones across the southwest, and approving over 15,000 megawatts of wind, solar and geothermal development – enough to power over five million homes. In finalizing the Wind and Solar Leasing Rule this year, BLM ensured that smart approaches advanced in recent years will become standard practice going forward. By prioritizing development in designated low-conflict areas, the rule will make the permitting process more efficient in appropriate areas while protecting wildlands and wildlife habitat from development, as demonstrated by the success at the Dry Lake Solar Energy Zone (SEZ) outside Las Vegas. It will also assure taxpayers fair compensation by implementing a competitive leasing process. The rule enjoys wide, bi-partisan support and will facilitate responsible renewables development, helping us protect our natural heritage, tackle the threat of climate change, and benefit western economies.

BLM also continues to make renewable energy zones more attractive to developers and ensure that unavoidable impacts from development are offset through mitigation. The agency finalized two Solar Regional Mitigation Strategies (SRMSs) this year, one for the Dry Lake Valley North (DLVN) SEZ in eastern Nevada and one for Arizona's three SEZs. These build off BLM's pilot SRMS for the Dry Lake SEZ, which proved to be a key element of the agency's success in providing an efficient permitting process for projects in that zone and giving predictability to developers on their mitigation obligations, while investing mitigation resources in strategic conservation actions in the region. BLM has continued to refine its approach to SRMSs, and the DLVN and Arizona SRMSs included improvements such as better addressing uncertainty on mitigation outcomes in fee calculations. We expect that the completion of

these SRMSs will increase the attractiveness of these SEZs for responsible development when market conditions are right.

We applaud the BLM in creating a robust renewable energy program from scratch, culminating with the finalization of the Wind and Solar Leasing Rule this year. We look forward to working with the BLM, project developers, and other stakeholders to put the rule to work, including establishing implementation guidance, helping projects succeed in zones, designating new zones in appropriate areas, and protecting wildlands and wildlife habitat from development. We also look forward to engaging with BLM as it finalizes the SRMSs underway in Colorado, New Mexico, and Utah to facilitate responsible solar development and mitigation in those regions. We hope BLM will continue to refine its approach to SRMSs, including elevating the potential for addressing mitigation obligations by adding or strengthening protections for other public lands in SEZ regions.

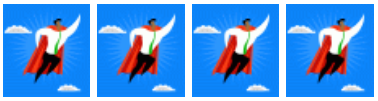
6. Natural Heritage Protected in the Arctic – 5 CAPEs

Hot off the presses, this week the BLM finalized a plan for 6.5 million acres of extremely wild public lands in Alaska's Eastern Interior planning area. The public lands managed by the BLM here include some traditional land of twelve federally recognized tribes, several of which have worked throughout the planning process to ensure their cultural heritage and identities, realized through subsistence lifestyles, are protected. Moose, caribou, grizzly bear, wolverine, and eagles are among the many species that make their home in the Eastern Interior along with dozens of fish species that depend on vast and complex river systems, including the mighty Yukon. The public lands in Alaska's interior also provide outstanding opportunities for hunting, fishing, rafting, and cross-country skiing to winter huts. The final Eastern Interior plan strikes a good balance for conserving important fish and wildlife habitat, providing quality backcountry recreation experiences, and protecting traditional uses. It also identifies and includes measures to protect 3 million acres of lands with wilderness characteristics, and substantially restricts new mining.

This year, the Department of the Interior also decided to protect the Arctic Ocean from oil and gas leasing for the next five years in the Bureau of Ocean Energy Management's 2017-2022 program for offshore oil and gas leasing. The Arctic Ocean provides habitat for numerous species of whales, polar bears, seals, walruses and many populations of fish and birds, and has supported the lives and cultures of Alaska Natives for thousands of years. These places would be gravely threatened by oil and gas leasing, and we are relieved that the Arctic Ocean will be spared for the near future.

We are inspired by the BLM's commitment to protect Alaska's indigenous people and their subsistence cultures, as well as critically important wildlife habitat and epically vast wilderness-quality lands, from destructive mining and development in the Eastern Interior. We are also grateful that the Department of the Interior recognized the Arctic Ocean is not appropriate for oil and gas leasing due to its extraordinarily vulnerable environment and important natural resources.

7. BLM Finalizes Strong Mitigation Manual and Handbook – 4 CAPEs



BLM has demonstrated great leadership in recent years in modernizing its approach to "mitigation", the practice of avoiding and offsetting damage caused to public lands from development. Federal regulations require agencies to follow a five-step hierarchy to address impacts – avoid, minimize, rectify, reduce/eliminate, and compensate – which can be summarized as avoidance, minimization and compensation. Historically, work to mitigate the negative impacts of development such as oil and gas drilling and transmission lines was implemented on a project-by-project basis, which was insufficient to protect our resources and inefficient for permitting projects.

The new policies from BLM and other federal agencies provide guidelines for a broad, landscape-scale approach to balancing development and conservation on public lands. If the policies are used properly, future development projects will avoid impacts to sensitive resources while benefitting from more predictable and efficient permitting processes, and federal agencies will require conservation gains to address and overcome any loss of resources that does occur. Key concepts emphasized in the manual and handbook include a focus on the mitigation hierarchy; use of a landscape-scale approach; setting a no net loss or net benefit outcome for resources that are considered important, scarce, sensitive, or have a protective legal mandate; use of mitigation strategies and plans to establish mitigation standards in advance of development; and emphasizing BLM's preference for achieving compensatory mitigation outcomes in advance of impacts.

The handbook also provides important details on tools BLM can use to durably protect mitigation sites on public lands such as identification of a protective land use plan allocation for the site (e.g. an Area of Critical Environmental Concern) or issuance of a lease or easement to a member of the public to conserve the site (via the authority granted in FLPMA Title III and/or Title V).

As described elsewhere in these awards, we've seen the value of BLM's smarter approach to mitigation in Solar Regional Mitigation Strategies, transmission line project approvals and other contexts. With the manual and handbook now finalized, we look forward to continuing to work with BLM to advance these important mitigation guidelines through land use planning and project permitting. Used properly, they will better balance conservation and development on our public lands while increasing permitting predictability and efficiency.

8. Coal Gets a Reboot – 4 CAPEs

On January 15, 2016, Interior Secretary Sally Jewell signed Secretarial Order 3338 directing the BLM to prepare a Programmatic Environmental Impact Statement (PEIS) to analyze potential leasing and management reforms to the federal coal program. The BLM held six public meetings across the county and solicited comment from stakeholders to gather information on policies and practices that need to be updated. The PEIS seeks to address how, when and where to lease public lands for future coal development, as well as how to secure a fair return to taxpayers from royalties, address climate impacts, and address our domestic energy needs. BLM also implemented a temporary pause on significant new coal leasing while it completes the process.

Colorado's North Fork Valley, by Jim Ramey

The coal program has not been reassessed in almost thirty years and significant changes are necessary to bring the program in line with 21st century energy demands and public expectations for our shared public lands. An updated coal program should also seek ways to assist coal dependent communities in this time of transition – like Colorado's North Fork Valley. We commend BLM's extensive public outreach process and we hope the scoping report due to be released in early January will provide the agency and the public with information to move forward with smart reforms.

While we realize the incoming administration may not agree with all the steps taken to date, we believe that the incredible amount of time, energy, and analysis that has gone into the process thus far should not be wasted. International and domestic market factors point to a decline in coal production and use regardless of a shift in federal energy policy. We hope that smart and sensible reforms are pursued to ensure that the American taxpayer is not being shortchanged and that American coal workers and coal dependent communities are not forgotten amid this transition. We applaud the BLM for initiating this monumental undertaking.

9. Planning for Oil and Gas at a Landscape Level – 3 CAPEs

In 2016 BLM made headway towards smart and balanced landscape level planning for energy development on public lands. This was highlighted by the agency's work on several Master Leasing Plans (MLPs) across the West. The Moab MLP, finalized on December 15th, illustrates how effective this tool can be. The final plan protects Canyonlands and Arches National Parks from nearby development and ensures the region's economy will continue to thrive by managing lands to support recreation, tourism and cultural sites. Also in Utah, the BLM released preliminary alternatives for the San Rafael Desert MLP. The planning area contains valuable wilderness quality lands and endemic bee habitat, and abuts Canyonlands National Park. The preliminary alternatives contain measures that emphasize the importance of protecting these other resources while maintaining ample opportunity for responsible oil and gas development.

In Colorado, the BLM made notable progress on the South Park MLP this year. There, elected officials, sportsmen, the state wildlife agency, local residents and municipal service providers like Denver Water have come together to ensure oil and gas drilling does not harm wildlife habitat, Gold Medal fishing streams, South Park's scenic wildlands, or vitally important drinking water sources for Colorado's front range. And just before the holidays, BLM Colorado announced that the Tres Rios Field Office will be moving forward with the Southwest Colorado MLP. This plan has been largely driven forward by support from the local community who highlighted the need to establish protections for agriculture, Mesa Verde National Park and the renowned mountain biking area Phil's World.

Finally, in the greater Chaco landscape in northwest New Mexico, tribal leaders, industry and conservation groups have encouraged the BLM to establish a workable process to help preserve unique cultural values in an energy-rich region. The BLM is embarking on a joint planning process with the Bureau of Indian Affairs to ensure everyone has a seat at the table in planning for the future of oil and gas development in the Chaco region.

W*e are encouraged by the leaps forward the BLM has taken in the last year to ensure true multiple-use management of our public lands and smart planning for oil and gas development. We hope the BLM will continue to use Master Leasing Plans and other tools for smart from the start oil and gas planning to manage our public lands in a way that balances community needs and other resource values with energy development.*

Chaco Culture National Historical Park, by Ti Hays

10. Greater Sage-grouse Conservation Plan Implementation Moving Forward – 2 CAPEs

Since completion of the range-wide conservation plans last year, BLM has been moving to implement their commitments. Initial guidance has been issued, through seven instruction memoranda, regarding oil and gas leasing and development, grazing permit review priorities, grazing management thresholds and responses, adaptive management triggers, disturbance tracking, effectiveness monitoring, and habitat assessment framework. These memoranda provide key direction for implementing various aspects of managing resources uses and evaluating how the plans are meeting their goals. BLM has also issued a Draft Environmental Impact Statement setting out the results of its analysis of potential mineral withdrawals, following on the recommendations for withdrawal in the conservation plans and developing alternatives based on input from states and other stakeholders.

Additional direction, such as specific mitigation strategies, and implementation, such as through travel planning, is still needed to ensure the success of the conservation plans. Similarly, BLM must move forward on the mineral withdrawals that were recommended as part of conserving the greater sage-grouse and its habitat, and supported the U.S. Fish and Wildlife Service's conclusion that this species no longer warrants protection under the Endangered Species Act.

11. Opportunity Abounds to Protect the North Fork Valley – 1 CAPE

This year, the BLM released its draft plan for the Uncompahgre area in western Colorado, and included an alternative to largely protect the North Fork Valley from oil and gas development. The North Fork Valley, surrounding the North Fork of the Gunnison River, is Colorado's farm-to-table capital and is home to idyllic vineyards and one of the largest concentrations of organic farming in the state, not to mention outstanding hiking, biking, and hunting. The local community rose in opposition to the BLM's plan to issue oil and gas leases in the area in 2012, and came together to develop the "North Fork Alternative Plan," a proposal to the BLM for managing oil and gas development in the scenic valley. The BLM's draft plan would adopt this community vision in one alternative – but not the agency's preferred alternative.

We greatly appreciate that the BLM included the local community's North Fork Alternative Plan in the draft RMP, making room for the agency to ultimately adopt the community vision in the final plan. The BLM must seize this opportunity to develop a final plan for the North Fork Valley that protects agriculture, recreation, the Gunnison River and the livelihoods of the locals from oil and gas development.

Honorable Mention

With transition to new ePlanning system, the BLM aims to increase transparency

Over the past year, the BLM has been transitioning its online National Environmental Policy Act (NEPA) Registers to a new ePlanning system. As a central database for the agency, ePlanning will house land use planning information and NEPA documents across all BLM planning areas. We appreciate that the BLM has invested resources in improving the functionality and accessibility of online information for the general public. From approving the construction of new roads and transmission lines to authorizing off-road vehicle races, the NEPA Registers are the fundamental tool for the public to understand and engage in decisions affecting our public lands. Allowing users to search based on location, filter based on BLM program, and readily view projects that have an open opportunity for public comment are a few of the ePlanning features that improve usability. As the BLM further develops ePlanning webpages, we hope to see relevant mapping information and data for all projects readily available and greater collaboration with stakeholders to explore ways that ePlanning might further support public participation.

Regional Review of West-wide Energy Corridors moves forward in Arizona, California, and Nevada

BLM initiated its first Regional Review of West-wide Energy Corridors this fall for energy corridors in the California desert, western Arizona, and southern Nevada. These Regional Reviews allow BLM to take a second look at existing energy corridors on our public lands and make sure they are helping promote responsible development. To be effective, energy corridors must be functional and attractive for developers, and avoid sensitive resources such as lands with wilderness characteristics and wildlife habitat. Corridors should also help facilitate renewable energy for our nation's energy grid.

As the first Regional Review out the door, there is a tremendous opportunity for BLM to begin engraining a 'smart-from-the-start' approach to planning for transmission lines and other energy infrastructure. In fact, recommendations in Region 1 have the immediate potential to improve ongoing projects and planning, such as the proposed Ten West Link transmission project between Arizona and California, and corridors in the ongoing Las Vegas-Pahrump Resource Management Plan revision. For all corridors in review, BLM should analyze the full range of resources on public lands and put forward recommendations that address serious environmental concerns. Overall, we have welcomed the emphasis BLM has placed on public and stakeholder participation in the process, including the creation of the interactive Energy Corridor Mapping Tool and multiple stakeholder meetings. We look forward to continued work with BLM and other federal agencies in Region 1 and setting a strong example for future Regional Reviews.

From: Nada Culver
To: "rwelch@blm.gov"; Gregory Shoop; Bagley, Lonny
Subject: TWS BLM Action Center"s annual awards recognizing BLM"s great work
Date: Wednesday, January 4, 2017 5:48:40 PM
Attachments: 2016 CAPE Awards.pdf

Dear Ruth, Greg and Lonny – I'm attaching our annual CAPE awards, which highlight BLM's accomplishments from the previous year. We wanted to forward to you, personally, since we wanted to thank you for all your work on the Tres Rios MLP and support for the consideration of the North Fork Alternative in the Uncompahgre MLP. We're also noting Colorado's accomplishments in protecting lands with wilderness characteristics. It's been an impressive year for Colorado BLM. Hope you're enjoying 2017 so far.

Nada Culver

Senior Counsel and Director, BLM Action Center

The Wilderness Society

1660 Wynkoop, #850

Denver, CO 80202

Main: 303-650-5818

Direct: 303-225-4635

Nada_Culver@tws.org

The 2016 CAPE Awards

Celebrating Milestones in Conservation for our Public Lands

The Interior Department hit its stride in 2016, and rolled out some inspired final decisions to cap off the Obama administration's tenure. We were delighted to see years of effort culminate in major progress for stewardship of wilderness quality lands, more balanced oil and gas management, and smart from the start renewable energy planning. And, how we could not spotlight right off the bat finalization of the BLM's new planning rule?! Way to go, BLM, it's been quite a ride.

Unfortunately, there have also been isolated affronts towards our western public lands and the civil servants that steward them for all Americans. In these challenging times, as in years past, we'd like to start our annual year-end celebratory awards to first recognize and appreciate all BLM employees and their commitment to managing our vast shared real estate for the benefit of us all. In coming years, we hope the agency maintains pride in its mission, continues its exciting trajectory towards landscape-level planning and managing for the greatest threat of the future – climate change – and keeps the faith that the American public overwhelmingly supports public lands.

The Comparative Analysis of Particular Excellence (CAPE) rating system, inspired by the superhero-like character of the BLM Action Center team (able to leap tall stacks of RMPs in a single bound!), ranges from one CAPE on the low end (worth a pat on the back) to five CAPEs on the high end (HUGE PROGRESS!!! WAY TO GO!!!).

1. New Rule to Update Planning for Public Lands – 5 CAPEs

Acknowledging that the BLM's land use planning rule has not been substantially updated since the Internet was invented in 1983, the agency finalized updates to the rule this year to help bring planning for our public lands into the 21st century. The rule is part of the BLM's "Planning 2.0" initiative to make planning more cooperative, transparent and efficient. Under the new rule, the public has new and improved opportunities to make their voices heard in management decisions affecting our public lands. The rule also encourages planning at a landscape-scale rather than by political boundaries to better address issues such as wildlife movement corridors and planning for energy development while protecting valuable lands for conservation.

The rule has broad public support, including from many local governments, who appreciate the agency's commitment to expand public participation in land use planning decisions, utilize modern science in assessing land conditions and planning for the future, and strive to make our public lands more resilient

and adaptable. Through this rule, the BLM will be better equipped to design land management plans that truly reflect the needs and desires of the public.

We congratulate the BLM on getting this important and essential rule over the finish line and look forward to seeing it implemented. We are also looking forward to seeing the Planning 2.0 initiative come to completion with the issuance of an updated land use planning handbook to help guide implementation.

2. Wilderness Quality Lands Get the Love They Deserve – 5 CAPEs

In 2016, the BLM continued to make significant progress in its efforts to conduct and maintain inventories of lands with wilderness characteristics. Lands with wilderness characteristics are an important resource that the BLM is obligated to identify under the Federal Land Policy and Management Act of 1976. In the last few years, we've seen the BLM improve its inventory methods while extending the agency's commitments to funding and executing on-the-ground inventory work. The BLM has or is currently updating inventories in planning areas around the country—including the Colorado River Valley and San Luis Valley field offices in Colorado, as well as the Basin and Range National Monument in Nevada.

Basin and Range National Monument, by Bob Wick

In addition to improving inventory methods and conducting field inventories, the BLM is also clarifying its obligations to address wilderness resources in a more consistent manner. This year, the BLM developed statewide guidance in Colorado and Utah to provide more detail on conducting inventories, responding to citizens' inventories, and considering lands with wilderness characteristics in planning efforts, including at the project level. This guidance helps to provide uniformity in how individual field offices meet their obligations to identify and consider lands with wilderness characteristics.

The BLM further committed to stewarding wilderness resources this year through requiring compensatory mitigation for impacts to lands with wilderness characteristics from development. Mitigation is an important tool because it ensures that the public receives compensation for the loss of wilderness quality lands due to projects such as energy development. In the case of the recently approved TransWest Express and Gateway South transmission lines, the BLM will offset impacts to lands with wilderness characteristics by protecting wilderness-quality lands elsewhere.

The BLM has been ushering in a renewed dedication to assessing and protecting wilderness quality public lands over the past few years, and the momentum continued in 2016 thanks to extensive inventory work, state-specific guidance and compensatory mitigation commitments. We expect the BLM will continue with this important work in coming years to meet the agency's obligations under FLPMA.

3. Employing a Commonsense Approach to Oil and Gas Development – 5 CAPEs

For far too long, the oil and gas industry has run the roost on our public lands. The BLM has prioritized oil and gas leasing and drilling at the expense of wildlands, wildlife, clean air and water, recreation and numerous other values of our shared western landscapes. This year, the BLM took the reins and implemented commonsense decisions and reforms to ensure oil and gas has just one seat at the table – along with all other multiple uses. Two of the most impactful decisions were to cancel oil and gas leases in Colorado's Thompson Divide and Montana's Badger-Two Medicine area. In both cases, the BLM responded to strong local support – including ranchers in the Thompson Divide and the Blackfeet Nation in Badger-Two – to rectify a historic wrong and dispose of improperly-issued leases. These landscapes are truly too wild to drill, and we are elated that the BLM has finally taken strong action to protect them for future generations.

The BLM also adopted other commonsense reforms for oil and gas development this year. Chief among them is the "methane rule," which aims to cut natural gas waste and methane pollution from oil and gas operations on public lands. The methane rule will help move us toward agreements to cut U.S. methane emissions by 40 to 45 percent by 2025, building on 2015 U.S. commitments in Paris to reduce emissions and slow global warming. The BLM also finalized Onshore Orders 3, 4 and 5 to accurately measure and report oil and gas produced from federal lands and ensure companies pay full royalties.

Lease cancellations in the Thompson Divide and Badger-Two Medicine areas are landmark victories for nationally important landscapes that should never have been leased in the first place. We are thrilled to see the BLM take a proactive approach to oil and gas management on our public lands by protecting special lands and adopting rules to make drilling safer and smarter, for the climate and for taxpayers.

4. California Desert Plan Protects 4.2 Million Acres – 5 CAPEs

In September, the California BLM released its highly anticipated Record of Decision (ROD) for the Desert Renewable Energy Conservation Plan (DRECP) – a land use planning effort designed to balance smart renewable energy development with land conservation in the California Desert. The signing of the DRECP ROD not only marks the end of the first phase of a broader plan, but also affirms that developing clean energy and protecting wildlife, plants, cultural resources, and recreation opportunities are not mutually exclusive.

The DRECP ROD will protect 4.2 million acres of wild and vulnerable public land, including permanently protecting almost 3 million acres of newly designated California Desert National Conservation Lands. The BLM has already initiated the mineral withdrawal procedures for over 1.3 million acres of these new conservation lands as required by the DRECP ROD. This early action will not only reinforce their designation as protected conservation areas, but help drive DRECP implementation forward. The DRECP ROD also designates carefully selected low-conflict areas dedicated to renewable energy production, including locations that are already adjacent to existing infrastructure like transmission lines and roads. This decision will help elevate and streamline renewable energy production in locations that are attractive to developers and pose limited risk to other resources.

California's Silurian Valley, by Mason Cummings

With the ROD, the plan has set a high bar for future collaborative, multi-agency planning initiatives unfolding across the West. While the work in the California Desert is just beginning, signing the DRECP ROD for Phase I is an important achievement and an essential building block for what is to come from implementation and Phase II.

We enthusiastically support the DRECP ROD, which will protect over 4.2 million of acres of delicate desert resources and pristine landscapes for future generations while helping California meet its renewable energy and climate goals. In a time of serious climate uncertainty, forward-thinking planning measures like the DRECP will help reduce stress and impacts to a vulnerable landscape. Moving forward, the BLM needs to tackle the implementation of the DRECP Phase I head-on, beginning with the recently initiated mineral withdrawal procedures on over 1.3 million acres of designated conservation lands and to diligently assess the landscape for disturbances, as well as helping renewables projects succeed in designated low-conflict areas.

5. BLM Codifies "Smart from the Start" Renewable Energy Program – 5 CAPEs

The BLM has made great strides in advancing responsible renewable energy in the last five years. This includes permitting the first-ever solar projects on public lands, establishing landscape-scale plans to guide development to low-conflict zones across the southwest, and approving over 15,000 megawatts of wind, solar and geothermal development – enough to power over five million homes. In finalizing the Wind and Solar Leasing Rule this year, BLM ensured that smart approaches advanced in recent years will become standard practice going forward. By prioritizing development in designated low-conflict areas, the rule will make the permitting process more efficient in appropriate areas while protecting wildlands and wildlife habitat from development, as demonstrated by the success at the Dry Lake Solar Energy Zone (SEZ) outside Las Vegas. It will also assure taxpayers fair compensation by implementing a competitive leasing process. The rule enjoys wide, bi-partisan support and will facilitate responsible renewables development, helping us protect our natural heritage, tackle the threat of climate change, and benefit western economies.

BLM also continues to make renewable energy zones more attractive to developers and ensure that unavoidable impacts from development are offset through mitigation. The agency finalized two Solar Regional Mitigation Strategies (SRMSs) this year, one for the Dry Lake Valley North (DLVN) SEZ in eastern Nevada and one for Arizona's three SEZs. These build off BLM's pilot SRMS for the Dry Lake SEZ, which proved to be a key element of the agency's success in providing an efficient permitting process for projects in that zone and giving predictability to developers on their mitigation obligations, while investing mitigation resources in strategic conservation actions in the region. BLM has continued to refine its approach to SRMSs, and the DLVN and Arizona SRMSs included improvements such as better addressing uncertainty on mitigation outcomes in fee calculations. We expect that the completion of

these SRMSs will increase the attractiveness of these SEZs for responsible development when market conditions are right.

We applaud the BLM in creating a robust renewable energy program from scratch, culminating with the finalization of the Wind and Solar Leasing Rule this year. We look forward to working with the BLM, project developers, and other stakeholders to put the rule to work, including establishing implementation guidance, helping projects succeed in zones, designating new zones in appropriate areas, and protecting wildlands and wildlife habitat from development. We also look forward to engaging with BLM as it finalizes the SRMSs underway in Colorado, New Mexico, and Utah to facilitate responsible solar development and mitigation in those regions. We hope BLM will continue to refine its approach to SRMSs, including elevating the potential for addressing mitigation obligations by adding or strengthening protections for other public lands in SEZ regions.

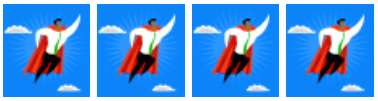
6. Natural Heritage Protected in the Arctic – 5 CAPEs

Hot off the presses, this week the BLM finalized a plan for 6.5 million acres of extremely wild public lands in Alaska's Eastern Interior planning area. The public lands managed by the BLM here include some traditional land of twelve federally recognized tribes, several of which have worked throughout the planning process to ensure their cultural heritage and identities, realized through subsistence lifestyles, are protected. Moose, caribou, grizzly bear, wolverine, and eagles are among the many species that make their home in the Eastern Interior along with dozens of fish species that depend on vast and complex river systems, including the mighty Yukon. The public lands in Alaska's interior also provide outstanding opportunities for hunting, fishing, rafting, and cross-country skiing to winter huts. The final Eastern Interior plan strikes a good balance for conserving important fish and wildlife habitat, providing quality backcountry recreation experiences, and protecting traditional uses. It also identifies and includes measures to protect 3 million acres of lands with wilderness characteristics, and substantially restricts new mining.

This year, the Department of the Interior also decided to protect the Arctic Ocean from oil and gas leasing for the next five years in the Bureau of Ocean Energy Management's 2017-2022 program for offshore oil and gas leasing. The Arctic Ocean provides habitat for numerous species of whales, polar bears, seals, walruses and many populations of fish and birds, and has supported the lives and cultures of Alaska Natives for thousands of years. These places would be gravely threatened by oil and gas leasing, and we are relieved that the Arctic Ocean will be spared for the near future.

We are inspired by the BLM's commitment to protect Alaska's indigenous people and their subsistence cultures, as well as critically important wildlife habitat and epically vast wilderness-quality lands, from destructive mining and development in the Eastern Interior. We are also grateful that the Department of the Interior recognized the Arctic Ocean is not appropriate for oil and gas leasing due to its extraordinarily vulnerable environment and important natural resources.

7. BLM Finalizes Strong Mitigation Manual and Handbook – 4 CAPEs



BLM has demonstrated great leadership in recent years in modernizing its approach to "mitigation", the practice of avoiding and offsetting damage caused to public lands from development. Federal regulations require agencies to follow a five-step hierarchy to address impacts – avoid, minimize, rectify, reduce/eliminate, and compensate – which can be summarized as avoidance, minimization and compensation. Historically, work to mitigate the negative impacts of development such as oil and gas drilling and transmission lines was implemented on a project-by-project basis, which was insufficient to protect our resources and inefficient for permitting projects.

The new policies from BLM and other federal agencies provide guidelines for a broad, landscape-scale approach to balancing development and conservation on public lands. If the policies are used properly, future development projects will avoid impacts to sensitive resources while benefitting from more predictable and efficient permitting processes, and federal agencies will require conservation gains to address and overcome any loss of resources that does occur. Key concepts emphasized in the manual and handbook include a focus on the mitigation hierarchy; use of a landscape-scale approach; setting a no net loss or net benefit outcome for resources that are considered important, scarce, sensitive, or have a protective legal mandate; use of mitigation strategies and plans to establish mitigation standards in advance of development; and emphasizing BLM's preference for achieving compensatory mitigation outcomes in advance of impacts.

The handbook also provides important details on tools BLM can use to durably protect mitigation sites on public lands such as identification of a protective land use plan allocation for the site (e.g. an Area of Critical Environmental Concern) or issuance of a lease or easement to a member of the public to conserve the site (via the authority granted in FLPMA Title III and/or Title V).

As described elsewhere in these awards, we've seen the value of BLM's smarter approach to mitigation in Solar Regional Mitigation Strategies, transmission line project approvals and other contexts. With the manual and handbook now finalized, we look forward to continuing to work with BLM to advance these important mitigation guidelines through land use planning and project permitting. Used properly, they will better balance conservation and development on our public lands while increasing permitting predictability and efficiency.

8. Coal Gets a Reboot – 4 CAPEs

On January 15, 2016, Interior Secretary Sally Jewell signed Secretarial Order 3338 directing the BLM to prepare a Programmatic Environmental Impact Statement (PEIS) to analyze potential leasing and management reforms to the federal coal program. The BLM held six public meetings across the county and solicited comment from stakeholders to gather information on policies and practices that need to be updated. The PEIS seeks to address how, when and where to lease public lands for future coal development, as well as how to secure a fair return to taxpayers from royalties, address climate impacts, and address our domestic energy needs. BLM also implemented a temporary pause on significant new coal leasing while it completes the process.

Colorado's North Fork Valley, by Jim Ramey

The coal program has not been reassessed in almost thirty years and significant changes are necessary to bring the program in line with 21st century energy demands and public expectations for our shared public lands. An updated coal program should also seek ways to assist coal dependent communities in this time of transition – like Colorado's North Fork Valley. We commend BLM's extensive public outreach process and we hope the scoping report due to be released in early January will provide the agency and the public with information to move forward with smart reforms.

While we realize the incoming administration may not agree with all the steps taken to date, we believe that the incredible amount of time, energy, and analysis that has gone into the process thus far should not be wasted. International and domestic market factors point to a decline in coal production and use regardless of a shift in federal energy policy. We hope that smart and sensible reforms are pursued to ensure that the American taxpayer is not being shortchanged and that American coal workers and coal dependent communities are not forgotten amid this transition. We applaud the BLM for initiating this monumental undertaking.

9. Planning for Oil and Gas at a Landscape Level – 3 CAPEs

In 2016 BLM made headway towards smart and balanced landscape level planning for energy development on public lands. This was highlighted by the agency's work on several Master Leasing Plans (MLPs) across the West. The Moab MLP, finalized on December 15th, illustrates how effective this tool can be. The final plan protects Canyonlands and Arches National Parks from nearby development and ensures the region's economy will continue to thrive by managing lands to support recreation, tourism and cultural sites. Also in Utah, the BLM released preliminary alternatives for the San Rafael Desert MLP. The planning area contains valuable wilderness quality lands and endemic bee habitat, and abuts Canyonlands National Park. The preliminary alternatives contain measures that emphasize the importance of protecting these other resources while maintaining ample opportunity for responsible oil and gas development.

In Colorado, the BLM made notable progress on the South Park MLP this year. There, elected officials, sportsmen, the state wildlife agency, local residents and municipal service providers like Denver Water have come together to ensure oil and gas drilling does not harm wildlife habitat, Gold Medal fishing streams, South Park's scenic wildlands, or vitally important drinking water sources for Colorado's front range. And just before the holidays, BLM Colorado announced that the Tres Rios Field Office will be moving forward with the Southwest Colorado MLP. This plan has been largely driven forward by support from the local community who highlighted the need to establish protections for agriculture, Mesa Verde National Park and the renowned mountain biking area Phil's World.

Finally, in the greater Chaco landscape in northwest New Mexico, tribal leaders, industry and conservation groups have encouraged the BLM to establish a workable process to help preserve unique cultural values in an energy-rich region. The BLM is embarking on a joint planning process with the Bureau of Indian Affairs to ensure everyone has a seat at the table in planning for the future of oil and gas development in the Chaco region.

W*e are encouraged by the leaps forward the BLM has taken in the last year to ensure true multiple-use management of our public lands and smart planning for oil and gas development. We hope the BLM will continue to use Master Leasing Plans and other tools for smart from the start oil and gas planning to manage our public lands in a way that balances community needs and other resource values with energy development.*

Chaco Culture National Historical Park, by Ti Hays

10. Greater Sage-grouse Conservation Plan Implementation Moving Forward – 2 CAPEs

Since completion of the range-wide conservation plans last year, BLM has been moving to implement their commitments. Initial guidance has been issued, through seven instruction memoranda, regarding oil and gas leasing and development, grazing permit review priorities, grazing management thresholds and responses, adaptive management triggers, disturbance tracking, effectiveness monitoring, and habitat assessment framework. These memoranda provide key direction for implementing various aspects of managing resources uses and evaluating how the plans are meeting their goals. BLM has also issued a Draft Environmental Impact Statement setting out the results of its analysis of potential mineral withdrawals, following on the recommendations for withdrawal in the conservation plans and developing alternatives based on input from states and other stakeholders.

Additional direction, such as specific mitigation strategies, and implementation, such as through travel planning, is still needed to ensure the success of the conservation plans. Similarly, BLM must move forward on the mineral withdrawals that were recommended as part of conserving the greater sage-grouse and its habitat, and supported the U.S. Fish and Wildlife Service's conclusion that this species no longer warrants protection under the Endangered Species Act.

11. Opportunity Abounds to Protect the North Fork Valley – 1 CAPE

This year, the BLM released its draft plan for the Uncompahgre area in western Colorado, and included an alternative to largely protect the North Fork Valley from oil and gas development. The North Fork Valley, surrounding the North Fork of the Gunnison River, is Colorado's farm-to-table capital and is home to idyllic vineyards and one of the largest concentrations of organic farming in the state, not to mention outstanding hiking, biking, and hunting. The local community rose in opposition to the BLM's plan to issue oil and gas leases in the area in 2012, and came together to develop the "North Fork Alternative Plan," a proposal to the BLM for managing oil and gas development in the scenic valley. The BLM's draft plan would adopt this community vision in one alternative – but not the agency's preferred alternative.

We greatly appreciate that the BLM included the local community's North Fork Alternative Plan in the draft RMP, making room for the agency to ultimately adopt the community vision in the final plan. The BLM must seize this opportunity to develop a final plan for the North Fork Valley that protects agriculture, recreation, the Gunnison River and the livelihoods of the locals from oil and gas development.

Honorable Mention

With transition to new ePlanning system, the BLM aims to increase transparency

Over the past year, the BLM has been transitioning its online National Environmental Policy Act (NEPA) Registers to a new ePlanning system. As a central database for the agency, ePlanning will house land use planning information and NEPA documents across all BLM planning areas. We appreciate that the BLM has invested resources in improving the functionality and accessibility of online information for the general public. From approving the construction of new roads and transmission lines to authorizing off-road vehicle races, the NEPA Registers are the fundamental tool for the public to understand and engage in decisions affecting our public lands. Allowing users to search based on location, filter based on BLM program, and readily view projects that have an open opportunity for public comment are a few of the ePlanning features that improve usability. As the BLM further develops ePlanning webpages, we hope to see relevant mapping information and data for all projects readily available and greater collaboration with stakeholders to explore ways that ePlanning might further support public participation.

Regional Review of West-wide Energy Corridors moves forward in Arizona, California, and Nevada

BLM initiated its first Regional Review of West-wide Energy Corridors this fall for energy corridors in the California desert, western Arizona, and southern Nevada. These Regional Reviews allow BLM to take a second look at existing energy corridors on our public lands and make sure they are helping promote responsible development. To be effective, energy corridors must be functional and attractive for developers, and avoid sensitive resources such as lands with wilderness characteristics and wildlife habitat. Corridors should also help facilitate renewable energy for our nation's energy grid.

As the first Regional Review out the door, there is a tremendous opportunity for BLM to begin engraining a 'smart-from-the-start' approach to planning for transmission lines and other energy infrastructure. In fact, recommendations in Region 1 have the immediate potential to improve ongoing projects and planning, such as the proposed Ten West Link transmission project between Arizona and California, and corridors in the ongoing Las Vegas-Pahrump Resource Management Plan revision. For all corridors in review, BLM should analyze the full range of resources on public lands and put forward recommendations that address serious environmental concerns. Overall, we have welcomed the emphasis BLM has placed on public and stakeholder participation in the process, including the creation of the interactive Energy Corridor Mapping Tool and multiple stakeholder meetings. We look forward to continued work with BLM and other federal agencies in Region 1 and setting a strong example for future Regional Reviews.

From: Nada Culver
To: Clementson, Connie
Subject: RE: FW: Tres Rios and Happy Holidays
Date: Wednesday, January 4, 2017 5:51:21 PM
Attachments: 2016 CAPE Awards.pdf

Hi again, Connie – I just wanted to let you know that we highlighted the Tres Rios MLP in our annual TWS end of year CAPE awards, which acknowledge BLM's accomplishments from the previous year.

Nada Culver

Senior Counsel and Director, BLM Action Center

The Wilderness Society

1660 Wynkoop, #850

Denver, CO 80202

Main: 303-650-5818

Direct: 303-225-4635

Nada_Culver@tws.org <mailto:Nada_Culver@tws.org>

From: Clementson, Connie [mailto:cclementson@blm.gov]
Sent: Tuesday, January 3, 2017 11:10 AM
To: Nada Culver <nada_culver@tws.org>
Cc: Justin Abernathy <jabernathy@blm.gov>; Joseph Meyer <jmeyer@blm.gov>
Subject: Re: FW: Tres Rios and Happy Holidays

Thank you Nada... and happy new year as well!

I truly believe our SWRAC community process really assisted us in further clarifying issues that will be addressed as we move forward!

Connie Clementson, Field Manager

Tres Rios Field Office

office 970-882-6808 Dolores

office 970-385-1357 Durango

cell 970-394-4045

email: cclementson@blm.gov

On Fri, Dec 23, 2016 at 8:21 AM, Nada Culver <nada_culver@tws.org> wrote:

Hi Connie – I just wanted to express our appreciation for all the work that went into the announcement on the master leasing plan in Tres Rios. I've pasted our statement below in case it's of interest.

I hope you have a Merry Christmas and Happy Holidays.

New roadmap for successful public lands planning in Colorado moves forward

Dec 19, 2016

Denver, CO

Mesa Verde National Park, as well as renowned mountain biking destinations, would be protected through the master leasing plan.

Credit Steve Dunleavy, flickr.

BLM approves Tres Rios Master Leasing Plan

Today the Bureau of Land Management in Colorado announced that it will move forward with a master leasing plan for oil and gas leasing and development in Montezuma and La Plata counties, on lands managed by BLM's Tres Rios Field Office.

The Wilderness Society issued the following statement from senior counsel and director of the BLM Action Center, Nada Culver:

"We strongly support BLM's decision to move forward with the Tres Rios Master Leasing Plan and are excited to see the agency acknowledge the will of the local community and the need for smart and sound energy management in southwestern Colorado.

"By consulting early on with local communities, the BLM can provide more certainty, transparency and public involvement in issues that impact our public lands. For too long, the industry has had policy tilted in its favor without sufficient input from the public and other stakeholders. Master leasing plans provide a path forward for oil and gas development to take into account other users and uses of our public lands like recreation businesses, local communities and our immense cultural and historic resources.

"We are glad to see the BLM continuing to make this type of progress in its management of public lands."

Nada Culver

Senior Counsel and Director, BLM Action Center

The Wilderness Society

1660 Wynkoop, #850

Denver, CO 80202

Main: 303-650-5818

Direct: 303-225-4635

Nada_Culver@tws.org

The 2016 CAPE Awards

Celebrating Milestones in Conservation for our Public Lands

The Interior Department hit its stride in 2016, and rolled out some inspired final decisions to cap off the Obama administration's tenure. We were delighted to see years of effort culminate in major progress for stewardship of wilderness quality lands, more balanced oil and gas management, and smart from the start renewable energy planning. And, how we could not spotlight right off the bat finalization of the BLM's new planning rule?! Way to go, BLM, it's been quite a ride.

Unfortunately, there have also been isolated affronts towards our western public lands and the civil servants that steward them for all Americans. In these challenging times, as in years past, we'd like to start our annual year-end celebratory awards to first recognize and appreciate all BLM employees and their commitment to managing our vast shared real estate for the benefit of us all. In coming years, we hope the agency maintains pride in its mission, continues its exciting trajectory towards landscape-level planning and managing for the greatest threat of the future – climate change – and keeps the faith that the American public overwhelmingly supports public lands.

The Comparative Analysis of Particular Excellence (CAPE) rating system, inspired by the superhero-like character of the BLM Action Center team (able to leap tall stacks of RMPs in a single bound!), ranges from one CAPE on the low end (worth a pat on the back) to five CAPEs on the high end (HUGE PROGRESS!!! WAY TO GO!!!).

1. New Rule to Update Planning for Public Lands – 5 CAPEs

Acknowledging that the BLM's land use planning rule has not been substantially updated since the Internet was invented in 1983, the agency finalized updates to the rule this year to help bring planning for our public lands into the 21st century. The rule is part of the BLM's "Planning 2.0" initiative to make planning more cooperative, transparent and efficient. Under the new rule, the public has new and improved opportunities to make their voices heard in management decisions affecting our public lands. The rule also encourages planning at a landscape-scale rather than by political boundaries to better address issues such as wildlife movement corridors and planning for energy development while protecting valuable lands for conservation.

The rule has broad public support, including from many local governments, who appreciate the agency's commitment to expand public participation in land use planning decisions, utilize modern science in assessing land conditions and planning for the future, and strive to make our public lands more resilient

and adaptable. Through this rule, the BLM will be better equipped to design land management plans that truly reflect the needs and desires of the public.

We congratulate the BLM on getting this important and essential rule over the finish line and look forward to seeing it implemented. We are also looking forward to seeing the Planning 2.0 initiative come to completion with the issuance of an updated land use planning handbook to help guide implementation.

2. Wilderness Quality Lands Get the Love They Deserve – 5 CAPEs

In 2016, the BLM continued to make significant progress in its efforts to conduct and maintain inventories of lands with wilderness characteristics. Lands with wilderness characteristics are an important resource that the BLM is obligated to identify under the Federal Land Policy and Management Act of 1976. In the last few years, we've seen the BLM improve its inventory methods while extending the agency's commitments to funding and executing on-the-ground inventory work. The BLM has or is currently updating inventories in planning areas around the country—including the Colorado River Valley and San Luis Valley field offices in Colorado, as well as the Basin and Range National Monument in Nevada.

Basin and Range National Monument, by Bob Wick

In addition to improving inventory methods and conducting field inventories, the BLM is also clarifying its obligations to address wilderness resources in a more consistent manner. This year, the BLM developed statewide guidance in Colorado and Utah to provide more detail on conducting inventories, responding to citizens' inventories, and considering lands with wilderness characteristics in planning efforts, including at the project level. This guidance helps to provide uniformity in how individual field offices meet their obligations to identify and consider lands with wilderness characteristics.

The BLM further committed to stewarding wilderness resources this year through requiring compensatory mitigation for impacts to lands with wilderness characteristics from development. Mitigation is an important tool because it ensures that the public receives compensation for the loss of wilderness quality lands due to projects such as energy development. In the case of the recently approved TransWest Express and Gateway South transmission lines, the BLM will offset impacts to lands with wilderness characteristics by protecting wilderness-quality lands elsewhere.

The BLM has been ushering in a renewed dedication to assessing and protecting wilderness quality public lands over the past few years, and the momentum continued in 2016 thanks to extensive inventory work, state-specific guidance and compensatory mitigation commitments. We expect the BLM will continue with this important work in coming years to meet the agency's obligations under FLPMA.

3. Employing a Commonsense Approach to Oil and Gas Development – 5 CAPEs

For far too long, the oil and gas industry has run the roost on our public lands. The BLM has prioritized oil and gas leasing and drilling at the expense of wildlands, wildlife, clean air and water, recreation and numerous other values of our shared western landscapes. This year, the BLM took the reins and implemented commonsense decisions and reforms to ensure oil and gas has just one seat at the table – along with all other multiple uses. Two of the most impactful decisions were to cancel oil and gas leases in Colorado's Thompson Divide and Montana's Badger-Two Medicine area. In both cases, the BLM responded to strong local support – including ranchers in the Thompson Divide and the Blackfeet Nation in Badger-Two – to rectify a historic wrong and dispose of improperly-issued leases. These landscapes are truly too wild to drill, and we are elated that the BLM has finally taken strong action to protect them for future generations.

The BLM also adopted other commonsense reforms for oil and gas development this year. Chief among them is the "methane rule," which aims to cut natural gas waste and methane pollution from oil and gas operations on public lands. The methane rule will help move us toward agreements to cut U.S. methane emissions by 40 to 45 percent by 2025, building on 2015 U.S. commitments in Paris to reduce emissions and slow global warming. The BLM also finalized Onshore Orders 3, 4 and 5 to accurately measure and report oil and gas produced from federal lands and ensure companies pay full royalties.

Lease cancellations in the Thompson Divide and Badger-Two Medicine areas are landmark victories for nationally important landscapes that should never have been leased in the first place. We are thrilled to see the BLM take a proactive approach to oil and gas management on our public lands by protecting special lands and adopting rules to make drilling safer and smarter, for the climate and for taxpayers.

4. California Desert Plan Protects 4.2 Million Acres – 5 CAPEs

In September, the California BLM released its highly anticipated Record of Decision (ROD) for the Desert Renewable Energy Conservation Plan (DRECP) – a land use planning effort designed to balance smart renewable energy development with land conservation in the California Desert. The signing of the DRECP ROD not only marks the end of the first phase of a broader plan, but also affirms that developing clean energy and protecting wildlife, plants, cultural resources, and recreation opportunities are not mutually exclusive.

The DRECP ROD will protect 4.2 million acres of wild and vulnerable public land, including permanently protecting almost 3 million acres of newly designated California Desert National Conservation Lands. The BLM has already initiated the mineral withdrawal procedures for over 1.3 million acres of these new conservation lands as required by the DRECP ROD. This early action will not only reinforce their designation as protected conservation areas, but help drive DRECP implementation forward. The DRECP ROD also designates carefully selected low-conflict areas dedicated to renewable energy production, including locations that are already adjacent to existing infrastructure like transmission lines and roads. This decision will help elevate and streamline renewable energy production in locations that are attractive to developers and pose limited risk to other resources.

California's Silurian Valley, by Mason Cummings

With the ROD, the plan has set a high bar for future collaborative, multi-agency planning initiatives unfolding across the West. While the work in the California Desert is just beginning, signing the DRECP ROD for Phase I is an important achievement and an essential building block for what is to come from implementation and Phase II.

We enthusiastically support the DRECP ROD, which will protect over 4.2 million of acres of delicate desert resources and pristine landscapes for future generations while helping California meet its renewable energy and climate goals. In a time of serious climate uncertainty, forward-thinking planning measures like the DRECP will help reduce stress and impacts to a vulnerable landscape. Moving forward, the BLM needs to tackle the implementation of the DRECP Phase I head-on, beginning with the recently initiated mineral withdrawal procedures on over 1.3 million acres of designated conservation lands and to diligently assess the landscape for disturbances, as well as helping renewables projects succeed in designated low-conflict areas.

5. BLM Codifies "Smart from the Start" Renewable Energy Program – 5 CAPEs

The BLM has made great strides in advancing responsible renewable energy in the last five years. This includes permitting the first-ever solar projects on public lands, establishing landscape-scale plans to guide development to low-conflict zones across the southwest, and approving over 15,000 megawatts of wind, solar and geothermal development – enough to power over five million homes. In finalizing the Wind and Solar Leasing Rule this year, BLM ensured that smart approaches advanced in recent years will become standard practice going forward. By prioritizing development in designated low-conflict areas, the rule will make the permitting process more efficient in appropriate areas while protecting wildlands and wildlife habitat from development, as demonstrated by the success at the Dry Lake Solar Energy Zone (SEZ) outside Las Vegas. It will also assure taxpayers fair compensation by implementing a competitive leasing process. The rule enjoys wide, bi-partisan support and will facilitate responsible renewables development, helping us protect our natural heritage, tackle the threat of climate change, and benefit western economies.

BLM also continues to make renewable energy zones more attractive to developers and ensure that unavoidable impacts from development are offset through mitigation. The agency finalized two Solar Regional Mitigation Strategies (SRMSs) this year, one for the Dry Lake Valley North (DLVN) SEZ in eastern Nevada and one for Arizona's three SEZs. These build off BLM's pilot SRMS for the Dry Lake SEZ, which proved to be a key element of the agency's success in providing an efficient permitting process for projects in that zone and giving predictability to developers on their mitigation obligations, while investing mitigation resources in strategic conservation actions in the region. BLM has continued to refine its approach to SRMSs, and the DLVN and Arizona SRMSs included improvements such as better addressing uncertainty on mitigation outcomes in fee calculations. We expect that the completion of

these SRMSs will increase the attractiveness of these SEZs for responsible development when market conditions are right.

We applaud the BLM in creating a robust renewable energy program from scratch, culminating with the finalization of the Wind and Solar Leasing Rule this year. We look forward to working with the BLM, project developers, and other stakeholders to put the rule to work, including establishing implementation guidance, helping projects succeed in zones, designating new zones in appropriate areas, and protecting wildlands and wildlife habitat from development. We also look forward to engaging with BLM as it finalizes the SRMSs underway in Colorado, New Mexico, and Utah to facilitate responsible solar development and mitigation in those regions. We hope BLM will continue to refine its approach to SRMSs, including elevating the potential for addressing mitigation obligations by adding or strengthening protections for other public lands in SEZ regions.

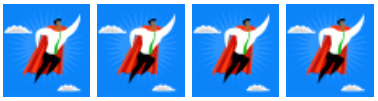
6. Natural Heritage Protected in the Arctic – 5 CAPEs

Hot off the presses, this week the BLM finalized a plan for 6.5 million acres of extremely wild public lands in Alaska's Eastern Interior planning area. The public lands managed by the BLM here include some traditional land of twelve federally recognized tribes, several of which have worked throughout the planning process to ensure their cultural heritage and identities, realized through subsistence lifestyles, are protected. Moose, caribou, grizzly bear, wolverine, and eagles are among the many species that make their home in the Eastern Interior along with dozens of fish species that depend on vast and complex river systems, including the mighty Yukon. The public lands in Alaska's interior also provide outstanding opportunities for hunting, fishing, rafting, and cross-country skiing to winter huts. The final Eastern Interior plan strikes a good balance for conserving important fish and wildlife habitat, providing quality backcountry recreation experiences, and protecting traditional uses. It also identifies and includes measures to protect 3 million acres of lands with wilderness characteristics, and substantially restricts new mining.

This year, the Department of the Interior also decided to protect the Arctic Ocean from oil and gas leasing for the next five years in the Bureau of Ocean Energy Management's 2017-2022 program for offshore oil and gas leasing. The Arctic Ocean provides habitat for numerous species of whales, polar bears, seals, walruses and many populations of fish and birds, and has supported the lives and cultures of Alaska Natives for thousands of years. These places would be gravely threatened by oil and gas leasing, and we are relieved that the Arctic Ocean will be spared for the near future.

We are inspired by the BLM's commitment to protect Alaska's indigenous people and their subsistence cultures, as well as critically important wildlife habitat and epically vast wilderness-quality lands, from destructive mining and development in the Eastern Interior. We are also grateful that the Department of the Interior recognized the Arctic Ocean is not appropriate for oil and gas leasing due to its extraordinarily vulnerable environment and important natural resources.

7. BLM Finalizes Strong Mitigation Manual and Handbook – 4 CAPEs



BLM has demonstrated great leadership in recent years in modernizing its approach to "mitigation", the practice of avoiding and offsetting damage caused to public lands from development. Federal regulations require agencies to follow a five-step hierarchy to address impacts – avoid, minimize, rectify, reduce/eliminate, and compensate – which can be summarized as avoidance, minimization and compensation. Historically, work to mitigate the negative impacts of development such as oil and gas drilling and transmission lines was implemented on a project-by-project basis, which was insufficient to protect our resources and inefficient for permitting projects.

The new policies from BLM and other federal agencies provide guidelines for a broad, landscape-scale approach to balancing development and conservation on public lands. If the policies are used properly, future development projects will avoid impacts to sensitive resources while benefitting from more predictable and efficient permitting processes, and federal agencies will require conservation gains to address and overcome any loss of resources that does occur. Key concepts emphasized in the manual and handbook include a focus on the mitigation hierarchy; use of a landscape-scale approach; setting a no net loss or net benefit outcome for resources that are considered important, scarce, sensitive, or have a protective legal mandate; use of mitigation strategies and plans to establish mitigation standards in advance of development; and emphasizing BLM's preference for achieving compensatory mitigation outcomes in advance of impacts.

The handbook also provides important details on tools BLM can use to durably protect mitigation sites on public lands such as identification of a protective land use plan allocation for the site (e.g. an Area of Critical Environmental Concern) or issuance of a lease or easement to a member of the public to conserve the site (via the authority granted in FLPMA Title III and/or Title V).

As described elsewhere in these awards, we've seen the value of BLM's smarter approach to mitigation in Solar Regional Mitigation Strategies, transmission line project approvals and other contexts. With the manual and handbook now finalized, we look forward to continuing to work with BLM to advance these important mitigation guidelines through land use planning and project permitting. Used properly, they will better balance conservation and development on our public lands while increasing permitting predictability and efficiency.

8. Coal Gets a Reboot – 4 CAPEs

On January 15, 2016, Interior Secretary Sally Jewell signed Secretarial Order 3338 directing the BLM to prepare a Programmatic Environmental Impact Statement (PEIS) to analyze potential leasing and management reforms to the federal coal program. The BLM held six public meetings across the county and solicited comment from stakeholders to gather information on policies and practices that need to be updated. The PEIS seeks to address how, when and where to lease public lands for future coal development, as well as how to secure a fair return to taxpayers from royalties, address climate impacts, and address our domestic energy needs. BLM also implemented a temporary pause on significant new coal leasing while it completes the process.

Colorado's North Fork Valley, by Jim Ramey

The coal program has not been reassessed in almost thirty years and significant changes are necessary to bring the program in line with 21st century energy demands and public expectations for our shared public lands. An updated coal program should also seek ways to assist coal dependent communities in this time of transition – like Colorado's North Fork Valley. We commend BLM's extensive public outreach process and we hope the scoping report due to be released in early January will provide the agency and the public with information to move forward with smart reforms.

While we realize the incoming administration may not agree with all the steps taken to date, we believe that the incredible amount of time, energy, and analysis that has gone into the process thus far should not be wasted. International and domestic market factors point to a decline in coal production and use regardless of a shift in federal energy policy. We hope that smart and sensible reforms are pursued to ensure that the American taxpayer is not being shortchanged and that American coal workers and coal dependent communities are not forgotten amid this transition. We applaud the BLM for initiating this monumental undertaking.

9. Planning for Oil and Gas at a Landscape Level – 3 CAPEs

In 2016 BLM made headway towards smart and balanced landscape level planning for energy development on public lands. This was highlighted by the agency's work on several Master Leasing Plans (MLPs) across the West. The Moab MLP, finalized on December 15th, illustrates how effective this tool can be. The final plan protects Canyonlands and Arches National Parks from nearby development and ensures the region's economy will continue to thrive by managing lands to support recreation, tourism and cultural sites. Also in Utah, the BLM released preliminary alternatives for the San Rafael Desert MLP. The planning area contains valuable wilderness quality lands and endemic bee habitat, and abuts Canyonlands National Park. The preliminary alternatives contain measures that emphasize the importance of protecting these other resources while maintaining ample opportunity for responsible oil and gas development.

In Colorado, the BLM made notable progress on the South Park MLP this year. There, elected officials, sportsmen, the state wildlife agency, local residents and municipal service providers like Denver Water have come together to ensure oil and gas drilling does not harm wildlife habitat, Gold Medal fishing streams, South Park's scenic wildlands, or vitally important drinking water sources for Colorado's front range. And just before the holidays, BLM Colorado announced that the Tres Rios Field Office will be moving forward with the Southwest Colorado MLP. This plan has been largely driven forward by support from the local community who highlighted the need to establish protections for agriculture, Mesa Verde National Park and the renowned mountain biking area Phil's World.

Finally, in the greater Chaco landscape in northwest New Mexico, tribal leaders, industry and conservation groups have encouraged the BLM to establish a workable process to help preserve unique cultural values in an energy-rich region. The BLM is embarking on a joint planning process with the Bureau of Indian Affairs to ensure everyone has a seat at the table in planning for the future of oil and gas development in the Chaco region.

W*e are encouraged by the leaps forward the BLM has taken in the last year to ensure true multiple-use management of our public lands and smart planning for oil and gas development. We hope the BLM will continue to use Master Leasing Plans and other tools for smart from the start oil and gas planning to manage our public lands in a way that balances community needs and other resource values with energy development.*

Chaco Culture National Historical Park, by Ti Hays

10. Greater Sage-grouse Conservation Plan Implementation Moving Forward – 2 CAPEs

Since completion of the range-wide conservation plans last year, BLM has been moving to implement their commitments. Initial guidance has been issued, through seven instruction memoranda, regarding oil and gas leasing and development, grazing permit review priorities, grazing management thresholds and responses, adaptive management triggers, disturbance tracking, effectiveness monitoring, and habitat assessment framework. These memoranda provide key direction for implementing various aspects of managing resources uses and evaluating how the plans are meeting their goals. BLM has also issued a Draft Environmental Impact Statement setting out the results of its analysis of potential mineral withdrawals, following on the recommendations for withdrawal in the conservation plans and developing alternatives based on input from states and other stakeholders.

Additional direction, such as specific mitigation strategies, and implementation, such as through travel planning, is still needed to ensure the success of the conservation plans. Similarly, BLM must move forward on the mineral withdrawals that were recommended as part of conserving the greater sage-grouse and its habitat, and supported the U.S. Fish and Wildlife Service's conclusion that this species no longer warrants protection under the Endangered Species Act.

11. Opportunity Abounds to Protect the North Fork Valley – 1 CAPE

This year, the BLM released its draft plan for the Uncompahgre area in western Colorado, and included an alternative to largely protect the North Fork Valley from oil and gas development. The North Fork Valley, surrounding the North Fork of the Gunnison River, is Colorado's farm-to-table capital and is home to idyllic vineyards and one of the largest concentrations of organic farming in the state, not to mention outstanding hiking, biking, and hunting. The local community rose in opposition to the BLM's plan to issue oil and gas leases in the area in 2012, and came together to develop the "North Fork Alternative Plan," a proposal to the BLM for managing oil and gas development in the scenic valley. The BLM's draft plan would adopt this community vision in one alternative – but not the agency's preferred alternative.

We greatly appreciate that the BLM included the local community's North Fork Alternative Plan in the draft RMP, making room for the agency to ultimately adopt the community vision in the final plan. The BLM must seize this opportunity to develop a final plan for the North Fork Valley that protects agriculture, recreation, the Gunnison River and the livelihoods of the locals from oil and gas development.

Honorable Mention

With transition to new ePlanning system, the BLM aims to increase transparency

Over the past year, the BLM has been transitioning its online National Environmental Policy Act (NEPA) Registers to a new ePlanning system. As a central database for the agency, ePlanning will house land use planning information and NEPA documents across all BLM planning areas. We appreciate that the BLM has invested resources in improving the functionality and accessibility of online information for the general public. From approving the construction of new roads and transmission lines to authorizing off-road vehicle races, the NEPA Registers are the fundamental tool for the public to understand and engage in decisions affecting our public lands. Allowing users to search based on location, filter based on BLM program, and readily view projects that have an open opportunity for public comment are a few of the ePlanning features that improve usability. As the BLM further develops ePlanning webpages, we hope to see relevant mapping information and data for all projects readily available and greater collaboration with stakeholders to explore ways that ePlanning might further support public participation.

Regional Review of West-wide Energy Corridors moves forward in Arizona, California, and Nevada

BLM initiated its first Regional Review of West-wide Energy Corridors this fall for energy corridors in the California desert, western Arizona, and southern Nevada. These Regional Reviews allow BLM to take a second look at existing energy corridors on our public lands and make sure they are helping promote responsible development. To be effective, energy corridors must be functional and attractive for developers, and avoid sensitive resources such as lands with wilderness characteristics and wildlife habitat. Corridors should also help facilitate renewable energy for our nation's energy grid.

As the first Regional Review out the door, there is a tremendous opportunity for BLM to begin engraining a 'smart-from-the-start' approach to planning for transmission lines and other energy infrastructure. In fact, recommendations in Region 1 have the immediate potential to improve ongoing projects and planning, such as the proposed Ten West Link transmission project between Arizona and California, and corridors in the ongoing Las Vegas-Pahrump Resource Management Plan revision. For all corridors in review, BLM should analyze the full range of resources on public lands and put forward recommendations that address serious environmental concerns. Overall, we have welcomed the emphasis BLM has placed on public and stakeholder participation in the process, including the creation of the interactive Energy Corridor Mapping Tool and multiple stakeholder meetings. We look forward to continued work with BLM and other federal agencies in Region 1 and setting a strong example for future Regional Reviews.

From: Nada Culver
To: mnedd@blm.gov
Subject: TWS BLM Action Center"s annual awards recognizing BLM"s great work
Date: Wednesday, January 4, 2017 6:04:33 PM
Attachments: 2016 CAPE Awards.pdf

Hi Mike – I'm attaching our annual CAPE awards, which highlight BLM's accomplishments from the previous year. We wanted to forward to you, personally, since we wanted to thank you for all your work on the methane rule and onshore orders. Hope you';re enjoying 2017 so far.

Nada Culver

Senior Counsel and Director, BLM Action Center

The Wilderness Society

1660 Wynkoop, #850

Denver, CO 80202

Main: 303-650-5818

Direct: 303-225-4635

Nada_Culver@tws.org

The 2016 CAPE Awards

Celebrating Milestones in Conservation for our Public Lands

The Interior Department hit its stride in 2016, and rolled out some inspired final decisions to cap off the Obama administration's tenure. We were delighted to see years of effort culminate in major progress for stewardship of wilderness quality lands, more balanced oil and gas management, and smart from the start renewable energy planning. And, how we could not spotlight right off the bat finalization of the BLM's new planning rule?! Way to go, BLM, it's been quite a ride.

Unfortunately, there have also been isolated affronts towards our western public lands and the civil servants that steward them for all Americans. In these challenging times, as in years past, we'd like to start our annual year-end celebratory awards to first recognize and appreciate all BLM employees and their commitment to managing our vast shared real estate for the benefit of us all. In coming years, we hope the agency maintains pride in its mission, continues its exciting trajectory towards landscape-level planning and managing for the greatest threat of the future – climate change – and keeps the faith that the American public overwhelmingly supports public lands.

The Comparative Analysis of Particular Excellence (CAPE) rating system, inspired by the superhero-like character of the BLM Action Center team (able to leap tall stacks of RMPs in a single bound!), ranges from one CAPE on the low end (worth a pat on the back) to five CAPEs on the high end (HUGE PROGRESS!!! WAY TO GO!!!).

1. New Rule to Update Planning for Public Lands – 5 CAPEs

Acknowledging that the BLM's land use planning rule has not been substantially updated since the Internet was invented in 1983, the agency finalized updates to the rule this year to help bring planning for our public lands into the 21st century. The rule is part of the BLM's "Planning 2.0" initiative to make planning more cooperative, transparent and efficient. Under the new rule, the public has new and improved opportunities to make their voices heard in management decisions affecting our public lands. The rule also encourages planning at a landscape-scale rather than by political boundaries to better address issues such as wildlife movement corridors and planning for energy development while protecting valuable lands for conservation.

The rule has broad public support, including from many local governments, who appreciate the agency's commitment to expand public participation in land use planning decisions, utilize modern science in assessing land conditions and planning for the future, and strive to make our public lands more resilient

and adaptable. Through this rule, the BLM will be better equipped to design land management plans that truly reflect the needs and desires of the public.

We congratulate the BLM on getting this important and essential rule over the finish line and look forward to seeing it implemented. We are also looking forward to seeing the Planning 2.0 initiative come to completion with the issuance of an updated land use planning handbook to help guide implementation.

2. Wilderness Quality Lands Get the Love They Deserve – 5 CAPEs

In 2016, the BLM continued to make significant progress in its efforts to conduct and maintain inventories of lands with wilderness characteristics. Lands with wilderness characteristics are an important resource that the BLM is obligated to identify under the Federal Land Policy and Management Act of 1976. In the last few years, we've seen the BLM improve its inventory methods while extending the agency's commitments to funding and executing on-the-ground inventory work. The BLM has or is currently updating inventories in planning areas around the country—including the Colorado River Valley and San Luis Valley field offices in Colorado, as well as the Basin and Range National Monument in Nevada.

Basin and Range National Monument, by Bob Wick

In addition to improving inventory methods and conducting field inventories, the BLM is also clarifying its obligations to address wilderness resources in a more consistent manner. This year, the BLM developed statewide guidance in Colorado and Utah to provide more detail on conducting inventories, responding to citizens' inventories, and considering lands with wilderness characteristics in planning efforts, including at the project level. This guidance helps to provide uniformity in how individual field offices meet their obligations to identify and consider lands with wilderness characteristics.

The BLM further committed to stewarding wilderness resources this year through requiring compensatory mitigation for impacts to lands with wilderness characteristics from development. Mitigation is an important tool because it ensures that the public receives compensation for the loss of wilderness quality lands due to projects such as energy development. In the case of the recently approved TransWest Express and Gateway South transmission lines, the BLM will offset impacts to lands with wilderness characteristics by protecting wilderness-quality lands elsewhere.

The BLM has been ushering in a renewed dedication to assessing and protecting wilderness quality public lands over the past few years, and the momentum continued in 2016 thanks to extensive inventory work, state-specific guidance and compensatory mitigation commitments. We expect the BLM will continue with this important work in coming years to meet the agency's obligations under FLPMA.

3. Employing a Commonsense Approach to Oil and Gas Development – 5 CAPEs

For far too long, the oil and gas industry has run the roost on our public lands. The BLM has prioritized oil and gas leasing and drilling at the expense of wildlands, wildlife, clean air and water, recreation and numerous other values of our shared western landscapes. This year, the BLM took the reins and implemented commonsense decisions and reforms to ensure oil and gas has just one seat at the table – along with all other multiple uses. Two of the most impactful decisions were to cancel oil and gas leases in Colorado's Thompson Divide and Montana's Badger-Two Medicine area. In both cases, the BLM responded to strong local support – including ranchers in the Thompson Divide and the Blackfeet Nation in Badger-Two – to rectify a historic wrong and dispose of improperly-issued leases. These landscapes are truly too wild to drill, and we are elated that the BLM has finally taken strong action to protect them for future generations.

The BLM also adopted other commonsense reforms for oil and gas development this year. Chief among them is the "methane rule," which aims to cut natural gas waste and methane pollution from oil and gas operations on public lands. The methane rule will help move us toward agreements to cut U.S. methane emissions by 40 to 45 percent by 2025, building on 2015 U.S. commitments in Paris to reduce emissions and slow global warming. The BLM also finalized Onshore Orders 3, 4 and 5 to accurately measure and report oil and gas produced from federal lands and ensure companies pay full royalties.

Lease cancellations in the Thompson Divide and Badger-Two Medicine areas are landmark victories for nationally important landscapes that should never have been leased in the first place. We are thrilled to see the BLM take a proactive approach to oil and gas management on our public lands by protecting special lands and adopting rules to make drilling safer and smarter, for the climate and for taxpayers.

4. California Desert Plan Protects 4.2 Million Acres – 5 CAPEs

In September, the California BLM released its highly anticipated Record of Decision (ROD) for the Desert Renewable Energy Conservation Plan (DRECP) – a land use planning effort designed to balance smart renewable energy development with land conservation in the California Desert. The signing of the DRECP ROD not only marks the end of the first phase of a broader plan, but also affirms that developing clean energy and protecting wildlife, plants, cultural resources, and recreation opportunities are not mutually exclusive.

The DRECP ROD will protect 4.2 million acres of wild and vulnerable public land, including permanently protecting almost 3 million acres of newly designated California Desert National Conservation Lands. The BLM has already initiated the mineral withdrawal procedures for over 1.3 million acres of these new conservation lands as required by the DRECP ROD. This early action will not only reinforce their designation as protected conservation areas, but help drive DRECP implementation forward. The DRECP ROD also designates carefully selected low-conflict areas dedicated to renewable energy production, including locations that are already adjacent to existing infrastructure like transmission lines and roads. This decision will help elevate and streamline renewable energy production in locations that are attractive to developers and pose limited risk to other resources.

California's Silurian Valley, by Mason Cummings

With the ROD, the plan has set a high bar for future collaborative, multi-agency planning initiatives unfolding across the West. While the work in the California Desert is just beginning, signing the DRECP ROD for Phase I is an important achievement and an essential building block for what is to come from implementation and Phase II.

We enthusiastically support the DRECP ROD, which will protect over 4.2 million of acres of delicate desert resources and pristine landscapes for future generations while helping California meet its renewable energy and climate goals. In a time of serious climate uncertainty, forward-thinking planning measures like the DRECP will help reduce stress and impacts to a vulnerable landscape. Moving forward, the BLM needs to tackle the implementation of the DRECP Phase I head-on, beginning with the recently initiated mineral withdrawal procedures on over 1.3 million acres of designated conservation lands and to diligently assess the landscape for disturbances, as well as helping renewables projects succeed in designated low-conflict areas.

5. BLM Codifies "Smart from the Start" Renewable Energy Program – 5 CAPEs

The BLM has made great strides in advancing responsible renewable energy in the last five years. This includes permitting the first-ever solar projects on public lands, establishing landscape-scale plans to guide development to low-conflict zones across the southwest, and approving over 15,000 megawatts of wind, solar and geothermal development – enough to power over five million homes. In finalizing the Wind and Solar Leasing Rule this year, BLM ensured that smart approaches advanced in recent years will become standard practice going forward. By prioritizing development in designated low-conflict areas, the rule will make the permitting process more efficient in appropriate areas while protecting wildlands and wildlife habitat from development, as demonstrated by the success at the Dry Lake Solar Energy Zone (SEZ) outside Las Vegas. It will also assure taxpayers fair compensation by implementing a competitive leasing process. The rule enjoys wide, bi-partisan support and will facilitate responsible renewables development, helping us protect our natural heritage, tackle the threat of climate change, and benefit western economies.

BLM also continues to make renewable energy zones more attractive to developers and ensure that unavoidable impacts from development are offset through mitigation. The agency finalized two Solar Regional Mitigation Strategies (SRMSs) this year, one for the Dry Lake Valley North (DLVN) SEZ in eastern Nevada and one for Arizona's three SEZs. These build off BLM's pilot SRMS for the Dry Lake SEZ, which proved to be a key element of the agency's success in providing an efficient permitting process for projects in that zone and giving predictability to developers on their mitigation obligations, while investing mitigation resources in strategic conservation actions in the region. BLM has continued to refine its approach to SRMSs, and the DLVN and Arizona SRMSs included improvements such as better addressing uncertainty on mitigation outcomes in fee calculations. We expect that the completion of

these SRMSs will increase the attractiveness of these SEZs for responsible development when market conditions are right.

We applaud the BLM in creating a robust renewable energy program from scratch, culminating with the finalization of the Wind and Solar Leasing Rule this year. We look forward to working with the BLM, project developers, and other stakeholders to put the rule to work, including establishing implementation guidance, helping projects succeed in zones, designating new zones in appropriate areas, and protecting wildlands and wildlife habitat from development. We also look forward to engaging with BLM as it finalizes the SRMSs underway in Colorado, New Mexico, and Utah to facilitate responsible solar development and mitigation in those regions. We hope BLM will continue to refine its approach to SRMSs, including elevating the potential for addressing mitigation obligations by adding or strengthening protections for other public lands in SEZ regions.

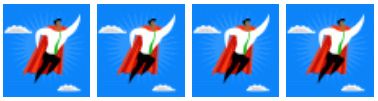
6. Natural Heritage Protected in the Arctic – 5 CAPEs

Hot off the presses, this week the BLM finalized a plan for 6.5 million acres of extremely wild public lands in Alaska's Eastern Interior planning area. The public lands managed by the BLM here include some traditional land of twelve federally recognized tribes, several of which have worked throughout the planning process to ensure their cultural heritage and identities, realized through subsistence lifestyles, are protected. Moose, caribou, grizzly bear, wolverine, and eagles are among the many species that make their home in the Eastern Interior along with dozens of fish species that depend on vast and complex river systems, including the mighty Yukon. The public lands in Alaska's interior also provide outstanding opportunities for hunting, fishing, rafting, and cross-country skiing to winter huts. The final Eastern Interior plan strikes a good balance for conserving important fish and wildlife habitat, providing quality backcountry recreation experiences, and protecting traditional uses. It also identifies and includes measures to protect 3 million acres of lands with wilderness characteristics, and substantially restricts new mining.

This year, the Department of the Interior also decided to protect the Arctic Ocean from oil and gas leasing for the next five years in the Bureau of Ocean Energy Management's 2017-2022 program for offshore oil and gas leasing. The Arctic Ocean provides habitat for numerous species of whales, polar bears, seals, walruses and many populations of fish and birds, and has supported the lives and cultures of Alaska Natives for thousands of years. These places would be gravely threatened by oil and gas leasing, and we are relieved that the Arctic Ocean will be spared for the near future.

We are inspired by the BLM's commitment to protect Alaska's indigenous people and their subsistence cultures, as well as critically important wildlife habitat and epically vast wilderness-quality lands, from destructive mining and development in the Eastern Interior. We are also grateful that the Department of the Interior recognized the Arctic Ocean is not appropriate for oil and gas leasing due to its extraordinarily vulnerable environment and important natural resources.

7. BLM Finalizes Strong Mitigation Manual and Handbook – 4 CAPEs



BLM has demonstrated great leadership in recent years in modernizing its approach to "mitigation", the practice of avoiding and offsetting damage caused to public lands from development. Federal regulations require agencies to follow a five-step hierarchy to address impacts – avoid, minimize, rectify, reduce/eliminate, and compensate – which can be summarized as avoidance, minimization and compensation. Historically, work to mitigate the negative impacts of development such as oil and gas drilling and transmission lines was implemented on a project-by-project basis, which was insufficient to protect our resources and inefficient for permitting projects.

The new policies from BLM and other federal agencies provide guidelines for a broad, landscape-scale approach to balancing development and conservation on public lands. If the policies are used properly, future development projects will avoid impacts to sensitive resources while benefitting from more predictable and efficient permitting processes, and federal agencies will require conservation gains to address and overcome any loss of resources that does occur. Key concepts emphasized in the manual and handbook include a focus on the mitigation hierarchy; use of a landscape-scale approach; setting a no net loss or net benefit outcome for resources that are considered important, scarce, sensitive, or have a protective legal mandate; use of mitigation strategies and plans to establish mitigation standards in advance of development; and emphasizing BLM's preference for achieving compensatory mitigation outcomes in advance of impacts.

The handbook also provides important details on tools BLM can use to durably protect mitigation sites on public lands such as identification of a protective land use plan allocation for the site (e.g. an Area of Critical Environmental Concern) or issuance of a lease or easement to a member of the public to conserve the site (via the authority granted in FLPMA Title III and/or Title V).

As described elsewhere in these awards, we've seen the value of BLM's smarter approach to mitigation in Solar Regional Mitigation Strategies, transmission line project approvals and other contexts. With the manual and handbook now finalized, we look forward to continuing to work with BLM to advance these important mitigation guidelines through land use planning and project permitting. Used properly, they will better balance conservation and development on our public lands while increasing permitting predictability and efficiency.

8. Coal Gets a Reboot – 4 CAPEs

On January 15, 2016, Interior Secretary Sally Jewell signed Secretarial Order 3338 directing the BLM to prepare a Programmatic Environmental Impact Statement (PEIS) to analyze potential leasing and management reforms to the federal coal program. The BLM held six public meetings across the county and solicited comment from stakeholders to gather information on policies and practices that need to be updated. The PEIS seeks to address how, when and where to lease public lands for future coal development, as well as how to secure a fair return to taxpayers from royalties, address climate impacts, and address our domestic energy needs. BLM also implemented a temporary pause on significant new coal leasing while it completes the process.

Colorado's North Fork Valley, by Jim Ramey

The coal program has not been reassessed in almost thirty years and significant changes are necessary to bring the program in line with 21st century energy demands and public expectations for our shared public lands. An updated coal program should also seek ways to assist coal dependent communities in this time of transition – like Colorado's North Fork Valley. We commend BLM's extensive public outreach process and we hope the scoping report due to be released in early January will provide the agency and the public with information to move forward with smart reforms.

While we realize the incoming administration may not agree with all the steps taken to date, we believe that the incredible amount of time, energy, and analysis that has gone into the process thus far should not be wasted. International and domestic market factors point to a decline in coal production and use regardless of a shift in federal energy policy. We hope that smart and sensible reforms are pursued to ensure that the American taxpayer is not being shortchanged and that American coal workers and coal dependent communities are not forgotten amid this transition. We applaud the BLM for initiating this monumental undertaking.

9. Planning for Oil and Gas at a Landscape Level – 3 CAPEs

In 2016 BLM made headway towards smart and balanced landscape level planning for energy development on public lands. This was highlighted by the agency's work on several Master Leasing Plans (MLPs) across the West. The Moab MLP, finalized on December 15th, illustrates how effective this tool can be. The final plan protects Canyonlands and Arches National Parks from nearby development and ensures the region's economy will continue to thrive by managing lands to support recreation, tourism and cultural sites. Also in Utah, the BLM released preliminary alternatives for the San Rafael Desert MLP. The planning area contains valuable wilderness quality lands and endemic bee habitat, and abuts Canyonlands National Park. The preliminary alternatives contain measures that emphasize the importance of protecting these other resources while maintaining ample opportunity for responsible oil and gas development.

In Colorado, the BLM made notable progress on the South Park MLP this year. There, elected officials, sportsmen, the state wildlife agency, local residents and municipal service providers like Denver Water have come together to ensure oil and gas drilling does not harm wildlife habitat, Gold Medal fishing streams, South Park's scenic wildlands, or vitally important drinking water sources for Colorado's front range. And just before the holidays, BLM Colorado announced that the Tres Rios Field Office will be moving forward with the Southwest Colorado MLP. This plan has been largely driven forward by support from the local community who highlighted the need to establish protections for agriculture, Mesa Verde National Park and the renowned mountain biking area Phil's World.

Finally, in the greater Chaco landscape in northwest New Mexico, tribal leaders, industry and conservation groups have encouraged the BLM to establish a workable process to help preserve unique cultural values in an energy-rich region. The BLM is embarking on a joint planning process with the Bureau of Indian Affairs to ensure everyone has a seat at the table in planning for the future of oil and gas development in the Chaco region.

W*e are encouraged by the leaps forward the BLM has taken in the last year to ensure true multiple-use management of our public lands and smart planning for oil and gas development. We hope the BLM will continue to use Master Leasing Plans and other tools for smart from the start oil and gas planning to manage our public lands in a way that balances community needs and other resource values with energy development.*

Chaco Culture National Historical Park, by Ti Hays

10. Greater Sage-grouse Conservation Plan Implementation Moving Forward – 2 CAPEs

Since completion of the range-wide conservation plans last year, BLM has been moving to implement their commitments. Initial guidance has been issued, through seven instruction memoranda, regarding oil and gas leasing and development, grazing permit review priorities, grazing management thresholds and responses, adaptive management triggers, disturbance tracking, effectiveness monitoring, and habitat assessment framework. These memoranda provide key direction for implementing various aspects of managing resources uses and evaluating how the plans are meeting their goals. BLM has also issued a Draft Environmental Impact Statement setting out the results of its analysis of potential mineral withdrawals, following on the recommendations for withdrawal in the conservation plans and developing alternatives based on input from states and other stakeholders.

Additional direction, such as specific mitigation strategies, and implementation, such as through travel planning, is still needed to ensure the success of the conservation plans. Similarly, BLM must move forward on the mineral withdrawals that were recommended as part of conserving the greater sage-grouse and its habitat, and supported the U.S. Fish and Wildlife Service's conclusion that this species no longer warrants protection under the Endangered Species Act.

11. Opportunity Abounds to Protect the North Fork Valley – 1 CAPE

This year, the BLM released its draft plan for the Uncompahgre area in western Colorado, and included an alternative to largely protect the North Fork Valley from oil and gas development. The North Fork Valley, surrounding the North Fork of the Gunnison River, is Colorado's farm-to-table capital and is home to idyllic vineyards and one of the largest concentrations of organic farming in the state, not to mention outstanding hiking, biking, and hunting. The local community rose in opposition to the BLM's plan to issue oil and gas leases in the area in 2012, and came together to develop the "North Fork Alternative Plan," a proposal to the BLM for managing oil and gas development in the scenic valley. The BLM's draft plan would adopt this community vision in one alternative – but not the agency's preferred alternative.

We greatly appreciate that the BLM included the local community's North Fork Alternative Plan in the draft RMP, making room for the agency to ultimately adopt the community vision in the final plan. The BLM must seize this opportunity to develop a final plan for the North Fork Valley that protects agriculture, recreation, the Gunnison River and the livelihoods of the locals from oil and gas development.

Honorable Mention

With transition to new ePlanning system, the BLM aims to increase transparency

Over the past year, the BLM has been transitioning its online National Environmental Policy Act (NEPA) Registers to a new ePlanning system. As a central database for the agency, ePlanning will house land use planning information and NEPA documents across all BLM planning areas. We appreciate that the BLM has invested resources in improving the functionality and accessibility of online information for the general public. From approving the construction of new roads and transmission lines to authorizing off-road vehicle races, the NEPA Registers are the fundamental tool for the public to understand and engage in decisions affecting our public lands. Allowing users to search based on location, filter based on BLM program, and readily view projects that have an open opportunity for public comment are a few of the ePlanning features that improve usability. As the BLM further develops ePlanning webpages, we hope to see relevant mapping information and data for all projects readily available and greater collaboration with stakeholders to explore ways that ePlanning might further support public participation.

Regional Review of West-wide Energy Corridors moves forward in Arizona, California, and Nevada

BLM initiated its first Regional Review of West-wide Energy Corridors this fall for energy corridors in the California desert, western Arizona, and southern Nevada. These Regional Reviews allow BLM to take a second look at existing energy corridors on our public lands and make sure they are helping promote responsible development. To be effective, energy corridors must be functional and attractive for developers, and avoid sensitive resources such as lands with wilderness characteristics and wildlife habitat. Corridors should also help facilitate renewable energy for our nation's energy grid.

As the first Regional Review out the door, there is a tremendous opportunity for BLM to begin engraining a 'smart-from-the-start' approach to planning for transmission lines and other energy infrastructure. In fact, recommendations in Region 1 have the immediate potential to improve ongoing projects and planning, such as the proposed Ten West Link transmission project between Arizona and California, and corridors in the ongoing Las Vegas-Pahrump Resource Management Plan revision. For all corridors in review, BLM should analyze the full range of resources on public lands and put forward recommendations that address serious environmental concerns. Overall, we have welcomed the emphasis BLM has placed on public and stakeholder participation in the process, including the creation of the interactive Energy Corridor Mapping Tool and multiple stakeholder meetings. We look forward to continued work with BLM and other federal agencies in Region 1 and setting a strong example for future Regional Reviews.

From: Clementson, Connie
To: Nada Culver
Cc: Joseph Meyer; Justin Abernathy
Subject: Fwd: FW: Tres Rios and Happy Holidays
Date: Monday, January 9, 2017 8:53:13 AM
Attachments: 2016 CAPE Awards.pdf

Thank you Nada for sharing this great news. I am proud that the SWRAC was able, through their community process, to provide BLM focused information regarding this area. Happy New Year!

Connie Clementson, Field Manager
Tres Rios Field Office
office 970-882-6808 Dolores
office 970-385-1357 Durango
cell 970-394-4045
email: cclementson@blm.gov

---------- Forwarded message ----------
From: Nada Culver <nada_culver@tws.org>
Date: Wed, Jan 4, 2017 at 3:51 PM
Subject: RE: FW: Tres Rios and Happy Holidays
To: "Clementson, Connie" <cclementson@blm.gov>

Hi again, Connie – I just wanted to let you know that we highlighted the Tres Rios MLP in our annual TWS end of year CAPE awards, which acknowledge BLM's accomplishments from the previous year.

Nada Culver

Senior Counsel and Director, BLM Action Center

The Wilderness Society

1660 Wynkoop, #850

Denver, CO 80202

Main: 303-650-5818

Direct: 303-225-4635

Nada_Culver@tws.org <mailto:Nada_Culver@tws.org>

From: Clementson, Connie [mailto:cclementson@blm.gov]
Sent: Tuesday, January 3, 2017 11:10 AM
To: Nada Culver <nada_culver@tws.org>
Cc: Justin Abernathy <jabernathy@blm.gov>; Joseph Meyer <jmeyer@blm.gov>

Subject: Re: FW: Tres Rios and Happy Holidays

Thank you Nada... and happy new year as well!

I truly believe our SWRAC community process really assisted us in further clarifying issues that will be addressed as we move forward!

Connie Clementson, Field Manager

Tres Rios Field Office

office 970-882-6808 Dolores

office 970-385-1357 Durango

cell 970-394-4045

email: cclementson@blm.gov

On Fri, Dec 23, 2016 at 8:21 AM, Nada Culver <nada_culver@tws.org> wrote:

Hi Connie – I just wanted to express our appreciation for all the work that went into the announcement on the master leasing plan in Tres Rios. I've pasted our statement below in case it's of interest.

I hope you have a Merry Christmas and Happy Holidays.

New roadmap for successful public lands planning in Colorado moves forward

Dec 19, 2016

Denver, CO

Mesa Verde National Park, as well as renowned mountain biking destinations, would be protected through the master leasing plan.

Credit Steve Dunleavy, flickr.

BLM approves Tres Rios Master Leasing Plan

Today the Bureau of Land Management in Colorado announced that it will move forward with a master leasing

plan for oil and gas leasing and development in Montezuma and La Plata counties, on lands managed by BLM's Tres Rios Field Office.

The Wilderness Society issued the following statement from senior counsel and director of the BLM Action Center, Nada Culver:

"We strongly support BLM's decision to move forward with the Tres Rios Master Leasing Plan and are excited to see the agency acknowledge the will of the local community and the need for smart and sound energy management in southwestern Colorado.

"By consulting early on with local communities, the BLM can provide more certainty, transparency and public involvement in issues that impact our public lands. For too long, the industry has had policy tilted in its favor without sufficient input from the public and other stakeholders. Master leasing plans provide a path forward for oil and gas development to take into account other users and uses of our public lands like recreation businesses, local communities and our immense cultural and historic resources.

"We are glad to see the BLM continuing to make this type of progress in its management of public lands."

Nada Culver

Senior Counsel and Director, BLM Action Center

The Wilderness Society

1660 Wynkoop, #850

Denver, CO 80202

Main: 303-650-5818

Direct: 303-225-4635

Nada_Culver@tws.org

The 2016 CAPE Awards

Celebrating Milestones in Conservation for our Public Lands

The Interior Department hit its stride in 2016, and rolled out some inspired final decisions to cap off the Obama administration's tenure. We were delighted to see years of effort culminate in major progress for stewardship of wilderness quality lands, more balanced oil and gas management, and smart from the start renewable energy planning. And, how we could not spotlight right off the bat finalization of the BLM's new planning rule?! Way to go, BLM, it's been quite a ride.

Unfortunately, there have also been isolated affronts towards our western public lands and the civil servants that steward them for all Americans. In these challenging times, as in years past, we'd like to start our annual year-end celebratory awards to first recognize and appreciate all BLM employees and their commitment to managing our vast shared real estate for the benefit of us all. In coming years, we hope the agency maintains pride in its mission, continues its exciting trajectory towards landscape-level planning and managing for the greatest threat of the future – climate change – and keeps the faith that the American public overwhelmingly supports public lands.

The Comparative Analysis of Particular Excellence (CAPE) rating system, inspired by the superhero-like character of the BLM Action Center team (able to leap tall stacks of RMPs in a single bound!), ranges from one CAPE on the low end (worth a pat on the back) to five CAPEs on the high end (HUGE PROGRESS!!! WAY TO GO!!!).

1. New Rule to Update Planning for Public Lands – 5 CAPEs

Acknowledging that the BLM's land use planning rule has not been substantially updated since the Internet was invented in 1983, the agency finalized updates to the rule this year to help bring planning for our public lands into the 21st century. The rule is part of the BLM's "Planning 2.0" initiative to make planning more cooperative, transparent and efficient. Under the new rule, the public has new and improved opportunities to make their voices heard in management decisions affecting our public lands. The rule also encourages planning at a landscape-scale rather than by political boundaries to better address issues such as wildlife movement corridors and planning for energy development while protecting valuable lands for conservation.

The rule has broad public support, including from many local governments, who appreciate the agency's commitment to expand public participation in land use planning decisions, utilize modern science in assessing land conditions and planning for the future, and strive to make our public lands more resilient

and adaptable. Through this rule, the BLM will be better equipped to design land management plans that truly reflect the needs and desires of the public.

We congratulate the BLM on getting this important and essential rule over the finish line and look forward to seeing it implemented. We are also looking forward to seeing the Planning 2.0 initiative come to completion with the issuance of an updated land use planning handbook to help guide implementation.

2. Wilderness Quality Lands Get the Love They Deserve – 5 CAPEs

In 2016, the BLM continued to make significant progress in its efforts to conduct and maintain inventories of lands with wilderness characteristics. Lands with wilderness characteristics are an important resource that the BLM is obligated to identify under the Federal Land Policy and Management Act of 1976. In the last few years, we've seen the BLM improve its inventory methods while extending the agency's commitments to funding and executing on-the-ground inventory work. The BLM has or is currently updating inventories in planning areas around the country—including the Colorado River Valley and San Luis Valley field offices in Colorado, as well as the Basin and Range National Monument in Nevada.

Basin and Range National Monument, by Bob Wick

In addition to improving inventory methods and conducting field inventories, the BLM is also clarifying its obligations to address wilderness resources in a more consistent manner. This year, the BLM developed statewide guidance in Colorado and Utah to provide more detail on conducting inventories, responding to citizens' inventories, and considering lands with wilderness characteristics in planning efforts, including at the project level. This guidance helps to provide uniformity in how individual field offices meet their obligations to identify and consider lands with wilderness characteristics.

The BLM further committed to stewarding wilderness resources this year through requiring compensatory mitigation for impacts to lands with wilderness characteristics from development. Mitigation is an important tool because it ensures that the public receives compensation for the loss of wilderness quality lands due to projects such as energy development. In the case of the recently approved TransWest Express and Gateway South transmission lines, the BLM will offset impacts to lands with wilderness characteristics by protecting wilderness-quality lands elsewhere.

The BLM has been ushering in a renewed dedication to assessing and protecting wilderness quality public lands over the past few years, and the momentum continued in 2016 thanks to extensive inventory work, state-specific guidance and compensatory mitigation commitments. We expect the BLM will continue with this important work in coming years to meet the agency's obligations under FLPMA.

3. Employing a Commonsense Approach to Oil and Gas Development – 5 CAPEs

For far too long, the oil and gas industry has run the roost on our public lands. The BLM has prioritized oil and gas leasing and drilling at the expense of wildlands, wildlife, clean air and water, recreation and numerous other values of our shared western landscapes. This year, the BLM took the reins and implemented commonsense decisions and reforms to ensure oil and gas has just one seat at the table – along with all other multiple uses. Two of the most impactful decisions were to cancel oil and gas leases in Colorado's Thompson Divide and Montana's Badger-Two Medicine area. In both cases, the BLM responded to strong local support – including ranchers in the Thompson Divide and the Blackfeet Nation in Badger-Two – to rectify a historic wrong and dispose of improperly-issued leases. These landscapes are truly too wild to drill, and we are elated that the BLM has finally taken strong action to protect them for future generations.

The BLM also adopted other commonsense reforms for oil and gas development this year. Chief among them is the "methane rule," which aims to cut natural gas waste and methane pollution from oil and gas operations on public lands. The methane rule will help move us toward agreements to cut U.S. methane emissions by 40 to 45 percent by 2025, building on 2015 U.S. commitments in Paris to reduce emissions and slow global warming. The BLM also finalized Onshore Orders 3, 4 and 5 to accurately measure and report oil and gas produced from federal lands and ensure companies pay full royalties.

Lease cancellations in the Thompson Divide and Badger-Two Medicine areas are landmark victories for nationally important landscapes that should never have been leased in the first place. We are thrilled to see the BLM take a proactive approach to oil and gas management on our public lands by protecting special lands and adopting rules to make drilling safer and smarter, for the climate and for taxpayers.

4. California Desert Plan Protects 4.2 Million Acres – 5 CAPEs

In September, the California BLM released its highly anticipated Record of Decision (ROD) for the Desert Renewable Energy Conservation Plan (DRECP) – a land use planning effort designed to balance smart renewable energy development with land conservation in the California Desert. The signing of the DRECP ROD not only marks the end of the first phase of a broader plan, but also affirms that developing clean energy and protecting wildlife, plants, cultural resources, and recreation opportunities are not mutually exclusive.

The DRECP ROD will protect 4.2 million acres of wild and vulnerable public land, including permanently protecting almost 3 million acres of newly designated California Desert National Conservation Lands. The BLM has already initiated the mineral withdrawal procedures for over 1.3 million acres of these new conservation lands as required by the DRECP ROD. This early action will not only reinforce their designation as protected conservation areas, but help drive DRECP implementation forward. The DRECP ROD also designates carefully selected low-conflict areas dedicated to renewable energy production, including locations that are already adjacent to existing infrastructure like transmission lines and roads. This decision will help elevate and streamline renewable energy production in locations that are attractive to developers and pose limited risk to other resources.

California's Silurian Valley, by Mason Cummings

With the ROD, the plan has set a high bar for future collaborative, multi-agency planning initiatives unfolding across the West. While the work in the California Desert is just beginning, signing the DRECP ROD for Phase I is an important achievement and an essential building block for what is to come from implementation and Phase II.

We enthusiastically support the DRECP ROD, which will protect over 4.2 million of acres of delicate desert resources and pristine landscapes for future generations while helping California meet its renewable energy and climate goals. In a time of serious climate uncertainty, forward-thinking planning measures like the DRECP will help reduce stress and impacts to a vulnerable landscape. Moving forward, the BLM needs to tackle the implementation of the DRECP Phase I head-on, beginning with the recently initiated mineral withdrawal procedures on over 1.3 million acres of designated conservation lands and to diligently assess the landscape for disturbances, as well as helping renewables projects succeed in designated low-conflict areas.

5. BLM Codifies "Smart from the Start" Renewable Energy Program – 5 CAPEs

The BLM has made great strides in advancing responsible renewable energy in the last five years. This includes permitting the first-ever solar projects on public lands, establishing landscape-scale plans to guide development to low-conflict zones across the southwest, and approving over 15,000 megawatts of wind, solar and geothermal development – enough to power over five million homes. In finalizing the Wind and Solar Leasing Rule this year, BLM ensured that smart approaches advanced in recent years will become standard practice going forward. By prioritizing development in designated low-conflict areas, the rule will make the permitting process more efficient in appropriate areas while protecting wildlands and wildlife habitat from development, as demonstrated by the success at the Dry Lake Solar Energy Zone (SEZ) outside Las Vegas. It will also assure taxpayers fair compensation by implementing a competitive leasing process. The rule enjoys wide, bi-partisan support and will facilitate responsible renewables development, helping us protect our natural heritage, tackle the threat of climate change, and benefit western economies.

BLM also continues to make renewable energy zones more attractive to developers and ensure that unavoidable impacts from development are offset through mitigation. The agency finalized two Solar Regional Mitigation Strategies (SRMSs) this year, one for the Dry Lake Valley North (DLVN) SEZ in eastern Nevada and one for Arizona's three SEZs. These build off BLM's pilot SRMS for the Dry Lake SEZ, which proved to be a key element of the agency's success in providing an efficient permitting process for projects in that zone and giving predictability to developers on their mitigation obligations, while investing mitigation resources in strategic conservation actions in the region. BLM has continued to refine its approach to SRMSs, and the DLVN and Arizona SRMSs included improvements such as better addressing uncertainty on mitigation outcomes in fee calculations. We expect that the completion of

these SRMSs will increase the attractiveness of these SEZs for responsible development when market conditions are right.

We applaud the BLM in creating a robust renewable energy program from scratch, culminating with the finalization of the Wind and Solar Leasing Rule this year. We look forward to working with the BLM, project developers, and other stakeholders to put the rule to work, including establishing implementation guidance, helping projects succeed in zones, designating new zones in appropriate areas, and protecting wildlands and wildlife habitat from development. We also look forward to engaging with BLM as it finalizes the SRMSs underway in Colorado, New Mexico, and Utah to facilitate responsible solar development and mitigation in those regions. We hope BLM will continue to refine its approach to SRMSs, including elevating the potential for addressing mitigation obligations by adding or strengthening protections for other public lands in SEZ regions.

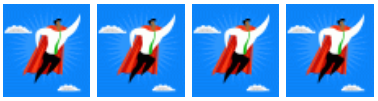
6. Natural Heritage Protected in the Arctic – 5 CAPEs

Hot off the presses, this week the BLM finalized a plan for 6.5 million acres of extremely wild public lands in Alaska's Eastern Interior planning area. The public lands managed by the BLM here include some traditional land of twelve federally recognized tribes, several of which have worked throughout the planning process to ensure their cultural heritage and identities, realized through subsistence lifestyles, are protected. Moose, caribou, grizzly bear, wolverine, and eagles are among the many species that make their home in the Eastern Interior along with dozens of fish species that depend on vast and complex river systems, including the mighty Yukon. The public lands in Alaska's interior also provide outstanding opportunities for hunting, fishing, rafting, and cross-country skiing to winter huts. The final Eastern Interior plan strikes a good balance for conserving important fish and wildlife habitat, providing quality backcountry recreation experiences, and protecting traditional uses. It also identifies and includes measures to protect 3 million acres of lands with wilderness characteristics, and substantially restricts new mining.

This year, the Department of the Interior also decided to protect the Arctic Ocean from oil and gas leasing for the next five years in the Bureau of Ocean Energy Management's 2017-2022 program for offshore oil and gas leasing. The Arctic Ocean provides habitat for numerous species of whales, polar bears, seals, walruses and many populations of fish and birds, and has supported the lives and cultures of Alaska Natives for thousands of years. These places would be gravely threatened by oil and gas leasing, and we are relieved that the Arctic Ocean will be spared for the near future.

We are inspired by the BLM's commitment to protect Alaska's indigenous people and their subsistence cultures, as well as critically important wildlife habitat and epically vast wilderness-quality lands, from destructive mining and development in the Eastern Interior. We are also grateful that the Department of the Interior recognized the Arctic Ocean is not appropriate for oil and gas leasing due to its extraordinarily vulnerable environment and important natural resources.

7. BLM Finalizes Strong Mitigation Manual and Handbook – 4 CAPEs



BLM has demonstrated great leadership in recent years in modernizing its approach to "mitigation", the practice of avoiding and offsetting damage caused to public lands from development. Federal regulations require agencies to follow a five-step hierarchy to address impacts – avoid, minimize, rectify, reduce/eliminate, and compensate – which can be summarized as avoidance, minimization and compensation. Historically, work to mitigate the negative impacts of development such as oil and gas drilling and transmission lines was implemented on a project-by-project basis, which was insufficient to protect our resources and inefficient for permitting projects.

The new policies from BLM and other federal agencies provide guidelines for a broad, landscape-scale approach to balancing development and conservation on public lands. If the policies are used properly, future development projects will avoid impacts to sensitive resources while benefitting from more predictable and efficient permitting processes, and federal agencies will require conservation gains to address and overcome any loss of resources that does occur. Key concepts emphasized in the manual and handbook include a focus on the mitigation hierarchy; use of a landscape-scale approach; setting a no net loss or net benefit outcome for resources that are considered important, scarce, sensitive, or have a protective legal mandate; use of mitigation strategies and plans to establish mitigation standards in advance of development; and emphasizing BLM's preference for achieving compensatory mitigation outcomes in advance of impacts.

The handbook also provides important details on tools BLM can use to durably protect mitigation sites on public lands such as identification of a protective land use plan allocation for the site (e.g. an Area of Critical Environmental Concern) or issuance of a lease or easement to a member of the public to conserve the site (via the authority granted in FLPMA Title III and/or Title V).

As described elsewhere in these awards, we've seen the value of BLM's smarter approach to mitigation in Solar Regional Mitigation Strategies, transmission line project approvals and other contexts. With the manual and handbook now finalized, we look forward to continuing to work with BLM to advance these important mitigation guidelines through land use planning and project permitting. Used properly, they will better balance conservation and development on our public lands while increasing permitting predictability and efficiency.

8. Coal Gets a Reboot – 4 CAPEs

On January 15, 2016, Interior Secretary Sally Jewell signed Secretarial Order 3338 directing the BLM to prepare a Programmatic Environmental Impact Statement (PEIS) to analyze potential leasing and management reforms to the federal coal program. The BLM held six public meetings across the county and solicited comment from stakeholders to gather information on policies and practices that need to be updated. The PEIS seeks to address how, when and where to lease public lands for future coal development, as well as how to secure a fair return to taxpayers from royalties, address climate impacts, and address our domestic energy needs. BLM also implemented a temporary pause on significant new coal leasing while it completes the process.

Colorado's North Fork Valley, by Jim Ramey

The coal program has not been reassessed in almost thirty years and significant changes are necessary to bring the program in line with 21st century energy demands and public expectations for our shared public lands. An updated coal program should also seek ways to assist coal dependent communities in this time of transition – like Colorado's North Fork Valley. We commend BLM's extensive public outreach process and we hope the scoping report due to be released in early January will provide the agency and the public with information to move forward with smart reforms.

While we realize the incoming administration may not agree with all the steps taken to date, we believe that the incredible amount of time, energy, and analysis that has gone into the process thus far should not be wasted. International and domestic market factors point to a decline in coal production and use regardless of a shift in federal energy policy. We hope that smart and sensible reforms are pursued to ensure that the American taxpayer is not being shortchanged and that American coal workers and coal dependent communities are not forgotten amid this transition. We applaud the BLM for initiating this monumental undertaking.

9. Planning for Oil and Gas at a Landscape Level – 3 CAPEs

In 2016 BLM made headway towards smart and balanced landscape level planning for energy development on public lands. This was highlighted by the agency's work on several Master Leasing Plans (MLPs) across the West. The Moab MLP, finalized on December 15th, illustrates how effective this tool can be. The final plan protects Canyonlands and Arches National Parks from nearby development and ensures the region's economy will continue to thrive by managing lands to support recreation, tourism and cultural sites. Also in Utah, the BLM released preliminary alternatives for the San Rafael Desert MLP. The planning area contains valuable wilderness quality lands and endemic bee habitat, and abuts Canyonlands National Park. The preliminary alternatives contain measures that emphasize the importance of protecting these other resources while maintaining ample opportunity for responsible oil and gas development.

In Colorado, the BLM made notable progress on the South Park MLP this year. There, elected officials, sportsmen, the state wildlife agency, local residents and municipal service providers like Denver Water have come together to ensure oil and gas drilling does not harm wildlife habitat, Gold Medal fishing streams, South Park's scenic wildlands, or vitally important drinking water sources for Colorado's front range. And just before the holidays, BLM Colorado announced that the Tres Rios Field Office will be moving forward with the Southwest Colorado MLP. This plan has been largely driven forward by support from the local community who highlighted the need to establish protections for agriculture, Mesa Verde National Park and the renowned mountain biking area Phil's World.

Finally, in the greater Chaco landscape in northwest New Mexico, tribal leaders, industry and conservation groups have encouraged the BLM to establish a workable process to help preserve unique cultural values in an energy-rich region. The BLM is embarking on a joint planning process with the Bureau of Indian Affairs to ensure everyone has a seat at the table in planning for the future of oil and gas development in the Chaco region.

W*e are encouraged by the leaps forward the BLM has taken in the last year to ensure true multiple-use management of our public lands and smart planning for oil and gas development. We hope the BLM will continue to use Master Leasing Plans and other tools for smart from the start oil and gas planning to manage our public lands in a way that balances community needs and other resource values with energy development.*

Chaco Culture National Historical Park, by Ti Hays

10. Greater Sage-grouse Conservation Plan Implementation Moving Forward – 2 CAPEs

Since completion of the range-wide conservation plans last year, BLM has been moving to implement their commitments. Initial guidance has been issued, through seven instruction memoranda, regarding oil and gas leasing and development, grazing permit review priorities, grazing management thresholds and responses, adaptive management triggers, disturbance tracking, effectiveness monitoring, and habitat assessment framework. These memoranda provide key direction for implementing various aspects of managing resources uses and evaluating how the plans are meeting their goals. BLM has also issued a Draft Environmental Impact Statement setting out the results of its analysis of potential mineral withdrawals, following on the recommendations for withdrawal in the conservation plans and developing alternatives based on input from states and other stakeholders.

Additional direction, such as specific mitigation strategies, and implementation, such as through travel planning, is still needed to ensure the success of the conservation plans. Similarly, BLM must move forward on the mineral withdrawals that were recommended as part of conserving the greater sage-grouse and its habitat, and supported the U.S. Fish and Wildlife Service's conclusion that this species no longer warrants protection under the Endangered Species Act.

11. Opportunity Abounds to Protect the North Fork Valley – 1 CAPE

This year, the BLM released its draft plan for the Uncompahgre area in western Colorado, and included an alternative to largely protect the North Fork Valley from oil and gas development. The North Fork Valley, surrounding the North Fork of the Gunnison River, is Colorado's farm-to-table capital and is home to idyllic vineyards and one of the largest concentrations of organic farming in the state, not to mention outstanding hiking, biking, and hunting. The local community rose in opposition to the BLM's plan to issue oil and gas leases in the area in 2012, and came together to develop the "North Fork Alternative Plan," a proposal to the BLM for managing oil and gas development in the scenic valley. The BLM's draft plan would adopt this community vision in one alternative – but not the agency's preferred alternative.

We greatly appreciate that the BLM included the local community's North Fork Alternative Plan in the draft RMP, making room for the agency to ultimately adopt the community vision in the final plan. The BLM must seize this opportunity to develop a final plan for the North Fork Valley that protects agriculture, recreation, the Gunnison River and the livelihoods of the locals from oil and gas development.

Honorable Mention

With transition to new ePlanning system, the BLM aims to increase transparency

Over the past year, the BLM has been transitioning its online National Environmental Policy Act (NEPA) Registers to a new ePlanning system. As a central database for the agency, ePlanning will house land use planning information and NEPA documents across all BLM planning areas. We appreciate that the BLM has invested resources in improving the functionality and accessibility of online information for the general public. From approving the construction of new roads and transmission lines to authorizing off-road vehicle races, the NEPA Registers are the fundamental tool for the public to understand and engage in decisions affecting our public lands. Allowing users to search based on location, filter based on BLM program, and readily view projects that have an open opportunity for public comment are a few of the ePlanning features that improve usability. As the BLM further develops ePlanning webpages, we hope to see relevant mapping information and data for all projects readily available and greater collaboration with stakeholders to explore ways that ePlanning might further support public participation.

Regional Review of West-wide Energy Corridors moves forward in Arizona, California, and Nevada

BLM initiated its first Regional Review of West-wide Energy Corridors this fall for energy corridors in the California desert, western Arizona, and southern Nevada. These Regional Reviews allow BLM to take a second look at existing energy corridors on our public lands and make sure they are helping promote responsible development. To be effective, energy corridors must be functional and attractive for developers, and avoid sensitive resources such as lands with wilderness characteristics and wildlife habitat. Corridors should also help facilitate renewable energy for our nation's energy grid.

As the first Regional Review out the door, there is a tremendous opportunity for BLM to begin engraining a 'smart-from-the-start' approach to planning for transmission lines and other energy infrastructure. In fact, recommendations in Region 1 have the immediate potential to improve ongoing projects and planning, such as the proposed Ten West Link transmission project between Arizona and California, and corridors in the ongoing Las Vegas-Pahrump Resource Management Plan revision. For all corridors in review, BLM should analyze the full range of resources on public lands and put forward recommendations that address serious environmental concerns. Overall, we have welcomed the emphasis BLM has placed on public and stakeholder participation in the process, including the creation of the interactive Energy Corridor Mapping Tool and multiple stakeholder meetings. We look forward to continued work with BLM and other federal agencies in Region 1 and setting a strong example for future Regional Reviews.

From: Nada Culver
To: "bcribley@blm.gov"
Subject: TWS BLM Action Center"s annual awards recognizing BLM"s great work
Date: Tuesday, January 10, 2017 10:05:58 PM
Attachments: 2016 CAPE Awards.pdf

Hi Bud – I wanted to forward our annual awards to you, personally, since we wanted to thank you for BLM Alaska's work this year, especially on the Eastern Interior RMP. Thanks so much.

Nada Culver

Senior Counsel and Director, BLM Action Center

The Wilderness Society

1660 Wynkoop, #850

Denver, CO 80202

Main: 303-650-5818

Direct: 303-225-4635

Nada_Culver@tws.org

The 2016 CAPE Awards

Celebrating Milestones in Conservation for our Public Lands

The Interior Department hit its stride in 2016, and rolled out some inspired final decisions to cap off the Obama administration's tenure. We were delighted to see years of effort culminate in major progress for stewardship of wilderness quality lands, more balanced oil and gas management, and smart from the start renewable energy planning. And, how we could not spotlight right off the bat finalization of the BLM's new planning rule?! Way to go, BLM, it's been quite a ride.

Unfortunately, there have also been isolated affronts towards our western public lands and the civil servants that steward them for all Americans. In these challenging times, as in years past, we'd like to start our annual year-end celebratory awards to first recognize and appreciate all BLM employees and their commitment to managing our vast shared real estate for the benefit of us all. In coming years, we hope the agency maintains pride in its mission, continues its exciting trajectory towards landscape-level planning and managing for the greatest threat of the future – climate change – and keeps the faith that the American public overwhelmingly supports public lands.

The Comparative Analysis of Particular Excellence (CAPE) rating system, inspired by the superhero-like character of the BLM Action Center team (able to leap tall stacks of RMPs in a single bound!), ranges from one CAPE on the low end (worth a pat on the back) to five CAPEs on the high end (HUGE PROGRESS!!! WAY TO GO!!!).

1. New Rule to Update Planning for Public Lands – 5 CAPEs

Acknowledging that the BLM's land use planning rule has not been substantially updated since the Internet was invented in 1983, the agency finalized updates to the rule this year to help bring planning for our public lands into the 21st century. The rule is part of the BLM's "Planning 2.0" initiative to make planning more cooperative, transparent and efficient. Under the new rule, the public has new and improved opportunities to make their voices heard in management decisions affecting our public lands. The rule also encourages planning at a landscape-scale rather than by political boundaries to better address issues such as wildlife movement corridors and planning for energy development while protecting valuable lands for conservation.

The rule has broad public support, including from many local governments, who appreciate the agency's commitment to expand public participation in land use planning decisions, utilize modern science in assessing land conditions and planning for the future, and strive to make our public lands more resilient

and adaptable. Through this rule, the BLM will be better equipped to design land management plans that truly reflect the needs and desires of the public.

We congratulate the BLM on getting this important and essential rule over the finish line and look forward to seeing it implemented. We are also looking forward to seeing the Planning 2.0 initiative come to completion with the issuance of an updated land use planning handbook to help guide implementation.

2. Wilderness Quality Lands Get the Love They Deserve – 5 CAPEs

In 2016, the BLM continued to make significant progress in its efforts to conduct and maintain inventories of lands with wilderness characteristics. Lands with wilderness characteristics are an important resource that the BLM is obligated to identify under the Federal Land Policy and Management Act of 1976. In the last few years, we've seen the BLM improve its inventory methods while extending the agency's commitments to funding and executing on-the-ground inventory work. The BLM has or is currently updating inventories in planning areas around the country—including the Colorado River Valley and San Luis Valley field offices in Colorado, as well as the Basin and Range National Monument in Nevada.

Basin and Range National Monument, by Bob Wick

In addition to improving inventory methods and conducting field inventories, the BLM is also clarifying its obligations to address wilderness resources in a more consistent manner. This year, the BLM developed statewide guidance in Colorado and Utah to provide more detail on conducting inventories, responding to citizens' inventories, and considering lands with wilderness characteristics in planning efforts, including at the project level. This guidance helps to provide uniformity in how individual field offices meet their obligations to identify and consider lands with wilderness characteristics.

The BLM further committed to stewarding wilderness resources this year through requiring compensatory mitigation for impacts to lands with wilderness characteristics from development. Mitigation is an important tool because it ensures that the public receives compensation for the loss of wilderness quality lands due to projects such as energy development. In the case of the recently approved TransWest Express and Gateway South transmission lines, the BLM will offset impacts to lands with wilderness characteristics by protecting wilderness-quality lands elsewhere.

The BLM has been ushering in a renewed dedication to assessing and protecting wilderness quality public lands over the past few years, and the momentum continued in 2016 thanks to extensive inventory work, state-specific guidance and compensatory mitigation commitments. We expect the BLM will continue with this important work in coming years to meet the agency's obligations under FLPMA.

3. Employing a Commonsense Approach to Oil and Gas Development – 5 CAPEs

For far too long, the oil and gas industry has run the roost on our public lands. The BLM has prioritized oil and gas leasing and drilling at the expense of wildlands, wildlife, clean air and water, recreation and numerous other values of our shared western landscapes. This year, the BLM took the reins and implemented commonsense decisions and reforms to ensure oil and gas has just one seat at the table – along with all other multiple uses. Two of the most impactful decisions were to cancel oil and gas leases in Colorado's Thompson Divide and Montana's Badger-Two Medicine area. In both cases, the BLM responded to strong local support – including ranchers in the Thompson Divide and the Blackfeet Nation in Badger-Two – to rectify a historic wrong and dispose of improperly-issued leases. These landscapes are truly too wild to drill, and we are elated that the BLM has finally taken strong action to protect them for future generations.

The BLM also adopted other commonsense reforms for oil and gas development this year. Chief among them is the "methane rule," which aims to cut natural gas waste and methane pollution from oil and gas operations on public lands. The methane rule will help move us toward agreements to cut U.S. methane emissions by 40 to 45 percent by 2025, building on 2015 U.S. commitments in Paris to reduce emissions and slow global warming. The BLM also finalized Onshore Orders 3, 4 and 5 to accurately measure and report oil and gas produced from federal lands and ensure companies pay full royalties.

Lease cancellations in the Thompson Divide and Badger-Two Medicine areas are landmark victories for nationally important landscapes that should never have been leased in the first place. We are thrilled to see the BLM take a proactive approach to oil and gas management on our public lands by protecting special lands and adopting rules to make drilling safer and smarter, for the climate and for taxpayers.

4. California Desert Plan Protects 4.2 Million Acres – 5 CAPEs

In September, the California BLM released its highly anticipated Record of Decision (ROD) for the Desert Renewable Energy Conservation Plan (DRECP) – a land use planning effort designed to balance smart renewable energy development with land conservation in the California Desert. The signing of the DRECP ROD not only marks the end of the first phase of a broader plan, but also affirms that developing clean energy and protecting wildlife, plants, cultural resources, and recreation opportunities are not mutually exclusive.

The DRECP ROD will protect 4.2 million acres of wild and vulnerable public land, including permanently protecting almost 3 million acres of newly designated California Desert National Conservation Lands. The BLM has already initiated the mineral withdrawal procedures for over 1.3 million acres of these new conservation lands as required by the DRECP ROD. This early action will not only reinforce their designation as protected conservation areas, but help drive DRECP implementation forward. The DRECP ROD also designates carefully selected low-conflict areas dedicated to renewable energy production, including locations that are already adjacent to existing infrastructure like transmission lines and roads. This decision will help elevate and streamline renewable energy production in locations that are attractive to developers and pose limited risk to other resources.

California's Silurian Valley, by Mason Cummings

With the ROD, the plan has set a high bar for future collaborative, multi-agency planning initiatives unfolding across the West. While the work in the California Desert is just beginning, signing the DRECP ROD for Phase I is an important achievement and an essential building block for what is to come from implementation and Phase II.

We enthusiastically support the DRECP ROD, which will protect over 4.2 million of acres of delicate desert resources and pristine landscapes for future generations while helping California meet its renewable energy and climate goals. In a time of serious climate uncertainty, forward-thinking planning measures like the DRECP will help reduce stress and impacts to a vulnerable landscape. Moving forward, the BLM needs to tackle the implementation of the DRECP Phase I head-on, beginning with the recently initiated mineral withdrawal procedures on over 1.3 million acres of designated conservation lands and to diligently assess the landscape for disturbances, as well as helping renewables projects succeed in designated low-conflict areas.

5. BLM Codifies "Smart from the Start" Renewable Energy Program – 5 CAPEs

The BLM has made great strides in advancing responsible renewable energy in the last five years. This includes permitting the first-ever solar projects on public lands, establishing landscape-scale plans to guide development to low-conflict zones across the southwest, and approving over 15,000 megawatts of wind, solar and geothermal development – enough to power over five million homes. In finalizing the Wind and Solar Leasing Rule this year, BLM ensured that smart approaches advanced in recent years will become standard practice going forward. By prioritizing development in designated low-conflict areas, the rule will make the permitting process more efficient in appropriate areas while protecting wildlands and wildlife habitat from development, as demonstrated by the success at the Dry Lake Solar Energy Zone (SEZ) outside Las Vegas. It will also assure taxpayers fair compensation by implementing a competitive leasing process. The rule enjoys wide, bi-partisan support and will facilitate responsible renewables development, helping us protect our natural heritage, tackle the threat of climate change, and benefit western economies.

BLM also continues to make renewable energy zones more attractive to developers and ensure that unavoidable impacts from development are offset through mitigation. The agency finalized two Solar Regional Mitigation Strategies (SRMSs) this year, one for the Dry Lake Valley North (DLVN) SEZ in eastern Nevada and one for Arizona's three SEZs. These build off BLM's pilot SRMS for the Dry Lake SEZ, which proved to be a key element of the agency's success in providing an efficient permitting process for projects in that zone and giving predictability to developers on their mitigation obligations, while investing mitigation resources in strategic conservation actions in the region. BLM has continued to refine its approach to SRMSs, and the DLVN and Arizona SRMSs included improvements such as better addressing uncertainty on mitigation outcomes in fee calculations. We expect that the completion of

these SRMSs will increase the attractiveness of these SEZs for responsible development when market conditions are right.

We applaud the BLM in creating a robust renewable energy program from scratch, culminating with the finalization of the Wind and Solar Leasing Rule this year. We look forward to working with the BLM, project developers, and other stakeholders to put the rule to work, including establishing implementation guidance, helping projects succeed in zones, designating new zones in appropriate areas, and protecting wildlands and wildlife habitat from development. We also look forward to engaging with BLM as it finalizes the SRMSs underway in Colorado, New Mexico, and Utah to facilitate responsible solar development and mitigation in those regions. We hope BLM will continue to refine its approach to SRMSs, including elevating the potential for addressing mitigation obligations by adding or strengthening protections for other public lands in SEZ regions.

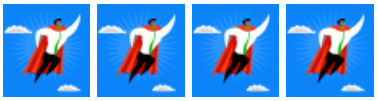
6. Natural Heritage Protected in the Arctic – 5 CAPEs

Hot off the presses, this week the BLM finalized a plan for 6.5 million acres of extremely wild public lands in Alaska's Eastern Interior planning area. The public lands managed by the BLM here include some traditional land of twelve federally recognized tribes, several of which have worked throughout the planning process to ensure their cultural heritage and identities, realized through subsistence lifestyles, are protected. Moose, caribou, grizzly bear, wolverine, and eagles are among the many species that make their home in the Eastern Interior along with dozens of fish species that depend on vast and complex river systems, including the mighty Yukon. The public lands in Alaska's interior also provide outstanding opportunities for hunting, fishing, rafting, and cross-country skiing to winter huts. The final Eastern Interior plan strikes a good balance for conserving important fish and wildlife habitat, providing quality backcountry recreation experiences, and protecting traditional uses. It also identifies and includes measures to protect 3 million acres of lands with wilderness characteristics, and substantially restricts new mining.

This year, the Department of the Interior also decided to protect the Arctic Ocean from oil and gas leasing for the next five years in the Bureau of Ocean Energy Management's 2017-2022 program for offshore oil and gas leasing. The Arctic Ocean provides habitat for numerous species of whales, polar bears, seals, walruses and many populations of fish and birds, and has supported the lives and cultures of Alaska Natives for thousands of years. These places would be gravely threatened by oil and gas leasing, and we are relieved that the Arctic Ocean will be spared for the near future.

We are inspired by the BLM's commitment to protect Alaska's indigenous people and their subsistence cultures, as well as critically important wildlife habitat and epically vast wilderness-quality lands, from destructive mining and development in the Eastern Interior. We are also grateful that the Department of the Interior recognized the Arctic Ocean is not appropriate for oil and gas leasing due to its extraordinarily vulnerable environment and important natural resources.

7. BLM Finalizes Strong Mitigation Manual and Handbook – 4 CAPEs



BLM has demonstrated great leadership in recent years in modernizing its approach to "mitigation", the practice of avoiding and offsetting damage caused to public lands from development. Federal regulations require agencies to follow a five-step hierarchy to address impacts – avoid, minimize, rectify, reduce/eliminate, and compensate – which can be summarized as avoidance, minimization and compensation. Historically, work to mitigate the negative impacts of development such as oil and gas drilling and transmission lines was implemented on a project-by-project basis, which was insufficient to protect our resources and inefficient for permitting projects.

The new policies from BLM and other federal agencies provide guidelines for a broad, landscape-scale approach to balancing development and conservation on public lands. If the policies are used properly, future development projects will avoid impacts to sensitive resources while benefitting from more predictable and efficient permitting processes, and federal agencies will require conservation gains to address and overcome any loss of resources that does occur. Key concepts emphasized in the manual and handbook include a focus on the mitigation hierarchy; use of a landscape-scale approach; setting a no net loss or net benefit outcome for resources that are considered important, scarce, sensitive, or have a protective legal mandate; use of mitigation strategies and plans to establish mitigation standards in advance of development; and emphasizing BLM's preference for achieving compensatory mitigation outcomes in advance of impacts.

The handbook also provides important details on tools BLM can use to durably protect mitigation sites on public lands such as identification of a protective land use plan allocation for the site (e.g. an Area of Critical Environmental Concern) or issuance of a lease or easement to a member of the public to conserve the site (via the authority granted in FLPMA Title III and/or Title V).

As described elsewhere in these awards, we've seen the value of BLM's smarter approach to mitigation in Solar Regional Mitigation Strategies, transmission line project approvals and other contexts. With the manual and handbook now finalized, we look forward to continuing to work with BLM to advance these important mitigation guidelines through land use planning and project permitting. Used properly, they will better balance conservation and development on our public lands while increasing permitting predictability and efficiency.

8. Coal Gets a Reboot – 4 CAPEs

On January 15, 2016, Interior Secretary Sally Jewell signed Secretarial Order 3338 directing the BLM to prepare a Programmatic Environmental Impact Statement (PEIS) to analyze potential leasing and management reforms to the federal coal program. The BLM held six public meetings across the county and solicited comment from stakeholders to gather information on policies and practices that need to be updated. The PEIS seeks to address how, when and where to lease public lands for future coal development, as well as how to secure a fair return to taxpayers from royalties, address climate impacts, and address our domestic energy needs. BLM also implemented a temporary pause on significant new coal leasing while it completes the process.

Colorado's North Fork Valley, by Jim Ramey

The coal program has not been reassessed in almost thirty years and significant changes are necessary to bring the program in line with 21st century energy demands and public expectations for our shared public lands. An updated coal program should also seek ways to assist coal dependent communities in this time of transition – like Colorado's North Fork Valley. We commend BLM's extensive public outreach process and we hope the scoping report due to be released in early January will provide the agency and the public with information to move forward with smart reforms.

While we realize the incoming administration may not agree with all the steps taken to date, we believe that the incredible amount of time, energy, and analysis that has gone into the process thus far should not be wasted. International and domestic market factors point to a decline in coal production and use regardless of a shift in federal energy policy. We hope that smart and sensible reforms are pursued to ensure that the American taxpayer is not being shortchanged and that American coal workers and coal dependent communities are not forgotten amid this transition. We applaud the BLM for initiating this monumental undertaking.

9. Planning for Oil and Gas at a Landscape Level – 3 CAPEs

In 2016 BLM made headway towards smart and balanced landscape level planning for energy development on public lands. This was highlighted by the agency's work on several Master Leasing Plans (MLPs) across the West. The Moab MLP, finalized on December 15th, illustrates how effective this tool can be. The final plan protects Canyonlands and Arches National Parks from nearby development and ensures the region's economy will continue to thrive by managing lands to support recreation, tourism and cultural sites. Also in Utah, the BLM released preliminary alternatives for the San Rafael Desert MLP. The planning area contains valuable wilderness quality lands and endemic bee habitat, and abuts Canyonlands National Park. The preliminary alternatives contain measures that emphasize the importance of protecting these other resources while maintaining ample opportunity for responsible oil and gas development.

In Colorado, the BLM made notable progress on the South Park MLP this year. There, elected officials, sportsmen, the state wildlife agency, local residents and municipal service providers like Denver Water have come together to ensure oil and gas drilling does not harm wildlife habitat, Gold Medal fishing streams, South Park's scenic wildlands, or vitally important drinking water sources for Colorado's front range. And just before the holidays, BLM Colorado announced that the Tres Rios Field Office will be moving forward with the Southwest Colorado MLP. This plan has been largely driven forward by support from the local community who highlighted the need to establish protections for agriculture, Mesa Verde National Park and the renowned mountain biking area Phil's World.

Finally, in the greater Chaco landscape in northwest New Mexico, tribal leaders, industry and conservation groups have encouraged the BLM to establish a workable process to help preserve unique cultural values in an energy-rich region. The BLM is embarking on a joint planning process with the Bureau of Indian Affairs to ensure everyone has a seat at the table in planning for the future of oil and gas development in the Chaco region.

W*e are encouraged by the leaps forward the BLM has taken in the last year to ensure true multiple-use management of our public lands and smart planning for oil and gas development. We hope the BLM will continue to use Master Leasing Plans and other tools for smart from the start oil and gas planning to manage our public lands in a way that balances community needs and other resource values with energy development.*

Chaco Culture National Historical Park, by Ti Hays

10. Greater Sage-grouse Conservation Plan Implementation Moving Forward – 2 CAPEs

Since completion of the range-wide conservation plans last year, BLM has been moving to implement their commitments. Initial guidance has been issued, through seven instruction memoranda, regarding oil and gas leasing and development, grazing permit review priorities, grazing management thresholds and responses, adaptive management triggers, disturbance tracking, effectiveness monitoring, and habitat assessment framework. These memoranda provide key direction for implementing various aspects of managing resources uses and evaluating how the plans are meeting their goals. BLM has also issued a Draft Environmental Impact Statement setting out the results of its analysis of potential mineral withdrawals, following on the recommendations for withdrawal in the conservation plans and developing alternatives based on input from states and other stakeholders.

Additional direction, such as specific mitigation strategies, and implementation, such as through travel planning, is still needed to ensure the success of the conservation plans. Similarly, BLM must move forward on the mineral withdrawals that were recommended as part of conserving the greater sage-grouse and its habitat, and supported the U.S. Fish and Wildlife Service's conclusion that this species no longer warrants protection under the Endangered Species Act.

11. Opportunity Abounds to Protect the North Fork Valley – 1 CAPE

This year, the BLM released its draft plan for the Uncompahgre area in western Colorado, and included an alternative to largely protect the North Fork Valley from oil and gas development. The North Fork Valley, surrounding the North Fork of the Gunnison River, is Colorado's farm-to-table capital and is home to idyllic vineyards and one of the largest concentrations of organic farming in the state, not to mention outstanding hiking, biking, and hunting. The local community rose in opposition to the BLM's plan to issue oil and gas leases in the area in 2012, and came together to develop the "North Fork Alternative Plan," a proposal to the BLM for managing oil and gas development in the scenic valley. The BLM's draft plan would adopt this community vision in one alternative – but not the agency's preferred alternative.

We greatly appreciate that the BLM included the local community's North Fork Alternative Plan in the draft RMP, making room for the agency to ultimately adopt the community vision in the final plan. The BLM must seize this opportunity to develop a final plan for the North Fork Valley that protects agriculture, recreation, the Gunnison River and the livelihoods of the locals from oil and gas development.

Honorable Mention

With transition to new ePlanning system, the BLM aims to increase transparency

Over the past year, the BLM has been transitioning its online National Environmental Policy Act (NEPA) Registers to a new ePlanning system. As a central database for the agency, ePlanning will house land use planning information and NEPA documents across all BLM planning areas. We appreciate that the BLM has invested resources in improving the functionality and accessibility of online information for the general public. From approving the construction of new roads and transmission lines to authorizing off-road vehicle races, the NEPA Registers are the fundamental tool for the public to understand and engage in decisions affecting our public lands. Allowing users to search based on location, filter based on BLM program, and readily view projects that have an open opportunity for public comment are a few of the ePlanning features that improve usability. As the BLM further develops ePlanning webpages, we hope to see relevant mapping information and data for all projects readily available and greater collaboration with stakeholders to explore ways that ePlanning might further support public participation.

Regional Review of West-wide Energy Corridors moves forward in Arizona, California, and Nevada

BLM initiated its first Regional Review of West-wide Energy Corridors this fall for energy corridors in the California desert, western Arizona, and southern Nevada. These Regional Reviews allow BLM to take a second look at existing energy corridors on our public lands and make sure they are helping promote responsible development. To be effective, energy corridors must be functional and attractive for developers, and avoid sensitive resources such as lands with wilderness characteristics and wildlife habitat. Corridors should also help facilitate renewable energy for our nation's energy grid.

As the first Regional Review out the door, there is a tremendous opportunity for BLM to begin engraining a 'smart-from-the-start' approach to planning for transmission lines and other energy infrastructure. In fact, recommendations in Region 1 have the immediate potential to improve ongoing projects and planning, such as the proposed Ten West Link transmission project between Arizona and California, and corridors in the ongoing Las Vegas-Pahrump Resource Management Plan revision. For all corridors in review, BLM should analyze the full range of resources on public lands and put forward recommendations that address serious environmental concerns. Overall, we have welcomed the emphasis BLM has placed on public and stakeholder participation in the process, including the creation of the interactive Energy Corridor Mapping Tool and multiple stakeholder meetings. We look forward to continued work with BLM and other federal agencies in Region 1 and setting a strong example for future Regional Reviews.

From:	Carnahan, Rachel
To:	morgan.skinner@kcsg.com; Tnesmith@cherrycreekradio.com; Nichole Osinski; acabrero@ksl.com; Aspen Stoddard; Ben Pollchik; Ben.winslow@fox13now.com; BLM_AZ WebPostings; Bob Paterson KTIM Radio; Bree Burkitt; brettoutdoors@yahoo.com; Brian Passey; Burkett, Jud; Carin Miller; Carl Rich; carl@canyonmedia.net; Casie Forbes; Chris Caldwell; Chris Campbell; chris@canyonmedia.net; Craig Bennett; Daily Sun Randy Wilson; Daily Sun Todd Glasenapp; Darren Edwards; Dave DeMille; Derek Dowsett; Desert Valley Times Mesquite_Spectrum; Dixie Brunner; DJ Bolerjack News2; editor@ironcountytoday.com; editor@lakepowellchronicle.com; editor@todayindixie.com; Emily Havens; Gary Sorensen; Gholdston@SUU.EDU; Hailey Higgins; Haven Scott; John Mangalonzo Local News Editor Spectrum; Jordan Allred; Josh Warburton; Julie Applegate; Julie Hawk KCSG; kejenkin@ad.gannett.com; KSUB Radio 590 AM Cedar City; kuzmanic@infowest.com; leepulaski@lakepowellchronicle.com; Luke Wilkins; Matthew Jacobson; Melissa Anderson; Mori Kessler; news@kcsg.com; news@ksl.com; news@stgeorgechamber.com; News_Matt Piper SLTrib; Peter and Barbara Leadenham; Rachel Tueller; Rachel Tueller; radio@backcountry-magazine.com; Richard Briggs; Sarah Gambles; Shane Brown-Cherry Creek KDXU; Spencer Ricks; sports@thespectrum.com; Stace Hall; Stephanie Frehner; Steve Kiggins; Steven Law Lake Powell Chronicle; Teresa Lees; Todd Seliga; Tom Wharton SLTrib; Tracie Sullivan; Zach Renstrom; Victor Iverson; Dean Cox; Nate Abbott; Trish Carter; Gary Watson Mohave Co Supervisor; Aaron Baker
Subject:	BLM requests public's assistance in preserving cultural resources for current and future generations of Americans
Date:	Thursday, January 12, 2017 5:28:12 PM
Attachments:	01-12-17 Preserving Cultural Resources_Press Release.doc

---

For Immediate Release: 01-12-17

Contact: Rachel T. Carnahan, BLM Arizona Strip District Public Affairs Officer

Phone: 435-688-3303 or E-mail: rcarnahan@blm.gov

BLM requests public's assistance in preserving cultural resources

for current and future generations of Americans

ST. GEORGE, Utah — BLM Arizona manages some of the most significant and best preserved prehistoric and historic archaeological sites in the American Southwest. On the Arizona Strip, the human stories etched on the landscapes are diverse and include everything from Little Black Mountain and Nampaweap Petroglyphs, to historic sites like the Mt. Trumbull Schoolhouse, Grand Gulch Mine and Dominguez-Escalante Trail. More than 750,000 acres of Arizona public lands have been inventoried for cultural resources and nearly 11,000 sites recorded.

A December 2016 prosecution and conviction in a looting case in nearby Beaver Dam, Arizona illustrates the important role the public plays in preserving archeological resources for present and future generations of Americans.

When BLM Law Enforcement Officers were notified that damage had occurred to a nearby archeological site, they began an investigation that led to the conviction of perpetrators who damaged the site and had stolen a number of artifacts. Although the impacts to the site amounted to more than $4,000 in damages, the long term impacts are greater for the public and Native American tribes who hold these sites sacred.

The theft, disturbance, or vandalism of archaeological resources, including surface collection of arrowheads or pottery sherds is not only illegal; these activities strip sites of precious resources that aid scientists in their study of earlier occupants. In addition, the losses deny present and future generations the ability to enjoy the privilege of learning from and observing the site in its original state.

BLM law enforcement rangers, special agents and archeologists work closely together to monitor and protect more than 150,000 prehistoric and historic sites on public lands across the country. In 1976 through the enactment of the Federal Land Policy and Management Act, Congress recognized the need for BLM law enforcement officers to provide for public safety and to help protect the nation's public land resources. The BLM's law enforcement program is responsible for protecting resources across the nation's 245 million acres of BLM-managed public land, which it does in partnership with state and local law enforcement agencies.

BLM Arizona's public lands contain a wealth of cultural resources that are important to our understanding of both

recorded history and prehistory. These resources represent a priceless heritage in need of preservation for the enjoyment of present and future generations.

To help protect your public lands and natural resources report resource crimes like vandalism, dumping and other suspicious activities by calling 1-800-637-9152, 24 hours a day, 7 days a week or go to: https://www.treadlightly.org/programs/respect-and-protect/ to learn more about how to Respect and Protect the nations' priceless natural resources.

The BLM manages more than 245 million acres of public land, the most of any Federal agency. This land, known as the National System of Public Lands, is primarily located in 12 Western states, including Alaska. The BLM also administers 700 million acres of sub-surface mineral estate throughout the nation. The BLM's mission is to manage and conserve the public lands for the use and enjoyment of present and future generations under our mandate of multiple-use and sustained yield. In Fiscal Year 2014, the BLM generated $5.2 billion in receipts from public lands.

Rachel T. Carnahan
Public Affairs Officer, BLM Arizona Strip District
345 East Riverside Drive, St. George, UT 84790
O-435-688-3303
C-435-218-6594
E-mail: rcarnahan@blm.gov

BLM NEWS RELEASE

U.S. Department of the Interior • Bureau of Land Management • Arizona Strip District Office • 345 East Riverside Drive • St. George, UT 84790

For Immediate Release: 01-12-17
Contact: Rachel T. Carnahan, BLM Arizona Strip District Public Affairs Officer
Phone: 435-688-3303 or E-mail: rcarnahan@blm.gov

BLM requests public's assistance in preserving cultural resources for current and future generations of Americans

ST. GEORGE, Utah — BLM Arizona manages some of the most significant and best preserved prehistoric and historic archaeological sites in the American Southwest. On the Arizona Strip, the human stories etched on the landscapes are diverse and include everything from Little Black Mountain and Nampaweap Petroglyphs, to historic sites like the Mt. Trumbull Schoolhouse, Grand Gulch Mine and Dominguez-Escalante Trail. More than 750,000 acres of Arizona public lands have been inventoried for cultural resources and nearly 11,000 sites recorded.

A December 2016 prosecution and conviction in a looting case in nearby Beaver Dam, Arizona illustrates the important role the public plays in preserving archeological resources for present and future generations of Americans.

When BLM Law Enforcement Officers were notified that damage had occurred to a nearby archeological site, they began an investigation that led to the conviction of perpetrators who damaged the site and had stolen a number of artifacts. Although the impacts to the site amounted to more than $4,000 in damages, the long term impacts are greater for the public and Native American tribes who hold these sites sacred.

The theft, disturbance, or vandalism of archaeological resources, including surface collection of arrowheads or pottery sherds is not only illegal; these activities strip sites of precious resources that aid scientists in their study of earlier occupants. In addition, the losses deny present and future generations the ability to enjoy the privilege of learning from and observing the site in its original state.

BLM law enforcement rangers, special agents and archeologists work closely together to monitor and protect more than 150,000 prehistoric and historic sites on public lands across the country. In 1976 through the enactment of the Federal Land Policy and Management Act, Congress recognized the need for BLM law enforcement officers to provide for public safety and to help protect the nation's public land resources. The BLM's law enforcement program is responsible for protecting resources across the nation's 245 million acres of BLM-managed public land, which it does in partnership with state and local law enforcement agencies.

BLM Arizona's public lands contain a wealth of cultural resources that are important to our understanding of both recorded history and prehistory. These resources represent a priceless heritage in need of preservation for the enjoyment of present and future generations.

To help protect your public lands and natural resources report resource crimes like vandalism, dumping and other suspicious activities by calling 1-800-637-9152, 24 hours a day, 7 days a week or go to: https://www.treadlightly.org/programs/respect-and-protect/ to learn more about how to Respect and Protect the nations' priceless natural resources.

The BLM manages more than 245 million acres of public land, the most of any Federal agency. This land, known as the National System of Public Lands, is primarily located in 12 Western states, including Alaska. The BLM also administers 700 million acres of sub-surface mineral estate throughout the nation. The BLM's mission is to manage and conserve the public lands for the use and enjoyment of present and future generations under our mandate of multiple-use and sustained yield. In Fiscal Year 2014, the BLM generated $5.2 billion in receipts from public lands.

From:	Spotts, Richard
To:	Phil Hanceford; scott@suwa.org; Terri Martin; Dave Pacheco; davidr@suwa.org; kim@grandcanyonwildlands.org; kelly@grandcanyonwildlands.org; Katie Davis; mark.clemens@sierraclub.org; utah.chapter@sierraclub.org; Michael Kellett; erickson.steve1@comcast.net; wildutah@xmission.com; Utah Native Plant Society; joro.walker@westernresources.org; Roger Clark; eaumack@grandcanyontrust.org; Tim Peterson; mobrien@grandcanyontrust.org; Kieran Suckling; rspivak@biologicaldiversity.org; Rob Mrowka; Susan Crook; Tom Butine; Jane Whalen; Arthur Haines; bluesage10@yahoo.com; Dave Ribacchi; utahsmalls@msn.com; Kathleen Harcksen; eyork@tnc.org; lisar@bajabb.com; Chris Gorzalski; Iris Picat; Kirk Robinson; Greta Anderson; alicyn.gitlin@sierraclub.org; Christine Albano; Sandy Bahr; friendsofgoldbutte@gmail.com; Tony Barron; Samantha Hammer; admin@sonorandesert.org; kim@wildlandsnetwork.org; Sara Vickerman Gage; ianderson@biologicaldiversity.org; nada_culver@tws.org
Subject:	FYI - National Parks: NPS unveils sweeping vision for next century
Date:	Wednesday, January 18, 2017 5:56:45 PM
Attachments:	NationalParkServiceSystemPlan2017.pdf

FYI - If you have not already seen it, you may find the article below of interest. The referenced NPS plan is also attached. RS

NATIONAL PARKS

NPS unveils sweeping vision for next century

Emily Yehle <http://www.eenews net/staff/Emily_Yehle> , E&E News reporter

Published: Wednesday, January 18, 2017

The National Park Service today released its "holistic vision" for the next century, laying out goals that include sustainable funding, more accessible parks and expanded partnerships.

Today's plan <https://parkplanning.nps.gov/files/NationalParkServiceSystemPlan2017.pdf> is an update to the 1972 National Park System Plan. Released just days before the end of the Obama administration, it is part of former NPS Director Jonathan Jarvis' effort to transition the agency to the 21st century.

Acting NPS Director Michael Reynolds said that while the park system is still growing, "we rarely look at the park system holistically or think about its development in a deliberate, systematic way."

Today's revamped plan "is designed to identify the themes of the evolving American experience that are expressed through our National Park System and identify gaps where we could better express the full story of our nation," Reynolds said in a statement. "The system plan makes that information available when people think about future national park sites."

The 150-page plan emphasizes the need to work with communities and outside partners to build an "interconnected and inclusive" park system. It identifies numerous goals, including everything from expanding the agency's authority to enter partnerships to simplifying the titles of parks.

In part, it reflects the views of Jarvis, who retired earlier this month. During his tenure, Jarvis sought to increase the opportunities for NPS to raise money, amid an $11 billion maintenance backlog and stagnant federal funding.

Last month, Jarvis put in place Director's Order 21 that calls on top agency officials to raise more money from corporations and wealthy patrons (Greenwire <http://www.eenews net/greenwire/stories/1060047757> , Jan. 3).

Email: eyehle@eenews net <mailto:eyehle@eenews net>

National Park Service

SYSTEM PLAN

One Hundred Years

National Park Service Organic Act of 1916

"…the fundamental purposes of the said parks, monuments, and reservations…which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

National Park Service Mission

"The National Park Service preserves unimpaired the natural and cultural resources and values of the national park system for the enjoyment, education, and inspiration of this and future generations. The Park Service cooperates with partners to extend the benefits of natural and cultural resource conservation and outdoor recreation throughout this country and the world."

National Park Service | U.S. Department of the Interior | January 2017

National Park Service

SYSTEM PLAN

One Hundred Years

The National Park Service is extraordinarily honored to be the steward of over 400 places that define our most important natural wonders and our collective history. We also understand there are gaps in this inventory. During the past 100 years, the national park system grew by individual and collective initiatives born of the love for our nation's natural wonders and historical treasures, rather than by design. The next century will require strategic decision-making based on scientific insight, attention to our diverse citizenry, a need to tell a more complete history of our nation, and increased urbanization.

Scientific insight has transformed our understanding of natural resource conservation, illuminating the need for increasing resiliency through redundancy and landscape connectivity. Guided by these and the principles of representation, and restoration, parks in the national park system can be cornerstones and catalysts in a larger system of interconnected protected areas. New scholarship on the historical and contemporary contributions of women and minorities has shown the need to interpret history from multiple perspectives and fill in the gaps in our nation's narrative.

The National Park Service envisions a system that is integrated with the conservation and preservation work conducted by other agencies, organizations, and communities. The system must also incorporate new models of park management, where robust partnerships are embraced and nurtured. The advice offered by citizens serving on the National Park System Advisory Board has guided the National Park Service System Plan's road map for our next century of conservation and preservation. While this plan does not specify or recommend individual sites for inclusion in the national park system, it will serve as a framework for future consideration. I invite you to take part by embracing and advancing the strategic guidance and recommended actions outlined in this plan.

Michael Reynolds, Acting Director

USNPS

Contents

Introduction & Plan Objectives 1
Background of the System Plan 8
Planning for the Future 12

The System & The Service Today 15
The Beginning of the National Park System 18
The Park System Today 20
Evaluation and Designation of National Park System Units 36
The National Park Service – Beyond the System of Units 42
Summary 54

Potential for Greater Preservation 57
Opportunities to Highlight Important Resource Gaps 59
Underrepresented Cultural Resources and Values 62
Underrepresented Natural Resources 70
Summary 80

A Vision for Success:
The National Park Service in the Second Century 83
Goal #1: Support Continuous Gap Analysis 86
Goal #2: Improve Process for Consideration of New Units 89
Goal #3: Embrace New Conservation Roles 98
Goal #4: Bring Parks to People 106
The Path Forward 114

Appendixes 117
Contributors 118
Glossary 123
Selected References 126
Appendix A: Units in the national park system and related areas as of December 2016 129
Appendix B: NPS Programs 140

Introduction & Plan Objectives

One

The National Park Service (NPS) preserves much of the nation's most distinctive natural and cultural heritage. Since its establishment in 1916, the NPS has evolved into one of the most respected federal agencies; and is widely emulated by other countries striving to protect and conserve their natural and cultural treasures. NPS parks afford visitors opportunities to immerse themselves in places where important events took place and enjoy some of the most significant natural and historic places in America. In this way, national park system units serve as some of the nation's richest places for learning, recreation, and discovery.

The growth of the national park system has generally proceeded unit by unit, and has not always been directed by an overarching vision or systematic thinking on a national scale. The desire to tell the stories of major chapters in US history and to protect the natural beauty of American landscapes has persuaded Congress to designate new park units through legislation. Presidents have invoked the 1906 Antiquities Act to establish new park units by presidential proclamation. These successful efforts resulted in our collection of 413 park units in the national park system to date.

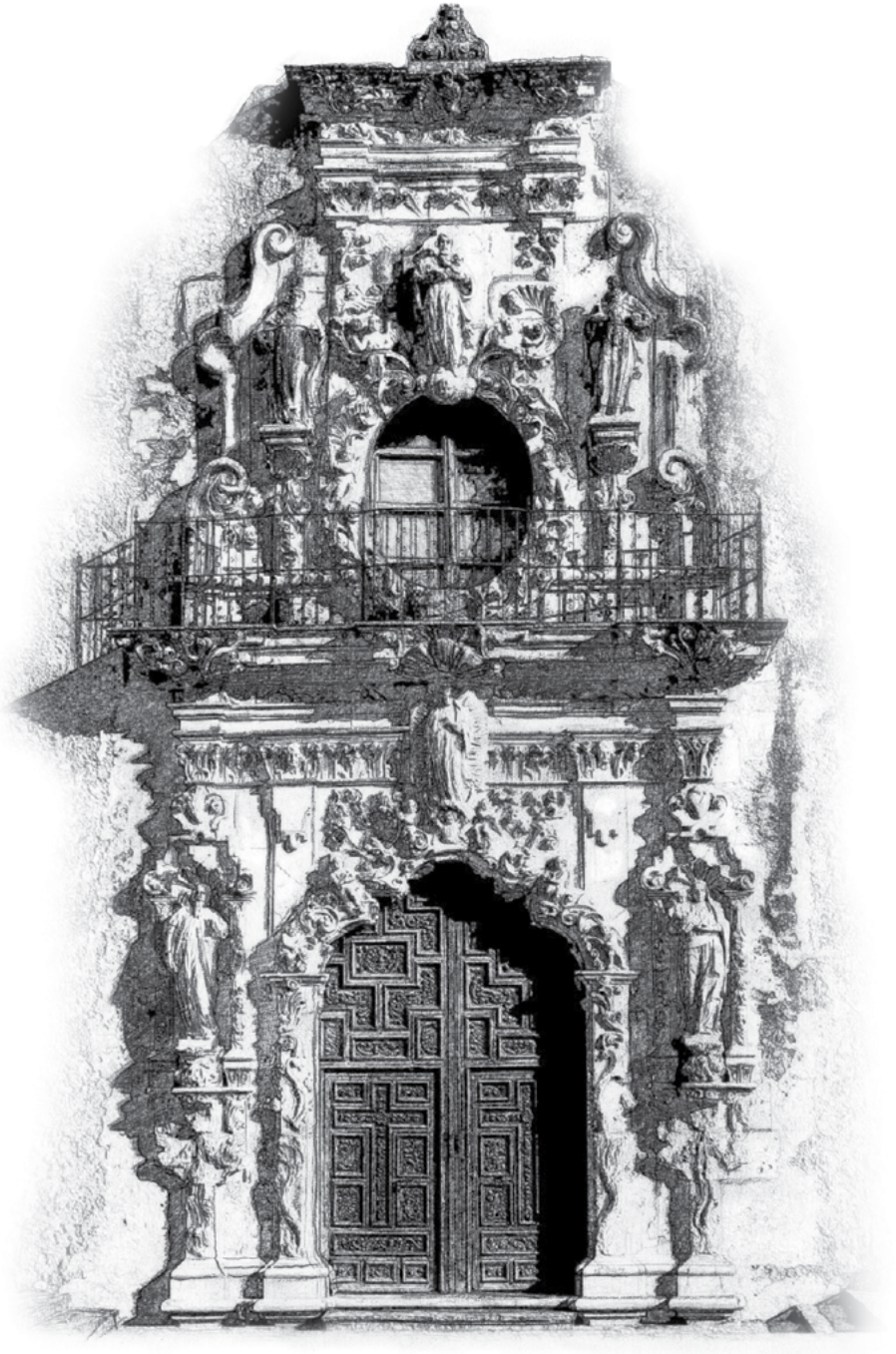
This incremental approach to increasing the system has been highly effective in preserving and protecting many treasured places. However, unintentionally, it has resulted in gaps in the protection of certain themes or significant resources left unprotected because they have had no successful advocates. Taking a broad view of our natural and cultural heritage allows us to recognize significant ecological and cultural landscapes that are currently unprotected or underprotected. To meet its mission of preservation, the NPS must continue to explore new and collaborative ways to protect these important resources and values. The NPS also has a responsibility to the American taxpayer to continue striving for increased efficiency of core operations.

Similarly, the growth of the national park system has not always been reflective of the evolving American public and the dynamic nature of the nation's population and changing demographics. In addition, the American population is becoming more urbanized, and many NPS units are not where the majority of our nation's people live today. To meet the NPS mission of preservation, education and recreation, the NPS needs to more fully represent the stories and experiences of all Americans and adapt to increasing urbanization, while also focusing on places traditionally thought of as park land. Additionally, the future system needs to reflect and incorporate the collaborative and landscape level approaches to conservation in the 21st century.

The National Park Service System Plan (System Plan) addresses these needs by providing a framework for proactively directing the future of the national park system, identifying gaps in the nation's protected natural and cultural areas, and establishing a collaborative conservation system that fully reflects our nation's cultural and natural heritage.

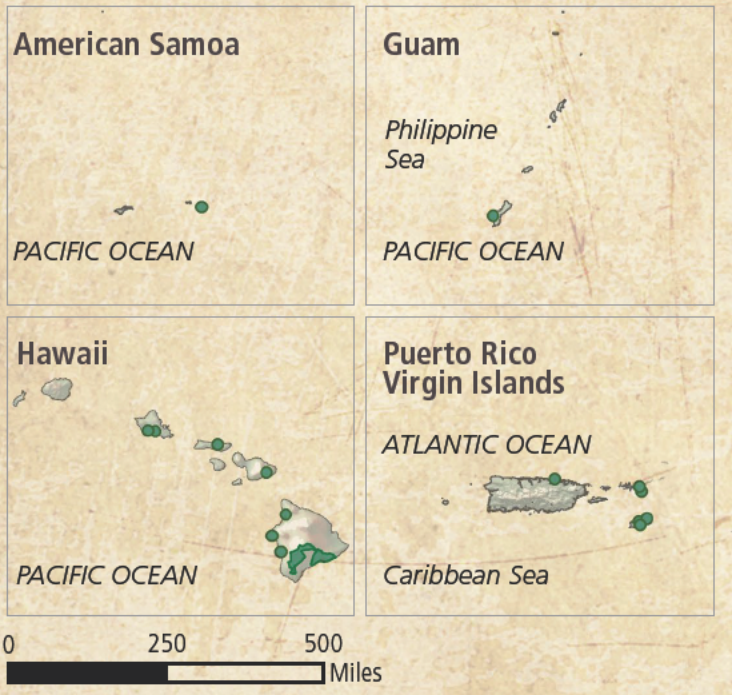
To achieve this vision, the NPS must be strategic in its actions to ensure that the future national park system is more interconnected and inclusive. The System Plan examines the special places, stories, ecosystems, and recreational opportunities that the NPS currently protects, while identifying gaps and opportunities to seek new ways to protect important natural areas and cultural heritage in the national park system and beyond. This plan sets forth strategies for establishing a more inclusive system of parks and protected areas that will serve all of the nation's populations, expand opportunities for learning and conservation, and safeguard the important places that have shaped American communities, while providing a framework for preservation as the American population continues to grow and change. In 2016, the NPS commemorated the centennial of the agency's creation. In looking to its next 100 years, the NPS envisions a system that is integrated with other agencies, organizations, and communities, improving its ability to link important natural and cultural landscapes, respond to a changing environment, and adapt to the challenges of the future for the benefit of all Americans.

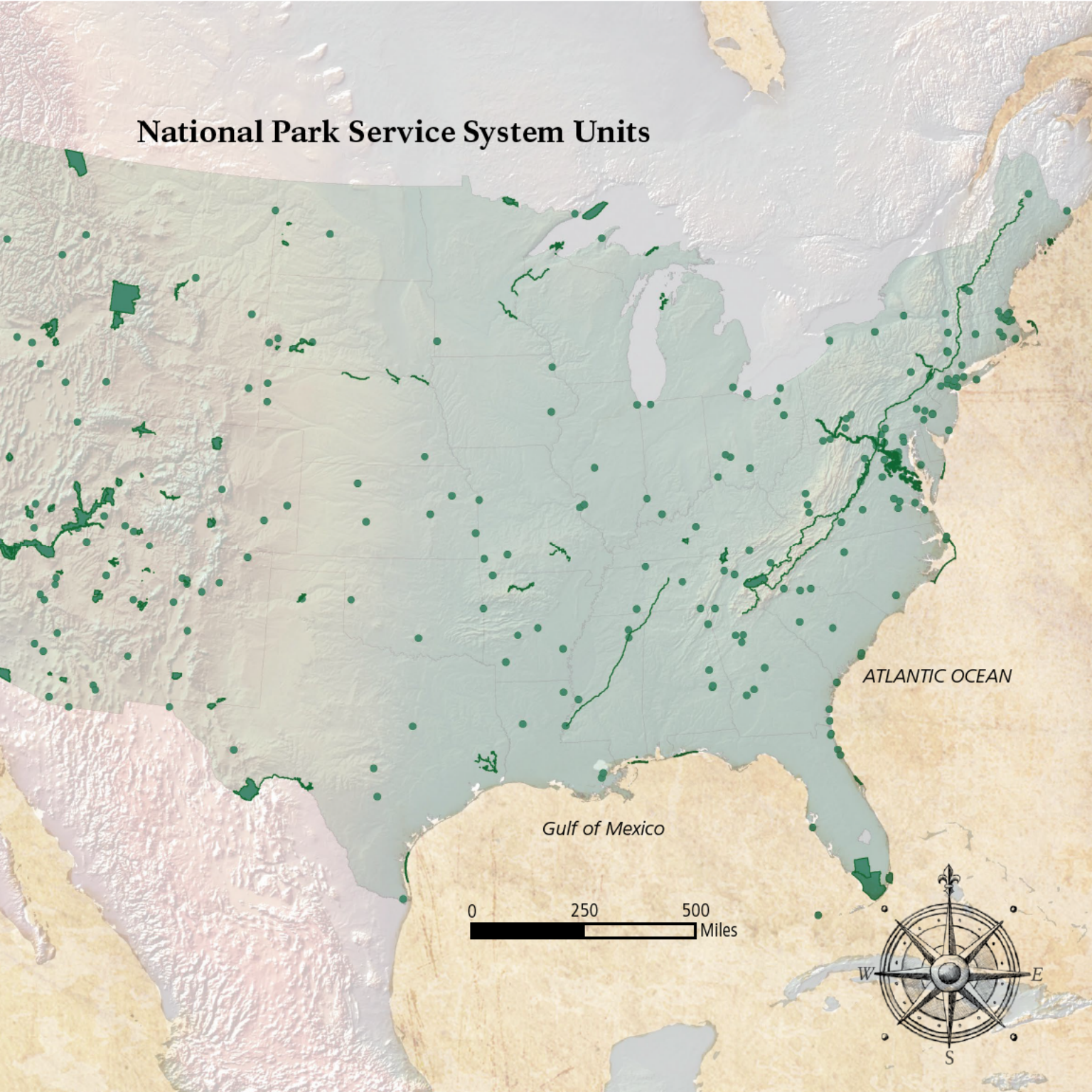
This System Plan is intended for the NPS, stakeholders, friends groups, partners, park visitors, and users of NPS programs, and the American public. It is to inform members of the US Congress and the President as they consider establishment of new park units or other protected areas, either through congressional legislation or by presidential proclamation. This System Plan has been written to inform the growth and management of the NPS for the next 20 years.



Total Designation Types for the
413 System Units

11	national battlefield
04	national battlefield park
01	national battlefield site
09	national military park
50	national historical park
78	national historic site
01	international historic site
04	national lakeshore
30	national memorial
84	national monument
59	national park
04	national parkway
19	national preserve
02	national reserve
18	national recreation area
05	national river
10	national wild and scenic rivers and riverways
03	national scenic trail
10	national seashore
11	other designations




National Park Service System Units
ATLANTIC OCEAN
Gulf of Mexico
0
250
500
Miles
W
E
S

Background of the System Plan

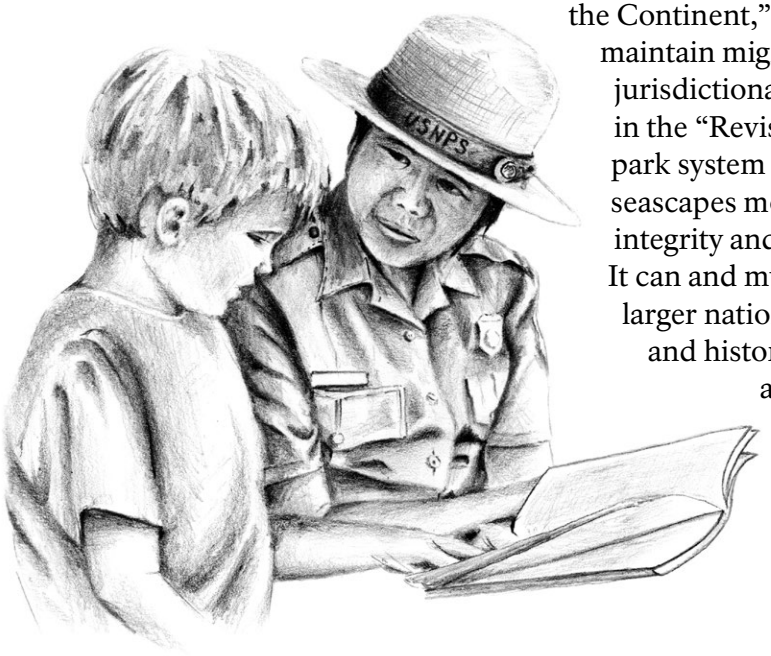
The last National Park Service System Plan was written by the NPS in 1972. That plan provided an analysis of the state of the national park system at that time, and identified thematic gaps. In 1990, the NPS updated the thematic framework for natural resources, which was intended to be used to evaluate the significance of these resources for potential addition to the national park system. In 1992, the NPS 75th Anniversary Symposium in Vail, Colorado, led to the "National Parks for the 21st Century: The Vail Agenda," a report that provided direction for charting the future course of the NPS. The first recommendation outlined in the report was to "revise the 'National Park Service System Plan' using previous studies as a starting point." Then in 1994, the NPS developed a new thematic framework for cultural resources, which was intended to be used to evaluate the significance of these resources for potential addition to the national park system. In 1999, NPS Director Robert Stanton charged the National Park System Advisory Board with the task of taking a long-range scholarly look at the future of the NPS and the national park system by preparing a report with its findings and recommendations. The board's 2001 "Rethinking the National Parks for the 21st Century," reexamined the relationship between the nation's social, cultural, and political environment and made recommendations for the NPS to effectively serve a growing American public.

In 2008, the nonprofit National Parks Conservation Association convened an independent commission, the National Parks Second Century Commission, and charged it with developing a 21st century vision for the NPS, and for the collection of unique places it holds in trust for the American people. The commission consisted of a diverse group of nearly 30 national leaders and experts. The Commission released its findings in a report on September 24, 2009.That report, "Advancing the National Park Idea," suggested the development of a system plan for the future of the NPS. In 2010, NPS Director Jonathan Jarvis asked the National Park System Advisory Board to support actions and priorities for strengthening NPS work in stewardship, education, relevancy, and the NPS workforce. Members of the National Park System Advisory Board formed a committee to offer guidance for developing a new system plan as one of 10 tasks in this effort.

In 2011, the NPS issued its strategic plan for the next century titled "A Call to Action—Preparing for a Second Century of Stewardship and Engagement" to unite NPS employees and partners toward a shared vision of the future of the NPS. Action #1 addressed the need for a National Park System Plan:

> Fill in the Blanks – Identify a national system of parks and protected sites (rivers, heritage areas, trails, and landmarks) that fully represents the nation's natural resources and cultural experience. To achieve this we will work with communities and partners to submit to Congress a comprehensive National Park System Plan that delineates the ecological regions, cultural themes, and stories of diverse communities that are not currently protected and interpreted.

In 2012, the National Park System Advisory Board issued a report titled "Revisiting Leopold: Resource Stewardship in the National Parks." That report emphasized the importance of landscape connectivity and local, regional, and international collaboration: "Confronted with continuous and dynamic change and the goal of preserving ecological integrity, NPS management strategies must be expanded to encompass a geographic scope beyond park boundaries to larger landscapes and to consider longer time horizons. Specific tactics include improving the representation of unique ecosystem types with the national park system, prioritizing the protection of habitats that may serve as climate refugia (or refuges), ensuring the maintenance of critical migration and dispersal corridors, and strengthening the resilience of park ecosystems." For example, protecting the complex array of sensitive resources and ecosystems in the "Crown of the Continent" (Alberta, British Columbia, and Montana) is only possible through collaboration at the large landscape scale of the Waterton-Glacier International Peace Park. Wildlife today move freely through the "Crown of the Continent," thanks to collaborative efforts to maintain migration corridors, despite numerous jurisdictional boundaries. As also emphasized in the "Revisiting Leopold" report, the national park system contains many of the land and seascapes most capable of sustaining ecological integrity and cultural and historical authenticity. It can and must be both core and essential to a larger national vision, with the national parks and historic sites serving as permanent anchors of conservation in a continuum of uses.



The National Park System Advisory Board published a planning committee report in November 2012, titled "Planning for a Future National Park System," detailing their findings and guidance for developing a new system plan. The report included a summary of major recommendations that informed the development of this System Plan.

In 2013, the National Park System Advisory Board published "Engaging Independent Perspectives for a 21st-Century National Park System" to summarize their progress toward advancing the director's priority objectives. Soon after, the NPS responded to the call for a comprehensive system plan.

In July 2013, a steering committee composed of 12 members representing each NPS region and several Washington Office programs formed to develop a National Park Service System Plan, with support from the Denver Service Center Planning Division. The steering committee members and Denver Service Center staff conducted internal scoping from October 2013 through January 2014. Face-to-face meetings and teleconference sessions comprised the 24 scoping sessions held across the country, in all NPS regions. More than 700 people participated in these discussions. Five hundred staff provided 428 comments and represented a wide cross-section of the NPS, including staff from parks, regions, and the Washington Office, with superintendents, program managers and specialists, rangers, and other field staff participating. These comments provided invaluable insight and advice to the steering committee and were integral in the development of this plan.

Planning for the Future

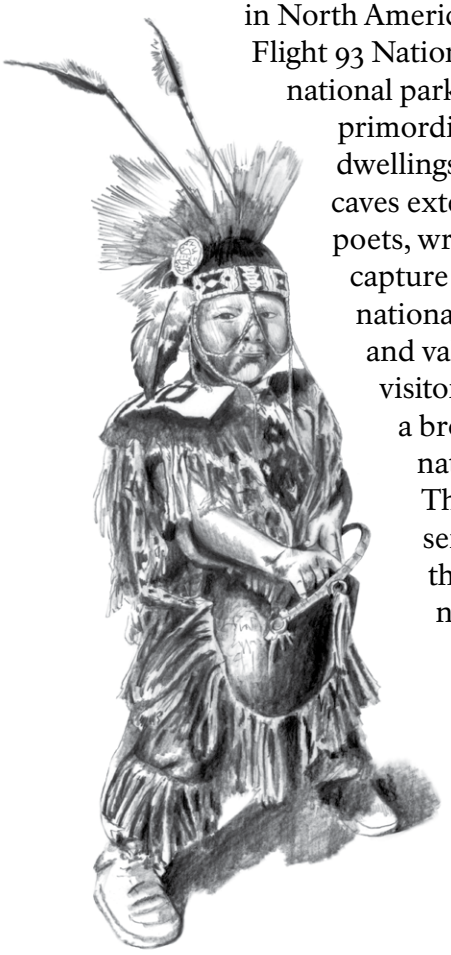
Charting the future course for the national park system and ensuring that the NPS continues to protect and maintain the natural and cultural treasures of the United States long into the future requires a firm understanding of where the system fits within the broader spectrum of protected lands and places. A key component of the System Plan is to proactively identify and define the NPS role within that spectrum.

In this document, chapter 2 provides an overview of how the national park system has evolved as well as the role the NPS plays in local, state, regional, national, and international contexts. Chapter 3 identifies the gaps and missing links in the national park system for which opportunities for future preservation, conservation, or interpretation exist. Chapter 4 sets forth recommendations for achieving an interconnected and inclusive future national park system.

As the NPS looks forward to its next 100 years, it recognizes that working with others will be the key to successfully establishing a collaborative conservation system. This plan presents a conceptual framework for how the NPS will work with communities, partners, concessioners, and travel industry interests. The plan also is intended to serve as a catalyst for meeting shared purposes and goals in the stewardship of nationally important resources and the enjoyment of future generations. With this plan, the NPS can strive for a national park system that fully reflects the people of our past, present, and future while safeguarding the nation's most treasured places.

The System & The Service Today

Two



The tapestry of the national park system spans the nation from Denali, the highest peak in North America in Denali National Park and Preserve, to the lowest point in the Western Hemisphere in Death Valley National Park. It represents collective US history that extends from the oldest documented human remains in North America to solemn landscapes of the recent past such as the Flight 93 National Memorial in Pennsylvania. Woven in the fabric of the national park system are opportunities for visitors to experience the primordial forces of active volcanoes; walk through ancient cliff dwellings and pueblos of American Indians; explore networks of caves extending deep inside the earth; visit homes of presidents, poets, writers, and civil rights activists; examine ancient fossils that capture more than 500 million years of history; or hike along a national scenic trail. In addition to protecting these resources and values, the NPS has an equally important role in providing visitors outstanding recreational opportunities and facilitating a broad public understanding and appreciation of the unique natural and cultural history of this country and its people. The NPS protects places where Americans can engage their sense of what it means to be an American by examining the nation's evolving definitions of freedom, liberty, and national identity. These places include more than 27,000 historic structures, 3,500 historic statues and monuments, an estimated 2 million archeological sites, and more than 123 million museum items.

This chapter revisits the history of how the NPS developed into a multifaceted agency that protects this mosaic of nationally important places and stories. It briefly outlines the roles and responsibilities that the NPS assumes today to protect its park units as well as areas beyond park boundaries. It explains how the national park *system* and the National Park *Service* are integrated but not synonymous. The most important points of this chapter are that the national park system is much larger and more diverse than most people realize; an overarching vision did not always guide the growth of the national park system; the activities of the NPS extend well beyond the "system" itself; and although the NPS has done much to protect the nation's natural and cultural resources and provide for the enjoyment of these resources, there may be additional nationally significant resources the bureau can protect in achieving its ongoing mission.

The Beginning of the National Park System

Three common themes are present throughout the history of the national park system: passionate citizen-advocates, a desire to preserve a place, and the reality that the establishment of a national park is an early chapter in a long history of stewardship. These themes are illustrated in the story of Yellowstone, the first national park, established in 1872.

Attention was first drawn to the Yellowstone area by members of the Folsom, Washburn, and Hayden expeditions in 1869–1871 when they published their findings about the area's magnificent geysers, wildlife, mountains, and lakes. Some members of the expeditions suggested that the area be set aside for public use rather than transferred to private control. A number of passionate citizen-advocates rallied around the park idea (NPS 1991). This notion of preserving a place for qualities such as scenery and aesthetics was relatively new in the United States. It signaled an increased willingness to forego extractive use of the land—logging, mining, hunting—and to instead appreciate its intrinsic value and its value as a public destination. Concessioners played a key role in developing access to the early parks by providing transportation, supplies, and services. Park advocates rallied support from a variety of interest groups and pushed their elected officials to take action.

The bill to establish Yellowstone National Park soon passed Congress and President Ulysses S. Grant signed it into law on March 1, 1872. The establishment of the park did not mean that the work was done; instead, there were serious challenges regarding the stewardship of Yellowstone. For instance, at first, there was no one agency or organization directly assigned to care for the park and hence, poaching and vandalism were problematic. Other difficulties arose when visitors began to arrive,

which in turn led to complex issues concerning park access, facilities, and services. Over time, Yellowstone adapted to these demands by developing an approach to park management that allowed a variety of visitor experiences while seeking to balance resource enjoyment with stewardship.

As Yellowstone gained global recognition, it attracted more people, both Americans and international visitors. The park adapted to changing visitation patterns spurred by the invention of the automobile and, later, the surge of auto tourism following World War II. It responded by adding new types of park infrastructure and architecture, including the NPS visitor center. At the same time, the park gained the support of a network of volunteers, friends groups, neighboring public land agencies, and other organizations and individuals interested in helping the NPS care for the park and its resources. Today, these partners provide important support for education, sustainability initiatives, management solutions, and park research at Yellowstone and beyond.

Yellowstone was the first national park but the key themes in the story of its creation are not unique. In fact, the stories behind the creation of each park unit are often very similar: passionate citizen-advocates who desire to see such places protected in perpetuity identify a site of a nationally significant historic event or an inspiring and ecologically valuable landscape or a place with spectacular outdoor recreation opportunities. They engage in long, hard-fought campaigns to urge Congress or the President to create a national park. When they succeed, a new chapter begins—the challenge of taking care of it.

The Park System Today

Today, the national park system is composed of 413 park units managed by the NPS in accordance with the Organic Act of 1916. These units offer the American people a chance to explore nature and history, relax, and recreate. Collectively, the units protect more than 84 million acres across the United States and its territories. Units are typically established through legislation enacted by Congress or by presidential proclamation.

Several key points are important for understanding the national park system as a whole. First, the system is a collection of individual park units that represent different aspects of US natural, cultural, and recreation history. This system is part of a much larger network of public lands that include national forests, wildlife refuges, and other public lands. Second, becoming a unit of the system has legal, regulatory, policy, and budgetary implications. Legally, a park unit must be managed according to the Organic Act of 1916, other pertinent statutes, and NPS administrative policies as outlined in NPS *Management Policies 2006*. The NPS provides facilities and services for visitor enjoyment, while also protecting the park's resources to ensure they can be enjoyed by future generations. In terms of funding, units receive a portion of the federal appropriation for the NPS, an annual budget that supports management, visitor use, and preservation-related activities. New units may create additional long-term financial obligations to the federal budget.

The NPS manages the national park system, and also has management responsibilities for NPS programs and some related areas. The mission of the NPS is to preserve, unimpaired, the natural and cultural resources and values of the national park system for the enjoyment, education, and inspiration of this and future generations. The NPS is also responsible for managing an array of national and international programs designed to help extend the benefits of natural and cultural resource conservation

and outdoor recreation throughout the United States and the world. Some of these programs are required by law (i.e., management of the National Historic Landmarks Program, established by the 1935 Historic Sites Act), while others are entered into under the discretion of the NPS. This includes administration and oversight of a broad range of partnership, community, cultural, heritage, and conservation assistance programs beyond the NPS system of units. (NPS activities outside the national park system are described in more detail in the section titled The National Park Service—Beyond the System of Units, later in this chapter.)

The NPS does not manage the national park system without assistance. Throughout the history of the NPS, other organizations, government agencies, and nonprofit organizations have been important in meeting the NPS mission. These partnerships enable the NPS to achieve conservation goals and objectives that might not be attainable by the bureau acting alone. The NPS works with partners on a full range of activities. This includes interpretation, education, facility development and maintenance, research, and administration. Partnerships may work to build capacity to prevent habitat fragmentation, preserve corridors, protect watershed resources, and promote the landscape connectivity necessary to allow wildlife to adjust to shifts in habitats and range and adapt to climate change. In some places, the NPS depends on partners to fulfill these needs; in other places, the NPS provides critical support to partners for fulfillment of their conservation goals. In many areas of the country, there are NPS-administered lands that are geographically and ecologically related to nearby lands owned or administered by other federal, state, county, municipal, or nonprofit agencies and organizations. While these various units may have different missions, jurisdictions, ownership patterns, and uses, the overall contiguous nature of units creates a much greater ecological whole than the sum of their individual parts.

Successful partnerships exist at many national park units and NPS-sponsored programs where the NPS is just one part of a much larger team effort. More than 200 nonprofit park friends groups contribute time and expertise to national parks across the country. The National Park Foundation, chartered by Congress, raises funds, creates partnerships, distributes grants, and increases public awareness about the national park system and the NPS, while 72 cooperating associations enhance park educational and interpretive experiences (NPS 2016). All of these partners together contribute over $150 million annually to the national park system (NPS Advisory Board 2014).

Individual volunteers, community organizations, and local and state agencies play a critical role in park stewardship as well, especially in parks that cross numerous geopolitical boundaries such as national recreation areas, scenic trails, and wild and scenic rivers. In 2015 more than 400,000 volunteers assisted park sites, programs, and offices, equaling more than 18 volunteers for each of the 22,000 permanent, temporary, and seasonal NPS employees (NPS 2016).

MISSION STATEMENTS FROM KEY FEDERAL PARTNERS

Each of the federal agencies listed below plays an important role in managing US natural, cultural, and outdoor recreation resources for future generations. The National Park Service currently works with the following federal agencies, among others, to meet its mission.

Department of the Interior - Bureau of Land Management
It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

Department of the Interior - US Fish and Wildlife Service
The mission of the US Fish and Wildlife Service is working with others to conserve, protect, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people.

Department of Agriculture - US Forest Service
The mission of the USDA Forest Service is to sustain the health, diversity, and productivity of the nation's forests and grasslands to meet the needs of present and future generations.

Department of Commerce - National Oceanic and Atmospheric Administration
The mission of the National Oceanic and Atmospheric Administration is to understand and predict changes in climate, weather, oceans, and coasts; to share that knowledge and information with others; and to conserve and manage coastal and marine ecosystems and resources.

Department of Defense - US Army Corps of Engineers
The mission of the US Army Corps of Engineers is to deliver vital public and military engineering services; partnering in peace and war to strengthen our nation's security, energize the economy, and reduce risks from disasters.

Spectrum of Park Unit Management

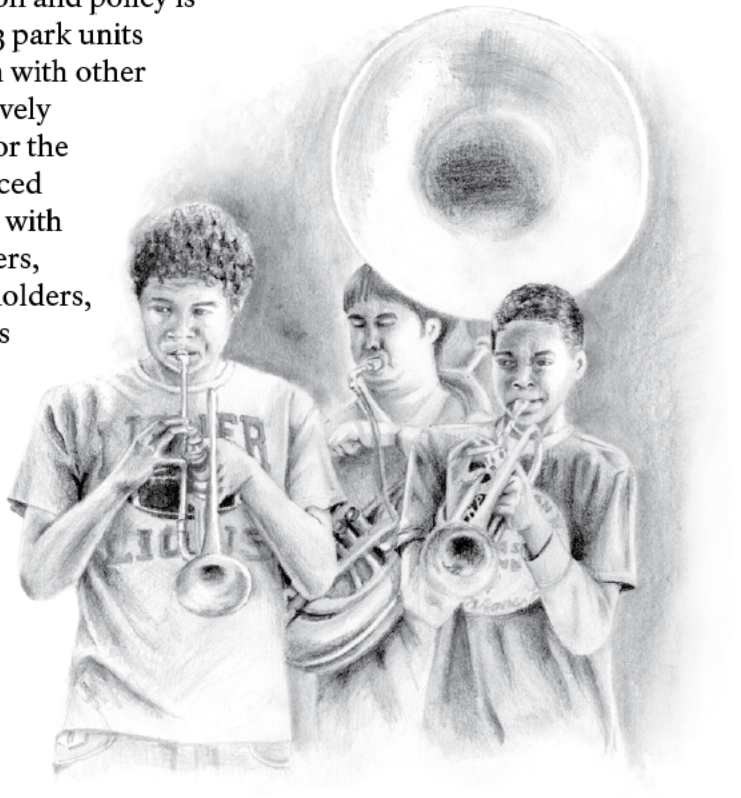
Park units in the system are managed across a broad continuum of management structures. In some instances, the NPS manages a defined property with fixed boundaries. In most of these cases, land ownership patterns within the boundary are relatively simple and the NPS is the sole entity with management responsibility. This type of ownership provides the most extensive involvement of the NPS as a land manager.

The NPS also cooperatively manages some park units as one agency within a larger network of entities that own land and have management responsibility. For example, private landowners, nonprofits, as well as local and state governments, may all have a direct role in the stewardship of a park. In some cases, the NPS is not the largest landowner within the park.

These cooperative management scenarios require a high degree of interdependence among managing organizations and an extensive need for collaborative solutions to management challenges. Complex land ownership patterns are common in such parks. At the Santa Monica Mountains National Recreation Area, California, the NPS shares management responsibilities of a mosaic of public and private lands across 153,000 acres extending from the western edge of Los Angeles, California.

The national park system also includes parks where the NPS does not own or directly manage real property. In such cases, NPS activities are primarily focused on interpretive programming, planning and coordination rather than infrastructure and resources. A park may lease property from other organizations for the purposes of visitor facilities. At New Orleans Jazz National Historical Park, park staff use a variety of leased performance and recording sites throughout the city of New Orleans, Louisiana.

Across this wide spectrum of NPS park management and land ownership patterns, the NPS management philosophy under the Organic Act and other NPS legislation and policy is the same. NPS staff and leaders in all 413 park units are increasingly focused on consultation with other land managers to identify and cooperatively work toward achieving common goals for the overall landscape. Great emphasis is placed on establishing productive relationships with communities and neighboring landowners, creating shared objectives among stakeholders, and engaging in complementary projects and initiatives. This paradigm encourages park managers to see themselves as one integrated piece of a larger community, ecosystem, or cultural landscape.



Park Unit Nomenclature Today

Every unit of the national park system is managed under a unified agency framework according to the same NPS-wide laws and policies. In fact, the NPS refers to each of the 413 units in the system by the shorthand "park," or "unit." However, there is great variation in the official title of each unit. One common misconception is that the national park system consists solely of beautiful natural landscapes in the western United States with the title "national park." In fact, there are 28 different types of parks in the system, and parks are present in every state in the United States. Only 14% of NPS units actually bear the title *national park*. Other titles for park units include historic sites, national monuments, battlefields, preserves, recreation areas, seashores, and parkways.

The 28 different park unit titles can reflect the laws and authorities used to create each place and sometimes the unique cultural and political circumstances in which they were designated. The park unit titles may also reflect differences in geographic size, type of resources, and allowed uses. Because of this range of factors, the overall trend has been an increase in the total number of titles used within the national park system. This proliferation of names causes confusion for citizens, who do not always understand that the NPS cares for sites with titles other than national park.

Listed below are the current titles for the 413 parks in the system, and the corresponding number of units (NPS 2016):

11	national battlefield	04	national parkway
04	national battlefield park	19	national preserve
01	national battlefield site	02	national reserve
09	national military park	18	national recreation area
50	national historical park	05	national river
78	national historic site	10	national wild and scenic rivers and riverways
01	international historic site		
04	national lakeshore	03	national scenic trail
30	national memorial	10	national seashore
84	national monument	11	other designations
59	national park		

See appendix A for the complete list of the different types of units in the national park system.

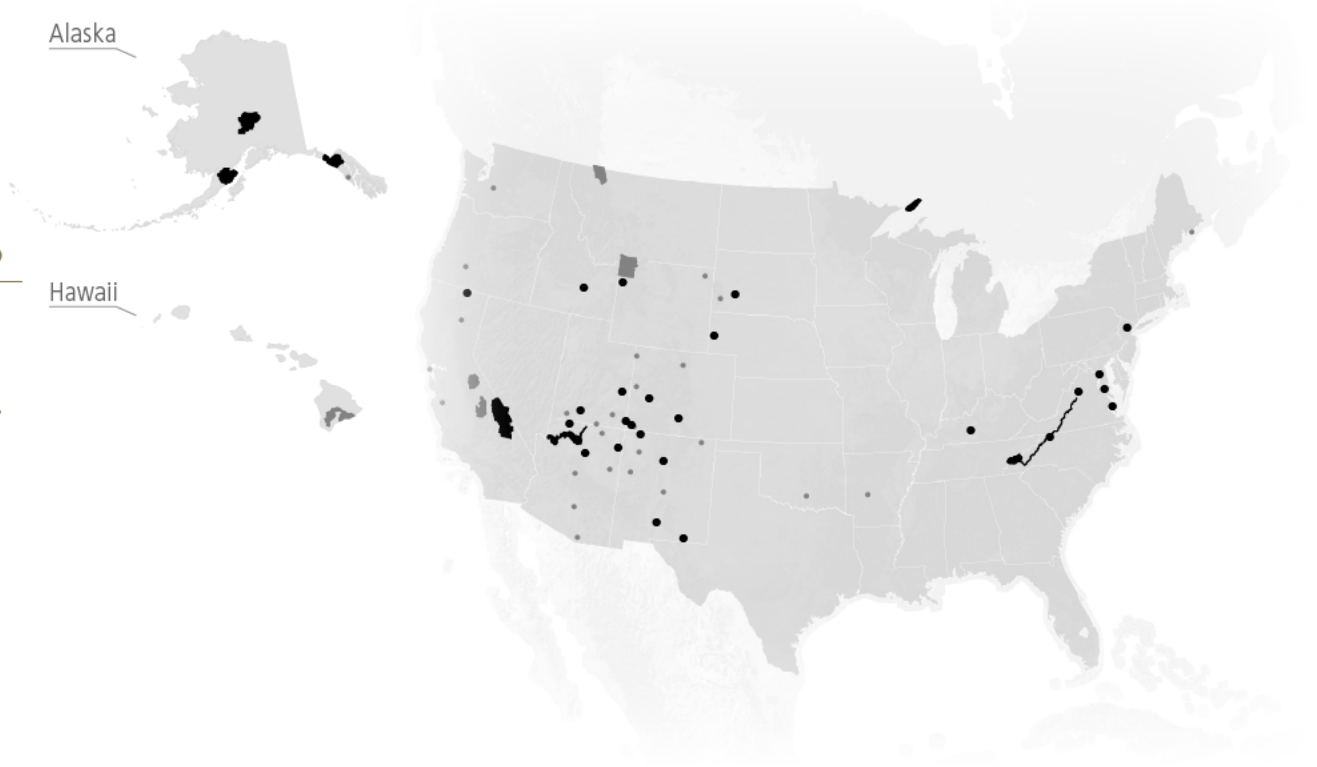
The Evolution of the National Park System[1]

Since the establishment of the first parks, the national park system has expanded considerably, progressing through several periods of major growth. A brief review of this evolution, much of it excerpted from the more detailed discussion in "Shaping the System" (NPS 2005), sheds light on how the current system came to be.

Prior to the establishment of the NPS, Congress and presidents established a number of national parks, national monuments, and other reservations that would later become part of the national park system. By August 1916 the Department of the Interior oversaw 12 national parks, 19 national monuments, and the Hot Springs and Casa Grande Ruin reservations. This collection of areas was not a true park system, however, for it lacked systematic management.

1 Citation for statistics throughout the Evolution of the National Park System section: irma.nps.gov/Stats/

Unit Establishment
Beginning–1916
33 new units
Alaska
Hawaii



Unit Establishment
1917–June 1933

35 new units

33 previous units

In 1916, the NPS was created and the agency assumed management responsibility for the existing system. The NPS gradually built up capacity and expertise in park management and worked to promote the parks to the American public.

The system grew dramatically two decades later in 1933 when President Franklin Roosevelt issued a reorganization order that brought the parks and monuments that had been administered by the War Department, the national monuments that had been administered by the US Forest Service, and the National Capital Parks all under the administration of the NPS. This reorganization order expanded the system to 121 units, and shifted the composition of the system such that it was no longer primarily a collection of western landscapes. US military sites, cemeteries, and other historic sites now represented a substantial portion of the national park system.

August 1933
Reorganization

- 53 new units
- 68 previous units

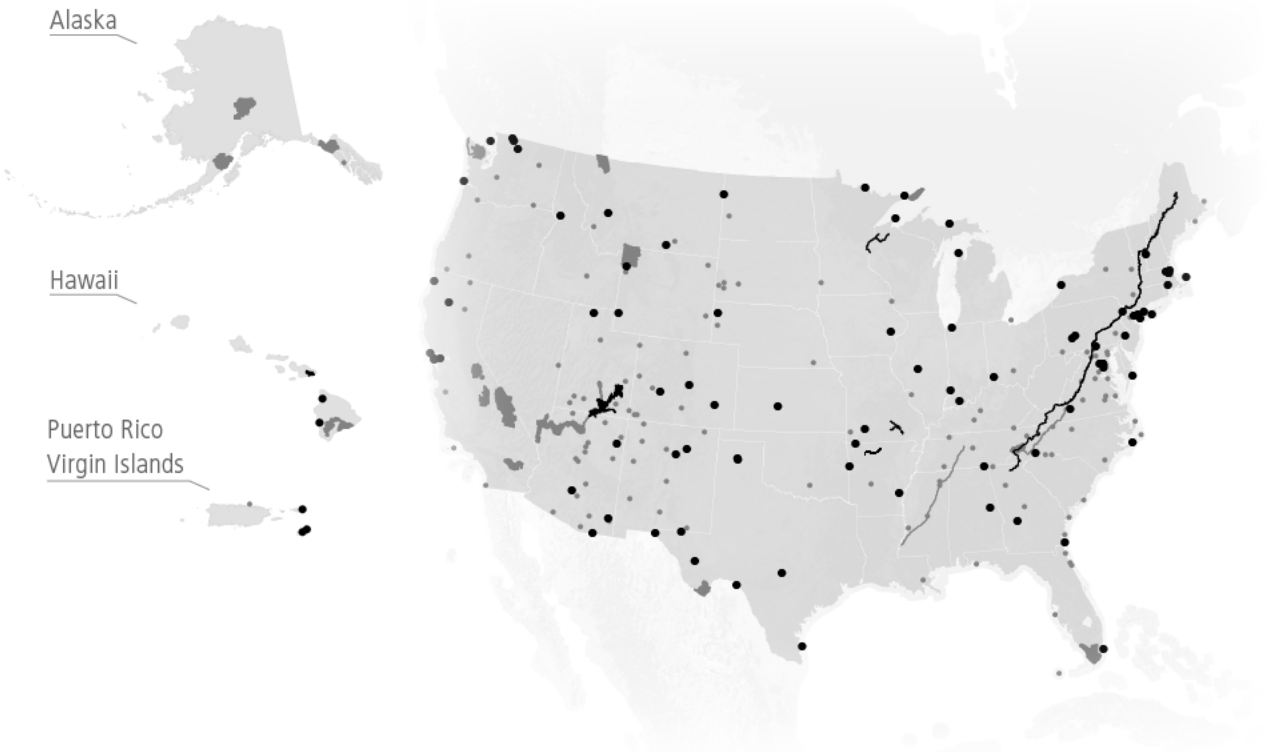
Unit Establishment
1934–1951

● 55 new units

● 121 previous units

In the years that followed, the Civilian Conservation Corps (CCC) and the Works Progress Administration (WPA) built a significant amount of infrastructure and completed many conservation projects in parks. The system also continued to grow during this time. From the reorganization to 1951, 55 of today's units were added to the rolls. Forty-one of them were historical areas, increasing the numerical majority attained by this category in the reorganization. Nine were predominantly natural in character, and five would be classified as recreational.

With NPS facilities becoming overwhelmed by surging visitation, in 1956 the NPS launched Mission 66, a 10-year program to upgrade facilities, staffing, and resource management throughout the system by the 50th anniversary of the NPS in 1966. In 1964, the NPS instituted a new organizational framework for the national park system that



recognized three categories of units in the system—natural, historical, and recreational. For the first time, recreation areas became a legitimate portion of the system.

In 1970, Congress enacted the General Authorities Act, which for the first time legally defined NPS-administered areas as a single "National Park System." The three-category system begun in 1964 was causing problems by the mid-1970s, because it inadequately recognized the diversity of many if not most parks. The NPS responded in 1975 by replacing its separate natural, historical, and recreational area policy manuals with a single management policy compilation addressing the range of characteristics each park possessed. With this advance in planning and management sophistication, the assignment of each park to a single management category was no longer appropriate, and in 1977 NPS officially abolished the area categories.

Unit Establishment
1952–1973

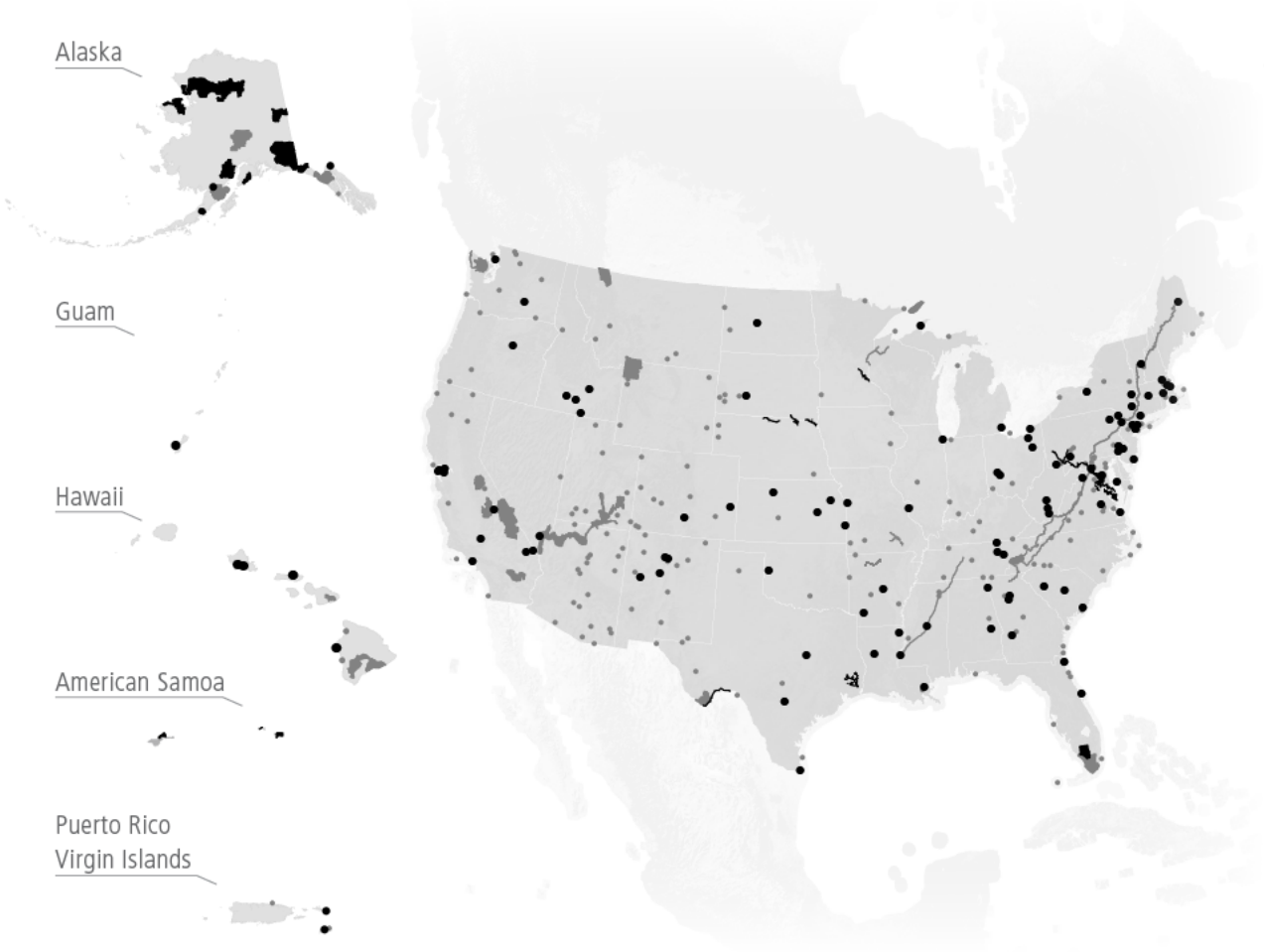
● 98 new units

● 176 previous units

Meanwhile, the system continued to undergo large-scale expansion in response to increased support for environmental protection and growing demand for close-to-home recreation in major urban centers. One-hundred-thirty-nine new parks were created from 1974 through 2016. This number does not tell the full story, for as a result of huge additions in Alaska in 1978 and 1980, the system's total land area more than doubled.

New units reflecting a variety of localities, ecosystems, and stories were regularly added throughout the 1990s and into the 21st century. Today, 413 units are present in all 50 states plus Washington, DC; US Virgin Islands; Puerto Rico; Guam; American Samoa; and Saipan. The national park system continues to grow and will likely continue to expand for the foreseeable future.

The creation and expansion of the system ultimately comes down to one simple truth—people have powerful emotional reactions to certain events and places. They are inspired by the valor of soldiers under enemy fire; they find personal strength from the courage of a civil rights leader; they are awed by the silent song of the stars over a desert canyon; they commemorate dark times in American history, or they want to paddle quietly down a river after a long day in a bustling city. These are some of the emotions that spurred citizen-advocates in the past to rally around ideas for parks; the advocates then expressed their passion through the political arena; and ultimately, the nations' elected officials took action and new parks were born.


Alaska
Guam
Hawaii
American Samoa
Puerto Rico
Virgin Islands
Unit Establishment
1974-Present
139 new units
274 previous units

Evaluation and Designation of National Park System Units

Special places can become park units through two different processes. Usually, a new unit of the national park system is established by an act of Congress, though in some cases, the President can designate a unit (national monuments) under the Antiquities Act if the lands are in federal ownership or control. Often, the early momentum for a new national park unit starts with individuals and local grassroots groups promoting areas they support. These individuals and groups enlist the support of the local public, stakeholders, and their congressional representatives. In 1976, Congress directed the NPS to provide a list of potential new units and in 1980 Congress directed the NPS to prepare a system plan. This direction was withdrawn in 1998 and replaced with a mandate only to provide Congress with a prioritized list of potential candidates for study each year. Potential new units are also identified in the Department of the Interior's annual legislative program.

There are two administrative processes that the NPS employs to evaluate proposed new units to the system:

1. *Reconnaissance surveys*, which include preliminary resource assessments, determine the likelihood of an area meeting established criteria for potential inclusion in the national park system. Reconnaissance surveys conclude with a recommendation for whether or not a special resource study is warranted.

2. *Special resource studies*, used to evaluate potential new units of the national park system. Special resource studies are transmitted to Congress with a determination of whether the study area meets the criteria for inclusion in the national park system.

After completion of a special resource study with a positive finding, NPS presents the study finding to Congress, which may designate a unit by passing a law, termed the "enabling legislation" for that unit. Congress may also choose to designate a unit when a special resource study has produced a negative finding. This legislation typically describes the reasons for inclusion in the system, the location, management, and other legal mandates that sometimes accompany the designation, such as partnerships, and particular allowed uses (e.g., hunting, livestock grazing, or utility easements). The enabling legislation can include documentation of the long-term goal of Congress for the unit. The enabling legislation may also reflect the values brought forth by grassroots efforts that prompted Congress to act in the first place.

These administrative evaluation processes—reconnaissance surveys and special resource studies—are already well-established tools to help Congress make informed decisions about additions to the national park system. Substantial changes to the processes are not warranted or needed. However, some aspects of these processes can be better employed by the NPS, Congress, the public, and stakeholders to ensure the continued success of a future national park system. These are outlined in chapter 4. In addition to the process-related ideas contained in this chapter, the designation of a new unit should reflect the themes described in chapter 3 that may warrant inclusion or expanded representation in the national park system.

Reconnaissance Surveys

Reconnaissance surveys are preliminary resource assessments that the NPS uses to determine whether a special resource study is warranted. In some, but not all cases, reconnaissance surveys precede a special resource study. A single member of Congress may request a reconnaissance survey, or the NPS may initiate the study. The number of reconnaissance surveys has risen in the past few decades because Congress views them as an economical and efficient way to assess the likelihood of a resource meeting the criteria for designation. NPS staff uses the same criteria as in special resource studies (see next page) to determine whether there is potential for a resource to be added to the national park system.

No public meetings are required as part of a reconnaissance survey, and the surveys are not subject to National Environmental Policy Act of 1969 (NEPA) compliance because they do not make a final determination or decision. Usually, surveys take less than one year to complete. If the NPS survey team finds that any one of the criteria for a special resource study is unlikely to be met with further study, then the reconnaissance survey recommends that no further action be taken to authorize a special resource study or designate the resource as a unit of the national park system. If the survey team finds the resource would likely meet the criteria in a special resource study, then the reconnaissance survey recommends the resource be evaluated in a special resource study.

Special Resource Studies

Congress requires reliable information about the quality of resources in the area under consideration before passing legislation to create a new unit. The NPS collects this information and reports its findings to Congress through special resource studies, which are grounded in public law (PL 91-383, sections 1216 and 1217 of PL 101-628, and PL 105-391).

Special resource studies are undertaken only when authorized by Congress. Funding comes from the planning program. Priorities for studies are established chronologically, based on the date of congressional legislation authorizing the study, with study funds allocated as funds become available. Each study is completed in compliance with NEPA, and includes public involvement and appropriate consultation with other agencies. The studies are conducted by the professional staff of the NPS.

NPS *Management Policies 2006*, section 1.3, "Criteria for Inclusion," stipulates that in order to qualify as a new unit of the national park system the resource being studied must:

1. possess nationally significant natural or cultural resources
2. be a suitable addition to the system
3. be a feasible addition to the system
4. require direct NPS management instead of protection by other public agencies or the private sector

These criteria are designed to ensure that the national park system includes only outstanding examples of the nation's natural and cultural resources. Positive findings must be made for all four criteria in order for the NPS to propose an area for inclusion in the national park system.

Evaluation of national significance is an important step on which subsequent stages of the process depend. NPS *Management Policies 2006*, section 1.3.1, "National Significance," directs that potential new units to the national park system must possess significance at the national level. An area is considered nationally significant if it meets all of the following criteria:

- It is an outstanding example of a particular type of resource.
- It possesses exceptional value or quality in illustrating or interpreting the natural or cultural themes of our nation's heritage.
- It offers superlative opportunities for public enjoyment or for scientific study.
- It retains a high degree of integrity as a true, accurate, and relatively unspoiled or restorable example of a resource.

Historic properties considered for inclusion in the national park system must be evaluated according to national historic landmark criteria contained in 36 *Code of Federal Regulations* (CFR) Part 65.

If a special resource study results in a positive finding, it is sent to the NPS director for approval and then to the Secretary of the Interior. The Secretary then transmits the study to Congress with his/her recommendation for what, if any, legislative action should be taken. Congress may then deliberate and decide whether the area will be added into the national park system. If a special resource study results in a negative finding, the process is considered complete with the finalization of the document. The negative finding is transmitted to Congress, but with a recommendation to not create a new unit. Congress does not necessarily vote on recommendations immediately and many changes can occur to resources between the transmission of a recommendation and congressional deliberation.

The National Park Service – Beyond the System of Units

The outreach of the NPS extends well beyond its unit boundaries to other related areas including affiliated areas, national heritage areas, national trails, and national wild and scenic rivers. These areas are not all units of the national park system, yet they preserve important segments of the nation's heritage beyond what the NPS manages.

Another important role of the NPS is as a cooperator and partner for promoting and supporting natural and cultural resource conservation and outdoor recreation throughout the nation via many programs administered by the park service. These programs offer a number of grants, financial incentives, technical assistance, and recognition to support citizens and communities as they engage in conservation, preservation, and recreation projects. Support is designed to initiate and propel local and regional efforts. Efforts are not confined to areas in or near park units. Many assistance programs are a result of specific legislative acts. These programs and associated activities accomplish similar objectives as the designation of units in the park system—namely, supporting the preservation of nationally significant places and stories and providing outstanding recreation opportunities for all visitors.

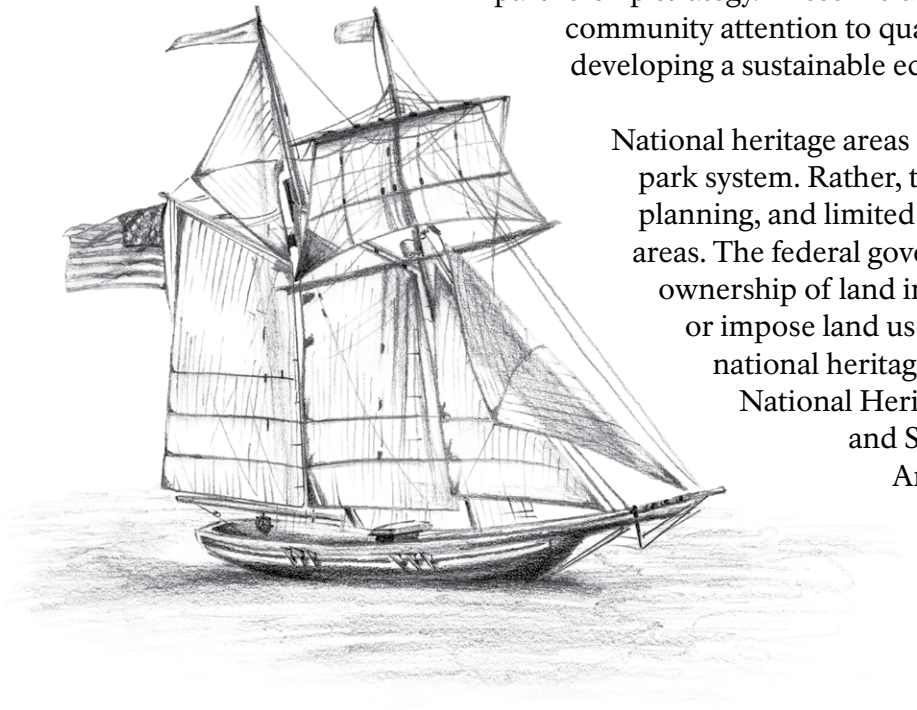
More detailed descriptions of related areas and programs follow. For a full list of all related areas, see appendix A.

Affiliated Areas

Affiliated areas are a select group of nationally significant areas. They are neither federally owned nor directly administered by the NPS, but use NPS assistance. Legally, they are not units of the national park system. Affiliated areas comprise a variety of locations in the United States and Canada that preserve significant properties outside the national park system. There are 25 officially designated affiliated areas (NPS 2016). Some of these have been recognized by acts of Congress, and some others have been designated national historic sites by the Secretary of the Interior under authority of the Historic Sites Act of 1935. Examples of affiliated areas include the Pineland National Reserve in New Jersey, Jamestown National Historic Site in Virginia, and Ice Age National Scientific Reserve in Wisconsin. Although the US government does not own, nor does the NPS manage, these affiliated areas, they draw on technical and/or limited financial aid from the NPS.

National Heritage Areas

Congress designates national heritage areas as places where natural, cultural, and historic resources combine to form a cohesive, nationally important landscape. Each national heritage area is designed by Congress under its own individual enabling legislation. There are 49 national heritage areas across the country (NPS 2016). Through a grassroots, community-driven approach to heritage conservation and economic development, national heritage areas further the mission of the NPS by fostering community stewardship at a large landscape scale. The areas are the management responsibility of federal commissions, nonprofit groups, universities, state agencies, or municipal authorities. This cooperative approach allows national heritage areas to achieve both conservation and economic growth in ways that do not compromise local land use controls. Participating areas realize significant benefits from this partnership strategy. These include resource conservation, community attention to quality of life issues, and help in developing a sustainable economy.



National heritage areas are not part of the national park system. Rather, the NPS provides technical, planning, and limited financial assistance to these areas. The federal government does not assume ownership of land inside national heritage areas or impose land use controls. Examples of national heritage areas include Rivers of Steel National Heritage Area in Pennsylvania and South Park National Heritage Area in Colorado.

National Trails System

The National Trails System Act of 1968, as amended, calls for establishing trails in both urban and rural settings for people of all ages, interests, skills, and physical abilities. The act promotes the enjoyment and appreciation of trails while encouraging greater public access. It establishes five classes of trails: national scenic trails, national historic trails, national recreation trails, national water trails, and side and connecting trails. National trails are considered part of the system but NPS generally does not treat them as separate "units" of the system unless specifically legislated as such. Of the 30 federally administrated national scenic and historic trails, the NPS administers or coadministers 23 (NPS 2014b). (The other national scenic and historic trails in the national trails system are managed by or comanaged with the US Forest Service and Bureau of Land Management.) Each NPS-administered trail has its own base budget. The NPS provides program leadership in developing the trails system through interagency coordination, policy development, partnership training, financial assistance, technical assistance, research, and communications, networking, mapping, and reporting.

National Wild and Scenic Rivers System

The Wild and Scenic Rivers Act provides for the establishment of a system of rivers to be preserved as free-flowing streams accessible for public use and enjoyment. Components of the system are classified as wild, scenic, or recreational rivers. Once a river (or portion of a river) is designated a component of the national wild and scenic rivers system, the managing agency preserves and enhances the features that qualified the river for inclusion within the system. The system encourages river management that crosses political boundaries and promotes public participation in developing goals for river protection. Rivers administered by the NPS are considered part of the national park system unless specifically excluded in their enabling legislation. NPS has responsibilities for 59 rivers in the system, of which 30 are national park system units. NPS also has wild and scenic river responsibilities as a partner with states or tribes that administer other wild and scenic rivers. Servicewide coordination activities include program leadership for the NPS Wild and Scenic Rivers Steering Committee, participation in the Interagency Wild and Scenic Rivers Coordinating Council, policy development and guidance, training, technical assistance, research and communication, and reporting.

Wilderness

In the Wilderness Act of 1964, Congress directed certain federal agencies, including the NPS, to study lands they administer for their suitability for inclusion in the National Wilderness Preservation System. Congress has now designated wilderness areas in 61 units of the national park system. Wilderness designation does not remove these lands from the parks, but ensures they are managed to retain their wilderness character. Because wilderness exists on lands of the national park system, national forest system, national wildlife refuge system, and national conservation lands (Bureau of Land Management), it offers a common statutory basis for interagency cooperation in ecosystem management. The untrammeled quality of wilderness is a unique legislative requirement among all types of land management, defining wilderness in terms of how it is managed rather than what is there.

Programs

Descriptions of five important programs are described below. Included here are: National Register of Historic Places; National Historic Landmarks Program; National Natural Landmarks Program; Land and Water Conservation Fund; and Rivers, Trails, and Conservation Assistance Program. These are just a few of the many programs administered by the NPS. More details can be found in appendix B or by visiting the following website: www.nps.gov/policy/NPSPrograms_September2013_small.pdf

National Register of Historic Places

The National Register of Historic Places is the official list of the nation's historic places worthy of preservation. Authorized by the National Historic Preservation Act of 1966, it is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect America's historic and archeological resources. It lists more than 90,000 properties that represent 1.6 million individual resources—buildings, sites, districts, structures, and objects. These properties are classified as being of local, state, regional, and national significance. Benefits of registration include access to federal preservation tax credits, research databases, and NPS-administered grant programs. Tax credit programs have leveraged more than $45 billion in private investment for the rehabilitation of historic properties and landscapes (NPS 2013c).

National Historic Landmarks Program

National historic landmarks (which are all automatically listed as national register properties) are nationally significant historic places designated by the Secretary of the Interior because they possess exceptional value or quality in illustrating or interpreting the heritage of the United States. Today, more than 2,500 historic places bear this national distinction.[2] National historic landmarks come in many forms: historic buildings, sites, structures, objects, and districts. Designation provides access to grants through the Historic Preservation Fund; tax incentives for easements and rehabilitation through federal historic preservation tax incentives; assistance through the NPS program Technical Preservation Services, and access to other technical databases administered by the NPS. The National Historic Landmarks Program does not own or manage sites; many national historic landmarks properties remain private and are not open to the public. However, if owners wish to advertise their designation, they are invited to accept a plaque to display at the landmark site.

2 http://www.nps.gov/nhl/learn/intro.htm

National Natural Landmarks Program

The National Natural Landmarks Program recognizes and advocates for the conservation of sites that best illustrate the nation's biological and geological history. National natural landmarks are owned by a variety of public and private land stewards, and participation in the program is voluntary. National natural landmark sites are designated by the Secretary of the Interior for their outstanding condition, illustrative character, rarity, diversity, and value to science and education. To date, nearly 600 natural areas, in both rural and urban landscapes, have been designated.[3] The NPS administers the program and works cooperatively with landowners, managers, and partners to promote landscape conservation and appreciation of natural heritage. Through the creation and cultivation of partnerships, the NPS and its partners cooperatively conserve the outstanding sites that illustrate the rich and diverse tapestry of America's natural landscape.

3 http:///www.nature.nps.gov/nnl/

Land and Water Conservation Fund

The Land and Water Conservation Fund supports NPS land acquisition activities, and provides grants for land acquisition through the American Battlefield Protection Program and the purchase and development of land for outdoor recreation activities by states and local governments through the State Conservation Assistance Grant Program. Royalty revenues paid by energy companies drilling for oil and gas on the Outer Continental Shelf finance the fund. The Land and Water Conservation Fund helps preserve, develop, and ensure access to outdoor recreation resources; provide clean water; preserve wildlife habitat; enhance scenic vistas; protect archeological and historical sites; and maintain the pristine nature of wilderness by providing funds for federal land acquisition and grants. The Land and Water Conservation Fund allows for leveraging of state and partner funding, and aligns conservation efforts across jurisdictions and in conjunction with other federal land management agencies.

Rivers, Trails, and Conservation Assistance Program

The NPS Rivers, Trails, and Conservation Assistance Program (RTCA) provides NPS expertise to help community groups, NPS units, nonprofits, state and local governments, and tribes plan parks and trails, conserve and improve access to rivers and natural areas, and create recreation opportunities through locally led partnerships. It has provided assistance and support to more than 7,000 urban and rural communities across all 50 states and many territories. The program has been a catalyst in creating or improving more than 28,000 miles of trails, conserving more than 17,000 miles of protected river corridors, and preserving more than one million acres of open space (NPS 2014b). RTCA projects have connected parks, waterways, and natural areas to people who might not otherwise have access. This program has assisted a wide range of projects that have helped make communities more livable, create new jobs, restore the environment, and foster the next generation of conservation stewards.

Summary

The national park system has grown and evolved considerably since its inception. While the NPS protects and supports the preservation of much of the nation's most significant landscapes and resources, the incremental nature of the system's growth and development has left opportunities to more fully represent America's collective natural and cultural heritage. The NPS continues to seek ways to extend outstanding and accessible recreation opportunities to all Americans. The nation's changing population and demographics and its decades-long migration into major urban areas, many of which lack national park units, highlights a degree of disconnection between the current NPS system and opportunities for parks and programs to become more relevant to the nation's growing and diverse communities.

Beyond the 413 park units, the programs of the NPS have also expanded considerably since the establishment of the agency in 1916. Each program arose in response to specific authorities and actions taken by the nation's elected officials on behalf of the American people. One significant challenge the NPS faces in its next 100 years is managing these different roles and programs in complementary ways. The strategic alignment of programs and services toward overarching goals is critical to the continued success of conservation for all stories, ecosystems, and resources currently underrepresented in the system.

Related areas and programs offer an exciting and forward-thinking alternative to unit designation. The future success of the NPS resides in managing all existing tools available to leverage federal investments and technical assistance with the skills, passion, and support of partnerships. Private landowners, partner groups, and nonprofits are often able to react more nimbly to conservation needs. Benefits to partners include eligibility to receive technical assistance for maintenance or conservation activities and/or receipt of financial assistance. In turn, the NPS receives significant support and is able to leverage funding by combining federal dollars with private investments. The result is a mutually beneficial relationship that exemplifies the best path forward for conservation efforts. When contemplating more robust conservation that more fully includes all stories and resources of the American people, alternatives such as related areas, programs, and expansion of interpretation within existing units, should be considered prior to establishing new park units.

The Chesapeake Conservation Partnership

An example of how the National Park Service is promoting landscape connectivity is the Chesapeake Conservation Partnership. The National Park Service is working with a coalition of more than 50 diverse organizations and agencies, including federal and state agencies, tribes, land trusts, and conservation-focused nonprofit groups, engaged in conservation within the Chesapeake Bay watershed. The partners are working to extend the conservation of large landscapes throughout the region to benefit multiple values, including economic sustainability; scenic, historic, and cultural heritage; working lands; important wildlife habitat; water quality and supply; and overall quality of life.

Potential for Greater Preservation

Three

hapter 3 focuses on opportunities for greater and more effective preservation, conservation, and recreation within the system, including identifying the gaps in resources and values that the system does not currently protect, while also working beyond boundaries to enhance relationships and preserve and restore connectivity.

As noted previously, the national park system is one among many types of protected areas in the United States, managed by other federal agencies, states, local government, and private organizations such as The Nature Conservancy, the National Trust for Historic Preservation, and both private and public landowners. Until recently, this larger network of protected areas was less focused on collaborative management and more focused on resources within their respective boundaries. However, land managers today are placing greater emphasis on connecting resources, collaborative decision making, and the sharing of expertise, funding, and information. The intent of additions and changes proposed in this plan is to reflect the diversity of the nation, inclusive of all Americans; to expand representation of the American story; to protect the nation's biological diversity and processes; and to include significant and vulnerable ecosystems and resources that are not being protected or are vulnerable to current and emerging threats.

In this chapter and in the following chapter, the focus is on future efforts the NPS can take to maintain and enhance both the national park system and this nation's larger system of protected areas.

Opportunities to Highlight Important Resource Gaps

Before looking at possible additions to the national park system, it is critical to note several important factors that guided the identification of possible additions to the system. For instance, an identified gap does *not* necessarily mean a new unit is required. Other federal, state, local, and private entities protect and conserve public land throughout the United States. The NPS does not, and cannot, protect all of America's important resources and stories within the national park system. However, the NPS can and should acknowledge critical cultural and natural resource gaps and opportunities, and strive to protect those for future generations where feasible. Additional protections can include expanded interpretation of missing themes within existing units; partnering with local conservation groups to use NPS facilities to share those stories; or using technology to highlight missing pieces.

In considering underrepresented and missing resources and stories identified in this chapter, several key points should be kept in mind:

- Every unit in the national park system provides opportunities for the public to promote history, protect resources, learn, recreate, and link to our American culture. These important, legitimate needs are recognized in the NPS Organic Act of 1916 and the NPS mission. Recreational and human values will continue to be important considerations within the NPS.

- Before seeking designation of a new unit, consider the possibility of telling missing stories using existing units, programs, or related areas.

- Some important stories and resources were not included in this chapter as being underrepresented or missing in the national park system because they are well protected and interpreted by other entities. For example, the story of space exploration is told well by the National Aeronautics and Space Administration (NASA) and the Smithsonian Institution. The magnificent Niagara Falls is protected by the State of New York as part of Niagara Falls State Park—America's oldest state park. Mount Vernon, President George Washington's historic home in Virginia, is fully protected by the Mount Vernon Ladies' Association, a private nonprofit organization.

- The possible additions to the national park system identified on the following pages are intentionally general and broad. Specific details, including site locations and ownership, have not been determined. Other than noting that resources and stories are underrepresented, missing, or unprotected, this plan does not make any judgments on the importance or priorities for action on any of the possible additions. The list of possible additions should assist Congress and the President when they are considering modifications to the national park system. The NPS is keenly aware of its authorities and recognizes that only Congress or the President can designate new NPS units.

- National park sites are influenced by continuous change: changes in history, recreation, science and knowledge, population demographics, climate, technology, and Americans' views and interests all continually alter, shape, and expand the national park system. Therefore, the suggested additions would not "complete" the national park system, but would strive toward a more fully representative system, including important themes, values, and stories. The cultural and natural resource gaps listed represent the themes and concepts studied by experts to date and are subject to the shortcomings of any subjective process. All need further study. The lists do not, and cannot, represent every possible gap in perpetuity. History is ongoing; cultural change and natural resource evolution will continue to progress. These lists will need to be frequently updated and revised to meet the standards of evolving science, culture, and theory.

Citizens will continue to advocate for additions to the national park system, and Congress will continue to consider legislation for new units. When a new park unit is added to the national park system, funding is required for park creation, operations, and long-term management of visitation and resources. When considering such increases to the system, every effort must be made to fully understand the budgetary implications before further obligating the taxpayer. Increasingly, the NPS is engaging in public/private partnerships and other models to leverage funding opportunities. Consideration for additional units should identify and analyze funding alternatives and strategies such as partnerships, philanthropy, and/or a park-specific endowment.

Underrepresented Cultural Resources and Values

Identifying patterns in cultural themes is inherently difficult due to the subjective nature of many topics, differences of opinion regarding categorization schemes, and the fact that many stories do not fit neatly into one category. Nonetheless, when the 413 park units are organized according to cultural and historic themes, some themes stand out as more heavily represented in the existing system (National Park System Advisory Board 2012):

- Of the 413 units in the system, 135 focus on war and armed conflict. This amounts to 33% of the total units. The vast majority of these 135 units are dedicated to wars and conflicts that occurred before World War II. Two particular conflicts are the most heavily represented: (1) the Civil War, which accounts for 54 units (13% of total), and (2) the Revolutionary War, which accounts for 20 units (5% of total). Four parks focus on armed conflict after World War II.

- Thirty-six units (9% of total) preserve remarkable architecture. An additional 12 units include places important in the field of landscape architecture. These units highlight a wide variety of architectural designs and styles.

- Thirty-five units (9% of total) celebrate the lives of US Presidents. Some Presidents have more than one unit dedicated to their life and accomplishments. For instance, many locations associated with President Abraham Lincoln's life and death are protected by park units, including his birthplace, his childhood home, the White House, the site of the Gettysburg Address, the site of his assassination, and his national memorial.

While this short analysis sheds some light on areas that may already be adequately represented, the existing national park system does not include all important cultural and historical resources and values that are part of America's heritage. To identify possible cultural resources and values unrepresented by specific units in the present national park system, recommendations from both the National Park System Advisory Board (specifically the National Park System Advisory Board's Cultural Resource Committee's 2012 report [appendix C]), and the results of the internal scoping effort for this plan were reviewed.

The committee looked at the NPS' 1994 thematic framework, "History in the National Park Service: Themes and Concepts,"[4] which identified eight major themes and concepts that help conceptualize US history. The committee identified some gaps in the national park system based on these eight themes as well as the authors' knowledge and insights of cultural resources and values. The committee suggested a number of topics the NPS could consider in proposing additions to the system.

Ideas on additions to the national park system were also solicited from NPS staff from all parks, regions, and programs from October 2013 through January 2014. Cultural resources and values identified by commenters and the steering committee were included below as possible additions to the system.

4 https://www.nps.gov/nhl/learn/themes/ThematicFramework.pdf

Based on the above sources, a number of historical and cultural topics were identified as being underrepresented, in need of greater emphasis or redundancy, or missing in the present system. Although the list below consigns groups of people to specific events in history, it is recognized that individuals and groups are not relegated to only the events captured here.

These resources and values are not listed in any order of priority.

- Social organizations history:
  - Professional organizations, fraternal orders, and reform groups each played a role in the transformation of American culture, attitudes, and communities. Nationally important topics include the change in gender roles and responsibilities; conditions in hospitals and prisons; abolition; civil rights; and the care of the poor, the elderly, and the infirm.
  - Unions and organized labor movements have their own unique history. They played a role in the political, economic, and social transformations of communities, and in the larger story of US industrial and economic development from the end of the Civil War to the period of economic prosperity following World War II, with public attitudes toward labor organizations changing throughout that time. The changing union story continues through the decline of the Detroit auto industry and the firing of unionized air traffic controllers.

- Immigration and migration shape American culture, economy, and society:
  - Nationally important topics include the 20th century "great migration" of African Americans northward, the movements of New England farmers to the West and Midwest, Asian immigration, Latino immigration from south to north, and migrant workers.

- American Indians, Alaska Natives, and Pacific Islanders history:
  - History of native people begins before European settlement and continues through modern accomplishments and challenges. Significant topics include Indian treaties and treaty rights, interactions between tribes, past and ongoing lawsuits, tribal economic development, the American Indian Movement, Indian education, and 20th century federal Indian policy.

- Women in American history:
  - Nationally important topics include pioneers in movements concerning health, changing roles of women in work and family, equal rights for women, and women's contributions to fields such as research, exploration, government, and the arts.

- African American history:
  - Nationally important topics include specific historic figures (e.g., W.E.B. Du Bois, Shirley Chisolm, Fannie Lou Hamer, and Malcolm X), the exchange and evolution of music within African American groups, housing discrimination, the role of newspapers and publications, the environmental ethic of African Americans, and the history of black colleges and universities.

- America's diversity:
  - The experience of minority groups, such as Asian Americans, Latino, and lesbian, gay, transgender, bisexual, and queer people, reflect the American political and social landscape. Topics that enlighten include important figures, places, and events such as Chinese labor in mining and the development of mines and US railroads, the role of Spanish land grants in the southwestern US, the 'No Irish Need Apply' movement, and the establishment of the Society for Gay Civil Rights in 1919.

- Music and arts:
  - American culture and artistic creativity has had an international influence. Topics that could be covered here include music history and innovation (e.g., blues, bluegrass, country-western, rap, hip-hop), the export of American music to the world, and influential artists (e.g., Ansel Adams, Andy Warhol, Maya Angelou).

- History of education:
  - Education is important to a democratic society. Nationally important topics include the increased necessity of the high school diploma, the evolution of the US public education system and higher education (colleges and universities), frontier schools, segregated schools, urban schools, mission schools, Indian schools, Rosenwald schools, public education, and schools for the deaf and blind.

- History of American industry:
  - The development of the US economy, including industrialization and de-industrialization, molded the America we know today. Important topics include the rise and decline of heavy industry, such as the steel industry; creation of the long-haul trucking industry; the rise of "industrialized" agriculture; and the history of extraction of natural resources, including mines, oil and gas, and lumber. Other topics that could be covered include forestry, cattle grazing, the US military industry, the automobile industry and transportation, outsourcing of American industry, and how industry built the US.

- Prohibition Era:
  - The Prohibition Era, from the beginning of the temperance movement in the 1830s through the passage of the 21st amendment in 1933, changed and challenged social norms during this time and had lasting social and political consequences. Topics include class warfare, the impacts of drugs and alcohol on society, the growth of organized crime, and the only time a constitutional amendment has been repealed.

- Reconstruction period:
  - The period following the Civil War, from 1865-1877, was called the Reconstruction period. Congress and Presidents Abraham Lincoln and Andrew Johnson took a number of actions that affected the South and the rights of African Americans. Topics include: abolition of slavery; civil rights; reactionary forces; black codes; and carpetbaggers.

- Science, technology, engineering, and math:
  - Science, technology, engineering, and math are key forces that have shaped American society and culture, particularly in recent times. Telecommunications and the development of the computer and the Internet have been huge influences on American culture and society. Topics include unsung heroes in the sciences, (including emphasis on women and minorities), innovations and inventors, new stories of advances in technology, pure science achievements unrelated to technology, changing American values about science, and the historic, technological contexts for the beginnings of the current communications explosion.

- History of land conservation and environmental awareness:
  - This theme directly relates to the mission of the NPS. Topics of national significance include the evolving history of conservation, environmental ethic of indigenous cultures, conservation movement figures (e.g., Aldo Leopold, Henry David Thoreau, Edward Abbey), the rise of an American environmental ethic, Americans' values and relationship to the landscape, the transformation of the American landscape, the Civilian Conservation Corps, the history of wilderness, and the 21st century paradigm for conservation (multijurisdictional, multipurpose, and multi-stakeholder).

- History of US diplomacy:
  - The national park system currently does little to address the history of US diplomacy and the changing role of the US in the world community throughout history. This could include topics such as the history of when and how the US decides to go to war; issues of peace diplomacy including US relationships with the League of Nations, the United Nations and others; and the influence of existing treaties.

All of these topics identified by NPS staff scoping comments and the National Park System Advisory Board reports warrant further study for potential inclusion in the national park system. Further information is needed to understand whether these resources and values are protected and addressed by other groups, if the places that represent these values are currently protected by other organizations, or if any of these should be added to the national park system. Wherever possible, new themes should be incorporated into existing units or affiliates. It should be stressed that the above underrepresented cultural resources and values reflect this point in time, and this list will continue to change as US population, society, and culture change.

Underrepresented Natural Resources

There are important natural resources and ecosystems representative of the nation's natural heritage and biodiversity that are not yet fully or adequately protected in the national park system or by other partners. Multiple investigations have helped inform our identification and understanding of these underrepresented resources and ecosystems, including assessment by the National Park System Advisory Board (National Park System Advisory Board 2012), gap analyses by the National Park Conservation Association and the US Geological Survey (Sayre, Nations, Benson 2012; and NPS staff scoping). This data argues, "the current national park system is not fully representative of the important natural features of the United States (e.g., land cover, ecological systems, topography, elevation, acoustic resources, water resources, and species). Additionally, the size, spatial distribution, and ecological integrity of the landscape surrounding many park units leaves the 'scenery, natural objects, and wildlife' of our national park system increasingly vulnerable" to stressors such as climate, air pollution, nonnative species invasions, and land-use change (NPSAB 2012, appendix B, page 1).

Of the primary terrestrial ecosystems in the United States, 111 are completely unrepresented in the national park system, and 392 ecosystems (55%) are underrepresented in the national park system (underrepresented is defined as an ecosystem with less than 5% of its total land mass held in protection) (Sayre et al. 2012a; NPCA 2013). Additionally, there are other important natural resources and ecosystems that have essentially zero conservation protection by the NPS or any other federal agency, state, local government, or privately owned conservation areas.

The International Union for Conservation of Nature (IUCN) urges countries to strive to achieve a target of conserving at least 17% of the world's terrestrial and inland water areas and 10% of coastal and marine areas by 2020. While the NPS cannot achieve this goal by itself, it can work with many partner agencies to help achieve this goal. Considerations for additional representation should include alternatives to unit status such as innovative partnerships with private groups and nonprofit organizations.

Unprotected and underrepresented ecosystems should be considered when new areas are being proposed for addition to the national park system. Where these ecosystems currently exist within the NPS, park management should prioritize their preservation. The National Park System Advisory Board recommended that 20 ecosystems without protected status and 206 ecosystems with less than 5% of their total area protected should be considered top priority for future protection (NPSAB 2012). It is clear that additional work is still needed to prioritize these ecosystems for protection, either as part of the national park system or in partnership for a national network of conservation areas.

The resources on the following page are not listed in any order of priority.

Underrepresented Categories of Ecosystems

- Freshwater biodiversity hotspots:
  - Only 1% of the earth's surface is covered with freshwater yet these areas provide habitat for over 10% of all animals and over 35% of all vertebrates (Biodiversity of Freshwater Ecosystems: Status, Trends, Pressures, and Conservation Priorities [BioFresh], 2010–2014). Lakes, rivers, and wetlands provide countless and invaluable benefits. Freshwater habitats have inherently higher biodiversity and species richness than adjacent terrestrial habitats. The headwaters of major rivers deserve additional consideration for protection because they support a wide array of human and ecosystem services such as clean water, healthy plant and wildlife populations, power generation, and economic benefits for downstream communities. Unfortunately, these hotspots are often influenced to a heightened degree by human pressures and, increasingly, by the effects of climate change. Freshwater biodiversity hotspots require heightened protection, yet in the United States and elsewhere globally, few freshwater sources are protected.

- Estuarine environments:
  - Estuaries, areas where freshwater and marine habitats meet, are extremely important ecosystems because of their ability to filter and mitigate human impacts, such as water pollution. Including tidal zones and mangroves, these areas support some of the highest levels of biodiversity because they are areas where freshwater and marine habitats meet. Estuaries serve as the breeding and nursery grounds for marine wildlife, and support more than three-quarters of the fish that humans catch for

food or recreational purposes. Estuaries also serve as natural buffers between the land and ocean, absorbing floodwaters and dissipating storm surges. This protects upland habitat as well as valuable real estate from storm and flood damage.[5] Sea level rise projections should be used to determine what areas need protection because they will be future estuaries.

- Marine ecosystems:
  - Marine ecosystems, including deep open water and shallow reef systems, are highly illustrative of the need for inclusion of underrepresented ecosystems into the national park system (see NPSAB 1999 "Rethinking the National Parks for the 21st Century"). Currently, national marine sanctuaries, national wildlife refuges, and national parks cover only a small fraction of the marine environment in need of protection. A strategically designed system of marine reserves covering a broad range of representative habitats is essential to ensure long-term survival of myriad species. As with terrestrial ecosystems, there are many different ecosystems beneath the surface of the water, but only a small percentage of the ecosystems in the ocean have received protection. Marine environments support some of the largest ecosystems on earth, and provide services such as resilience to climate change, sources for medical research, discovery of new species, and support for marine organisms whose habitats are being affected by climate change and ocean acidification.

5 http://water.epa.gov/type/oceb/nep/about.cfm

- Grasslands:
  - Also known as prairies, perennial bunchgrasses and, to a lesser degree, forbs comprise these areas. Grasslands are invaluable for a broad spectrum of reasons, including habitat for migrating and declining wildlife species. A quarter of the earth was once covered by grasslands. Today, approximately 5% of grasslands are protected globally. Protected grasslands are threatened by invasive species and fire suppression, as well as fragmentation and urbanization. For those grasslands not yet protected, the primary threat is conversion to farmland. In the continental US, 5% of original prairies remain intact (National Geographic Society. 1996-2015). Grassland units could be established through the restoration of disturbed lands.

- Terrestrial ecosystems dependent on maritime climate:
  - These terrestrial ecosystems are highly dependent on maritime climate, including wind and fog. A prominent example is the California coastal scrub community. The coastal scrub community is characterized by low-growing aromatic and drought-deciduous shrubs adapted to the semi-arid climate of the coastal lowlands. Other examples of terrestrial ecosystems dependent on maritime climate include California chaparral, the Atlantic coastal plain and longleaf pine woodlands, of which as few as 1,500 acres of old growth forest remain. [6] Located on high-value coastal zone real estate, chaparral is particularly vulnerable to threats associated with human population expansion. This community is drought tolerant and adapted to a specific fire regime of infrequent, high-intensity fire. Human-caused fires have dramatically increased fire frequency in chaparral, especially in southern California. Fire suppression may further erode this community. There is a relatively high incidence of threatened or endangered species

6 http://www.longleafs.info/pages/ecosystem.html

dependent on chaparral habitat. This habitat also serves as an example of human population growth infringing on rapidly diminishing ecosystems.

- Coastal ecosystems:
  - Coastal ecosystems in need of protection are located on the Gulf of Mexico, in the Florida Keys, in Alaska, along Arctic tidal flats, and along the Pacific northwest coastline, to name a few. These areas provide important habitat for plants, wildlife, and fisheries, and help protect communities from the impacts of storms, sea level rise, and climate change. They are often highly desirable locations for residential and commercial uses, which have resulted in hardened surfaces and development in what is normally a naturally dynamic environment. Coastal ecosystems deserve close consideration for additional future protection due to their high diversity and productivity, proximity to human population centers, and their ability to buffer environmental change, such as sea level rise, when functioning naturally.

- High elevation desert:
  - High deserts are generally over 2,000 feet in elevation and include examples such as the Mojave or Great Basin Deserts. Urban encroachment and the associated wildfire suppression threaten high deserts and exacerbate the impacts of climate change. Between 1990 and 2007, more than eight million homes were built in the wildland urban interface of the western US. During this same period, winter snows have melted earlier. Invasive species and some native species, such as predatory insects, have affected other components of the ecosystem. Declining desert species (such as sagebrush), and/or those seeking refuge in higher elevations because of the effects of

climate change, are becoming increasingly dependent on high deserts. Much of the western United States has high elevation desert, some of which is protected by other federal and state agencies.

Additional Natural Resource Gaps

In addition to the underrepresented ecosystems mentioned, other natural resources, systems, and ecological processes are underrepresented in the national park system. These invaluable resources include habitat corridors, migratory avian stopovers, highly productive ecosystems, dark skies, and/or geological features. They support key ecological functions found in a variety of ecosystem types and locations. For example, habitat corridors are conservation tools that enable land managers to restore and maintain habitat connectivity for species. They are important features that facilitate the movement of species between areas of core habitat. Corridors were once thought to be linear strips of premier habitat but this strict interpretation has been proven too narrow from a biodiversity perspective. The size, shape, and quality of a corridor depend on the needs and characteristics of the species for which they are designed and on the landscapes in which they occur.

Another example is the broad category of highly productive ecosystems, which have been largely eliminated in the United States through commercial and housing development. These communities were once among the most productive in terms of plant and animal species diversity and abundance.

Dark skies or natural lightscapes, and natural soundscapes, describe a natural resource value that exists in the absence of human-caused light and sound. Natural lightscapes are critical for nighttime scenery, such as viewing a starry sky, but are also critical for maintaining nocturnal habitat. Many wildlife species rely on natural patterns of light and dark

for navigation, to cue behaviors, or hide from predators. Lightscapes can be cultural as well, and may be integral to the historical fabric of a place. When thinking about gaps in the national park system, it is critical to consider these more abstract types of gaps that serve to fill certain ecosystem functions or services.

One more important consideration in adding underrepresented natural resources to the system is the need to ensure some level of redundancy in conserving natural resources, systems, and ecological processes. Scientists generally agree that several examples of diverse species and ecosystems need to be preserved to weather potentially catastrophic events (including climate change).

Landscape Connectivity

In addition to protection of important natural resources and ecosystems described above, it is critical to protect what the national park system already includes through "landscape connectivity" at spatial scales across park boundaries, including international boundaries. Landscape connectivity means collaborative conservation is targeted at ensuring that protection is enacted at the appropriate spatial scales that ensure long-term conservation. The national park system contains many of the land and seascapes most capable of sustaining ecological integrity and cultural and historical authenticity. It can and must be both core and essential to a larger national vision, with the national parks and historic sites serving as permanent anchors of conservation in a continuum of uses.

Landscape connectivity is a well-established principle supported by the scientific community. This landscape function is critical for many species' well-being, but landscape attributes are challenging to protect compared to parcels of the landscape. Although connectivity has been an attribute of conservation area designs for more than 20 years, current applications of species, habitat, overall biodiversity, and landscape conservation are failing to implement the extensive connectivity needed.

Landscape connectivity is key to addressing the interactive effects of major large-scale stressors such as climate change, air pollution, land use change, and invasive species. Understanding and managing our response to stressors such as climate change and alternative energy development is vital to reducing impacts on people and natural ecosystems through strategic approaches. The upslope and latitudinal shifting of biomes (major ecosystem types) due to climate change makes connectivity even more important to conserving plants and animals under potential future conditions. Although the first-order effects of the biodiversity crisis—the loss of species—are dire, the second-order consequences—the loss of species interactions—may be more ominous. It is widely agreed that connectivity identification, preservation, and restoration is important for natural resource conservation at all levels.

Summary

While the NPS mission is genuinely embraced, our nation's population, with its changing communication and lifestyles, and diversity of cultures, will continue to shape and influence our system. Parks and protected areas will likely become increasingly valued for the societal and human benefits they provide. Communities and researchers alike are growing in their awareness and understanding of the health, recreation, and economic benefits parks provide. The future system should be mindful of potential additions that offer and serve these multiple benefits in addition to the environmental and resource conservation benefits they provide.

Success of the NPS will depend on the agency's flexibility and responsiveness to a changing population and environment, and the ability to remain relevant.

A Vision for Success:
The National Park Service in the Second Century

Four

he goals of the plan are organized in the following categories:

- Continuous Gap Analysis
- Consideration of New Units
- Embracing New Conservation Roles
- Bringing Parks to People

These broad-reaching goals can best be achieved through the support of local communities, state and national government agencies, friends groups and other long-standing partners, new partners, and individuals. The plan includes the identification of challenges and suggested follow-up actions under each goal.

The goals and proposals in this plan should be viewed as a framework for future action—it is intended that the proposals will be further explored, developed, and elaborated on with scientific rigor.

The goals and key actions in this plan will be reevaluated and updated periodically by the NPS Park Planning and Special Studies Program. In addition, different groups can use this plan in different ways, to all work toward the common, shared goals of this plan.

Goal #1: Support Continuous Gap Analysis

Chapter 3 provides detailed information on cultural and natural resource gaps that are unrepresented or underrepresented in the current national park system. These should be priorities for inclusion in the system or expansion of interpretation within existing units. However, history and our interpretation of it is dynamic; therefore, these lists of gaps must also continue to evolve.

Challenges:

- History is ongoing. Cultural values and natural resource conservation needs will continue to evolve. Any list of underrepresented resources will need to be frequently updated and revised to meet the standards of evolving science, culture, and theory.

- Connectivity needs to be examined across a broader perspective and needs to include natural systems and resources, as well as cultural themes and studies.

- Cultural stories should be connected across themes; examples include civil rights stories and immigration stories that are represented throughout many layers of history.

Follow-up Actions:

- Use GIS and other databases to facilitate a dynamic evaluation of gaps in the national park system over time. Build partnerships with companies willing to donate mapping services to ensure an updated picture of ecosystems and cultural resources in North America.

- The NPS director could request a committee of the NPS Advisory Board or appropriate professional organizations to examine cultural and natural resource gaps in the system and recommend priorities for underrepresented areas every five years. The group would connect with the American public, scientists, and conservation organizations such as the National Trust (and others) to gather authentic and valid preservation needs. If there are outstanding candidates proposed through grassroots advocacy or a member of Congress, the board may recommend additional underrepresented areas.

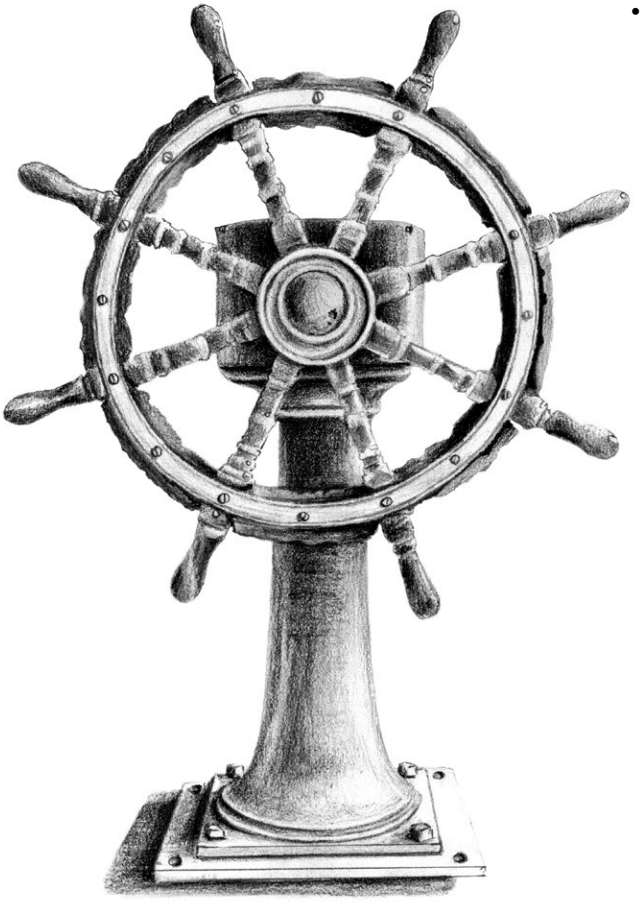
- Convene discussions with other experts, authors, and advocates for different segments of the American population to identify possible gaps in the system.

- Contract with a CESU to provide additional analysis of natural and cultural resource gaps in the system.

- Once park foundation documents have been completed for all park units, categorize fundamental resources and values in order to identify which themes are adequately addressed in the national park system, and what themes are underrepresented. Provide this analysis to partners and Congress for use when identifying new units.

- Enlist an objective, professional organization, such as the National Association for Interpretation, to evaluate the stories being told in parks to ensure they are balanced and historically correct. Explore ways to include missing themes within existing units.

- Support the development of a scientifically based indexing system by a university research group to identify the quality of representation of a particular set of resources or stories. Correlate existing data to create an index rating number for major natural and cultural themes. The index number would change over time, depending on whether resources/stories were being preserved or degraded.



- Update older NPS documents that describe themes and gaps in the system as needed. These include *History in the National Park Service, Themes and Concepts* (Cultural Resource Report NPS, 1994) and *Natural History in the National Park System and on the National Registry of Natural Landmarks* (Natural Resource Report NPS, 2003). Updated documents should be maintained as living documents rather than static papers.

Goal #2: Improve Process for Consideration of New Units

A. Enhanced Assessment of Criteria during Special Resource Studies

The national significance, suitability, feasibility, and direct management criteria should all continue to be evaluated in special resource studies as stipulated in NPS *Management Policies 2006*. It is recommended that several improvements be made in the analysis of the four criteria, which will allow Congress and the public to better consider whether a particular area or theme should be included in the national park system. The outcomes of a study should continue to include alternatives to unit status recommendation or denial when applicable. Alternative conservation options include the potential to recommend related area status (such as an affiliated area, national historic area, and national natural landmark), or participation with specific NPS programs that will bolster and leverage protection efforts in partnership with others. As stated elsewhere in this document a cultural or natural resource gap does not mean a new unit is required. Special resource studies should first and foremost address all possible ways to incorporate new themes into existing units or other alternative conservation options before recommending a positive finding for potential new unit designation.

The analysis of suitability should include a discussion of climate change, and how the potential unit would provide redundancy or protection of resources in the face of climate change. In addition, it should include analysis of the unit as part of a larger landscape context. For some potential units, national suitability should also include an analysis of the provision of appropriate recreational opportunities for urban populations and connect to efforts under the "Urban Agenda"—an NPS effort to strategically organize its many parks and programs to build relevancy for all Americans.

Thoughtful reflection upon the missing resources, values, and stories presented in chapter 3 should be an important part of the deliberation about suitability. Investigations should include considerations of the NPS role in preserving values or systems as a whole; exploration should include the significance of creating connections across physical landscape and thematic stories.

NPS needs to improve its analyses of the required details on the feasibility of management. This will enable Congress and the public to more fully consider aspects of management such as operations, management constraints, the ability of the agency to acquire the land or resources, start-up costs, total cost of ownership, partner commitment (of funding and other resources), and the difficulty or ease of protection of the land or resources in the future. Budgetary considerations should be carefully weighed, and funding alternatives explored, before a new unit is recommended.

This analysis of feasibility needs to include an investigation of the opportunity to provide visitor services, technological and other infrastructure needs. Study evaluation should include a detailed analysis of development and operational alternatives, and associated funding requirements. Alternative funding sources and strategies should be identified and analyzed for feasibility. The potential role of partnerships and philanthropy should also be a consideration of feasibility for potential new park units. Funding should be identified and a preferred funding strategy recommended prior to designating a new unit. In an era of constrained funding, this analysis is becoming increasingly important and should be a more developed element of special resource studies.

Feasibility analysis should consider climate change projections in evaluating potential effects on the NPS's ability to maintain the area and on the infrastructure necessary to support park operations and visitation. For example, consider sea level rise projections in evaluating potential effects on the area.

Finally, NPS needs to improve its analyses of whether the resource requires NPS direct management that cannot or will not be accomplished by another governmental entity, partner, or private sector. Considerations of direct management should identify the strengths brought by NPS management and clearly outline the benefits the agency can provide. In some cases, state or local agencies, nonprofit partners, and other groups may be identified as the better direct manager of a resource. In this case, partnership opportunities may be considered, such as a national heritage area, landmark site, or affiliated area.

Challenges:

- Consistent application of study criteria across the nation is needed.
- Suitability, feasibility, and direct NPS management need to be analyzed with the same vigor as national significance
- Conditions of resources during the time of study efforts may change prior to resource protection or unit designation.
- Availability of financial resources is needed to complete thorough study analysis.

Follow-up Actions:

- Reassess the current criteria to incorporate more consistent evaluation techniques and study suitability, feasibility, and the requirement for direct management, in greater depth.

- Include physical and emotional connectivity to urban communities, to ecological systems, to large-scale landscape conservation efforts, to cultural resources, to other programs and units, and to other protected areas outside the national park system.

- Consider the relationship of the resource or theme to human values and experiences, as a way to better connect to new visitors and users of NPS programs.

- Take into consideration the opportunities for appropriate recreational experiences that a new unit may provide.

- Consider units that provide redundancy, and resiliency, to protect natural resources, cultural resources, recreational amenities, and other visitor experiences that may be affected by climate change or other stressors.

- Establish consistent and clear guidelines for related area status (such as an affiliate or national heritage area).

- Continue to seek legislation or other means that clearly defines the relationship of related areas, such as national heritage areas and national scenic and historic trails, to the national park system.

- Use special resource studies to identify alternatives to a proposed unit when applicable. This may include designation as an affiliated area, related area (such as a national heritage area), or connections to NPS conservation programs.

- Carefully consider new and long-term financial obligations to the taxpayer by rigorous analysis of funding needed to create and provide long-term operational support for a new unit. Identify funding alternatives for development and operations.

B. Seek Sustainable Funding

Maintaining a high quality national park system, continuing to be a leader in safeguarding our national resources, and providing continued programmatic support and leadership for communities throughout the country requires the NPS to be proactive in addressing financial sustainability.

Another important step in ensuring the long-term financial viability of the national park system is promoting awareness and appreciation of what America's national parks and NPS programs have to offer. The 2015–2016 NPS "Find Your Park" campaign, which was made possible through the support of the National Park Foundation, is a step in this direction. Complementing such an effort is the need to collaborate with other agencies and private and nonprofit partners to promote an understanding of the wide range of public benefits and the high investment returns that flow from the NPS as it approaches its second century. High returns are demonstrated by the more than 307.2 million recreation visits to national park units in 2015. During this time, visitors generated $32 billion in economic activity and supported 295,000 jobs (NPS 2015c).

National Park Foundation™

Key partners like the National Park Foundation help fulfill critical funding needs. Each year the National Park Foundation contributes millions of dollars to the NPS for its highest priority projects and initiatives. Like the NPS, the Foundation also provides broader support for initiatives that demonstrate environmental leadership, promote sustainable practices, inspire innovative solutions, and motivate citizens to take action.

Congress charged the NPS with protecting units of the park system in perpetuity. The annual appropriations of Congress allow the NPS to manage these special places. Additionally, the NPS has embraced a number of opportunities to develop additional funding sources through entrance fees, new models for concession operations, new partnership models of public-private land management, and increasing our capacity to leverage partner resources. Funding for the national park system primarily comes from congressional appropriations, fees from visitors who use the parks, fees from concessioner operations, and through philanthropy. Additionally, in 2015, volunteers contributed approximately eight million hours, estimated at a total value to the NPS of more than $182 million, easing the financial operations burden for hundreds of parks (NPS 2016). Financial sustainability is fundamental to sufficiently maintaining and protecting existing park resources and being able to play a role in promoting and supporting a more integrated system.

Challenges:

- Without a clear understanding of the economic benefits generated by the NPS, the public and Congress may not fully support the funding needed to conserve and protect units and programs of the service.

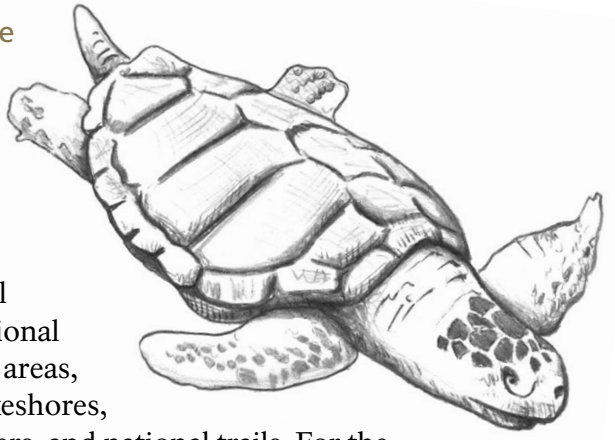
Follow-up Actions:

- Explore alternative and creative funding models to meet the needs of the national park system as well as enhance the capacity of national park programs to provide assistance and services including philanthropic assistance by individuals and organizations; monetary and nonmonetary contributions from nonprofits, states, local governments, and other partners and programs.

- Establish an independent endowment structure funded to support parks and programs, in perpetuity, similar to the Smithsonian Institution's endowment.

- Implement a policy inclusion of total cost of ownership principles into all major planning activities that involve capital investment, infrastructure, unit expansion, or new unit designation.

C. Simplify Park Nomenclature



As discussed in chapter 2, there are 28 different types of units in the national park system, including: national parks, national monuments, national preserves, national historic sites, national historical parks, national battlefields, national cemeteries, national recreation areas, national seashores, national lakeshores, national parkways, national rivers, and national trails. For the most part, there is no functional difference in these units. All of the units in the national park system have equal legal standing, and all of them are subject to the same NPS management policies.

Additional designations are used for places affiliated with the NPS but not part of the national park system, such as national heritage areas and some National Wild and Scenic Rivers. These designations are not subject to the same laws and are managed by different entities.

The numerous designations of national park units confuse staff, visitors, and the public, and diminish the NPS identity. Commenters during the scoping process for this plan noted the national park system has too many different labels. The National Parks Second Century Commission in 2009 also recommended simplifying the number of designations to enhance public awareness of the unity of the system.

Park nomenclature should be streamlined. Ideally, all existing park units should update their names to reflect the following streamlined list.

However, it is recognized that such a change may result in even more confusion for the public, and would be very costly and time consuming to implement. Therefore all new units should be limited to one of five titles as listed below.

Challenges:

- Numerous designations confuse visitors and the public.
- Different titles diminish NPS identity and lead to perceptions that different areas are managed under different policies.

Follow-up Actions:

- Preferably, all units should be updated to a streamlined nomenclature. At a minimum, future additions to the national park system should be limited to the following five titles:
  - National Historical Park
  - National Memorial Park
  - National Monument
  - National Park
  - National Recreational Park
- During the special resource study process, the planning team should identify a preferred name for the proposed new unit.

Goal #3: Embrace New Conservation Roles

In addition to the procedural modifications outlined in the previous section, new approaches for parks and protected areas will be critical to the success of the agency and its partners in achieving shared goals in conservation and preservation. Alignment of all NPS parks, programs, and partnerships would leverage existing efforts and provide new opportunities to increase partnerships. The NPS and its partners already have successful tools to support conservation and preservation goals, and the NPS proactively works with a variety of groups including other federal agencies, local governments, the private sector, and both new and long-time partners. Focusing additional effort on partnerships and relationships with new groups and agencies will become even more important in the NPS' second century.

Collaborative partnerships with others result in greater efficiency and effectiveness toward meeting shared goals and ultimately they advance work that benefits the public good. This will be a cornerstone of implementation efforts that stem from the System Plan. Partners are often essential to establishing, managing, monitoring, and acquiring protected areas and historic sites throughout the United States. For these reasons, the long-term viability of the national park system, and the broader platform in which its parks and programs play a key role, depends on effective cooperative arrangements and collaboration with others. The national park system should become the core element of a national (and with international collaboration, continental and oceanic) network of lands and waters. Where terrestrial and aquatic protected areas share

borders, such as Olympic National Park and the Olympic Coast National Marine Sanctuary, unique opportunities exist to embrace this holistic vision across ecologically connected boundaries. This network should be managed for resiliency and connectivity, guided by scientific research, and responsible for life cycle stewardship, thereby fulfilling a conservation imperative of protecting the distinctive role and future of the national park system within the broader American landscape and consciousness. ("Revisiting Leopold" report, 2012.)

While partnerships have always been an important component of park unit and programmatic efforts, a renewed emphasis on partnerships and collaboration marks a shift in the way the NPS operates. Internally, within the NPS, this shift requires that all park units and program staff focus more on working within an increasingly integrated structure—a structure that extends beyond park boundaries. This may require a change in the way park and program managers define and measure success. This includes objectives they set, how they manage, and how they communicate with stakeholders. It also requires a broader understanding and appreciation for national park system connections among other NPS programs and park units; connections within landscapes such as national heritage areas; connections across landscapes such as wildlife corridors; and connections with communities and partners. It means actively cultivating partnerships and building reciprocal relationships with communities and other agencies to achieve multiple public goals, including stewardship and civic engagement.

The NPS can perform a variety of roles with partners to achieve its mission. By working with others, the NPS is a catalyst and a leader in conserving resources and histories beyond park boundaries. Interagency planning efforts and collaboration are, and will continue to be, a critical pathway to successful conservation efforts with local communities and other land management organizations. As with all partnerships, thoughtful consideration of both partner and NPS capacity will be essential to success of these models as long-term solutions to preservation and conservation. The NPS intends to build partner relationships on equitable footing. Partnerships should be based on a common desire to solve issues related to conservation, cultural preservation, education, research, and interpretation.

While the NPS has made great strides in these areas over the years, NPS parks and programs should strive to:

- promote, build upon, and expand already successful partnerships
- nurture and sustain reciprocal relationships with community members and partners
- develop new, innovative, and collaborative approaches to park and regional planning , and landscape-scale resource protection
- support the One NPS principle, engaging in coordinated conservation, education, economic, and recreation efforts
- seek new and more meaningful methods of engaging park stakeholders
- explore ways to better integrate and connect existing park units, related areas, and conservation program lands (e.g., national natural landmarks)

- partner more broadly with other federal, state, and local agencies, local communities, and increasingly, private and nonprofit groups to conserve important wildlife corridors, historic places and trails, and larger ecosystems

- explore new models of parks featuring more partnerships and mixes of land ownership

- test innovative new approaches for more expansive and effective public outreach and engagement to build relationships with diverse communities and demographic segments of society

As an example, national heritage areas are one partnership model that connects visitors to nationally important cultural, natural, and scenic resources across large-scale landscapes. By encompassing large geographic areas, national heritage areas have the ability to promote and encourage the protection of the interconnected historic, cultural, and natural assets of a region. These community-based efforts preserve and share stories about a region's history and character, and often contain a mixture of public and private property. National heritage areas also work to support conservation, community revitalization, and economic development across these lived-in landscapes. For example, the Silos and Smoke Stacks National Heritage Area interprets and promotes the preservation of the historical development of US agriculture and its global significance across a 37-county area in northeastern Iowa.

The Atchafalaya National Heritage Area connects cultural and natural resources along the Atchafalaya River across 14 parishes in south-central Louisiana to tell the stories of the culturally rich Cajun culture as well as a diverse population of European, African, Caribbean, and American Indian descent. Although national heritage areas are not NPS units, the NPS provides technical assistance, planning, and limited financial assistance in partnership with national heritage areas around the country.

Challenges:

- As a government agency, the NPS faces limitation in terms of legal authority to enter into and maintain partnerships. It can be difficult to develop and sustain partnerships with other organizations that do not have the same level of oversight or necessity for public involvement as the federal government. Issues range from NPS legal authority to developing partnership skills of NPS employees to partners recognizing and valuing the responsibility the NPS has to engage all members of the public in providing input on park management.

- There is a need for a global network of conservation that includes a spectrum of protection systems including NPS units, related areas and programs, and all other conservation agencies, partners and nonprofits.

- Increasingly, partnership skills are needed by employees at all levels of the organization. No formal program or steps exist to help employees develop and maintain these essential skills.

The Gullah Geechee Cultural Heritage Corridor

The Gullah Geechee Cultural Heritage Corridor is a national heritage area that encompasses over 12,000 square miles on the coast in four states: North Carolina, South Carolina, Georgia, and Florida. The corridor commemorates the history and celebrates the ongoing cultural and linguistic traditions of descendants of enslaved Africans from various ethnic groups of western and central Africa. The Gullah Geechee Cultural Heritage Corridor is managed by the Gullah Geechee Cultural Heritage Corridor Commission. Commissioners work in partnership with the NPS and the State Historic Preservation Offices of Florida, Georgia, North Carolina and South Carolina.

Follow-up Actions:

- Seek to clarify and expand NPS authority to enter into and support partnerships. Currently legal and policy authorities limit NPS access to tools used by states and nongovernmental organizations. By expanding NPS authorities we can more easily move in sync with partners, and take steps to develop partnership knowledge skills and abilities throughout the NPS workforce.

- Seek better and more innovative training that will assist NPS staff in working with a more diverse public and, at the same time, provide nonfederal partners with a realistic view of what NPS policies and procedures are regarding resource protection.

- Engage in a study of new and emerging management paradigms that include partnership and joint management in which partners become part of a greater preservation and conservation vision.

- Explore new preservation models that combine federal ownership with partner management as a way to leverage federal legal protection with partner-supported management under limited federal funding.

- Strengthen related area evaluations so that study for inclusion as a related area (affiliate, national heritage area, national trail, or national wild and scenic river) is consistently applied and so that benefits of designation are strong and clearly defined.

- Clarify benefits of other NPS programs such as the National Historic Landmarks Program, National Natural Landmarks Program, and National Register of Historic Places so the public understands why a national park unit designation is not implicitly necessary for long-term protection.

- Promote a landscape-level approach to conservation that incorporates both biological and cultural systems, and considers development outside a park that can affect visitor enjoyment of unimpaired vistas, night skies, or natural sounds. Encourage park staff to use NPS funds to support landscape-level conservation outside of park boundaries.

- Conduct a gap analysis that includes current landmark sites, park units and other protected lands to understand where opportunities exist to support landscape connectivity, conservation, and/or connecting people to open space.

- Support the development of heritage areas and other collaborative approaches or designations such as the Chesapeake Bay Gateways and Watertrails Network and the Gullah Geechee Cultural Heritage Corridor, which are not traditional NPS units but are successful models of partnerships.

- Provide integration of parks and programs that enhance community connections around nationally significant resources, stories, history, or opportunities beyond traditional NPS boundaries. Some examples of current programs include the National Natural Landmarks Program, the Japanese American Confinement Site Grants Programs, and the Rivers, Trails, and Conservation Assistance Program.

- Examine and apply new ways to present multiple stories in parks, and improve coordination among units in telling these stories, ensuring the stories of all Americans are being told.

- The NPS should make as its central resource policy the stewardship of park resources to preserve ecological integrity and cultural and historical authenticity, provide transformative visitor experiences, and manage the national park system as the core of a national conservation network of connected lands and waters. ("Revisiting Leopold" report, 2012.)

Goal #4: Bring Parks to People

The first century of the NPS was about bringing people to parks and the second century will be more about bringing parks to the people. The NPS has a unique opportunity to bring wide-open spaces and national stories to homes and communities. Technology has changed our communication in ways that we could never have imagined and the NPS needs to embrace this evolution. For example, parks that are thematically linked could share resources and programming to connect visitors with other park units that are physically distant from the one they are visiting. By providing both physical and emotional connections for people to connect with parks and other protected areas, the NPS will build a stronger relationship with individuals and communities across a wide spectrum of locales and demographics.

The NPS envisions expanded opportunities for improved engagement of urban communities, rural communities, and new and more diverse visitors. For example, the NPS can explore opportunities to restore landscapes near urban areas in park units and use the restoration work as a way to engage local youth in the park unit. Existing programs also can be used where possible, but perhaps combined in novel ways. For example, the NPS Urban Agenda suggests using the full array of NPS support for tax credits, national historic landmarks, heritage areas, cooperative agreements, and partnerships to come together in urban areas such as Detroit. NPS programs and resources need to continue to be integrated to better reach diverse audiences. The nation's population is increasingly concentrated in urban areas with many people located far from park units. In these areas, NPS programs allow it to still have a presence in these communities.

- An analysis of acreage protected by NPS units reveals that the vast majority of NPS land is distant from major cities. For instance, 95% of all national park property is outside a 50-mile radius of the 20 most populated US cities. Sixty-six percent of all national park property is located in Alaska.

- Examining population and proximity shifts the story. Using the same criteria, there are 133 NPS units (32%) that are within 50 miles of those same city boundaries; so 31.9% of the US population is within a short drive of an NPS unit.

- Inside the city limits of these same 20 cities, there are 80 NPS units. These units offer the largest existing opportunity for outreach to urban citizens, as they are more likely to have connections to education programs through schools and to public transportation.

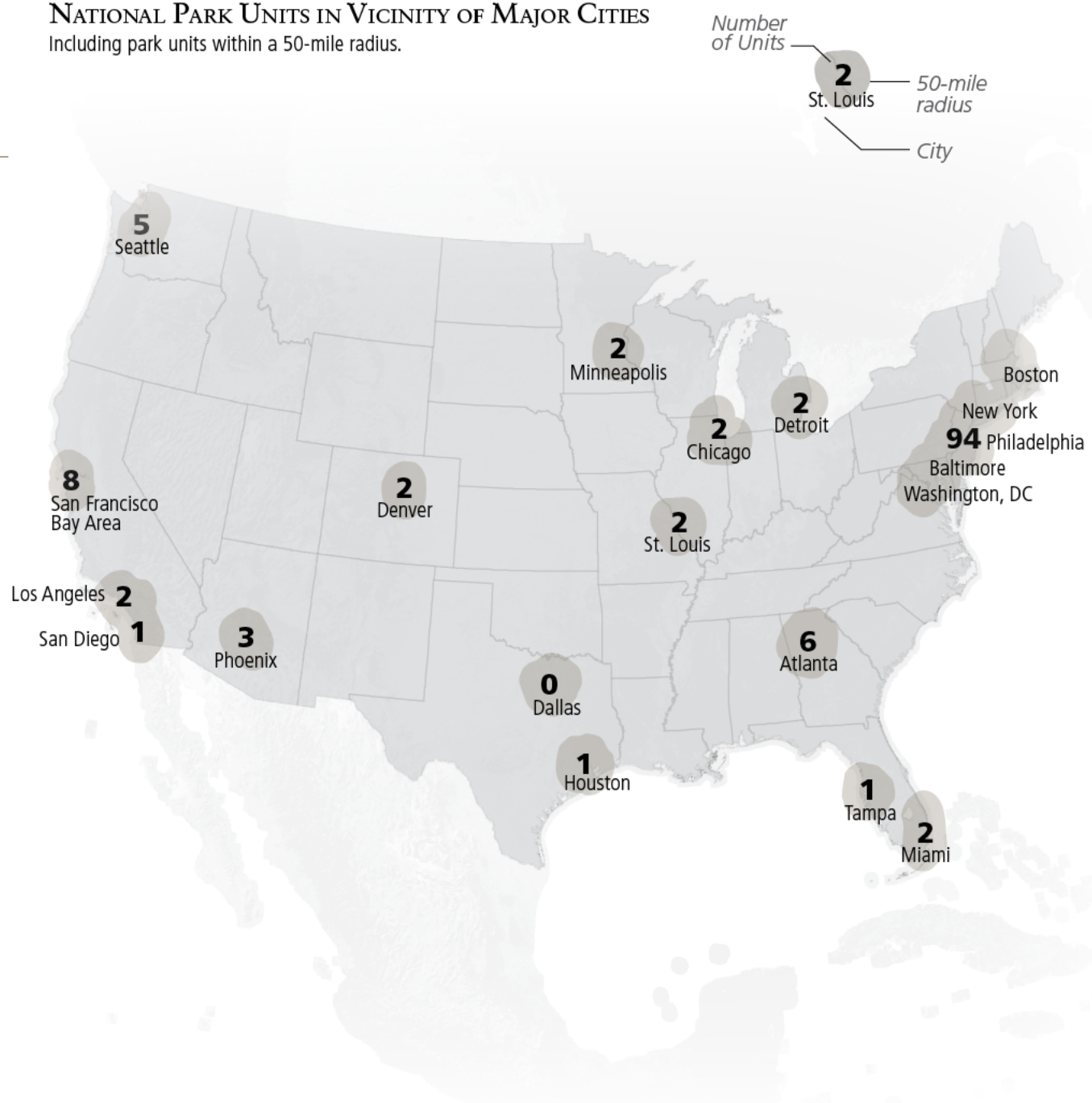
- In total, 40 of the 50 most populated urban areas have national park units located within them.

- More than 80% of Americans live in urban areas. www.nps.gov/urban

- Thirty-six percent of all NPS visitation occurs in urban areas.

National Park Units in Vicinity of Major Cities

Including park units within a 50-mile radius.



6 Atlanta
1 national scenic trail
1 national recreation area
1 national battlefield park
1 national preserve
1 national historic site
1 national monument

2 Chicago
1 national lakeshore
1 national monument

0 Dallas
N/A

2 Denver
1 national monument
1 national park

2 Detroit
1 national memorial
1 national battlefield park

1 Houston
1 national preserve

2 Los Angeles
1 national park
1 national recreation area

2 Miami
1 national preserve
1 national park

2 Minneapolis
1 national river
1 national wild and scenic river

94 Baltimore | Boston
New York | Philadelphia
Washington, DC
2 national battlefield
2 national battlefield park
24 national historic site
16 national historical park
17 national memorial
2 national military park
8 national monument
1 national park
3 national recreation area
1 national scenic river
2 national scenic trail
2 national seashore
2 national wild and scenic river
11 other designation
1 parkway

3 Phoenix
3 national monument

1 San Diego
1 national monument

8 San Francisco Bay Area
2 national historic site
1 national recreation area
1 national monument
1 national seashore
1 national memorial
2 national historical park

5 Seattle
1 national reserve
2 national park
1 national historical park
1 national historic site

2 St. Louis
1 national memorial
1 national historic site

1 Tampa
1 national memorial

Efforts to engage diverse audiences should not be limited to urban areas alone, as many diverse populations exist in suburban and rural locations across the United States. The NPS should identify these populations and work toward interpretation, education, and other opportunities to engage a diverse range of visitors. These efforts will embrace youth and encompass all generations of diverse populations in all types of communities across the country. There is also a need to better tell the diverse stories already present in parks.

Another way to connect visitors to natural and cultural resources across large landscapes is via river and trail corridors. The NPS and other federal agencies and states have a long history of cooperative development and management of river and trail corridors pursuant to the National Trails System Act of 1968 and the National Wild and Scenic Rivers Act of 1968. It is federal policy to recognize and promote trails and riverways by providing financial assistance, support of volunteers, and coordination with states and other authorities.

In addition to acting on these opportunities, the NPS will be proactive in engaging with communities. By developing a strong community of practice and expertise to work effectively in urban communities, rural communities, and areas with previously low exposure to the agency, the NPS will strengthen community outreach in the future.

Challenges:

- Increasingly, the American population is concentrated in urban areas. These citizens often rely on public transportation and may have limited access to areas preserved by the NPS and others.

- Government agencies are historically slow to adopt quickly changing technologies; this hinders the ability for outreach to younger demographics that quickly embrace these technologies.

Key Actions:

- Work to find methods to integrate system units and NPS programs to invigorate the approaches used to bring resources of the NPS to increasingly diverse communities.

- Collect existing data and new study data on park visitors (units and programs) to understand what the demographics of the second century will include. A comprehensive study and subsequent development plan will allow a better understanding of who is visiting parks now, what groups or demographics are not visiting parks and why, what groups are using NPS programs, and how to engage these underrepresented groups. This effort should be undertaken in a way that engages community partners, NPS and partner programs, and cutting-edge social science and related disciplines.

- Reassess the way the NPS counts visitors, including those who participate in educational programming outside park units or visit parks virtually.

- Work to ensure that physical connections to parks and other protected areas are accessible to all visitors. This includes accessible programming and facilities to accommodate visitors of all abilities.
- Develop themes and interpretive programming in other languages in addition to English.
- Invest in more mobile and distributed digital visitor experiences to create opportunities for underserved areas and populations.
- Connect visitors to parks virtually through new digital experiences that incorporate wearable, mobile simulated experiences.
- Develop a gap analysis that includes current landmark sites, park units, and other protected lands, to understand where opportunities exist to support landscape connectivity, conservation, and/or connect people to open space.
- Use new technologies to reach youth populations where they cannot only consume new content, but contribute their stories and perspectives.
- Reach out to youth by using popular platforms and interactive online media and applications.

- Support park managers and partners who wish to use creative methods to provide technical assistance and funding outside of park boundaries.

- Undertake a trail system assessment to identify needs and gaps in the national trail system and connected trail network, especially taking into account connections in urban areas.

- Provide technical assistance to encourage parks to consider better incorporation of health considerations in planning, interpretation, and management. Work with nonprofit organizations, universities, and researchers to identify locations where significant portions of the American population do not have any reasonable access to national parks or open spaces. Work with partners to explore opportunities for bridging these gaps.

The Path Forward

Today, more than ever, Americans have reason to be proud of their national parks. The national park system inspires us to connect with our heritage and learn more about who we are as a people, where we come from, and our connection to the natural world. The national parks continue to inspire present and future generations, and NPS programs continue to empower communities and further promote conservation and connections to our natural and cultural heritage.

Whether connecting people to the outdoors, providing federal matching grants to states to be used for community trails via the Land and Water Conservation Fund, or administering a national program (such as the National Register of Historic Places) to coordinate and support public and private efforts to identify, evaluate, and protect America's historic and archeological resources, the NPS has played an important role in enriching the lives of all Americans.

As we look to the future, there are a number of considerations, challenges, and opportunities that will influence the extent to which the NPS will be able to successfully achieve its mission. The NPS understands that in order to simultaneously balance needs within the system, as well as continue to foster broader conservation, historic preservation, and outdoor recreation efforts among its partners, it will need to strike a balance with many internal and external (often competing) factors.

The NPS recognizes that its future viability and success is inextricably linked to the success of its partners and the breadth of its partnerships. The path forward requires that the NPS continue to serve as a convener, catalyst, and collaborator with citizens groups and other government agencies. By identifying and promoting wider conservation initiatives and partnerships, the NPS can continue to play an important role in strengthening communities, extending economic benefits, improving quality of life, and ultimately preserving the values represented by our national park system.

While evolving responsibilities present new challenges to the NPS, the benefits of the NPS mission are often integral to improving the quality of life everywhere touched by the national park idea. An important component of the National Park Service System Plan is to generate a shared understanding of these evolving responsibilities and how they intersect with other ongoing efforts throughout the country that align with the NPS mission. In considering these and other factors, the System Plan identifies strategies, goals, and actions that will strengthen the system and ensure that the vibrancy of these places is reflective of our nation's cultural and natural heritage for the next 100 years.

APPE

Contributors

Glossary

Selected References

Appendix A: Units in the national park system and related areas as of December 2016

Appendix B: NPS Programs

ENDIXES

Contributors

System Plan Steering Committee

Shawn Benge	Associate Director, Park Planning, Facilities and Lands, Washington Office
Debora Cooper	Assistant Regional Director, Resources and Subsistence, Alaska Region
Sarah Craighead	Superintendent, Mammoth Cave National Park Mammoth Cave, Kentucky
Patrick Gregerson	Chief of Planning, Washington Office
B.J. Johnson	Former Chief of Planning, Denver Service Center
Vic Knox	Former Associate Director, Park Planning, Facilities and Lands, Washington Office
Don Kodak	Former Director, Harpers Ferry Center
Laura Joss	Regional Director, Pacific West Region
Elaine Leslie	Chief, Biological Resources, Natural Resource Stewardship and Science Directorate, Fort Collins, Colorado

Joel Lynch	Chief, State and Local Assistance Programs Division, Partnerships and Civic Engagement, Washington Office
Sande McDermott	Former Deputy Associate Director, Cultural Resources, Partnerships, and Science, Washington Office
Bob Ratcliffe	Chief, Conservation and Outdoor Recreation Program, Washington Office
Tammy Stidham	Chief, Planning, Compliance, and Geographic Information, National Capital Region
David Szymanski	Superintendent, Santa Monica National Recreation Area
Ray Todd	Director, Denver Service Center
Patricia Trap	Deputy Regional Director, Midwest Region
Gay Vietzke	Superintendent, National Mall and Memorial Parks, Washington, DC
Sam Whittington	Former Director, Denver Service Center

Document Contributors, Preparers and Reviewers

Laura Babcock	GIS Specialist, Denver Service Center
Scott Babcock	Project Manager, Denver Service Center
Warren Brown	Former NPS Chief of Planning, Washington Office
Nell Conti	Former Supervisory Technical GIS Specialist, Denver Service Center
Kerri Cahill	Planning Branch Chief, Denver Service Center
Tamara Delaplane	Planning Project Manager, Denver Service Center
Christina Goldfuss	Former Deputy Director, Congressional and External Relations, Washington Office
Shalanda Grier	Former Student Trainee, Denver Service Center
Kassandra Hardy	Management Assistant, Large Landscape Initiatives, NRSS-Biological Resource Management Division Fort Collins, Colorado
Joan Harn	Program Manager, Hydropower Assistance Program, Washington Office
Jonathan Jarvis	Former Director, National Park Service, Washington, DC

Ray McPadden	Project Manager, Denver Service Center
Carrie Miller	Cultural Resource Specialist, Denver Service Center
Cynthia Nelson	Planning Branch Chief, Denver Service Center
Stephan Nofield	Program Manager, Rivers, Trails and Conservation Assistance, Washington Office
Peggy O'Dell	Former Deputy Director, Operations, Washington Office
Larissa Read	Former Project Manager, Denver Service Center
Michael Rees	Natural Resource Specialist, Denver Service Center
Michael Reynolds	Acting Director, National Park Service, Washington, DC
Samantha Richardson	Chief of Staff, Denver Service Center
Mary Risser	Superintendent, Natchez Trace Parkway, Tupelo, Mississippi
Brenda Todd	Former Project Manager, Denver Service Center
Doug Wilder	GIS Supervisor, Denver Service Center

Publications Services, Denver Service Center

Melody Bentfield	Former Contract Librarian
Ken Bingenheimer	Former Editor
James Corbett	Former Publications Supervisor
Kelly Hatton	Former Editor
Wanda Lafferty	Former Contract Editor
Ángel López	Former Visual Information Specialist
Danielle Stevens	Former Contract Editor
Philip Viray	Publications Supervisor
Laura Watt	Contract Editor

* **About the artwork**. The drawings throughout this System Plan catch a breath of the National Park Service. All original artwork created by National Park Service artist Ángel López.

Glossary

Affiliated Area — Affiliated areas are neither federally owned nor directly administered by the NPS, but use NPS assistance. These areas preserve significant properties outside the national park system, some of which were recognized by acts of Congress and others which were designated as national historic sites by the Secretary of the Interior under the Historic Sites Act of 1935.

Cooperative Management — NPS management in partnership with other entities that may own land and have management responsibility for a park; for example, private landowners, nonprofits, as well as local and state governments may all have a direct role in the stewardship of a park. Cooperative management is characterized by a high degree of interdependence among managing organizations and extensive need for collaborative solutions to management challenges.

Cultural Resource — An aspect of a cultural system that is valued by or significantly representative of a culture, or that contains significant information about a culture. A cultural resource may be a tangible entity or a cultural practice. Tangible cultural resources are categorized as districts, sites, buildings, structures, and objects for the National Register of Historic Places, and as archeological resources, cultural landscapes, structures, museum objects, and ethnographic resources for NPS management purposes. (NPS *Management Policies 2006*.)

Gap Analysis — A methodology used to identify gaps in a system.

Landscape Connectivity — In a natural resource context, landscape connectivity can be defined as "the degree to which landscapes facilitate or impede movement between resource patches." (Taylor et al. 1993.)

National Park System Advisory Board — The National Park System Advisory Board, authorized in 1935, advises the Director of the NPS and the Secretary of the Interior on matters relating to the NPS, the national park system, and programs administered by the NPS.

Natural Resource —Term that encompasses natural resources, processes, systems, and values that would occur in the absence of human dominance over the landscape. The term includes physical resources (e.g., water, air, soils, topographic features, geologic features, paleontological resources, night skies and acoustic resources); physical processes (e.g., weather, erosion, cave formation, wildland fire); biological resources (e.g., native plants, animals, communities, biological processes [e.g., photosynthesis, succession, and evolution]); ecosystems; and highly valued associated characteristics such as scenic views. (Largely taken from NPS *Management Policies 2006*, Chapter 4.)

Park — Any one of the hundreds of areas of land and water administered as part of the national park system. The term is used interchangeably in this document with "unit," and "park unit." (NPS *Management Policies 2006*, Glossary.)

Partners — Partners are individuals, organizations, and agencies that play a crucial role in the stewardship of individual national parks or the national park system as a whole. Partner organizations and agencies often have complementary missions to the NPS, such as environmental stewardship or advancing outdoor recreation. Partnerships allow different organizations to pool their resources toward the achievement of common goals. The relationships are mutually beneficial and ultimately produce greater results than one entity could achieve alone.

Visitor — Anyone who physically visits a park for recreational, educational, or scientific purposes, or who otherwise uses a park's interpretive and educational services, regardless of where such use occurs (e.g., via Internet access, library, etc.). (NPS *Management Policies 2006*, Glossary.)

Selected References

Harmon, David

2012 "Beyond the 59th Park: Reforming the Nomenclature of the US National Park System," *The George Wright Forum*, vol. 29.

National Park Service (NPS)

1991 The National Parks: Shaping the System. Washington, DC

1992 "National Parks for the 21st Century: The Vail Agenda."

1994 "History in the National Park Service: Themes and Concepts" http://www.cr.nps.gov/history/hisnps/NPSThinking/themes_concepts.htm

2005 *The National Parks: Shaping the System*. 3rd ed. Harpers Ferry Center, West Virginia.

2006 NPS *Management Policies*

2009a "National Park System: 2009 Visitor Survey Card Data Report"

2009b *The National Parks Index 2009-2011*. Office of Public Affairs and Harpers Ferry Center, Washington, DC Available online at: http://www.nps.gov/hfc/products/pubs/salespub-feature.cfm

2011 "A Call to Action – Preparing for a Second Century of Stewardship and Engagement"

2013a "Engaging Independent Perspectives for a 21st-Century National Park System"

2013b "National Park Service Overview." Washington, DC

National Park Service (NPS)

2013c "National Park Service Programs." Washington, DC Available online at: http://www.nps.gov/policy/NPSPrograms_September2013_small.pdf

2014 "Call to Action 22, Scaling Up: Collaborative Approaches to Large Landscape Conservation"

2014b "FY 2015 NPS Greenbook" (http://www.nps.gov/aboutus/budget.htm)

2016 "Complete List of National Park Service Units and Affiliated Areas." Available online at: https://www.nps.gov/aboutus/news/upload/Site_Designations_02-23-16.pdf

2015b "FY 2016 NPS Greenbook" (http://www.nps.gov/aboutus/budget.htm)

2015c "2015 National Park Visitor Spending Effects. Economic Contributions to Local Communities, States, and the Nation." Natural Resource Report NPS/NRSS/EQD/NRR-2016/1200. (go.nps.gov/vse)

National Park System Advisory Board.

1999 "Rethinking the National Parks for the 21st Century"

2012 "Planning for a Future National Park System: A Foundation for the 21st Century"

National Parks Second Century Commission

2009 "Advancing the National Park Idea"

National Parks Conservation Association and National Park Hospitality Association

2012 "New Poll of Likely Voters Finds Unity in Public Support for National Parks." (http://www.npca.org/news/media-center/press-releases/2012/poll_parks_support_080712.html)

Sayre, Roger, James D. Nations, Laurence Benson

2012 USGS-NCPA Ecosystem Gap Analysis

Taylor, P. D., L. Fahrig, K. Henein, and G. Merriam

1993 "Connectivity is a Vital Element of Landscape Structure." *Oikos* 68: 571-573

Appendix A: Units in the national park system and related areas as of December 2016[7]

National Battlefields
Antietam
Big Hole
Cowpens
Fort Donelson
Fort Necessity
Monocacy
Moores Creek
Petersburg
Stones River
Tupelo
Wilson's Creek

National Battlefield Parks
Kennesaw Mountain
Manassas
Richmond
River Raisin

National Battlefield Site
Brices Cross Roads

National Military Parks
Chickamauga and Chattanooga
Fredericksburg and Spotsylvania County Battlefields Memorial
Gettysburg
Guilford Courthouse
Horseshoe Bend
Kings Mountain
Pea Ridge
Shiloh
Vicksburg

National Historical Parks
Abraham Lincoln Birthplace
Adams
Appomattox Court House
Blackstone River Valley
Boston
Cane River Creole
Cedar Creek and Belle Grove
Chaco Culture
Chesapeake & Ohio Canal
Colonial
Cumberland Gap
Dayton Aviation Heritage
First State
George Rogers Clark
Harpers Ferry
Harriet Tubman Underground Railroad
Hopewell Culture
Independence
Jean Lafitte NHP and Preserve
Kalaupapa
Kaloko-Honokohau
Keweenaw
Klondike Gold Rush

7 Source: NPS 2016.

Units in the National Park System

Lewis and Clark
Lowell
Lyndon B. Johnson
Manhattan Project
Marsh-Billings-Rockefeller
Minute Man
Morristown
Natchez
New Bedford Whaling
New Orleans Jazz
Nez Perce
Palo Alto Battlefield
Paterson Great Falls
Pecos
Pu'uhonua o Hōnaunau
Rosie the Riveter / World War II Home Front
Salt River Bay NHP and Ecological Preserve
San Antonio Missions
San Francisco Maritime
San Juan Island
Saratoga
Sitka
Thomas Edison
Tumacacori
Valley Forge
War in the Pacific
Women's Rights

National Historic Sites
Allegheny Portage Railroad
Andersonville
Andrew Johnson
Bent's Old Fort
Boston African American
Brown v. Board of Education
Carl Sandburg Home
Carter G. Woodson Home
Charles Pickney
Christiansted
Clara Barton
Edgar Allan Poe
Eisenhower
Eleanor Roosevelt
Eugene O'Neill
First Ladies
Ford's Theatre
Fort Bowie
Fort Davis
Fort Laramie
Fort Larned
Fort Point
Fort Raleigh
Fort Scott
Fort Smith
Fort Union Trading Post
Fort Vancouver
Frederick Douglass
Frederick Law Olmsted
Friendship Hill
Golden Spike
Grant-Kohrs Ranch
Hampton
Harry S. Truman
Herbert Hoover
Home of Franklin D. Roosevelt
Hopewell Furnace
Hubbell Trading Post
James A. Garfield
Jimmy Carter
John Fitzgerald Kennedy
John Muir
Knife River Indian Villages

Lincoln Home
Little Rock Central High School
Longfellow House – Washington's Headquarters
Maggie L. Walker
Manzanar
Martin Luther King, Jr.
Martin Van Buren
Mary McLeod Bethune Council House
Minidoka
Minuteman Missile
Nicodemus
Ninety Six
Pennsylvania Avenue
President William Jefferson Clinton Birthplace Home
Puukoholā Heiau
Sagamore Hill
Saint-Gaudens
Saint Paul's Church
Salem Maritime
San Juan
Sand Creek Massacre
Saugus Iron Works
Springfield Armory
Steamtown
Theodore Roosevelt Birthplace
Theodore Roosevelt Inaugural
Thomas Stone
Tuskegee Airmen
Tuskegee Institute
Ulysses S. Grant
Vanderbilt Mansion
Washita Battlefield
Weir Farm
Whitman Mission
William Howard Taft

International Historic Site
Saint Croix Island

National Lakeshores
Apostle Islands
Indiana Dunes
Pictured Rocks
Sleeping Bear Dunes

National Memorials
Arkansas Post
Arlington House, The Robert E. Lee Memorial
Chamizal
Coronado
De Soto
Federal Hall
Flight 93
Fort Caroline
Franklin Delano Roosevelt Memorial
General Grant
Hamilton Grange
Jefferson National Expansion Memorial
Johnstown Flood
Korean War Veterans
Lincoln Boyhood
Lincoln Memorial
Lyndon Baines Johnson Memorial Grove on the Potomac
Martin Luther King, Jr.
Mount Rushmore
Perry's Victory & International Peace
Port Chicago Naval Magazine

Roger Williams
Thaddeus Kosciuszko
Theodore Roosevelt Island
Thomas Jefferson
Vietnam Veterans
Washington Monument
World War I
World War II
Wright Brothers

National Monuments
African Burial Ground
Agate Fossil Beds
Alibates Flint Quarries
Aniakchak
Aztec Ruins
Bandelier
Belmont-Paul Women's Equality
Booker T. Washington
Buck Island Reef
Cabrillo
Canyon de Chelly
Cape Krusenstern
Capulin Volcano
Casa Grande Ruins
Castillo de San Marcos
Castle Clinton
Castle Mountains
Cedar Breaks
César E. Chávez
Charles Young Buffalo Soldiers
Chiricahua
Colorado
Craters of the Moon
Devils Postpile
Devils Tower
Dinosaur
Effigy Mounds
El Malpais
El Morro
Florissant Fossil Beds
Fort Frederica
Fort Matanzas
Fort McHenry NM and Historic Shrine
Fort Monroe
Fort Pulaski
Fort Stanwix
Fort Sumter
Fort Union
Fossil Butte
George Washington Birthplace
George Washington Carver
Gila Cliff Dwellings
Governors Island
Grand Portage
Hagerman Fossil Beds
Hohokam Pima
Homestead National Monument of America
Honouliuli
Hovenweep
Jewel Cave
John Day Fossil Beds
Katahdin Woods and Waters
Lava Beds
Little Bighorn Battlefield
Montezuma Castle
Muir Woods
Natural Bridges
Navajo
Ocmulgee
Oregon Caves
Organ Pipe Cactus

Petroglyph
Pipe Spring
Pipestone
Poverty Point
Pullman
Rainbow Bridge
Russell Cave
Salinas Pueblo Missions
Scotts Bluff
Statue of Liberty
Sunset Crater Volcano
Stonewall
Timpanogos Cave
Tonto
Tule Springs Fossil Beds
Tuzigoot
Virgin Islands Coral Reef
Waco Mammoth
Walnut Canyon
White Sands
World War II Valor in the Pacific
Wupatki
Yucca House

National Parks
Acadia
Arches
Badlands
Big Bend
Biscayne
Black Canyon of the Gunnison
Bryce Canyon
Canyonlands
Capitol Reef
Carlsbad Caverns
Channel Islands
Congaree
Crater Lake
Cuyahoga Valley
Death Valley
Denali
Dry Tortugas
Everglades
Gates of the Arctic
Glacier
Glacier Bay
Grand Canyon
Grand Teton
Great Basin
Great Sand Dunes NP and Preserve
Great Smoky Mountains
Guadalupe Mountains
Haleakalā
Hawai'i Volcanoes
Hot Springs
Isle Royale
Joshua Tree
Katmai
Kenai Fjords
Kings Canyon
Kobuk Valley
Lake Clark
Lassen Volcanic
Mammoth Cave
Mesa Verde
Mount Rainier
National Park of American Samoa
North Cascades
Olympic
Petrified Forest
Pinnacles
Redwood

Rocky Mountain
Saguaro
Sequoia
Shenandoah
Theodore Roosevelt
Virgin Islands
Voyageurs
Wind Cave
Wrangell-Saint Elias
Yellowstone
Yosemite
Zion

National Parkways
Blue Ridge Parkway
George Washington Memorial Parkway
John D. Rockefeller Jr. Memorial Parkway
Natchez Trace Parkway

National Preserves
Aniakchak
Bering Land Bridge
Big Cypress
Big Thicket
Craters of the Moon
Denali
Gates of the Arctic
Glacier Bay
Great Sand Dunes
Katmai
Lake Clark
Little River Canyon
Mojave
Noatak
Tallgrass Prairie
Timucuan Ecological & Historic
Valles Caldera
Wrangell-Saint Elias
Yukon-Charley Rivers

National Reserves
City of Rocks
Ebey's Landing National Historic Reserve

National Recreation Areas
Amistad
Bighorn Canyon
Boston Harbor Islands
Chattahoochee River
Chickasaw
Curecanti
Delaware Water Gap
Gateway
Gauley River
Glen Canyon
Golden Gate
Lake Chelan
Lake Mead
Lake Meredith
Lake Roosevelt
Ross Lake
Santa Monica Mountains
Whiskeytown Unit [8]

8 Administered under cooperative agreements with other federal agencies.

National Rivers
Big South Fork National River and Recreation Area
Buffalo
Mississippi National River and Recreation Areas
New River Gorge
Ozark National Scenic Riverways

National Wild and Scenic Rivers
Alagnak Wild River
Bluestone National Scenic River
Delaware National Scenic River
Great Egg Harbor National Scenic and Recreational River
Missouri National Recreational River
Niobrara National Scenic River
Obed Wild and Scenic River
Rio Grande Wild & Scenic River
Saint Croix National Scenic Riverway
Upper Delaware National Scenic and Recreational River

National Scenic Trails
Appalachian Trail
Natchez Trace
Potomac Heritage

National Seashores
Assateague Island
Canaveral
Cape Cod
Cape Hatteras
Cape Lookout
Cumberland Island
Fire Island
Gulf Islands
Padre Island
Point Reyes

Other Designations
Catoctin Mountain Park
Constitution Gardens
Fort Washington Park
Greenbelt Park
National Capital Parks
National Mall
Piscataway Park
Prince William Forest Park
Rock Creek Park
White House
Wolf Trap National Park for the Performing Arts

Related Areas

Affiliated Areas

Aleutian World War II National Historic Area
American Memorial Park
Benjamin Franklin National Memorial
Chicago Portage National Historic Site
Chimney Rock National Historic Site
Fallen Timbers Battlefield and Fort Miamis National Historic Site
Father Marquette National Memorial, Michigan
Gloria Dei (Old Swedes') Church National Historic Site
Green Springs National Historic Landmark District
Historic Camden Revolutionary War Site
Ice Age National Scientific Reserve
International Peace Garden
Inupiat Heritage Center
Jamestown National Historic Site
Kate Mullany National Historic Site
Lower East Side Tenement National Historic Site
New Jersey Coastal Heritage Trail Route
Oklahoma City National Memorial
Pinelands National Reserve
Red Hill Patrick Henry National Memorial
Roosevelt Campobello International Park
Thomas Cole National Historic Site
Touro Synagogue National Historic Site
Wing Luke Museum of the Asian Pacific American Experience

National Heritage Areas

Abraham Lincoln National Heritage Area
America's Agricultural Heritage Partnership (Silos & Smokestacks National Heritage Area)
Arabia Mountain National Heritage Area
Atchafalaya National Heritage Area
Augusta Canal National Heritage Area
Baltimore National Heritage Area
Blue Ridge National Heritage Area
Chache La Poudre River Corridor
Cane River National Heritage Area
Champlain Valley National Heritage Partnership
Crossroads of the American Revolution National Heritage Area
Delaware and Lehigh National Heritage Corridor
Erie Canalway National Heritage Corridor
Essex National Heritage Area
Freedom's Frontier National Heritage Area
Freedom's Way National Heritage Area
Great Basin National Heritage Area
Gullah Geechee Cultural Heritage Corridor
Hudson River Valley National Heritage Area
Illinois & Michigan Canal National Heritage Corridor
John H. Chafee Blackstone River Valley National Heritage Corridor
Journey Through Hallowed Ground National Heritage Area
Kenai Mountains-Turnagain Arm National Heritage Area
Lackawanna Valley National Heritage Area

Mississippi Delta National Heritage Area
Mississippi Gulf Coast National Heritage Area
Mississippi Hills National Heritage Area
Mormon Pioneer National Heritage Area
MotorCities National Heritage Area
Muscle Shoals National Heritage Area
National Aviation Heritage Area
National Coal Heritage Area
Niagara Falls National Heritage Area
Northern Plains National Heritage Area
Northern Rio Grande National Heritage Area
Ohio and Erie National Heritage Area
Oil Region National Heritage Area
Rivers of Steel National Heritage Area
Sangre de Cristo National Heritage Area
Schuylkill River Valley National Heritage Area
Shenandoah Valley Battlefields National Historic District
South Carolina National Heritage Corridor
South Park National Heritage Area
Tennessee Civil War National Heritage Area
The Last Green Valley National Heritage Corridor
Upper Housatonic Valley National Heritage Area
Wheeling National Heritage Area
Yuma Crossing National Heritage Area

National Trails System
Ala Kahakai National Historic Trail
Appalachian National Scenic Trail
Arizona National Scenic Trail
California National Historic Trail
Captain John Smith Chesapeake National Historic Trail
Continental Divide National Scenic Trail
El Camino Real de los Tejas National Historic Trail
El Camino Real de Tierra Adentro National Historic Trail
Florida National Historic Trail
Ice Age National Historic Trail
Iditarod National Historic Trail
Juan Bautista de Anza National Historic Trail
Lewis and Clark National Historic Trail
Mormon Pioneer National Historic Trail
Natchez Trace National Scenic Trail
New England National Scenic Trail
Nez Perce (Nee-Me-Poo) National Historic Trail
North Country National Scenic Trail
Old Spanish National Historic Trail
Oregon National Historic Trail
Overmountain Victory National Historic Trail
Pacific Crest National Scenic Trail
Pacific Northwest National Scenic Trial
Pony Express National Historic Trail
Potomac Heritage National Scenic Trail
Santa Fe National Historic Trail
Selma to Montgomery National Historic Trail
Star-Spangled Banner National Historic Trail
Trail of Tears National Historic Trail
Washington-Rochambeau Revolutionary Route National Historic Trail

National Wild & Scenic Rivers System
Alagnak Wild River
Alatna Wild River
Aniakchak Wild River
Bluestone National Scenic River
Cache la Poudre Wild and Scenic River
Charley Wild River
Chilikadrotna Wild River
Eightmile National Wild and Scenic River
Farmington National Wild and Scenic River
Flathead Wild and Scenic River
Great Egg Harbor Scenic
and Recreational River
John Wild River
Kern River
Kings River
Kobuk Wild River
Lamprey Wild and Scenic River
Lower Delaware Wild and Scenic River
Maurice Scenic and Recreational River
Merced River
Middle Delaware River
Missisquoi and Trout National Wild
and Scenic River
Missouri National Recreation River
Mulchatna Wild River
Musconetcong National Wild and Scenic River
Niobrara National Scenic River
Noatak Wild River
North Fork of the Koyukuk Wild River
Obed Wild and Scenic River
Rio Grande Wild and Scenic River
River Styx Wild and Scenic River
Saint Croix National Scenic Riverway
Salmon Wild River
Snake River Headwaters Wild and Scenic River
Sudbury, Assabet and Concord National Wild
and Scenic River
Taunton National Wild and Scenic River
Tinayguk Wild River
Tlikakila Wild River
Toulumne River, California
Upper Delaware Scenic and Recreational River
Virgin Wild and Scenic River
Wekiva National Wild and Scenic River
Westfield National Wild and Scenic River
White Clay Creek National Wild
and Scenic River

Appendix B: NPS Programs

The following list was compiled from the "Budget Justifications and Performance Information FY 2015" (the "Greenbook"). NPS organization programs, such as those under Workforce Management or Administrative Support (e.g., Human Resources, Pathways Program, Budget, Financial Management, Strategic Planning), Centennial initiatives, base funding for staff and the 413-unit system are not included in this list. The intention of this appendix is to illuminate the many ways the National Park Service supports conservation, interpretation, and education efforts outside of managing specific national park units. Organization of this list, including categorization, order and duplicative/similar entries is taken directly from the Greenbook. For more details on these programs, see the Greenbook. www.nps.gov/aboutus/budget.htm

Park Management – Resource Stewardship

Natural Resource Stewardship

- Air Resource Management and Research
- Biological Resource Management
- Cave Research
- Cooperative Ecosystem Studies Units (CESUs)
- Cooperative Landscape Conservation
- Environmental Response, Damage Assessment, and Restoration
- Geologic Resources
- Great Lakes Restoration Initiative
- Inventory & Monitoring (I&M)
- National Trails System (including the national water trails system, national scenic trails, national historic trails, national recreation trails, and connecting/side trails)
- Natural Sounds
- Research Learning Centers
- Social Science
- Water Resources
- Wild and Scenic Rivers

Cultural Resource Stewardship

- Archeological Resources
- Cultural Landscapes
- Cultural Resource Centers
- Cultural Resource Projects
- Ethnographic Resources
- Historic and Prehistoric Structures
- Historical Research (park history)
- Museum Collections
- National Underground Railroad Network to Freedom Program
- Native American Graves Protection and Repatriation Program (NAGPRA)
- Youth Programs (e.g., Cultural Resources Diversity Internship Program)

Everglades Restoration and Research

- Critical Ecosystems Studies Initiative
- Comprehensive Everglades Restoration Plan

Park Management – Visitor Services

Interpretation and Education

- National Council for the Traditional Arts Assistance (NCTA)
- Parks as Classrooms Programs
- National Unigrid Publications Program
- Volunteers-in-Parks (VIP) Program
- Teacher-Ranger-Teacher Program
- Youth Programs (NPS Youth Involvement and
- Employment Programs)
- Boy Scouts of America Partnership
- Groundwork USA Youth Development Partnership
- Historically Black Colleges and Universities Internship Program
- Junior Ranger
- Mosaics in Science Internship Program
- Public Land Corps
- Youth Conservation Corps (YCC)
- Youth Partnership Program
- WebRangers
- 2013 NPS Academy: Connecting Youth to NPS Careers

Commercial Services

- Commercial Services Management

National Recreation and Preservation

Natural Programs

- Rivers, Trails, and Conservation Assistance
- National Natural Landmarks
- Hydropower Recreation Assistance
- Chesapeake Bay Gateways and Watertrails Network

Cultural Programs

- American Battlefield Protection Program Assistance Grants
- Archeological Assistance Program
- Cultural Resources-GIS Program
- Cultural Resources Office of Outreach and Diversity
- Federal Preservation Institute
- Heritage Documentation Programs
- Heritage Education Services
- Japanese American Confinement Site Grants
- National Center for Preservation Technology and Training
- National Historic Landmarks Program
- National Register of Historic Places
- National Register Programs
- Technical Preservation Services

Grants Administration

- American Battlefield Protection Program Grants Administration
- Historic Preservation Fund Administration
- Japanese American Confinement Sites Grants Administration
- Native American Graves Protection Grants Administration

International Park Affairs
- Office of International Affairs
- Southwest Border Resource Protection Program

Heritage Partnership Programs (National Heritage Areas)
- Commissions and Grants
- Administrative Support

Historic Preservation Fund

Grants-in-Aid
- Grants-in-Aid to States and Territories
- Grants-in-Aid to Indian Tribes
- Competitive Grants to Underrepresented Communities

Land Acquisition and State Assistance

State Conservation Grants
- State Conservation Grants Administration

State and Local Conservation Grants
- Competitive State Conservation Grants
- Land Acquisition and State Assistance Program
- State and Local Conservation Grants

This document represents a snapshot in time and is based on the best information available to date. As the National Park Service evolves and resources change, it will be appropriate to revisit the recommendations and gaps contained within this document on an as-needed basis.

As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historic places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

WASO 909/133283
January 2017

National Park Service
SYSTEM PLAN
One Hundred Years

From:	Michael Saul
To:	gusg_amend@blm.gov
Cc:	Michael Saul
Subject:	Comments of Center for Biological Diversity on BLM Gunnison Sage-Grouse Rangewide DEIS
Date:	Thursday, January 19, 2017 5:56:10 PM
Attachments:	CBD Comments on GUSG DEIS 1-19-17.pdf

Please find attached for your consideration the comments of the Center for Biological Diversity on the Gunnison Sage-Grouse Rangewide Draft Resource Management Plan Amendment Draft Environmental Impact Statement.

Michael Saul

Michael Saul

Senior Attorney, Public Lands

Center for Biological Diversity

Denver, CO

phone/text 303-915-8308

msaul@biologicaldiversity.org

This email may contain material that is confidential, privileged and/or attorney work product for the sole use of the intended recipient. Any review, reliance or distribution by others or forwarding without express permission is strictly prohibited. If you are not the intended recipient, please contact the sender and delete all copies.

January 19, 2017

Bureau of Land Management
Attn: Gunnison Sage-Grouse EIS
Colorado State Office
2850 Youngfield Street
Lakewood CO 80215-7093

Via electronic mail to gusg_amend@blm.gov

RE: Comments on the Gunnison Sage-Grouse Rangewide Draft Resource Management Plan Amendment Draft Environmental Impact Statement

To Whom It May Concern:

Attached are comments from the Center for Biological Diversity ("Center") on the above-referenced Draft Environmental Impact Statement. They are presented on behalf of the staff and supporters of the Center who include over 1.1 million members and online activists nationwide. These include members and activists who live and/or recreate or visit lands managed by the Bureau of Land Management in Colorado and Utah, and who have serious concerns about the survival and recovery of the Gunnison Sage-Grouse (GUSG). The Center endorses the January 4, 2017 comments of Western Watersheds Project regarding the DEIS, and provides these additional comments regarding BLM's legal obligations, the scientific consensus regarding sage-grouse conservation and land management, concerns regarding fluid minerals management, and the need to conserve both Gunnison Basin and satellite populations of GUSG.

As you are well aware, the Gunnison Sage-Grouse was listed by the U.S. Fish and Wildlife Service ("FWS") as threatened under the Endangered Species Act ("ESA") in November 2014.[1] Section 7(a) of the ESA requires that the Secretary of the Interior "shall review all other programs administered by him [sic] and utilize such programs in furtherance of the purposes of the Act." Those purposes include Congress' intent that "all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act."[2] Those purposes are further defined as "provid[ing] a means whereby the eco-systems upon which endangered species and threatened species depend may be conserved."[3] That term "conserve" is defined to mean not only the avoidance of extinction, but to "mean to use and the use of all methods and procedures which are

[1] *See* U.S. Fish and Wildlife Service, Threatened Status for Gunnison Sage-Grouse, Final Rule, 79 Fed. Reg. 69,192 (Nov. 20, 2014). That decision is currently the subject of litigation, *Center for Biological Diversity v. U.S. Fish and Wildlife Serv.*, No. 1:15-cv-00130-JLK (D. Colo.), challenging FWS's decision to list the species as threatened rather than endangered.
[2] ESA Section 2(c)(1).
[3] ESA Section 2(b).

necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary."[4]

Based on the established similarities in habitat requirements between the GUSG and the Greater Sage-Grouse, a species that has been exhaustively studied in the context of its own consideration for ESA listing and a series of BLM and U.S. Forest Service range-wide planning amendments across the west, there is a substantial body of high-quality scientific evidence regarding the habitat management measures necessary to recover sage-grouse species. In particular, the 2011 Report on Greater Sage-Grouse Conservation Measures produced by the Sage-Grouse National Technical Team, and the U.S. Geological Survey's 2013 Summary of Science, Activities, Programs and Policies That Influence the Conservation of Greater Sage-Grouse, provide a scientific basis for evaluating the effectiveness of proposed BLM land management actions.[5] Additional, more recent federal scientists' reports and peer-reviewed articles provide substantial additional empirical information on the management measures necessary to conserve functional sage-grouse habitats in the face of oil and gas development in particular.[6] Based on this scientific literature, Alternatives C, D1, and D2 are all inadequate to meet BLM's obligation to conserve Gunnison sage-grouse habitat or to address the specific threats to the species identified by FWS. In particular, given the Gunnison sage-grouse's tenuous population viability and listed status under the ESA, it defies reason that BLM would propose a preferred alternative that falls short of the conservation measures it has adopted for Greater Sage-Grouse in its 2015 Northwest Colorado Resource Management Plans for that species.

The Gunnison sage-grouse is a beautiful, rare species of sage-grouse which is found nowhere else in the world except in the rapidly-disappearing sage-brush ecosystems of southwest Colorado and southeast Utah. It has been in decline since the 1950s and is now reduced to about 8.5 percent of its historic range, which once also included portions of Arizona and New Mexico, due to myriad threats including habitat destruction, livestock grazing, energy development, and climate change.

In 1977, Dr. Clait Braun, then a scientist with the Colorado Division of Wildlife ("CDOW"), noticed that sage-grouse wings collected in the Gunnison Basin of southwestern Colorado were smaller than sage-grouse wings collected in northern Colorado. Over the following two decades, Dr. Braun and others documented the morphological and genetic differences between these Gunnison Basin sage-grouse and other sage-grouse populations. Those differences were significant, and in 2000 the American Ornithologists' Union formally determined that sage-grouse in southwestern Colorado – *i.e.*, today what is now known as the Gunnison sage-grouse *(Centrocercus minimus*) – is a separate species, distinct from the greater sage-grouse (*Centrocercus urophasianus*).

With their elaborate mating dance, small size, and distinctive white barred tail feathers, Gunnison sage-grouse were once abundant in prairie habitats in southwestern Colorado, southeastern Utah, northeastern Arizona, and northwestern New Mexico. Yet today they are limited to southwestern Colorado and a small population in Utah, and they have been lost from 88-93 percent of their estimated historic range, primarily due to habitat destruction and fragmentation. Endangered Proposal, 78 Fed. Reg. at 2495.

[4] ESA Section 3(3).
[5] Manier, D.J. et al., Summary of science, activities, programs, and policies that influence the rangewide conservation of Greater Sage-Grouse (*Centrocercus urophasianus*) (2013); Sage-grouse National Technical Team, A Report on Greater Sage-Grouse Conservation Measures (2011)
[6] Manier, D.J. et al., Conservation Buffer Distance Estimates for Greater Sage-Grouse – A Review (2014); Green, A.W., Investigating Impacts of Oil and Gas Development on Greater Sage-Grouse, Journal of Wildlife Management (2016), doi:10.1002/jwmg.21179.

Gunnison sage-grouse rely on a variety of sagebrush habitats throughout the year. During the spring breeding season, males display on "leks" (*i.e.*, strutting grounds), which are open areas with good visibility and acoustics. After breeding, females select nest sites in the vicinity of leks and in relatively tall and dense stands of sagebrush with residual grass and forbs that provide additional hiding cover. As chicks mature through the summer, hens typically move their broods to wet meadow areas with succulent forbs and insects and tall grasses for hiding and foraging. In fall, sage-grouse rely on upland areas that have at least 20 percent sagebrush cover and green forbs. During winter, when snow cover is extensive and deep, sage-grouse forage in tall sagebrush in valleys and lower flat areas, and roost in shorter sagebrush along ridge tops.

Because sage-grouse derive food, shelter, and cover from sagebrush and are dependent on sagebrush for survival, sage-grouse are an indicator species for the health of "sagebrush-steppe" ecosystems, including other species that rely on such ecosystems.

There are now only seven, mostly isolated populations of Gunnison sage-grouse remaining in Colorado and Utah. These populations and their estimated populations are: the Gunnison Basin population with 3,978 birds; the San Miguel Basin population with 206 birds; the Pińon Mesa population with 182 birds; the Crawford population with 157 birds; the Monticello-Dove Creek population with 98 birds; and the Cerro Summit-Cimarron-Sims Mesa population with 74 birds. The Poncha Pass population exists only due to the translocation of birds from the Gunnison Basin population, and after translocations of birds in the fall of 2013 and spring of 2014, only 16 birds were known to survive into the summer in 2014.

At an estimated 3,978 birds in 2014, only the Gunnison Basin population currently contains more than about 200 birds. It has been estimated that the rangewide Gunnison sage-grouse population has declined between 42 and 90 percent since the 1950s.

Due to habitat loss and degradation from residential development, resource extraction, agricultural activities, and other threats, the National Audubon Society has identified the Gunnison sage-grouse as one of the nation's 10 most endangered birds and maintains the Gunnison sage-grouse on its "Watch List 2007 Red Category," which is for species that are declining rapidly or have very small populations or limited ranges and face major conservation threats. The International Union for Conservation of Nature ("IUCN") maintains the species on its Red List Category of "endangered," and NatureServe ranks the Gunnison sage-grouse as "critically imperiled."

According to FWS, 88 to 93 percent of the species's historical range has been lost since Euro-American settlement, and "[t]his contraction in the birds' range indicates the vulnerability of all the populations to extirpation." Gunnison Sage-Grouse Listing Rule, 79 Fed. Reg. at 69,228. The listing rule found that "the persistence of Gunnison sage-grouse is dependent on large and contiguous sagebrush habitats, that human development and disturbance contribute to the decline of this needed habitat, and that such impacts negatively affect the survival and persistence of Gunnison sage-grouse." ***Id.*** Numerous activities on BLM land and minerals contribute to loss of these sage-grouse habitats, including road-building, power lines, livestock grazing practices, invasive plants, fire, and leasable minerals (i.e. oil and gas development). Oil and gas development has numerous adverse effects on Gunnison sage-grouse habitat, behavior, and population not adequately acknowledged or analyzed in this DEIS:

> Energy development impacts sagegrouse and sagebrush habitats through direct habitat loss from well pad construction, seismic surveys, roads, powerlines and pipeline corridors, and indirectly from noise, gaseous emissions, changes in water availability and quality, and human presence. The interaction and intensity of effects could cumulatively or individually lead to habitat degradation and fragmentation (Suter 1978, pp. 6–13;

Aldridge 1998, p. 12; Braun 1998, pp. 144–148; Aldridge and Brigham 2003, p. 31; Knick *et al.* 2003, pp. 612, 619; Lyon and Anderson 2003, pp. 489–490; Connelly *et al.* 2004, pp. 7–40 to 7–41; Holloran 2005, pp. 56–57; Holloran *et al.* 2007, pp. 18–19; Aldridge and Boyce 2007, pp. 521–522; Walker *et al.* 2007a, pp. 2652–2653; Zou*et al.* 2006, pp. 1039–1040; Doherty *et al.* 2008, p. 193; Leu and Hanser 2011, pp. 270–271). Increased human presence resulting from oil and gas development can also impact sagegrouse either through avoidance of suitable habitat or disruption of breeding activities (Braun *et al.* 2002, pp. 4–5; Aldridge and Brigham 2003, pp. 30–31; Aldridge and Boyce 2007, p. 518; Doherty *et al.* 2008, p. 194). The development of oil and gas resources requires surveys for economically recoverable reserves, construction of well pads and access roads, subsequent drilling and extraction, and transport of oil and gas, typically through pipelines. Ancillary facilities can include compressor stations, pumping stations, electrical generators and powerlines (Connelly *et al.* 2004, p. 7–39; BLM 2007, p. 2–110). Surveys for recoverable resources occur primarily through loud seismic exploration activities. These surveys can result in the crushing of vegetation. Well pads vary in size from 0.10 ha (0.25 ac) for coal-bed natural gas wells in areas of level topography to greater than 7 ha (17.3 ac) for deep gas wells and multi-well pads (Connelly *et al.* 2004, p. 7–39; BLM 2007, p. 2–123). Pads for compressor stations require 5–7 ha (12.4–17.3 ac) (Connelly *et al.* 2004, p. 7–39). Individually, impacts from well pads, infrastructure, and ancillary features may be small; however, the cumulative impact of such development can be significant.

The amount of direct habitat loss within an area of oil and gas development is ultimately determined by well densities and the associated loss from ancillary facilities. Roads associated with oil and gas development were suggested as the primary impact to greater sage-grouse due to their persistence and continued use even after drilling and production ceased (Lyon and Anderson 2003, p. 489). Declines in male greater sage-grouse lek attendance were reported within 3 km (1.9 mi) of a well or haul road with a traffic volume exceeding one vehicle per day (Holloran 2005, p. 40). Because of reasons discussed previously, the effects of oil and gas development to Gunnison sage-grouse are expected to be similar to those observed in greater sage-grouse. Sage-grouse also may be at increased risk for collision with vehicles simply due to the increased traffic associated with oil and gas activities (Aldridge 1998, p. 14; BLM 2003, p. 4–222).

Habitat fragmentation resulting from oil and gas development infrastructure, including access roads, may have greater effects on sage-grouse than habitat loss associated with drill sites. Energy development and associated infrastructure works cumulatively with other human activity or development to decrease available habitat and increase fragmentation. Greater sage-grouse leks had the lowest probability of persisting (40–50 percent) in a landscape with less than 30 percent sagebrush within 6.4 km (4 mi) of the lek. These probabilities were even less in landscapes where energy development also was a factor.[7]

[7] Gunnison Sage-Grouse Final Listing Rule, 79 Fed. Reg. at 69,255-256 (attached as Exhibit 297).

FWS found, in considering the adequacy or inadequacy of existing regulatory mechanisms to safeguard Gunnison sage-grouse, that existing BLM RMPs are inadequate as regulatory mechanisms. Existing "RMPs provide only partial protection for Gunnison sage-grouse in terms of land use allocation decisions specific to the species and its habitat and, therefore, are considered inadequate to protect the species." In particular, with regard to fluid mineral development, "Given the already small and fragmented nature of the populations where future oil and gas leases are likely to occur, additional development within occupied habitat would negatively impact those populations by contributing to further habitat decline."[8] Moreover, subsequent peer-reviewed scientific publications have reviewed Greater Sage-Grouse population response to oil and gas management measures in Wyoming, and re-confirmed lek attendance by male sage-grouse declines approximately 2.5% per year in response to oil and gas development, and that attendance declines as development increases, even where well pad density is limited.[9] In light of this information, alternatives C, D1, and D2 all fail to rectify the deficiencies identified in FWS's 2014 final listing rule.

Recent scientific study confirms the established finding that sage-grouse lek attendance is negatively related to oil and gas density, regardless of sagebrush cover and participation.[10] Green et al. examined greater sage-grouse lek attendance ,oil and gas well, and habitat and precipitation data from Wyoming over the period 1984 to 2008, and, consistent with numerous prior studies, that lek attendance declines are closely associated with the density of oil and gas development:

> Oil and gas development correlates well with sage-grouse population declines from 1984 to 2008 in Wyoming, which is supported by other findings (Doherty et al. 2010b, Harju et al. 2010, Hess and Beck 2012, Taylor et al. 2013, Gregory and Beck 2014). As with other studies, we also found support for 4-year lag effects of oil and gas development on lek attendance (Walker et al. 2007, Doherty et al. 010a, Harju et al. 2010, Gregory and Beck 2014). This result suggests that development likely affects recruitment into the breeding population rather than avoidance of wells by adult males or adult survival. Adult sage-grouse are highly philopatric to lek sites (Dalke et al. 1963, Wallestad and Schladweiler 1974, Emmons and Braun 1984, Dunn and Braun 1985, Connelly et al. 2011a), and males typically recruit to the breeding population in 2–3 years. We would expect a delayed response in lek attendance if development affects recruitment, either by reducing fecundity or avoidance of disturbance by nesting females, as adult males die and are not replaced by young males.

On average, lek attendance was stable when no oil and gas development was present within 6,400m (Fig. 4). However, attendance declined as development increased. [11] Importantly, Green et al. confirmed that declines in sage-grouse populations may continue even within Wyoming's "core areas," where density of wells is limited to one pad per square mile. Of BLM's proposed alternatives, only Alternative B is consistent with the substantial body of science regarding oil

[8] Gunnison Sage-Grouse Listing Rule at 69,284.
[9] Green 2016.
[10] Green, Adam et al., Investigating Impacts of Oil and Gas Development on Greater Sage-Grouse, Journal of Wildlife Management (2016), DOI: 10.1002/jwmg.21179 (attached as Exhibit 299).
[11] Green et al. at 9.

and gas impacts to sage-grouse and the recommendations of the Greater Sage-Grouse National Technical Team.

If BLM does not adopt Alternative B and close Gunnison sage-grouse habitat to new leasing, in order to meet its ESA obligations and provide adequate regulatory mechanisms to conserve the species, it must consider and adopt an alternative that, at a minimum, protects GUSG breeding and other life-cycle needs by employing a No Surface Occupancy Buffer distance of no less than 3.2 kilometers (2 miles), in not greater, around known leks.[12] "Studies have shown that greater distance, anywhere from two to four miles, are required for viable Greater Sage-Grouse populations to persist."[13]

The threat to the continued existence of the Gunnison sage-grouse is extreme, and cannot be alleviated through business as usual on the public lands that comprise a significant share of the species' remaining range. FWS has determined that the Gunnison sage-grouse would become endangered in the "foreseeable future" – which the agency considered to be 40-60 years – even while it acknowledged that six of the species' seven remaining populations are in danger of extinction now and that the seventh, the Gunnison Basin population, has experienced recent declines and faces ongoing threats. Between proposing to list the species as endangered and downgrading it to threatened, FWS now considers one of the seven bird populations (Poncha Pass) to exist only due to the translocation of birds from the Gunnison Basin population. 79 Fed. Reg. at 69,200. Another five of the remaining populations are in decline and considered to be too small to maintain genetic integrity or survive stochastic fluctuations. *Id.* at 69,288, 69,304.

The remaining sage-grouse populations are scattered and isolated, and even the largest among them, Gunnison Basin, is not considered to be viable. *Id.* at 69,294-5, 69,303-4. . Cumulatively, population declines and instability, when combined with the changing climate and resulting drought, may cause the Gunnison Basin's population to go extinct in the next 30-58 years. *Id.*

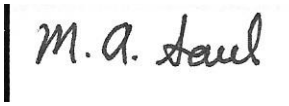
Gunnison sage-grouse have lost 88-93 percent of their historic range and are threatened by continued habitat destruction and fragmentation due to livestock grazing, oil and gas drilling, residential development, motorized recreation, urbanization, and the related road and fence construction and incursion of non-native plant species that accompanies these activities. Areas of remaining sage-brush habitat are in degraded condition, and their degradation results in an inability to support sage-grouse populations.

By assuming that oil and gas activity will be minimal and identical under all alternatives, the DEIS effectively ignores this unaddressed threat. By assuming, without any reasonable basis, that impacts to remaining GUSG populations will be essentially identical whether, as in Alternative B, most remaining federal habitat is made unavailable for oil and gas leasing, or whether new leasing is permitted, the BLM's DEIS fails in the most fundamental obligation of a National Environmental Policy Act review – to permit a reasoned choice among alternatives. If the prospect of leasing and drilling within GUSG habitat is indeed as remote as BLM contends, it defies reason to conclude that the BLM's interest in new leasing outweighs its statutory

[12] *Compare* Manier et al. 2014 at 14 & Table 1 (minimum buffer distance of 3.2 km) with National Technical Team 2011 at 21 (four-mile buffer).
[13] BLM, Wyoming Greater Sage-Grouse RMP Amendment DEIS at 4-335.

imperative to conserve a species on the verge of extinction. BLM has improperly limited its range of alternatives by failing to consider any action alternative (other than Alternative B) that would implement scientifically-warranted and potentially effective measures to minimize adverse impacts, such as a 3.2-km No Surface Occupancy around Gunnison Sage-Grouse leks.

Sincerely yours in conservation,



Michael Saul
Senior Attorney
Center for Biological Diversity
1536 Wynkoop Street, Suite 421
Denver CO 80220

From:	Christensen, David
To:	Nelson, Zachary; Rex Sacco; Lisa Baldwin; ALENE DALTON; Norma Dalton; (b) (6) - Lorena Thornton; David Yoder; cmeier@uintah.utah.gov; Laura Peterson; Steve Bloch; (b) (6) - Lowell Braxton; tparks@westernenergyalliance.org; Christopher Merritt; Elizabeth Hora-Cook
Cc:	Kelly Buckner; David Grant; David Christensen; Wood, Jack; Brown, Michelle; Jody Patterson
Subject:	Vernal Field Office Cultural Class I Consulting Party Meeting
Date:	Thursday, January 26, 2017 5:21:33 PM
Attachments:	January 31 2017 Consulting Parties Meeting Agenda2.docx OUTLINE Vernal Class I and Predictive Model.pdf

---

Dear Consulting Parties,

This is just a friendly reminder of our upcoming consultation meeting for the Vernal Field Office Cultural Class I project.

I have attached a working agenda. The meeting on Tuesday the 31st will focus on the Class I inventory, but if we have time we will introduce the Cultural Resource Planning Model as well. If there is anything you feel needs to be added to the agenda please let me know before hand.

I have also attached another copy of the Class I outline. Please take a look at it and come to the meeting with additional information you feel would enhance the inventory, or questions and concerns that need to be addressed.

This meeting is not the final opportunity to participate. Throughout this process we encourage you to submit comments, questions and concerns, and if necessary, we will meet to discuss the planning model or other aspects of the project.

Please let me know if you are planning on participating in person or by phone. Those who can't make it in person can access the conference call with the information below. All parties will receive the meeting notes whether they attend or not.

January 31, 2017

Vernal Field Office

1:00-4:00 p.m., MST

Dial the Conference Line #866-709-1340

Enter Passcode 6990429#

We thank you for your time and participation to make this a great product.

Thank You,

David Christensen

Archaeologist
Youth Outreach Coordinator
Utah BLM - Green River District

Vernal Field Office

170 South 500 East
Vernal, UT 84078

Phone: (435) 781-3423

U.S. Department of the Interior
Bureau of Land Management

Agenda

Section 106 Consulting Party Meeting Regarding the Vernal Field Office Cultural Class I Project

January 31, 2017
Vernal Field Office
1:00-4:00 p.m., MST

Conference Line #866-709-1340
Passcode 6990429#

Purpose:

- Introduce the Vernal Field Office Cultural Class I Project, discuss ideas and concerns, and set plans to move forward.

Objective(s):

- Understand the scope and purpose of the Cultural Class I
- Gather additional information
- Answer questions and address concerns
- Introduce cultural resource planning model
- Propose project timeline and set date for next meeting (if needed)

Schedule:

1:00-1:05 Welcome and Introductions

1:05-1:20 Vernal Field Office's scope, purpose, and outreach for a Cultural Class I project.

- *David Christensen, Archaeologist, Vernal Field Office*

1:20-1:50 Cultural Class I Report Outline, Strategy, Status

- *Jody Patterson, Ph.D., Principal Investigator, Montgomery Archaeology Consultants*

1:50-2:00 BREAK

2:00-2:50 Consulting party comments and questions (~10 minutes per organization)

2:50-3:00 BREAK

3:00-3:30 Consulting party comments and questions (Continued)

3:30-3:45 Introduction to the cultural resource planning model

- *Jody Patterson, Ph.D., Principal Investigator, Montgomery Archaeology Consultants*

3:45-3:55 Project timeline and potential follow up meeting

- *David Christensen, Archaeologist, Vernal Field Office*

3:55-4:00 Final Comments

Class I and Site Location Model for the Bureau of Land Management Vernal Field Office Area, Daggett, Duchesne, Uintah, and Grand Counties, Utah

Outline

Prepared By:

Jody J. Patterson

Prepared For:

Bureau of Land Management
Vernal Field Office

Prepared Under Contract With:

Bureau of Land Management
Vernal Field Office

Prepared By:

Montgomery Archaeological Consultants, Inc.
P.O. Box 219
Moab, Utah 84532

MOAC Report No. 16-044

November 5, 2016

United States Department of Interior (FLPMA)
Permit No. 16-UT-60122

A. EXECUTIVE SUMMARY
    1 *Purpose: To provide the foundation for the cultural resource planning models*
    2 Identify General Questions and Issues
        a. Define a research direction in consultation with the Field Office archaeologist to make more informed NRHP evaluations and adverse effect determinations
    3 Identify Gaps in the Present Data
        a. Where additional pedestrian inventory is needed to cover spatial inventory data gaps or data gaps in the archaeological record for the project area
    4 Identify Relevant CRM options
        a. What are the areas that are more amenable or of more conflict to oil and gas development?
        b. Are there areas, sites, or site types that should be identified for heightened levels of management to avoid or minimize direct or indirect effects.
        c. Where are inadvertent discoveries/looting/transgressions occuring
B. CLASS I REVIEW
    1 Regional Overview
        a. Locational Setting
            i. Political
            ii. Topography
        b. Environmental/Ecological Setting
            i. Geology/Geosphere
                1. Historical Geology
                2. Physical Geology
                3. Geomorphology
                4. Sediments/Soils
            ii. Biology/Biosphere
                1. Wildlife
                2. Vegetation
            iii. Climate
                1. Paleoclimate
                2. Modern Climate
                3. Recent Trends
            iv. Hydrology
                1. Drainage Basins/Catchments
                2. Springs

3. Seasonal Water
4. Permanent Water
5. Anthropogenic Hydrology (Dams, reservoirs, canals, etc)

v. Anthropogenic Factors
1. Landscape level changes
2. Sociocultural/Environmental Relationships

c. Cultural History
i. Paleoindian
1. Plains-based
2. Great Basin-based
3. Paleoarchaic
4. Future Data Requirements

ii. Archaic
1. Early
2. Middle
3. Late
4. Terminal
5. Future Data Requirements

iii. Formative
1. Fremont
2. Future Data Requirements

iv. Late Prehistoric/Protohistoric
1. Numic
a. Ute
b. Shoshone
c. Plains Influences
d. Horse Culture
2. Ethnohistory
3. Future Data Requirements

v. Historic
1. Early Exploration
a. Dominguez-Escalante
b. Trappers/Mountain Men
c. Military Expeditions
d. John Wesley Powell
2. European American Settlement
a. Settlement
i. Community Development
ii. Transportation/routes

iii. Reservation History
iv. Military History
b. Ranching/Agriculture
i. Homesteading
ii. Cattle/Sheep
3. Mineral and resource extraction
a. Gilsonite
b. Copper/other mining
c. Hydrocarbons
4. Civilian Conservation Corps
a. Camps
b. Projects
5. Future Data Requirements
vi. Modern Land Use
1. Agriculture/Ranching
2. Mining
3. Oil and Gas
4. Tourism/recreation

2 Existing Data Review
a. Early Archaeological Expeditions/Excavations
b. Previous Syntheses
i. Early Predictive Models
ii. Spangler Class I's
iii. Large Class I inventories (Nine Mile, Gasco, Monument Buttes, Chapita Wells, Natural Buttes, etc.)
c. Previous Projects
i. Projects-Overview (Table)
ii. Project Types
iii. Survey Coverage
1. Geographic
2. Topographic
3. Environment
iv. Qualitative Discussion
d. Previous Sites
i. Cultural resources
1. Archaeological Sites
2. Listed historic properties (State and Federal)
3. MPL, Districts, Landmarks, etc.
ii. Quantitative Discussion
1. Site Types

2. Affiliations/Chronology
3. Distribution

iii. Qualitative Discussion

3 Present Research Emphases

a. Site Eligibility Related Domains/Themes (to be determined upon completion of literature review)

i. Regional Interaction

1. Research Questions
2. Data Requirements

ii. Human Ecodynamics

1. Research Questions
2. Data Requirements

iii. Adaptive Systems

1. Research Questions
2. Data Requirements

iv. Etc.

b. Management Related Questions

i. Vandalism
ii. Looting/Pot hunting
iii. Transgressions
iv. Development
v. Transportation
vi. Recreation/Tourism
vii. TCPs

C. CULTURAL RESOURCE PLANNING MODEL

a. Purpose
b. Data Sources

i. Cultural Resource Recording Systems
ii. Data Reliability
iii. Formal Systems of Recognition

c. Data

i. Existing Site Location Data
ii. Initial Environmental Data

1. Distance to Water
2. Slope
3. Aspect
4. Rock Formations (Shelters, Rock Art, Mining)
5. Vegetation
6. Sediments/Soils
7. Topographic Position Index/Landscape metrics.

8. Variables proposed by Consulting Parties

d. Methods
    i. Variable Selection
    ii. Analytical Techniques
        1. Discriminant Analysis (if all data is continuous)
        2. Logistical Regression (if ordinal or nominal data is used)

e. GIS Analyses
    i. Raster Model Generation/Vector conversions (as necessary or appropriate)
    ii. Spatial Associations
        1. Spatial Patterning
        2. Spatial Autocorrelation among various site types
    iii. Comparison of Site Location Model to Developed Areas (mines ag. fields, towns, etc), ACECs, proposed and Anticipated Development Areas (Chi-square Overlay Analysis)

f. Results
    i. Model Results (Classification Results--Random and Leave One Out Classifications)
    ii. Quantitative Geography and Overlay Results
    iii. Identification of Survey Gaps
    iv. Development Conflicts

Working Bibliography

Adams, E. C.

1982 *Walpi Archaeological Project: Synthesis and Interpretation*. Museum of Northern Arizona, Flagstaff.

1991 *The Origin and Development of the Pueblo Katsina Cult*. University of Arizona Press, Tucson.

Alley, J. P. Jr.

1982 Prelude to Dispossession: The Fur Trade's Significance for the Northern Utes and Southern Paiutes. *Utah Historical Quarterly* 50(2):104-123.

Ambler, J. R.

1966 Caldwell Village. *University of Utah Anthropological Papers* No. 84. Salt Lake City.

Amick, D. S.

1996 Regional Patterns of Folsom Mobility and Land Use in the American Southwest. *World Archaeology* 27:411-426.

Anderson, R. S., J. L. Betancourt, J. I. Mead, R. H. Hevly, and D. P. Adam

2000 Middle- and late- Wisconsin Paleobotanic and Paleoclimatic Records from the southern Colorado Plateau, USA. *Paleogeography, Paleoclimatology, Paleoecology* 155:31-57

Anselin, L.

1994 Local Indicators of Spatial Association-LISA. *Research Paper 9331*, Regional Research Institute. West Virginia University, Morgantown.

2005 *Exploring Spatial Data with GeoDa: A Workbook*. Center for Spatially Integrated Social Science, Spatial Analysis Laboratory. University of Illinois, Urbana.

Antevs, E.

1955 Geologic-Climatic Dating in the West. *American Antiquity* 20:317-335.

Ashley National Forest

2007 Men on the Mountain, Ashley National Forest, Vernal Utah. Viewed on February 14th, 2007. http://www.fs.fed.us/r4/ashley/heritage/histories/men-on-the-mountain.pdf

Baker, S.

2003 Pacomio Chacon: Colorado's Master Sheepherder Artist. Paper presented at the Colorado Council of Professional Archaeologists, Annual Meeting in Durango, Colorado, March 14, 2003.

Barton, J. D.

1998 *A History of Duchesne County.* Utah Centennial County History Series. Utah State Historical Society, Salt Lake City.

Beck, C., and G. T. Jones
2007 Early Paleoarchaic Point Morphology and Chronology. In *Paleoindian or Paleoarchaic?: Great Basin Human Ecology at the Pleistocene-Holocene Transition*, edited by K.E. Graf and D.N. Schmitt, pp. 23-42. University of Utah Press, Salt Lake City.

Bell, M., and M. J. C. Walker
1992 *Late Quaternary Environmental Change, Physical and Human Perspectives*. Longman, London

Benson, L. V., M. S. Berry, E. A. Jolie, J. D. Spangler, D. W. Stahle, and E. M. Hattori
2007 Possible Impacts of Early-11th-, Middle-12th-, and Late 13th-Century Droughts on Western Native Americans and the Mississippian Cahokians. *Quaternary Science Reviews* 26:336-350.

Bernardini, W.
2005 *Hopi Oral Tradition and the Archaeology of Identity*. University of Arizona Press, Tucson.

Blanch, G. T.
1939 Bulletin No.285 - A Study of Farm Organization by Types of Farms in Uintah Basin, Utah. *UAES Bulletins*, Paper 247.

Boyd, R.
1999 Basque Families. In *Portraits of Basques in the New World*, edited by R. W. Etulain and J. Echeverria, pp. 97-113. University of Nevada Press, Reno.

Bradfield, R. M.
1995 *An Interpretation of Hopi Culture*. Privately Published, Derby, England.

Bradley, B. A.
1993 Paleo-Indian Flaked Stone Technology in the North American High Plains. In *From Kostenki to Clovis: Upper Paleolithaic-Paleo-Indian Adaptations*, edited by O. Soffer and N.D. Praslov, pp. 251-261. Plenum Press, New York.

Brandt, R. B. J. Groenewoudt, K. Kvamme
1992 An Experiment in Archaeological Site Location: Modeling in the Netherlands Using GIS Techniques. 24:268-282.

Buckles, W.G.
1971 *The Uncompahgre Complex: Historic Ute Archaeology and Prehistoric Archaeology on the Uncompahgre Plateau of West Central Colorado.* Unpublished Ph.D. dissertation, Department of Anthropology, University of Colorado, Boulder.

Bureau of Land Management
1985 *Record of Decision and Rangeland Program Summary for the Book Cliffs Resource Management Plan*. Vernal Field Office, Vernal, Utah.
2008 *Record of Decision and Approved Resource Management Plan*. Vernal Field Office, Vernal, Utah.

Burton, D. K.
1996 *A History of Uintah County: Scratching the Surface*. Utah State Historical Society, Salt Lake City.
1998 *Settlements of Uintah County: Digging Deeper*. Utah Centennial County History Series. Utah State Historical Society, Salt Lake City and Uintah County Commission, Vernal, Utah.
Butzer, K. W.
1982 Archaeology as Human Ecology. Cambridge: University of Cambridge Press.
Byers, D. A., C. S. Smith, and J. M. Broughton
2005 Holocene Artiodactyl Population Histories and Large Game Hunting in the Wyoming Basin, USA. *Journal of Archaeological Science* 32:125-142.
Callaway, D., J. Janetski, and O. C. Stewart.
1986 Ute. In *Handbook of North American Indians: Great Basin*, Vol. 11, edited by W. D'Azevedo, pp. 336-367. Smithsonian Institution, Washington D.C.
Cannon, B. Q.
1986 Struggle Against Great Odds: Challenges in Utah's Marginal Agricultural Areas. *Utah Historical Quarterly* 54:308-327.
Cannon, M. D., and D. J. Meltzer
2008 Explaining Variability in Early Paleoindian Foraging. *Quaternary International* 191:5-17.
Carrarra, P. E., S. K. Short, and R. R. Shroba
1985 A Pollen Study of Holocene Peat and Lake Sediments, Leidy Peak Area, Uinta Mountains, Utah. *Geological Studies* 32:1-7.
Cashion, W. B., and J. R. Donnell
1974 Revision of Nomenclature of the Upper Part of the Green River Formation, North Piceance Creek Basin, Colorado. *USGS Bulletin* 1934-F:F-1-F-13.
Certini, G. and R. Scalenghe
2011 Anthropogenic Soils are the Golden Spike for the Anthropocene. *Holocene* 21:1269-1274.
Chapman, H.
2006 *Landscape Archaeology and GIS*. Stroud: The History Press
Clark, G. A.
1994 Migration as an Explanatory Concept in Paleolithic Archaeology. *Journal of Archaeological Method and Theory* 1(4):305-342.
Clemmer, R. O.
1986 Hopis, Western Shoshones, and Southern Utes: Three Different Responses to the Indian Reorganization Act of 1934. *American Indian Culture and Research Journal* 10:15-40.
1995 *Roads in the Sky*. Westview Press, Boulder.

Clemmer, R. O., and Omer C. Stewart
1986 Treaties, Reservations, and Claims. in *Handbook Of North American Indians*, edited by W.Sturtevant, pp. 525-557, Smithsonian Institution, Washington D.C.

Conolly, J. and M. Lake
2006 *Geographical Informational Systems in Archaeology*.. Cambridge: Cambridge University Press.

Cole, S. J.
1990 *Legacy on Stone, Rock Art of the Colorado Plateau and Four Corner Region*. Johnson Books, Boulder.

Coltrain, J. B.
1993 Fremont Corn Agriculture: A Pilot Stable Carbon Isotope Study. *Utah Archaeology* 1993:49-56.

Conetah, F. A
1982 A History of the Northern Ute People, edited by K. L. MacKay and F. A. O'Neil. Uintah-Ouray Tribe, Salt Lake City.

Copeland, J. M and R. E. Fike
1988 Fluted Projectile Points in Utah. In *Utah Archaeology 1988*, Salt Lake City.

Connelly, J. C.
1979 Hopi Social Organization. In Handbook of North American Indians, Vol. 9, edited by A. Ortiz, pp. 539-553. Smithsonian Institution, Washington D.C.

Corbett, L. B. and J. S. Munroe
2010 Investigating the Influence of Hydrogeomorphic Setting and Response of Lake Sedimentation to Climactic Changes in the Uinta Mountains, Utah, USA. *Journal of Paleoliminology* 44:311-325.

Courtlander, H.
1971 *The Fourth World of the Hopis*. Crown, New York.

Crum, S.J.
1994 *The Road on Which We Came*. University of Utah Press, Salt Lake City.

Crumley, C. L. (ed)
1994 *Historical Ecology, Cultural Knowledge and Changing Landscapes*. Santa Fe. School of American Research.
2001 *New Directions in Anthropology and Environment*. Lanham: Alta Mira Press.

Cuch. F. Ed.
2000 *A History of Utah's American Indians*. Utah State Division of Indian Affairs, Salt Lake City.

Curewitz, D.C.
2001 High Elevation Land-Use on the Northern Wasatch Plateau, Manti-La Sal National Forest, Utah. *Journal of California and Great Basin Anthroplogy* 23(2):249-272.

Custer, J. F, T. Eveleigh, V. Klemas, and I. Wells
1986 Application of LANDSAT Data and Synoptic Remote sensing to Predictive models for Prehistoric Archaeological Sites: An Example from the Delware Coastal Plain. *American Antiquity* 51:572-588.

Day, K.C.
1964 Thorne Cave, Northeastern Utah: Archaeology. *American Antiquity* 30(1):50-59.

DeBloois, E.I.
1983 High-Altitude Sites in Utah. In *High-Altitude Adaptations in the Southwest*, J. C. Winter, ed. Pp. 53-68. Cultural Resources Management Report No. 2. USDA Forest Service Southwestern Region.

Dehart, W. A., and W. H. Metzler
1955 Bulletin No. 378 - Labor Structure and Labor Problems: Utah Sheep Ranches, 1952-1953. *UAES Bulletins*, Paper 341.

Dockstader, F.J.
1979 Hopi History, 1859-1940. In *Handbook Of North American Indians*, edited by A. Ortiz, pp. 524-532, Smithsonian Institution, Washington D.C.

Dozier, E. P.
1966 *Hano: Tewa Indian Community in Arizona*. Holt, Rinehart, and Winston, New York.

Duff, A. I.
1998 The Process of Migration in the Late Prehistoric Southwest. In *Migration and Reorganization: The Pueblo IV Period in the American Southeast*, edited K.A. Spielmann, pp. 31-52. Anthropological Research Papers 51. Arizona State University, Tempe.
2002 *Western Pueblo Identities: Regional Interaction, Migration and Transformation.* University of Arizona Press, Tucson.

Duncan, C.
2000 The Northern Utes of Utah. In *A History of Utah's American Indians*, edited by F. Cuch, pp. 167-224. Utah State University Press, Logan.

Ebert, J. I.
1992 Distributional Archaeology. Salt Lake City: University of Utah Press.

Eggan, F.
1950 *Social Organization of the Western Pueblos*. The University of Chicago Press, Chicago and London.
1967 From History to Myth: A Hopi Example. In *Meaning and History in the Languages of the American Southwest*, edited by D.H. Hymes and W. Bittles, pp. 33-53. The Hague, Mouton.
1980 Shoshone Kinship Structures and Their Significance for Anthropological Theory. *Journal of the Steward Society*, 11(2)165-193.
1983 Comparative Social Organization. In Handbook of North American Indians, Vol. 10, edited by A. Ortiz, pp. 723-742. Smithsonian Institution, Washington D.C.

1994 The Hopi Indians with Special Reference to Their Cosmology or World View. In Kachinas in the Pueblo World, edited by P. Schaafsma. University of New Mexico Press, Albuquerque.

Elkins, M., and K. Montgomery

2003 Cultural Resource Inventory of Eight Selected 40-Acre Parcels in Section 31 of T9S, R23E, Uintah County, Utah for Westport Oil & Gas Company. Montgomery Archaeological Consultants, Moab, Utah. Report No. U-03-MQ-0881b, on file at Utah Division of State History, Salt Lake City.

Elkins, M., R. Stash, J. Patterson, and K. Montgomery

2005 Ute/FNR LLC Naval Oil Shale Reserve No. 2 Phase 1 and Phase II Archaeological Survey on Ute Tribal Lands, Uintah County, Utah. Montgomery Archaeological Consultants, Moab. Report No. U-04-MQ-0507i, on file at Utah Division of State History, Salt Lake City.

Ellis, F. H.

1961 The Hopi, Their History and Use of Lands. Defendant's Exhibit E 51b in Docket 196 and Exhibit E-500 in Docket 229, Indian Claims Commission.

Esplin A. C., W. Peterson, P. V. Cardon, G. Stewart, and K.C. Ikler

1928 Sheep Ranching in Utah, A Report of a Preliminary Economic Survey of the Ranch Situation as of 1925. *UAES Bulletin* 204.

Fawcett, W. B.

1981 Implications of Ethnoarchaeological Research on Wyoming Pastoralists for Hunter-Gatherer Studies. *The Wyoming Archaeologist*, Symposium Issue, June/September, pp. 55-85.

Feiler, E. J., R. S. Anderson, and P. A. Koehler

1997 Late Quaternary Paleoenvironments of the White River Plateau, Colorado, USA. *Arctic and Alpine Research* 29:53-62.

Ferguson, T. J.

2001 *Ethnographic Study of Nine Tribes: Cultural Affiliation with the Uintah and Great Salt Lake Variants of Fremont in Northern Utah.* Bureau of Reclamation, Upper Colorado Regional Office. Salt Lake City, Utah.

Fewkes, J. W.

1900 *Tusayan Migration Traditions*. In 19th Annual Report of the Bureau of American Ethnology for the Years 1897-1989. Part 2, pp. 573-634. Government Printing Office, Washington D.C.

1907 Hopi. In *Handbook of American Indians North of Mexico, Part 1*, edited by F.W. Hodge, pp. 560-568. Bureau of American Ethnology Bulletin 30. Government Printing Office, Washington, D.C.

Fike, R. E. and H. B. Phillips II

1984 A Nineteenth Century Ute Burial from Northeast Utah. Cultural Resource Series No. 16. Salt Lake City: Bureau of Land Management.

Firmage, R. A.
1996 *A History of Grand County*. Utah State Historical Society.
Forbes, J. D.
1959 The Appearance of the Mounted Indian in Northern Mexico and the Southwest, to 1680. *Southwestern Journal of Anthropology* 15(2):189-212.
Fotheringham, A. S., C. Brunsdon, and M. Charlton
2000 *Quantitative Geography, Perspectives on Spatial Data Analysis*. Sage Publications, London.
Frison, G. C.
1991 *Prehistoric Hunters of the High Plains*. Academic Press, New York.
Frison, G.C., and R. Bonnichsen
1996 The Pleistocene-Holocene Transition on the Plains and Rocky Mountains of North American. In *Humans at the End of the Ice Age: The Archaeology of the Pleistocene-Holocene Transition*, edited by L. Straus, B. Eriksen, J. Erlandson, and D. Yesner, pp. 302-318. Plenum Press, New York.
Frison, G. C., and B. Bradley
1980 *Folsom Tools and Technology of the Hanson Site, Wyoming.* University of New Mexico Press, Albuquerque.
Frison, G. C., and D. J. Stanford
1982 *The Agate Basin Site: A Record of the Paleoindian Occupation of the Northwestern High Plains*. Academic Press, New York.
Fritz, J. N.
2004 *A Brief Overview of Ute-European Ranching and Farming in Hill Creek During the 1930s and 1950s*. Montgomery Archaeological Consultants, Moab, Utah.
2009 Report on the July 11 & 12 Field Trip to the NBU Study Area with Hopi Tribal Representative. Montgomery Archaeological Consultants, Moab, Utah. Report on file with Vernal BLM Field Office, Vernal.
Grady, J.
1980 Environmental Factors in Archaeological Site Locations, Piceance Basin, Colorado. *Cultural Resources Series No. 9*. Bureau of Land Management, Colorado State Office, Denver.
Graff, K.E. and D. N. Schmitt (eds)
2007 Paleoindian or Paleoarchaic, Great Basin Human Ecology at the Pleistocene-Holocene Transition. Salt Lake City: University of Utah Press.
Gray, S. T., S. T. Jackson, and J. L. Betancourt.
2004 Tree-ring Based Reconstructions of Interannual to Decadal Scale Precipitation Variability for Northeastern Utah Since 1226 AD. *Journal of the American Water Resources Association* 40:947-960.
Grayson, D. K.
1993 *The Desert's Past: A Natural Prehistory of the Great Basin*. Smithsonian Institution Press, Washington.

Gregory, I. N. and P. S. Ell
2007 *Historical GIS, Technologies, Methodologies, and Scholarship*. Cambrigde: Cambridge University Press.
Gunnerson, J. H.
1969 The Fremont Culture: A Study in Culture Dynamics on the Northern Anasazi Frontier.
Peabody Museum of Archaeology and Ethnology, Harvard University 59(2), Cambridge, Mass.
Harrower, M. J.
2013 Methods, Concepts, and Challenges in Archaeological Site Detection and Modeling. In *Mapping Archaeological Landscapes from Space*, D.C. Comer and M. J. Harrower, eds., pp 213-228. Springer: New York
Hauck, F. R., D. G. Weder, and S. Kennette
1979 Final Report of the Natural Buttes Cultural Mitigation Study. Archeological-Environmental Research Corporation Paper No. 13. Salt Lake City.
Haynes, C. V. Jr.
1993 Clovis-Folsom Geochronology and Climatic Change. In *From Kostenki to Clovis: Upper Paleolithic-Paleo-Indian Adaptations*, edited by O. Soffer and N.D. Praslov, pp. 219-236. Plenum, New York.
Hill, M. E. Jr.
2007 A Moveable Feast: Variation in Faunal Resource Use Among Central and Western North American Paleoindian sites. *American Antiquity* 72(3): 417-438.
Hochmuth, H. R., and E. R. Franklin
1942 *Circular No. 624 - Sheep Migration in the Intermountain Area*. USDA, Washington, D.C.
Hofman, J. L.
1982 Exploring Intrasite Patterning and Assemblage Variation on Historic Sheepherder Camps. *North American Archaeologist* 3:89-111.
Holmer, R.
1978 A Mathematical Typology for Archaic Projectile points of the Eastern Great Basin. Ph.D. dissertation. Anthropology Department, University of Utah.
1986 Projectile Points of the Intermountain West. In *Anthropology of the Desert West: Essays in Honor of Jesse D. Jennings*, edited by Carol J. Condie and Don D. Fowler, pp. 89-116. *University of Utah Anthropological Papers* No. 110. Salt Lake City.
Holmer, R. N., and K. Jones
1980 An Archaeological Excavation of the Triple S Rockshelter, Uintah County, Utah. Archaeological Center, Department of Anthropology, University of Utah. Report No. U-80-UA-0496b on file at Utah Division of State History, Salt Lake City.

Horn, J. C., A. D. Reed, and S. M. Chandler
1994 Grand Resource Area Class I Cultural Resource Inventory. Alpine Archaeological Consultants, Montrose, Colorado. Bureau of Land Management, Moab, Utah.

Hurlbett, R. E.
1976 Environmental Constraints and Settlement Predictability, Northwest Colorado. *Cultural Resource Series No. 3*. Bureau of Land Management, Colorado State Office, Denver.

Hutchings, T.B., and D.R. Murphy
1981 Soils. In *Atlas of Utah*, edited by Wayne L. Wahlquist, pp.28-29. Brigham Young University Press, Provo, Utah.

Inter-Tribal Council of Nevada
1976a NEWE: A Western Shoshone History. University of Utah Printing Services, Salt Lake City.
1976b WA SHE SHU: A Washo Tribal History. University of Utah Printing Services, Salt Lake City.

Jackson, S. T., J. L. Betancourt, M. E. Lyford, S. T. Gray, and K. A. Rylander.
2005 A 40,000-year Woodrat-midden Record of Vegetation and Biogeographical Dynamics in North-eastern Utah, USA. *Journal of Biogeography* 32:1085-1106.

James, H.
1944 *Papers From Hopi History*. University of Arizona Press, Tucson.

Janetski, J. C.
1994 Recent Transitions in the Eastern Great Basin: The Archaeological Record. In *Across the West: Human Population Movement and the Expansion of the Numa,* edited by D.B. Madsen and D. Rhode, pp. 157-178. University of Utah Press, Salt Lake City.
1997 Fremont Hunting and Resource Intensification in the Eastern Great Basin. *Journal of Archaeological Science* 24:1075-1088.

Janetski, J. C., and D. E. Newman
2000 Fremont Subsistence. In *Clear Creek Canyon Archaeological Project: Results and Synthesis* by J. C. Janetski, R. K. Talbot, D. E. Newman, L. D. Richens, and J. D. Wilde, pp. 185-198. Museum of Peoples and Cultures, Occasional Papers No. 7. Brigham Young University, Provo.

Jennings, J. D.
1978 Prehistory of Utah and the Great Basin. *University of Utah Anthropological Papers* No. 98, Salt Lake City.

Jennings, T. A.
2008 San Patrice: An Example of Late Paleoindian Adaptive Versatility in South-Central North America. *American Antiquity* 73(3).

Johnson, C., and B. Loosle
2002 Prehistoric Uinta Mountain Occupation. Heritage Report 2-02/2002. Ashley National Forest, U.S.D.A. Forest Service, Vernal, Utah.

Jorgensen, J. G.
1964 The Ethnohistory and Acculturation of the Northern Ute. Unpublished Ph.D. dissertation, Indiana University, Bloomington.

Judge, W. J., and L. Sebastian (eds.)
1988 *Quantifying the Present and Predicting the Past: Theory, Method, and Application of Archaeological Predictive Modeling*. Washington, D.C.,: U.S. Government Printing Office.

Kennard, E. A.
1979 Hopi Economy and Subsistence. In Handbook of North American Indians: Great Basin Vol. 11, edited by W. D'Azevedo, pp. 336-367. Smithsonian Institution, Washington D.C.

Knight, T. A., D. M. Meko, and C. H. Baisan
2009 A Bimillennial-length Tree-ring Reconstruction of Precipitation for the Tavaputs Plateau, Northeastern Utah. *Quaternary Research* 73: 107-117.

Knowles, A. K.
2002 *Past Time, Past Place, GIS for History*. Redlands: ESRI Press.

Kornfeld, M.
1983 A Model of High Plains and Intermountain Stockraising Settlement Systems. *North American Archaeologist* 4:51-62.

Laabs, B J. C,. and E. C. Carson
2005 Glacial Geology of the Southern Uinta Mountains. In *Uinta Mountain Geology*, edited by C. M. Dehler, C. M Pederson, D. A Sprinkel, and B. J Kowallis, pp. 235-253. Utah Geological Association Publication 33.

Laabs, B J. C, M. A. Plummer, and D. M. Mickelson
2006 Climate During the Last Glacial Maximum in the Wasatch and Southern Uinta Mountains Inferred from Glacial Modeling. *Geomorphology* 75:300-317.

Laabs, B J. C, K. A. Refsnider, J. S. Munroe, D. M. Mickelson, P. J. Applegate, B. S. Singer, and M. W. Caffe
2009 Late Pleistocene Glacial Chronology of the Uinta Mountains: Support for Moisture-driven Asynchrony of the Last Deglaciation. *Quaternary Science Reviews* 28:1171-1187.

Larralde, S., and S. Chandler
1981 Archaeological Inventory in the Seep Ridge Study Tract, Uintah County, Northeastern Utah. *Utah Bureau of Land Management Cultural Resource Series* No. 11, Salt Lake City.

Larson, M. L., M. Kornfeld, and G. C. Frison
2009 *Hell Gap: A Stratified Paleoindian Campsite at the Edge of the Rockies*. The University of Utah Press, Salt Lake City.

Leach, L. L.
1970 Archaeological Investigations at Deluge Shelter in Dinosaur National Monument. Ph.D. dissertation, University of Colorado, Boulder.

Leishmann, G.W., R.F. Fish, and R.J. Lewis
2003 Soil Survey of Uintah Area, Utah-Parts of Daggett, Grand, and Uintah Counties. National Resource Conservation Service, Washington D.C.

Lilijeblad, S.
1986 Oral Tradition: Content and Style of Verbal Arts, In Handbook of the American Indian. Great Basin Vol. 11, edited by W.L. D'Azevedo. Smithsonian Institution, Washington D.C.

Lindsay, L. W.
1986 Fremont Fragmentation. In *Anthropology of the Desert: Essays in Honor of Jesse D. Jennings*, edited by C.J. Condie and D. D. Fowler, pp. 229-251. University of Utah Anthropological Papers 110,. University of Utah, Salt Lake City.

Lloyd, C D. and P. M. Atkinson
2004 Archaeology and Geostatistics. *Journal of Archaeological Science* 31:151-165.

Loosle, B.
2000 The Acquisition of Nonlocal Lithic Material by the Uinta Fremont. *Journal of California and Great Basin Anthropology* 22 (2):277-294.

Loosle, B., and C. Johnson
2000 Dutch John Excavations: Seasonal Occupations on the North Slope of the Uinta Mountains. Heritage Report 1-01/2000, edited by B. Loole and C. Johnson. Ashley National Forest, Intermountain Region, U.S.D.A. Forest Service. Vernal, Utah.

Lowie, R. H.
1909 The Northern Shoshone. *Anthropology Papers of the American Museum of Natural History* 2(2):165-306. New York.
1915 Dances and Societies of the Poalin Shoshone. *Anthropological Papers of the American Museum of Natural History* 11(10):803-835.
1919 Sun Dance of the Shoshoni, Ute, and Hidatsa. *Anthropological Papers of the American Museum of Natural History* 16(5):387-431.
1924 Notes on Shoshonean Ethnography. *Anthropological Papers of the American Museum of Natural History* 20(3):185-314.

Lyons, P. D.
2003 *Ancestral Hopi Migrations*. The University of Arizona Press, Tucson.

Madsen, B. D.
1958 *The Bannock of Idaho*. Caxton Press, Caldwell, Idaho.
1979 *The Lemhi: Sacajewa's People*. Caxton Press, Caldwell, Idaho.
1980 *The Northern Shoshone*. Caxton Press, Caldwell, Idaho
1985 *The Shoshoni Frontier and the Bear River Massacre*. University of Utah Press, Salt Lake City.

Madsen, D. B.
2000 A High-Elevation Allerod-Younger Dryas Megafauna from the West-Central Rock Mountains. In Intermountain Archaeology, edited by David B. Madsen and Michael C. Metcalf, pp. 100-116. University of Utah Anthropological Papers, Number 122.
2007 The Paleoarchaic to Archaic Transistion in the Great Basin. In *Paleoindian or Paleoarchaic? Great Basin Human Ecology at the Pleistocene-Holocene Transition*, edited by K.E. Graf and D.N. Schmitt, pp. 3-23. University of Utah Press, Salt Lake City.

Madsen, D. B., and S. R. Simms
1998 The Fremont Complex: A Behavioral Perspective. *Journal of World Prehistory* 12:255-336.

Malotki, E.
2000 Kokopelli, The Making of an Icon. *University of Nebraska Press*. Lincoln.

Marwitt, J. P.
1970 Median Village and Fremont Culture Regional Variation. *University of Utah Anthropological Papers* No. 95. Salt Lake City.

Matheny, R. T., D. G. Matheny, P. W. Miller, and B. Miller
2004 Hunting Strategies and Winter Economy of the Fremont as Revealed in the Rock Art of Nine Mile Canyon. In New Dimensions of Rock Art Studies, edited by R. Matheny. *Museum of Peoples and Cultures Occasional Papers Series* No. 9. Brigham Young University, Provo.

Matson, R.G.
1991 *The Origins of Southwestern Agriculture*. University of Arizona Press, Tucson.

Mehrer, M. W. And K. L. Wescott (eds)
2006 *GIS and Archaeological Site Location Modeling*. Boca Raton: Taylor and Francis.

Meko, D.M., C.A. Woodhouse, C.A. Baisan, T. Knight, J.J. Lukas, M.H. Hughes, and M.W. Salzer
2007 Medieval Drought n the Upper Colorado River Basin. *Geophysical Research Letters* 34:1-5.

Miller, J.
1983 Basin Religion and Theology: A Comparative Study of Power (Puha). *Journal of California and Great Basin Anthropology* 5(1,2):66-86.

Mitchell, A.
2005 *The ESRI Guide to GIS Analysis Volume 2: Spatial Measurements and Statistics*. ESRI Press, Redlands.

Morss, N.
1931 The Ancient Culture of the Fremont River in Utah. *Peabody Museum of American Archaeology and Ethnology, Harvard University* 12(3), Cambridge, Massachusetts.

Munroe, J. S.
2003 Holocene Timberline and Palaeoclimate of the Northern Uinta Mountains, Northeastern Utah, USA. *The Holocene* 13:175-185.

Murphy, R. F., and Y. Murphy
1960 Shoshone-Bannock Subsistence and Society. *University of California Anthropological Records* 16(7):293-338.
1986 Northern Shoshone and Bannock. *In Handbook of North American Indians: Great Basin* Vol. 11, edited by W.L. D'Azevedo, pp. 284-307. Smithsonian Institution, Washington D.C.

Nagata, S.
1970 *Modern Transformations of Moenkopi Pueblo*. University of Illinois Press, Urbana.

Nash, R. G.
2012 The Role of Maize in Low-Level Food Production Among Northern Peripheral Fremont Groups in the Northeastern Uinta Mountains of Utah. Ph.D dissertation, University of California, Davis.

Olden, S. E.
1923 *Shoshone Folk Lore, as Discovered from the Rev. John Roberts, a Hidden Hero, on the Wind River Indian Reservation in Wyoming*. Morehouse Publishing Company, Milwaukee.

O'Neil, F. A., and K. L. MacKay
1978 *A History of the Uintah-Ouray Ute Lands*. American West Center Occasional Papers. University of Utah, Salt Lake City.

O'Neil, F.A., and J.D. Sylvester, eds.
1970 *Ute People: An Historical Study*. 3rd Edition. University of Utah, Salt Lake City.

Park, W. Z.
1938 Tribal Distribution in the Great Basin. *American Anthropologist* 40:622-638.

Patterson, J. J., J. Fritz, K. Lower-Eskelson, R. Stash and A. Thomas
2008 NBU Class I Existing Data Review for Kerr-McGee Oil & Gas Onshore LP, Uintah County, Utah. Montgomery Archaeological Consultants, Moab, Utah.

Peterson, C. S.
1989 Grazing in Utah: A Historical Perspective. *Utah Historical Quarterly* 57:300-319.

Pettit, J.
1990 *Utes: The Mountain People*. Johnson Books, Boulder.

Pitblado, B.L.
2003 Late Paleoindian Occupation of the Southern Rocky Mountains: Early Holocene Projectile Points and Land Use in the High Country. University Press of Colorado, Boulder.

Premo, L. S.
2004 Local Spatial Autocorrelation Statistics Quantify Multi-Scale Patterns in Distributional Data: An Example from the Maya Lowlands. *Journal of Archaeological Science* 31:855-866.

Pugh, D. C., and C. Johnson
2000 Slab-lined Basins. In *Dutch John Excavations: Seasonal Occupation on the North Slope of the Uinta Mountains*, edited by B. Loosle and C. Johnson, pp. 235-242. Heritage Report No. 1-01/2000. Ashley National Forest, Department of Agriculture.

Raschkow, W.
1998 *None-site Analysis of the Archaeology of the Wasatch Plateau*. Unpublished Master's Thesis, Department of Anthropology, University of Montana, Missoula.

Refsnider, K.A., BJ.C. Laabs, M.A. Plummer, D.M. Mickelson, B.S. Singer, and M.W. Caffee
2008 Last Glacial Maximum Climate Inferences from Cosmogenic dating and Glacier Modeling of the Western Uinta Ice Field, Uinta Mountains, Utah. *Quaternary Research* 69:130-144.

Reed, A. D.
1988 Ute Cultural Chronology. In *Archaeology of the Eastern Ute: A Symposium*, edited by P.R. Nickens, pp. 79-101. Colorado Council of Professional Archaeologists Occasional Papers No. 1, Denver.
1994 The Numic Occupation of Western Colorado and Eastern Utah During the Prehistoric and Protohistoric Periods. In *Across the West: Human Population Movement and the Expansion of the Numa*, edited by D.B. Madsen and D. Rhode, pp. 188-200. University of Utah Press, Salt Lake City.

Richens, L., S. A. Baker and J. C. Janetski
1996 Material Culture and Faunal Remains. In *Steinaker Gap: An Early Fremont Farmstead*, edited by R.K. Talbot and L.D. Richens, pp. 83-96. Museum of Peoples and Cultures Occasional Papers No. 2. Brigham Young University, Provo, Utah.

Ross, J. V. H.
1984 Managing the Public Rangelands: 50 Years Since the Taylor Grazing Act. *Rangelands* 6:147-151.

Rouston, C. C., C. A. Woodhouse, and J. T. Overpeck
2011 Second Century Drought in the Rio Grande Headwaters, Colorado: How Unusual was Medieval Drought? *Geophysical Research Letters* 38:1-5.

Russell, E. W. B.
1997 *People and Land through Time, Linking Ecology and History*. New Haven: Yale University Press.

Schaafsma, P.
1971 The Rock Art of Utah: From the Donald Scott Collection. *Papers of the Peabody Museum No. 65. Harvard University*, Cambridge, Massachusetts.

Sheppard, P. R., A. C. Comrie, G. D. Packin, K. Angersbach, and M. K. Hughes.
2002 The Climate of the US Southwest. *Climate Research* 21:219-238.

Sharrock, F. W.
1966 Prehistoric Occupation Patterns in Southwest Wyoming and Cultural Relationships with the Great Basin and Plains Culture Areas. *University of Utah Anthropological Papers* No. 77. Salt Lake City.

Shimkin, D. B.
1940 Shoshone-Commanche Origins and Migrations. Pp. 17-25. Proceeding of the 6th Pacific Congress of the Pacific Science Association at the University of California, Berkeley, Standford University, and San Francisco. University of California Press.
1942 Dynamics of Recent Wind River Shoshone History. *American Anthropologist* 44(3):451-462.
1947a Wind River Shoshone Ethnogeography. University of California Anthropological Records 5(4).
1947b Wind River Shoshone Literary Forms: An Introduction. *Journal of the Washington Academy of Sciences* 37(10):329-376.
1953 The Wind River Shoshone Sun Dance. *Anthropological Papers* No. 41. Bureau of American Ethnology Bulletin 151:397-484.
1980 Comanche-Shoshone Works of Acculturation. 1786-1848. *Journal of the Steward Anthropological Society* 11(2):195-248.
1986 Eastern Shoshone. In *Handbook of North American Indians: Great Basin*, Vol. 11, edited by W.L. D'Azevedo, pp. 308-335. Smithsonian Institution, Washington D.C.

Simms, S. R.
2008 *Ancient Peoples of the Great Basin and Colorado Plateau*. Left Coast Press, California.

Smith. A. M.
1974 Ethnography of the Northern Utes. *Papers in Anthropology* No. 17. Museum of New Mexico Press.

Smith, C. S., and L. M. McNees
1999 Facilities and Hunter-Gatherer Long-Term Land use Patterns: An Example from Southwest Wyoming. *American Antiquity* 64(1):117-136.

Smith C. S.
1992 The Fremont: A View from Southwest Wyoming. Utah Archaeology (1992)55-75.

Smith, M.
1918 *Herding and Handling Sheep on the Open Range in USA*. Salt Lake City.

Spangler, J. D.
1995 *Paradigms and Perspectives Revisited: A Class I Overview of Cultural Resources in the Uinta Basin and Tavaputs Plateau*, Vol. 11, Uinta Research, Salt Lake City.
2000 One-Pot Pithouses and Fremont Paradoxes: Formative Stage Adaptations in the Tavaputs Plateau Region of Northeastern Utah. In *Intermountain Archaeology*, edited by D. Madsen and M. Metcalf, pp. 25-38. University of Anthropology Papers No. 122, Salt Lake City.
2002 *Paradigms and Perspectives Revisited: A Class I Overview of Cultural Resources in the Uinta Basin and Tavaputs Plateau*. Utah Bureau of Land Management, Vernal Field Office.
Spaulding, W. G., and L. J. Grumlich
1986 The Last Pluvial Climatic Episodes in the Deserts of Southwestern North America. Nature 320:441-444.
Stephen, A. M.
1936 *Hopi Journal*. Columbia University Contribution to Anthropology 23.
Steward, J. H.
1937 Ecological Aspects of Southwestern Society. *Anthropos* 32:87-104.
1938 Basin-Plateau Aboriginal Sociopolitical Groups. *Bureau of American Ethnology Bulletin* 120. Washington, D.C.
1939 Some Observations on Shoshone Distribution. *American Anthropologist* 41:261-265.
1940 Native Cultures of the Intermontane (Great Basin) Area. In *Essays in Historical Anthropology of North America Published in Honor of J.R. Swanson*. Smithsonian Miscellaneous Collections No. 100:445-502.
1943 Culture Element Distribution XXIII Northern and Goshute Shoshone. *University of California Anthropological Records* 8:263-392.
1955 The Great Basin Shoshonean Indians. In *Theory of Culture Change*, edited by J.H. Steward, pp. 101-121. University of Illinois Press, Urbana.
1970 The Foundations of Basin-Plateau Shoshonean Society. In *Languages and Cultures of Western North America,* edited by E.H. Swanson, pp. 113-151. Idaho State University, Pocatello.
Stoddart, L. A., P. B. Lister, G. Stewart, T. D. Phinney, and L. W. Larson
1938 Bulletin No. 283 - Range Conditions in the Uinta Basin, Utah. *UAES Bulletins*, Paper 245.
Sutton, M. Q.
1993 The Numic Expansion in Great Basin Oral Tradition. *Journal of California and Great Basin Anthropology* 15(1):111-128.

Talbot, R. K., and L. D. Richens
1996 Steinaker Gap: An Early Fremont Farmstead. *Museum of Peoples and Cultures Occasional Papers* No. 2. Brigham Young University, Provo.
2004 Fremont Farming and Mobility on the Far Northern Colorado Plateau. *Museum of Peoples and Cultures Occasional Paper* No. 10. Brigham Young University, Provo.

Tipps, B.
1988 The Tar Sands Project: An inventory and Predictive Model for Central and South Utah. *Utah Bureau of Land Management Cultural Resource Series* No. 22. Salt Lake City: BLM.

Titiev, M.
1944 Old Oraibi: A Study of the Hopi Indians of Third Mesa. *Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University* 22(1). Harvard University Press, Cambridge.

Trenholm, V. C., and M. Carley
1964 The Shoshonis: Sentinels of the Rockies. University of Oklahoma Press, Norman.

Truesdale, J. A.
1990 Archaeological Investigations of the Uinta Fremont in Dinosaur National Monument (1988-1990). Paper presented at the 48th Plains Anthropological Conference, Norman, Oklahoma.

Twomey, A.C.
1942 The Birds of the Uinta Basin, Utah. *Annals of the Carnegie Museum* 28:341-490.

USGS National Gap Analysis Program
2005 Southwest Regional GAP Analysis Project-Land Cover Descriptions. RI/GIS Laboratory, College of Natural Resources, Utah State University.

Verhagen, P. (ed)
2007 *Case Studies in Archaeological Predictive Modelling*. Leiden: Leiden University Press.

Voget, F. W.
1948 Individual Motivation in the Diffusion of the Wind River Shoshone Sun Dance to the Crow Indians. *American Anthropologist* 50(4):624-646.
1950 A Shoshone Innovator. *American Anthropologist* 52(1):53-63.

Voget, F. W.
1953 Current Trends in the Wind River Shoshone Sun Dance. *Anthropological Papers 42, Bureau of American Ethnology Bulletin* 151:485-497.

Warner, T.J.
1995 *The Dominguez-Escalante Journal*. University of Utah Press, Salt Lake City.

Westcott, K. L. and R. J. Brandon (eds.)
2000 *Practical Applications of GIS for Archaeologists*. London: Taylor and Francis.

Wheatley, D. and M. Gillings
2002 *Spatial Technology and Archaeology, The Archaeological Applications of GIS*. Boca Raton: Taylor and Francis Group.

Winter, J.
1973 The Distribution and Development of Fremont Maize Agriculture: Some Preliminary Interpretations. *American Antiquity* 38(4):439-452.

White, L.
1926 Transhumance in the Sheep Industry in the Salt Lake Region. *Economic Geography* 2:414-425.

Whitley, T.G.
2003 *Causality and Cross-Purposes in Archaeological Predictive Modeling*. A Paper Presented at the Computer Applications in Archaeology Conference, April 8-12, Vienna

Whiting, J.
2008 Cultural resource Inventory of Newfield Production Company's Pleasant Valley Blocks, Duchesne and Uintah Counties, Utah. Montgomery Archaeological Consultants, Moab. Report No. U-07-MQ-0401i on file at Utah Division of State History, Salt Lake City.

Woodhouse, C. A., D. M. Meko, G. M. MacDonald, D. W. Stahle, and E. R. Cook
2010 A 1,200-year Perspective of 21st Century Drought in Southwestern North America. *PNAS* 107:21283-21288.

Wormington, H.M.
1955 A Reappraisal of the Fremont Culture. *Proceedings of the Denver Museum of Natural History* No. 4. Denver, Colorado.

Wyckoff, W. and L. M. Dilsaver (eds)
1995 *The Mountain West, Explorations in Historical Geography*. Lincoln: University of Nebraska Press.

Yoder, D. T.
2005 Storage and Mobility Among the Fremont: Changing Forms Through Time. Unpublished Master Thesis, Department of Anthropology, Brigham Young University, Provo.

Zalasiewicz, J., M. William, W. Steffen, and P. Crutzen
2010 The New World of the Anthropocene. *Environmental Science and Technology* 44:228-2231.

From: Boyd, David
To: David Boyd
Subject: News Release: BLM evaluating oil and gas leasing proposals in Garfield and Mesa counties
Date: Monday, February 6, 2017 1:11:30 PM
Attachments: Dec 17 lease EA scoping nr 2-6-17.pdf

News Release
Grand Junction Field Office, Colorado

Feb. 6, 2017

Contact: David Boyd, Public Affairs Specialist, (970) 876-9008
Christopher B Joyner, Public Affairs Specialist, (970) 244-3097

BLM evaluating oil and gas leasing proposals in Garfield and Mesa counties

GRAND JUNCTION, Colo. – The Bureau of Land Management is seeking public comments on a proposal to offer 28 parcels totaling about 29,600 acres of federal minerals in northwestern Colorado in the December 2017 competitive oil and gas lease sale.

The BLM wants to hear from the public about any issues and concerns they feel should be considered as it evaluates leasing these parcels. The evaluation itself will be released for public review and comment in May.

"The most effective comments will address issues and concerns specific to these parcels being considered," said BLM Acting Grand Junction Field Manager Wayne Werkmeister.

The proposal includes 7,278 acres in western Garfield County and 22,329 acres in various locations in Mesa County.

Maps and lease stipulations are available for review at https://www.blm.gov/programs/energy-and-minerals/oil-and-gas/leasing/regional-lease-sales/colorado.

Comments need to be received by March 8, 2017. They should be e-mailed to blm_co_december_2017_lease_sa@blm.gov, or mailed to the Bureau of Land Management, Attn: Dec 2017 Lease Sale, 220 E. Market St., Meeker, CO 81641.

The State of Colorado receives 49 percent of the proceeds from each mineral lease sale and from mineral royalties, with the remainder going to the U.S. government. In Fiscal Year 2015, Colorado received about $247 million from royalties, rentals and bonus bid payments for all federal minerals, including oil and gas. Statewide, more than 22,900 jobs are tied to mineral and energy development on public lands.

Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment—including your personal identifying information—may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

# # #

--

David Boyd

Bureau of Land Management

Public Affairs Specialist

NW Colorado District

2300 River Frontage Road
Silt, CO 81652

(970) 876-9008
(970) 319-4130 (cell)

U.S. Department of the Interior
Bureau of Land Management

News Release

Grand Junction Field Office, Colorado

Feb. 6, 2017

Contact: David Boyd, Public Affairs Specialist, (970) 876-9008
Christopher B Joyner, Public Affairs Specialist, (970) 244-3097

BLM evaluating oil and gas leasing proposals in Garfield and Mesa counties

GRAND JUNCTION, Colo. – The Bureau of Land Management is seeking public comments on a proposal to offer 28 parcels totaling about 29,600 acres of federal minerals in northwestern Colorado in the December 2017 competitive oil and gas lease sale.

The BLM wants to hear from the public about any issues and concerns they feel should be considered as it evaluates leasing these parcels. The evaluation itself will be released for public review and comment in May.

“The most effective comments will address issues and concerns specific to these parcels being considered,” said BLM Acting Grand Junction Field Manager Wayne Werkmeister.

The proposal includes 7,278 acres in western Garfield County and 22,329 acres in various locations in Mesa County.

Maps and lease stipulations are available for review at https://www.blm.gov/programs/energy-and-minerals/oil-and-gas/leasing/regional-lease-sales/colorado.

Comments need to be received by March 8, 2017. They should be e-mailed to blm_co_december_2017_lease_sa@blm.gov, or mailed to the Bureau of Land Management, Attn: Dec 2017 Lease Sale, 220 E. Market St., Meeker, CO 81641.

The State of Colorado receives 49 percent of the proceeds from each mineral lease sale and from mineral royalties, with the remainder going to the U.S. government. In Fiscal Year 2015, Colorado received about $247 million from royalties, rentals and bonus bid payments for all federal minerals, including oil and gas. Statewide, more than 22,900 jobs are tied to mineral and energy development on public lands.

Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment—including your personal identifying information—may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

# # #

From: Michael Freeman
To: Boyd, David
Subject: Automatic reply: News Release: BLM evaluating oil and gas leasing proposals in Garfield and Mesa counties
Date: Monday, February 6, 2017 1:11:53 PM

I am out of the office until Friday, February 10, and checking electronic mail intermittently during that time. If you need immediate assistance, please call my cell phone at 720/989-6896.

From: Michael Freeman
To: Boyd, David
Subject: Automatic reply: News Release: BLM evaluating oil and gas leasing proposals in Garfield and Mesa counties
Date: Monday, February 6, 2017 1:12:04 PM

I am out of the office until Friday, February 10, and checking electronic mail intermittently during that time. If you need immediate assistance, please call my cell phone at 720/989-6896.

From: Nada Culver
To: "bamme@blm.gov"
Subject: TWS comments on June 2017 Oil and Gas Lease EA comment
Date: Tuesday, February 7, 2017 11:53:17 PM
Attachments: Nevada June 2017 lease sale - TWS comments 020317.pdf
FNW_SulphurSprings_Package.pdf

Hi Brian – It was great to see you and catch up at the conference a couple of weeks ago.

Attached are the comments we submitted last week on the June 2017 lease sale. We'd love to discuss further or otherwise explain our concerns if that would be helpful.

Nada Culver

Senior Counsel and Director, BLM Action Center

The Wilderness Society

1660 Wynkoop, #850

Denver, CO 80202

Main: 303-650-5818

Direct: 303-225-4635

Nada_Culver@tws.org <mailto:Nada_Culver@tws.org>

From: Juli Slivka
Sent: Friday, February 03, 2017 1:40 PM
To: 'jfatooh@blm.gov' <jfatooh@blm.gov>
Subject: 2017 Oil and Gas Lease EA comment

Hi Joy,

Attached please find comments from The Wilderness Society regarding the June 2017 oil and gas lease sale. Please confirm that you received these comments and the attachment.

Thanks very much. I hope you have a great weekend.

Juli

Juli Slivka

Planning Specialist

The Wilderness Society | BLM Action Center

Ph: 303.650.1179 | Cell: 303.241.9431

www.wilderness.org <http://www.wilderness.org/>

#OurWild

Facebook <http://www.facebook.com/TheWildernessSociety> | Twitter <http://www.twitter.com/Wilderness> | Instagram <http://instagram.com/wildernesssociety> | Medium <https://medium.com/@wilderness>

We protect wilderness and inspire Americans to care for our wild places

February 3, 2017

Delivered via email to jfatooh@blm.gov

BLM Battle Mountain District Office
Attn.: Joy Fatooh
50 Bastian Road
Battle Mountain, NV 89820

Re: Comments on the Nevada June 2017 Oil and Gas Lease Sale

Dear Ms. Fatooh,

Thank you for the opportunity to submit comments on the Environmental Assessment for BLM Nevada's June 2017 oil and gas lease sale. We have significant concerns with the proposed lease sale, including primarily BLM's failure to comply with relevant policy governing lands with wilderness characteristics and unacceptable resource conflicts as documented in the Environmental Assessment. We therefore recommend BLM defer this lease sale until the agency completes adequate analysis to support leasing in the Battle Mountain District.

I. Public participation

BLM has failed to provide meaningful opportunity for public participation in the Nevada June 2017 lease sale. Not only is public participation in review of agency actions foundational to the National Environmental Policy Act (NEPA) and BLM's oil and gas leasing reforms, it assists the agency with conducting more thorough, efficient and effective environmental review processes. BLM is impeding public participation in this lease sale by neglecting to provide a public scoping opportunity and by not posting geospatial data for the lease parcels at issue.

A key, overarching purpose of NEPA is to increase public knowledge and participation in agency decision-making. NEPA requires that agencies make "*diligent efforts* to involve the public in preparing and implementing their NEPA procedures." *See* 40 CFR § 1506.6(a) (emphasis added). Agencies must provide "public notice of NEPA-related hearings, public meetings, and the availability of environmental documents so as to inform those persons or agencies who may be interested or affected." *Id*. § 1506.6(b). NEPA also directs that "There shall be an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action. This process shall be termed scoping." *Id.* § 1501.7. Although scoping is not strictly required for EAs, BLM almost always conducts scoping for lease sale EAs, and the absence of a scoping period here evidences a lack of diligent efforts to involve the public.

The absence of a public scoping period also undermines the oil and gas leasing reforms provided in IM 2010-117. That IM "established a process for ensuring orderly, effective, timely, and environmentally responsible leasing of oil and gas resources." IM 2010-117 at 1. Toward this end, the IM called for increased public participation in lease sales: "The process outlined in this IM—which includes site-specific parcel analysis and increased public participation—will help identify, address, and resolve most issues before the lease sale." IM 2010-117 at 13. Declining to provide a public scoping opportunity undermines the vision articulated in IM 2010-117 of increasing public participation and conducting more efficient and effective oil and gas leasing.

Additionally, the public has valuable information that BLM must consider in the NEPA review for this lease sale, which could have been provided to the agency during a scoping period if one was offered. For example, as detailed below, we have information regarding potential and existing lands with wilderness characteristics that we could have provided BLM during scoping and that BLM must incorporate into a revised EA. Instead, BLM has now prepared an entire environmental assessment without that information, and must revise the environmental assessment in light of that information. The NEPA review for this lease sale would have been more thorough, efficient and effective if BLM had provided a public scoping opportunity, a fact recognized by BLM in many other states where the agency regularly conducts public scoping as part of analyzing oil and gas lease sales.

In addition to not providing a public scoping opportunity, BLM has failed to make "diligent efforts to involve the public" by not providing any geospatial data for the lease parcels under consideration in the EA. Declining to provide geospatial data significantly impedes the public's ability to understand proposed actions on public lands or make substantive comments. It also conflicts with the almost universal practice in other BLM offices of publishing this data during the scoping period and throughout the NEPA process for lease sales.

BLM also failed to make diligent efforts to involve the public by breaking with customary practice of publishing an online schedule of public participation opportunities for this sale. Other BLM State Offices follow structured schedules for public comment periods and posting of documents to ensure compliance with IM 2010-117, and have those schedules posted online to assist public participation. For example, see BLM Colorado's Public Involvement Calendar online at: https://www.blm.gov/co/st/en/BLM_Programs/oilandgas/oil_and_gas_lease/2017/public_involvement.html. Other BLM State Offices also regularly post GIS data for nominated parcels and parcels that would be offered by alternative. These are critical steps to facilitate public participation in lease sales, and interested stakeholders like The Wilderness Society should be able to depend on the faithful, consistent execution of these steps.

The Battle Mountain District and BLM Nevada as a whole should provide for public scoping, publish notice of scoping online, publish geospatial data during the scoping and public comment periods, and provide a schedule of lease sale steps and public participation opportunities. By not doing so here, BLM broke with almost universal practice of other field offices and failed to make the "diligent efforts to involve the public" that NEPA requires.

II. Lands with wilderness characteristics

BLM must inventory the proposed lease parcels for lands with wilderness characteristics (LWC) and defer parcels where wilderness resources are identified in compliance with the Federal Land Policy and Management Act (FLPMA), NEPA and relevant agency policy issued under those statutes.

a. FLPMA requires BLM to maintain an inventory of lands with wilderness characteristics.

Lands with wilderness characteristics are one of the resources of the public lands that must be inventoried under the Federal Land Policy and Management Act (FLPMA). 43 U.S.C. § 1711(a); see also *Ore. Natural Desert Ass'n v. BLM*, 625 F.3d 1092, 1122 (9th Cir. 2008) (holding that "wilderness characteristics are among the 'resource and other values' of the public lands to be inventoried under § 1711"). Instruction Memorandum 2011-154 directs BLM to consider lands with wilderness characteristics in land use plans and when analyzing projects under NEPA. The IM promulgates current agency policy for considering the wilderness characteristics on public lands as part of its multiple-use mandate in developing and revising land use plans *and when making subsequent project level decisions*, consistent with FLPMA. The IM directs BLM to "conduct and maintain inventories regarding the presence or absence of wilderness characteristics, and to consider identified lands with wilderness characteristics in land use plans and when analyzing projects under [NEPA]." BLM Manual 6310 directs BLM on how to conduct lands with wilderness characteristics inventories in compliance with FLPMA and agency policy.

BLM Manual 6310 requires BLM to consider whether to update or conduct a wilderness characteristics inventory when a project that may impact wilderness characteristics is undergoing NEPA analysis, when the public identifies wilderness characteristics as an issue in a NEPA process, and/or when the public submits new information concerning resource conditions. BLM Manual 6310 at .06(A). Appropriately, the EA discusses lands with wilderness characteristics, but then incorrectly dismisses the resource as "not present". EA at 20. Because BLM does not have a current inventory of lands with wilderness characteristics for the Battle Mountain District, as detailed further in these comments, this is an inappropriate dismissal of this resource and is in violation of the agency's inventory obligations under FLPMA.

b. BLM must update its lands with wilderness characteristics inventory for all oil and gas lease parcels prior to offering them for sale.

BLM must consider lands with wilderness characteristics in evaluating lease parcels to be offered for sale. However, BLM does not have an updated, policy-compliant LWC inventory for all of the parcels proposed for lease. The Battle Mountain District completed some LWC inventory updates in 2012-2013 as part of the ongoing Battle Mountain Resource Management Plan (RMP) revision. BLM's Lands with Wilderness Characteristics Summary document[1] states that BLM identified all potential LWC units in the planning area, but then conducted almost no new inventory work, instead relying primarily on the 1980 Nevada BLM Intensive Wilderness Inventory:

> Existing BLM inventories were also reviewed to determine if their conclusions were still valid including the BLM Nevada Initial Inventory Decisions of 1979 and the Nevada BLM Intensive Wilderness Inventory of 1980. **For most inventory units, these conclusions were still valid and the inventory is considered maintained.**

LWC Summary at 3 (emphasis added). In fact, BLM conducted field inventory for only 13 units as part of the 2012-2013 inventory update, finding 215,200 acres of LWC in a 10.5 million-acre planning area. *Ibid.*

[1] Posted online at https://www.blm.gov/nv/st/en/fo/battle_mountain_field/blm_information/rmp.html.

As stated above, under FLPMA, BLM must maintain a current wilderness inventory for public lands under its jurisdiction. Furthermore, BLM must comply with its own policies that detail how to comply with FLPMA obligations on conducting inventories for wilderness characteristics and considering those inventories in oil and gas leasing. In addition to IM 2011-154 and BLM Manual 6310, BLM's leasing guidance, IM 2010-117, requires the agency to:

> review parcels in light of the most current national and local program-specific guidance to *determine availability of parcels for leasing and/or applicable stipulations* (e.g., to address conservation strategies and protect archaeological resources, traditional cultural properties, paleontological resources, specially designated areas on or near BLM-administered lands, sensitive species, watersheds, fisheries and wildlife habitat, visual resources, air quality, and *wilderness qualities*).

(emphases added).

Elsewhere, BLM regularly defers proposed lease parcels when, as here, updated information on wilderness characteristics is not available to inform lease parcel analysis and land use planning is ongoing. For example, the Bighorn Basin District Office in Wyoming deferred several parcels from Wyoming BLM's August 2013 lease sale because they overlapped with "Lands with Wilderness Characteristics inventory area" while BLM completed the RMP revision. DOI-BLM-WY-R010-2013-0014-EA at 4-37.

Similarly, the White River Field Office in Colorado deferred leasing in areas identified as potential lands with wilderness characteristics while the agency updated its inventory:

> To comply with this guidance, the WRFO did an initial assessment of the WRFO resource area and identified areas that have the potential to meet the criteria for Lands with Wilderness Characteristics. Parcels initially identified for the May 2011 lease sale containing any portions of lands that fell within these potential areas were deferred both to allow the BLM to take a closer look at these areas and to allow for another public comment period in which the new policy and the evaluation of these parcels could be discussed.

DOI-BLM-CO-110-2011-0056-EA at 3. The White River Field Office did not offer any leases that overlap with potential LWC until it had completed LWC inventory compliant with BLM Manual 6310. In another oil and gas leasing EA, the White River Field Office also deferred leasing on over 250,000 acres that may possess wilderness characteristics while it was completing an oil and gas RMP amendment:

> The WRFO is currently working on a Resource Management Plan Amendment and associated EIS that will address the potential impacts of significant increases in oil and gas development within the field office over the next 20 years… Because the leasing of lands with wilderness characteristics is likely to result in indirect, adverse impacts to this resource value, it is recommended that until a decision is made on the management of these units, the areas where lands with wilderness characteristics units overlap with nominated parcels be deferred, as under Alternative 3.

DOI-BLM-CO-110-2013-099-EA at 80. The Battle Mountain District must follow suit, and as required by FLPMA and associated policies, defer all lease parcels that may possess wilderness characteristics until BLM can complete updated LWC inventories for those areas. At a minimum,

this must include the areas for which BLM has received new LWC inventory information from Friends of Nevada Wilderness and areas described below that we have identified as having a high likelihood of meeting the agency's criteria for lands with wilderness characteristics:

- The Big Smoky Valley contains several polygons of contiguous unroaded BLM lands greater than 5,000 acres in size that may contain wilderness characteristics. BLM did not inventory any of the potential units in the Big Smoky Valley in its 2013 inventory update. It is unclear if this area has ever been inventoried; if so, those inventories are likely at least several decades old and are not conducted according to guidance in Manual 6310. By any standard, the existing inventory is out-of-date. Parcels 4-14 and 16-32 all overlap with potential lands with wilderness characteristics in the bottoms and alkali flats of the upper Big Smoky Valley in both Lander and Nye Counties and should be deferred until inventories are completed.

- Parcels 52, 69-82, 84-89, 98-99, and 101-103 are all located in the Diamond Valley in northern Eureka County. These parcels overlap with the Diamond Valley alkali flat, an area that is highly likely to meet the criteria for lands with wilderness characteristics because of its large size of over 90,000 acres of contiguous unroaded BLM lands. It is unclear if this area has ever been inventoried; if so, those inventories are likely at least several decades old and are not conducted according to guidance in Manual 6310. By any standard, the existing inventory is out-of-date. The parcels in the Diamond Valley (listed above) should be deferred until updated lands with wilderness characteristics inventories can be completed.

- The Diamond Mountains in Eureka County also contain large blocks of contiguous unroaded BLM lands that are likely to meet the criteria for lands with wilderness characteristics. It is unclear if this area has ever been inventoried, although the Ely District may have recently conducted some inventories in the Diamond Mountains that are contiguous with lands on the west side of the Diamond Mountains that overlap with parcels in this sale. Parcels 92-96 and 104-105 overlap with contiguous unroaded lands in the Diamond Mountains that may meet the criteria for lands with wilderness characteristics as defined in Manual 6310. BLM must defer these parcels until updated inventories are completed.

- The BLM lands that make up White Cloud Peak and Dave Keane Mountain in the Fish Creek Range southwest of Eureka are highly likely to contain contiguous blocks of unroaded BLM lands that meet the criteria for lands with wilderness characteristics. There are some large polygons of unroaded lands in the Fish Creek Range. Parcels 42-49 and Parcel 66 all overlap with potential lands with wilderness characteristics. Again, it is unclear if these lands have ever been inventoried by BLM for the presence of wilderness characteristics. However, these lands have not been inventoried recently, and existing inventories for these lands, if they exist, are likely more than 30 years old. BLM must defer these parcels until it is able to conduct a thorough and updated inventory of lands with wilderness characteristics in the Fish Creek Range under guidance outlined in Manual 6310.

For all areas that BLM finds to possess wilderness characteristics, BLM must defer leasing until the Battle Mountain RMP revision is complete and the agency has made management decisions for those lands consistent with BLM Manual 6320. The examples above illustrate BLM's authority and discretion to defer parcels while land use planning is ongoing.

c. BLM has failed to respond to significant new information submitted by the public regarding lands with wilderness characteristics.

Friends of Nevada Wilderness submitted inventory information to BLM in June 2016 for the Sulphur Springs area (attached to these comments as Exhibit 1). That inventory information meets the minimum standards for review of new information set forth in BLM Manual 6310:

i. a map of sufficient detail to determine specific boundaries of the area in question;

ii. a detailed narrative that describes the wilderness characteristics of the area and documents how that information substantially differs from the information in the BLM inventory of the area's wilderness characteristics; and

iii. photographic documentation.

BLM Manual 6310 at .06(B)(1)(b). When BLM receives information that meets these minimum standards, the agency is directed to review the information "as soon as practicable," "make the findings available to the public," and "retain a record of the evaluation and the findings as evidence of the BLM's consideration." *Id.* at .06(B)(2). BLM has not yet responded to the inventory information for Sulphur Springs submitted by Friends of Nevada Wilderness.

Specifically, the following parcels are all or partially within the Sulphur Springs LWC unit submitted by Friends of Nevada Wilderness:

NV-17-06-053	NV-17-06-054	NV-17-06-055	NV-17-06-056
NV-17-06-057	NV-17-06-060	NV-17-06-061	NV-17-06-063
NV-17-06-064	NV-17-06-065	NV-17-06-083	

The decision to ignore public input on affected wilderness resources likely contravenes the "hard look" requirement of NEPA. *See* 42 U.S.C. § 4332(2)(C). Numerous courts have applied the hard look mandate to overturn agency decisions that ignored substantive, relevant wilderness information provided by the public, including citizen-submitted wilderness inventories. *See, e.g.*, *Or. Natural Desert Ass'n v. Rasmussen,* 451 F. Supp. 2d 1202, 1211-13 (D. Ore. 2006) (holding that BLM violated the hard-look requirement of NEPA when it dismissed a citizen-submitted inventory "[w]ith a broad brush"); *SUWA v. Norton*, 457 Supp. 2d 1253 1263-65 (D. Utah 2006) ("…Utah BLM ignored significant new information…information provided by the Southern Utah Wilderness Alliance…presented a textbook example of significant new information about the affected environment (the wilderness attributes and characteristics…)"); *Biodiversity Conservation Alliance*, 183 IBLA 97, 2013 IBLA Lexis *1, *28-*29 (2013) (rejecting a claim that BLM violated the hard-look requirement where BLM "specifically evaluated citizens' wilderness proposals [so that the citizens' proposals had] become administratively final…").

Here, BLM has not taken the requisite "hard look" at how the sale of the parcels listed above would affect wilderness resources in the Battle Mountain District, as required by the cases cited above. The Battle Mountain District has disregarded substantive new information submitted by the public describing wilderness values that would be affected by the lease sale. Although BLM is not obligated to agree with any public assessment of the wilderness values affected by the lease sale, NEPA requires that the agency at least take a hard look at a complete and accurate inventory of wilderness values in the planning area. BLM cannot be said to have taken the requisite hard look where, as here, the agency ignored significant new information.

Furthermore, even if the agency were found to have considered, and decided against, an inventory update, the decision not to update would likely be found arbitrary and capricious under the Administrative Procedure Act (APA). *See* 5 U.S.C. § 706. Since its most recent wilderness inventory update, the Battle Mountain District has failed to respond to multiple citizen-submitted wilderness inventories for lands under its jurisdiction, all of which meet the "minimum standards for further review" as defined by BLM Manual 6310. *See* BLM Manual 6310 at .06(B)(1). Since BLM's last inventory update in 2013, Friends of Nevada Wilderness has submitted 25 additional LWC inventories. Additionally, the Battle Mountain District has yet to respond to comments submitted by Friends of Nevada Wilderness in June 2016 that identified deficiencies with four of BLM's LWC inventories. Nor has the most recent inventory for the Battle Mountain District been incorporated into the land use plans that are being applied to the June 2017 Lease Sale. Surely, BLM cannot conduct a deficient wilderness inventory, ignore citizen inventories and comments submitted in response to its inventory, and then rely on its inventory to make project-level decisions that could compromise wilderness quality lands within its jurisdiction. Since the agency has no obligation to involve the public during its inventory process, the duty to maintain a current inventory, which includes the obligation to consider updates before project-level decisions, was doubtlessly designed to safeguard wilderness lands, as well as the public interest in protecting those lands. Given the volume of comments and inventories that the Battle Mountain District has yet to respond to, any agency decision not to update its existing inventory in light of this information would likely constitute an abuse of agency discretion under the APA.

BLM must defer all of these parcels until the agency has updated its inventory for the Sulphur Springs area in response to the significant new information submitted by Friends of Nevada Wilderness. For all areas that BLM finds to possess wilderness characteristics, BLM must defer leasing until the Battle Mountain RMP revision is complete and the agency has made management decisions for those lands consistent with BLM Manual 6320.

d. Offering the lease parcels in the Battle Mountain District that may possess wilderness characteristics would violate NEPA.

BLM has not evaluated a reasonable range of alternatives for protecting the wilderness characteristics of parcels in the Battle Mountain District. Under NEPA, BLM must consider a broad range of alternatives to mitigate environmental impacts. 40 C.F.R. § 1502.14(a); *see also Theodore Roosevelt Conservation P'ship v. Salazar*, 661 F.3d 66, 72-73 (D.C. Cir. 2011) (requiring BLM to consider a reasonable range of alternatives for oil and gas activity); IM 2010-117 (requiring consideration of "alternatives to the proposed action that may address unresolved resource conflicts."). Additionally, under current policies, BLM must fully "consider" wilderness characteristics during planning actions and evaluate a range of measures to protect wilderness characteristics during the leasing process, including measures not contained in existing RMPs. *See* IM 2011-154 at Att. 2; IM 2010-117 at III. E., F.

A "rule of reason" is used to determine if an adequate range of alternatives have been considered; this rule is governed by two guideposts: (1) the agency's statutory mandates; and (2) the objectives for the project. *New Mexico ex rel. Richardson*, 565 F.3d at 708. Here, there is no doubt that BLM's legal mandates under FLPMA and NEPA require it to fully consider the protection of wilderness values, and under IM 2010-117, the agency must treat the "protection of other important resources and values" as an equally important objective to leasing.

Yet, in the Draft EA, the BLM has failed to evaluate an adequate range of alternatives that would protect the wilderness characteristics of parcels in the Battle Mountain District from the impacts of the lease sale. Such alternatives include offering the parcels with NSO stipulations or deferring the parcels. Because the BLM has not considered those alternatives, or additional alternatives to protect the wilderness characteristics of the proposed parcels, it must defer the parcels from the lease sale.

III. Unavoidable resource conflicts

The EA documents that the proposed action – offering all preliminary lease parcels in the June 2017 lease sale – would have unacceptable impacts on public lands resources. In developing the EA, BLM not only determined that more than half of the proposed lease parcels conflict with important public lands resources and those conflicts can not be avoided with stipulations in the existing RMPs, but BLM also went through the exercise of developing a "partial deferral" alternative and new stipulations that could and should be adopted in the revised Battle Mountain RMP to address those conflicts. The analysis included in the EA thus demonstrates unequivocally that BLM must adopt the partial deferral alternative or apply new stipulations to those parcels.

As the D.C. Circuit explained in *Sierra Club v. Peterson*, BLM must not base a FONSI on the bare assertion that oil and gas leases are not likely to be developed; instead, enforceable mitigation must be developed, evaluated and imposed, or an EIS must be prepared. 717 F.2d 1409, 1414 (D.C. Cir. 1983). In *Peterson*, BLM issued several oil and gas leases on national forest land in Idaho and Wyoming. BLM did so by issuing an EA/FONSI in which it expressly declared that "few issued leases result in active exploration operations and still fewer result in discovery or production of oil or gas" and "concluded that any impacts which might result from the act of leasing would either be insignificant or, if significant, could be mitigated by exercising controls in the lease stipulations." The court rejected that conclusion, stating that

> [w]hile it may well be true that the majority of these leases will never reach the drilling stage and that the environmental impacts of exploration are dependent upon the nature of the activity, nevertheless NEPA requires that federal agencies determine at the outset whether their major actions can result in "significant" environmental impacts. Here, the Forest Service concluded that any impacts which might result from the act of leasing would either be insignificant or, if significant, could be mitigated by exercising the controls provided in the lease stipulations.
>
> Even assuming, *arguendo*, that all lease stipulations are fully enforceable, once the land is leased the Department no longer has the authority to *preclude* surface disturbing activities even if the environmental impact of such activity is significant. The Department can only impose "mitigation" measures upon a lessee who pursues surface disturbing exploration and/or drilling activities. None of the stipulations expressly provides that the Department or the Forest Service can *prevent* a lessee from conducting surface disturbing activities. Thus, with respect to the smaller area with which we are here concerned, the decision to allow surface disturbing activities has been made at the *leasing stage* and, under NEPA, this is the point at which the environmental impacts of such activities must be evaluated.

Id. at 1413-14 (emphasis in original). Here, the BLM has committed the same mistake. It is concluding that any impacts of the proposed leases would be insignificant because "recent

exploration and development history provides a basis for estimating a low development potential for oil and gas disturbance" and/or that even if impacts are significant, then they can be mitigated through existing lease stipulations. EA at 14. Yet, in violation of NEPA, none of the stipulations that could mitigate impacts to non-significant levels, including those discussed in Appendix C, were actually included in the proposed action.

In describing the internal scoping process, the EA states:

> The ID Team also identified parcels to propose for deferral based on other resource concerns and land use conflicts that could not be resolved via stipulations in the existing RMPs as amended. For each proposed deferral, the ID Team recommended a new stipulation or other measure to address the issue via an upcoming revised RMP.

EA at 10. According to the environmental effects analysis, the 104,176 acres of parcels included in the partial deferral alternative are proposed for deferral due to sensitive wetlands, seeps and/or springs, floodplains, playas, steep slopes, and a segment of the Pony Express National Historical Trail. See, e.g., EA at 37, 51, 70.

To address these conflicts with oil and gas leasing, BLM developed Appendix C of the EA, which is comprised of BLM's recommended new stipulations or other measures that could be incorporated into the revised Battle Mountain RMP to allow for responsible management of oil and gas resources. The EA clearly states: "The stipulations proposed at this time represent the Battle Mountain District's current intentions for addressing the resource concerns." EA at 144. However, the proposed action would result in offering all of the nominated lease parcels without these stipulations, apparently in contradiction of BLM's intentions for addressing the resource concerns.

In order to avoid preparing an EIS, BLM must either defer the remaining leases from the sale or incorporate mitigation measures into the proposed action that would preserve the agency's ability to fully avoid any future impacts of development. Measure the BLM should consider include the following, which are identified in Appendix C:

- No Surface Occupancy for sites eligible for National Register of Historic Places (NV-B-07-C-NSO)
- No Surface Occupancy for National Historic Trails (NV-B-07-D-NSO)
- No Surface Occupancy for water bodies, riparian and wetland areas (NV-B-10-A-NSO)
- Controlled Surface Use for a 500 ft. riparian-wetland habitat buffer (NV-B-10-B-CSU)
- No Surface Occupancy for 100-year floodplains (NV-B-10-C-NSO)
- No Surface Occupancy for seasonally flooded playas (NV-B-10-D-NSO)
- No Surface Occupancy for slopes >40% (NV-B-11-B-NSO)

Ibid.

BLM does have the authority to adopt new measures at the leasing stage that could preclude future development, if necessary to protect other resource values. For example, in *Yates Petroleum Corporation*, 174 IBLA 155 (2008), the Interior Board of Land Appeals (IBLA) affirmed the BLM's authority to revise conditions of approval (COAs) for applications for permit to drill (APDs) to increase the stipulated seasonal buffers around sage-grouse leks from 2 to 3 miles, based on updated scientific information demonstrating previously conditioned smaller buffers as inadequate (looking at WAFWA studies). The IBLA based its conclusions in Section 6 of the standard oil and gas lease terms, which

provides that leases are subject to "reasonable measures" as needed to "minimize adverse impacts" to other resource values not otherwise addressed at the time of leasing. Thus, it follows that if BLM has the authority to adopt new, protective measures at the permitting stage, then it clearly does at the leasing stage, provided those measures are adequately evaluated in the relevant NEPA document.

Not only does the BLM have the authority to impose more protective measures in COAs, but the IBLA also required the BLM to consider such measures when a need exists for the agency to do so. In *William P. Maycock, et al.*, 177 IBLA 1 (March 16, 2009), the IBLA found that when the agency "acknowledges the validity of the more recent research that demonstrates that [previous] mitigation measures are not as effective as originally anticipated" the BLM is obligated to consider that a 2-mile seasonal buffer would not reduce the impacts of oil and gas drilling to insignificance. The BLM was required to reassess the potential mitigation measures included in the COAs prior to approving APDs. As a result, the BLM clearly has the legal *authority* to impose reasonable measures on existing and future leases and is *required to consider* the need for such measures.

In fact, BLM recognizes and implements its authority to add stipulations at the leasing stage to protect important resources. For example:

- New Mexico July 2012 Lease Sale: "One new stipulation has also been developed to protect resources within the 6 nominated parcels in the District. Those resource conflicts consist of areas that contain suitable Chihuhua scurfpea habitat." EA at 6.

- New Mexico July 2013 Lease Sale: "Three new stipulations are being identified, the first LC-51 CSU, is to protect resources such as playas and alkali lakes within areas that contain these features. The stipulation would prohibit surface disturbance within up to 200 meters of the outer edge of a playa or alkali lake, to protect the ecological and physical integrity of these features. . . . The second new stipulation is LC-52 CSU, to protect resources such as the floodplains within areas that contain these features. The stipulation would prohibit surface disturbance within up to 200 meters of the outer edge of 100 year floodplains, to protect the ecological and physical integrity of those floodplains. . . . The third new stipulation is LC-53 CSU, to protect private surface that is being used for cultivation. The stipulation would exclude surface disturbing activities associated with oil and gas development from occurring in areas used for cultivation. The BLM may consider on an individual application basis, an exception to this stipulation if the surface owner signs an agreement with the lessee or operator allowing the proposed surface-disturbing activity within the cultivated area. Each application submitted to the BLM must include a copy of any agreement signed by the surface owner." EA at 7-8.

- Wyoming February 2012 Lease Sale: "The addition of 2,454 acres to the NSO onsite protection for two Patten Creek sites (48PL32/68) (1,506 acres) and one for Hell Gap site (48GO305) (948 acres) is warranted, as these acres have been determined, in consultation with Wyoming State Historic Preservation Officer (SHPO), as listed on or eligible for the National Register of Historic Places. This stipulation will be applied to parcel WY-1202-65." EA at 26.

If BLM determines that it is necessary to amend the land use plans in order to apply these stipulations, then BLM must adopt the deferred parcel alternative. IM 2010-117 directs:

> If a proposed change in the terms of a stipulation would change the degree of the constraint from moderate to major or would result in the creation of a new lease stipulation not

contemplated in the RMP, a plan amendment would likely be required **and, if necessary, the parcel(s) should be withheld from leasing until the plan is amended.** (Emphasis added.)

The EA clearly demonstrates unacceptable impacts to public lands resources associated with more than half of the proposed lease parcels; therefore BLM has no choice but to defer those parcels pending adoption of new stipulations in the Battle Mountain RMP.

IV. Problems associated with speculative leasing

There is very low potential for oil and gas development in the Battle Mountain District. According to the EA, in the Tonopah Field Office, only five wells entered production between 1997 and 2015, and the last well drilled in the Tonopah Field Office was in 2013. EA at 14. The EA goes on to state: The recent exploration and development history provides a basis for estimating a low development potential for oil and gas disturbance that might indirectly result from the June 2016 Competitive Oil and Gas Lease Sale." *Ibid.* Similarly for the Mount Lewis Field Office, the EA documents that there have only been four exploration wells authorized since 2003, with the last well being drilled in 2013 and all four wells now plugged. The EA concludes: "The potential for oil and gas exploration and production in the MLFO can also be considered low." *Id.* at 15.

Copeland et al. mapped oil and gas development potential across the West in 2009, and the results demonstrate that the Battle Mountain District would anticipate little or no development:

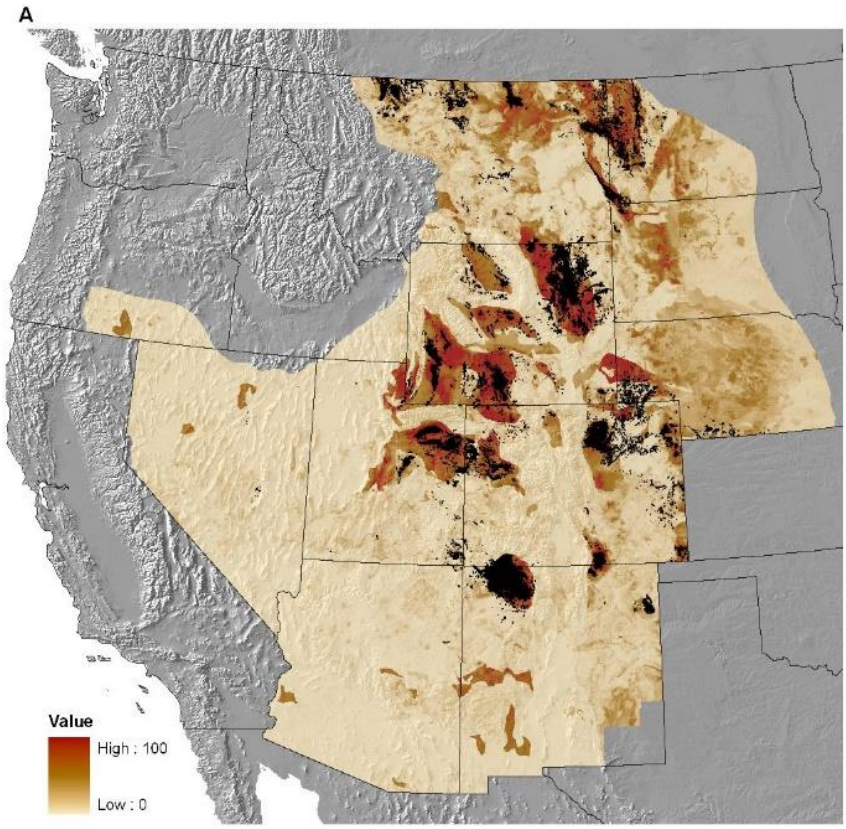


Figure A. Oil and Gas Development Potential in the US Intermountain West.[2]

[2] Journal article available online at: http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0007400.

Due to the low development potential in the Battle Mountain District, any leases issued would be speculative in nature. Speculative leasing ties up public lands, creates unnecessary public conflict, and generates minimal revenue. One of the most egregious problems associated with speculative leasing is that existing oil and gas leases tend to preclude protective management of other resources, thus restricting BLM's ability to manage for other multiple uses.

For example, in the Colorado River Valley Resource Management Plan, BLM decided not to manage lands for the protection of wilderness characteristics in the Grand Hogback lands with wilderness characteristics unit based on the presence of oil and gas leases, even though the leases had never experienced any development:

> The Grand Hogback citizens' wilderness proposal unit contains 11,360 acres of BLM lands. All of the proposed area meets the overall criteria for wilderness character…There are six active oil and gas leases within the unit, totaling approximately 2,240 acres. None of these leases shows any active drilling or has previously drilled wells. The ability to manage for wilderness characteristics in the unit would be difficult. If the current acres in the area continue to be leased and experience any development, protecting the unit's wilderness characteristics would be infeasible. . . .

Colorado River Valley PRMP (2015) at p. 3-135.

The Colorado River Valley RMP was finalized in July 2015, and within a year 5 of the 6 leases in the Grand Hogback lands with wilderness characteristics unit had expired. Yet, BLM has made a 20-year decision to not protect the wilderness qualities of this area.

Similarly, recently Wyoming BLM declined to manage the Rough Gulch area in the Cody Field Office for protection of wilderness characteristics because "64% of the area [was] covered] by oil and gas leases," even though the leases had never been drilled. Rough Gulch borders a WSA—the McCullough Peaks WSA—and has "very low" potential for oil and gas development. Like most federal leases, especially those in areas with low development potential, the leases in Rough Gulch were never drilled, and they expired within a year of the RMP being finalized. Yet, because the leases were in effect when Wyoming BLM made its land use planning decision for the area, BLM is not currently managing Rough Gulch for protection of wilderness characteristics.

Leases in low potential areas generate minimal revenue but can carry significant cost. In terms of revenue, they are most likely to be sold at or near the minimum bid of $2/acre, and they are least likely to actually produce oil or gas and generate royalties.[3] *See* Bighorn Basin PRMP (2015) at p. 73 ("Leasing may be based on speculation, with leases within high risk prospects usually purchased for the lowest prices."); White River PRMP (1996) at p. A-7 ("At any given time, most of the acreage that is available for oil and gas leasing in the WRRA is under lease. . . . Most of the area is leased for speculative purposes and consequently only a small percentage of leases will ever be developed."). In terms of costs, leasing in low potential areas requires processing lease nominations, preparing environmental reviews, and resolving protests and resource use conflicts.

[3] Center for Western Priorities, "A Fair Share" ("Oil Companies Can Obtain an Acre of Public Land for Less than the Price of a Big Mac. The minimum bid required to obtain public lands at oil and gas auctions stands at $2.00 per acre, an amount that has not been increased in decades. In 2014, oil companies obtained nearly 100,000 acres in Western states for only $2.00 per acre. . . .Oil companies are sitting on nearly 22 million acres of American lands without producing oil and gas from them. It only costs $1.50 per year to keep public lands idle, which provides little incentive to generate oil and gas or avoid land speculation.").

On the other hand, limiting leasing in low potential areas conflicts the least with industry objectives and can confer significant public benefits. Low potential lands are the "low-hanging fruit" by which the BLM can fulfill other objectives of its multiple-use mission, such as managing for wilderness, wildlife and recreation. Yet, as described above, speculative leases on low potential lands can prevent the BLM from otherwise managing lands for alternative purposes and fulfilling its multiple-use mandate. *See also* White River DRMPA (2012) at p. 4-377 (". . . authorized oil and gas uses would likely preclude other incompatible land use authorizations"). In addition, limiting exploration and development on low potential lands necessarily conflicts the least with industry objectives. As discussed in the Bighorn Basin PRMP (2015):

> [A]lternatives D and F place additional stipulations on oil and gas-related surface disturbances in the Absaroka Front, Fifteenmile, and Big Horn Front MLP analysis areas for the protection of big game, geologic features, and LRP soils. As a result, alternatives D and F could have additional adverse impacts on oil and gas development in these MLP analysis areas. . . . However, because of the generally low to very low potential for oil and gas development and redundancies with other restrictions on mineral leasing from the management of other program areas, management specific to the MLP is less likely to adversely affect oil and gas development in these areas.

Bighorn Basin PRMP at p. 4-87*; see also* White River DRMP (1994) at p. 4-21 ("Prohibiting development in Class I areas would not affect oil and gas production because oil and gas potential in these areas is low.").

In summary, leasing lands with low potential for oil and gas development – speculative leasing – carries significant costs by precluding BLM from managing for other multiple uses, creating unnecessary public conflict, and wasting agency resources while generating minimal revenue.

Conclusion: BLM should defer this lease sale until the Battle Mountain RMP revision is complete or BLM Nevada conducts updated oil and gas planning.

Given the issues outlined above, the low development potential in the Battle Mountain District, and the high costs associated with speculative leasing, BLM should defer this lease sale until the agency conducts and completes updated analysis to support new leasing, such as through the RMP revision or a programmatic oil and gas analysis, and a modern management approach to oil and gas leasing and development can be implemented. For example, the BLM Las Cruces District is currently deferring oil and gas leasing while it completes the TriCounty RMP: "Leasing of the Federal minerals in Sierra, Otero, and Doña Ana Counties are and will be deferred until a Record of Decision (ROD) for the TriCounty Resource Management Plan (RMP) is signed."[4]

The Tonopah and Shoshone-Eureka Resource Management Plans were last revised in 1997 and 1986, respectively. EA at 8-9. Thus, BLM is tiering to environmental analysis that is 20-30 years old in analyzing this lease sale. A great deal of resource information has changed since then, including oil and gas development potential and public lands resource inventories, and the agency has many new policies that are relevant to oil and gas management on our public lands. The Battle Mountain District would

[4] https://www.blm.gov/nm/st/en/fo/Las_Cruces_District_Office/tricounty_rmp.html, accessed Feb. 3, 2017.

therefore be well-served by an updated analysis and management plan to guide leasing and development.

If BLM moves forward with any oil and gas leasing in the Battle Mountain District prior to completing additional planning, the agency should implement interim measures to preserve its ability to protect public lands resources that are encumbered by leases. These could include:

- Applying more protective stipulations and/or conditions of approval through leasing EAs
- Attaching lease notices for specific resources, including for potential mitigation requirements

However, we emphasize that these interim measures would not relieve the agency of its obligations under FLPMA and NEPA to inventory and analyze public lands resources when conducting oil and gas leasing.

Thank you for considering these comments. Please contact us with any questions.

Sincerely,

Juli Slivka, Planning Specialist
The Wilderness Society
11050 Pioneer Trail, Ste. 202
Truckee, CA 96161
(303) 650-1179
jslivka@tws.org

Attachment

1. Exhibit 1: Friends of Nevada Wilderness, Citizen-Submitted Wilderness Characteristics Inventory Information for Sulphur Springs

Friends of Nevada Wilderness (FNW)
Citizen-Submitted Wilderness Characteristics Inventory Information

CITIZEN NAME: **Sulphur Springs**
BLM UNIT NAME: **Sulphur Springs** BLM UNIT NUMBER: **NV-060-543**

Narrative documentation of how the Citizen-Submitted information substantially differs from the information in the BLM inventory of the area's wilderness characteristics (as per BLM Manual 6310; .06; B; 1; b; ii.)

The only information from the BLM that Friends of Nevada Wilderness (FNW) could locate about the wilderness characteristics for this unit were found in the BLM 1979 Initial Inventory Decisions. The BLM information within that 1979 document is summarized below.

NOTE: Upon reviewing the BLM 1979 Initial Inventory Decisions, FNW found several inconsistencies within the descriptions. The Introduction states: *"[t]he intent of the initial phase of the wilderness inventory is to eliminate from further wilderness consideration those lands that beyond doubt clearly lack wilderness characteristics."* Although the purported intention of this document is to make decision about wilderness characteristics that are *"beyond doubt,"* the methodology used by the BLM raises serious doubts. The 1979 Decisions also states that the *"beyond doubt"* determination used by the BLM is based on eliminating *"…lands that nearly everyone can agree do not have wilderness values. Very little field work and written documentation were required to verify that these lands are definitely lacking wilderness qualities."* Furthermore, the 1979 document states*: "[t]his document includes a summary of public comments received for each area in the State, and explains whether or not the comments changed our original recommendation."* Both of these methodologies rely on preconceived notions and subjective opinion.

Although this may have been a valid approach in 1979, it is not in alignment with the scientific-based FLMPA mandate to [Sec. 201. [43 U.S.C. 1711] (a*) …"prepare and maintain on a continuing basis an inventory of all public lands and their resource and other values,"* and (c)(2*) "use a systematic interdisciplinary approach to achieve integrated consideration of physical, biological, economic, and other sciences."* Nor is abiding by the 1979 approach and decision in the best interest of current BLM Manual 6310 Guidelines.

SUMMARY OF BLM 1979 INITIAL INVENTORY DECISION for NV-060-543

UNIT NUMBER *NV-060-543* **NAME** *Sulphur Springs*

PUBLIC LAND ACREAGE *35,800*

ORIGINAL RECOMMENDATION: *Area to be intensively inventoried***.**

SUMMARY OF PUBLIC COMMENT RECEIVED*: Of 11 comments received, six disagreed noting roads or intrusions. Five comments supported the recommendation.*

FINAL DECISION: *35,800 acres will be dropped from further wilderness consideration.*

Friends of Nevada Wilderness (FNW)
Citizen-Submitted Wilderness Characteristics Inventory Information

RATIONALE: *In response to public comments that were verified by a field check, the Bureau has decided that the area clearly lacks wilderness characteristics and should be dropped from further wilderness consideration.*

FNW FINDINGS for NV-060-543

CHARACTERISTICS INVENTORIED:
1. Size: The BLM 1979 Initial Inventory Decisions documented Unit 543 as being 35,800 acres. The 2015 FNW Inventory is smaller and describes this roadless area as 29,916 acres. The 2015 FNW inventory eliminated areas with human disturbances that would detract for the wilderness characteristics of the unit. The FNW Inventory also found several of the posited "roads" within the unit failed to meet the criteria for "a road" under BLM Manual 6310 guidelines. (See Appendix C: Route Analysis for more information on routes and boundaries.)

2. Naturalness: The BLM 1979 Initial Inventory Decisions did not discuss the naturalness of the unit. The Initial Inventory did state, however, that the public comments "*noting roads or intrusions*" that "*were verified by a field check"* provided the Bureau with the bases for dropping the area from further wilderness consideration. The Bureau then stated that these impacts led to their decision that "*the area clearly lacks wilderness characteristics."* The 2015 FNW inventory found that after defining boundaries that effectively eliminated roads and human disturbances, 29,916 contiguous acres of this unit appeared to be affected primarily by natural processes. (See Wilderness Characteristics Form 2 provided with the FNW Inventory of this unit for more information about the naturalness of this unit.)

3. Outstanding Opportunities for:
A. Solitude: The BLM 1979 Initial Inventory Decisions did not discuss the opportunities for solitude within this unit. The 2015 FNW inventory of this unit found multiple outstanding opportunities for solitude throughout the unit. The basis for this finding of solitude is included within the Wilderness Characteristics Form 2 provided with the FNW Inventory of this unit. The FNW inventory based these findings for solitude on the current BLM Manual 6310 guidelines. The most significant changes in these current guidelines since the initial decisions were made is: *"[a]n area can have wilderness characteristics even though every acre within the area may not meet all the criteria. The boundary should be determined largely on the basis of wilderness inventory roads and naturalness rather than being constricted on the basis of opportunity for solitude or primitive and unconfined recreation."*

B. Primitive and Unconfined Type of Recreation: The BLM 1979 Initial Inventory Decisions did not discuss the opportunities for primitive and unconfined recreation within this unit. The 2015 FNW inventory of this unit found both outstanding opportunities in several primitive and unconfined types of recreation and a diversity of recreational opportunities within the unit. The basis for these findings of primitive and unconfined type of recreation is included within the Wilderness Characteristics Form 2 provided with the FNW Inventory of this unit. The FNW inventory based these findings for primitive and unconfined type of recreation on the current BLM Manual 6310 guidelines. One of the more significant changes in these current guidelines since the initial decisions were made is: *"[t]he presence of water is not essential for an outstanding primitive recreation opportunity."*

FNW is providing the BLM with New Information about Unit NV-060-543:

The wilderness characteristics generated from the FNW 2015 Inventory for the unit substantially differ from the information in the BLM 1979 Initial Inventory Decisions on the area's wilderness characteristics. Under current 6310 guidelines, FNW recommends that this unit should be re-considered for LWC status.

WILDERNESS CHARACTERISTICS INVENTORY
INVENTORY AREA EVALUATION (FORM 2)

Current Conditions: Presence or Absence of Wilderness Characteristics
Area Unique Identifier**: Sulphur Springs (NV-060-543)** Acreage**: 29,916**

(If the inventory area consists of subunits, list the acreage of each and evaluate each separately). In completing steps (1)-(5), use additional space as necessary.

(1) Is the area of sufficient size? (If the area meets one of the exceptions to the size criterion, check "Yes" and describe the exception in the space provided below),

YES
Description (describe the boundaries of the area--wilderness inventory roads, property lines, etc): **The east boundary follows the Saddler Brown road and steps-in in places to exclude private property and associated development. The southern boundary follows the Bailey Pass Road. The west boundary is complex. The southern portion of the west boundary follows a route from the Bailey Pass Road north to the historic Prince of Wales Mine. Here, the boundary steps around the main mining disturbances then continues in a north westerly direction nearly to State route 278. The west boundary continues north on a minor route parallel to State Route 278 to the eastern side of the private property at Chimney Springs. From here the west boundary steps eastward following a mix of minor routes and arbitrary lines to exclude the historic mining disturbances associated with Old Whalen Mining district. The west boundary joins a substantial route, which parallels the base of the mountains north of the Old Whalen Mine. This route continues north, west of Bald Mountain and through Bald Mountain Well. This west boundary route ends at Telegraph Canyon Road. The north boundary of the unit is formed by Telegraph Canyon Road.**

(2) Does the area appear to be natural?
YES

Note: If "No" is checked the area does not have wilderness characteristics; check "NA" for the remaining questions below.

Description (include land ownership, location, topography, vegetation, and summary of major human uses/activities):

This area is predominantly natural and controlled by wild forces. All of the unit as described by the FNW inventory is comprised of public lands administered by the BLM. The core of the unit is consists of a 13-mile limestone backbone of the Sulphur Springs Range. This rugged range towers to an elevation over 8000 feet and is heavily covered by a dense pinion/juniper woodland. Craggy limestone outcrops and cliffs can be found throughout the unit and impenetrable thickets of mountain mahogany can be found associated with the limestone formations. Bitter brush is also found throughout the unit. The volcanic intrusion of Bald Mountain creates a striking contrast with the limestone landscape and provides soils more conducive to sagebrush meadows. Other volcanic intrusions create the rolling foothills on both the east and west margins of the unit. These lower elevations include scattered stands of pinion/juniper interspaced with sagebrush, rabbit brush, and a host of grass lands comprised of squirrel tail, rice grass, great basin wild rye, and crested wheat grass. Several springs within or adjacent to the unit provide critical water resources for wildlife. Wildlife is abundant here, as evidenced by ample scat and other signs. Mule deer is the predominate herbivore, while smaller animals are also plentiful. Reptiles, rodents, and predators all exist here in this rich ecosystem. Birds of prey roost in the many cliffs and rocks, and can often be seen soaring high above. Ravens and other members of the jay family are frequent visitors. Smaller sage and pinyon habitat birds nest here as well. This unit provides sage grouse habitat. Several recent fires have burnt along the lower, northwestern flank of the unit. The 2013 FNW inventory of this unit found that the entirety of the unit appears to be affected primarily by the forces of nature.

(3) Does the area (or the remainder of the area if a portion has been excluded due to unnaturalness and the remainder is of sufficient size) have outstanding opportunities for solitude?
YES

Description (describe the area's outstanding opportunities for solitude): **Dense stands of pinion and juniper found scattered throughout the canyons and the aprons of this unit provide outstanding opportunities for solitude and for finding secluded spots. The convoluted terrain of the rugged backbone of this unit combines with nearly 2000 feet of vertical relief adds a deeper dimension to the outstanding opportunities for solitude in this unit. The highest elevations rise far above the surrounding roads and valleys and provide seclusion in craggy rock outcrops and among stands of mountain mahogany. Out here one gets a sense that they are truly alone. It is quiet except for wind through the hills and the occasional call of animals. This is truly a remote and isolated place.**

(4) Does the area (or the remainder of the area if a portion has been excluded due to unnaturalness and the remainder is of sufficient size) have outstanding opportunities for primitive and unconfined recreation?
YES

Description (describe the area's outstanding opportunities for primitive and unconfined recreation):
This unit offers outstanding opportunities for primitive and unconfined recreation. Nearly every inch of this unit is accessible to the visitor with the determination and skills to traverse trackless wilderness. Hiking and backpacking the rugged 13 mile crest of this unit provides a challenging and outstanding opportunity primitive and unconfined recreation. Many birds and wildlife are present as well, providing opportunities for viewing and excellent hunting. Mule deerand chukar are some of the animals available for game. Rock scrambling routes abound in the solid limestone canyons, ridges, and along the crest of the unit. Here the rock is firm and has plentiful holds. Rock alcoves and shallow caves present opportunities for shelter and exploration. Other activities include: cross country skiing; snowshoeing; orienteering, landscape painting and sketching; rock scrambling; hiking; ; backpacking; rock hounding; geological sight-seeing, bird watching; primitive camping; horseback riding, hunting, and nature studies. The 2015 FNW Inventory found this area has outstanding opportunities for primitive and unconfined recreation in hiking, exploration, and photography. The 2013 FWN Inventory also found that this area has a wide diversity of recreational opportunities.

This unit is within one of the darkest regions of the United States. The opportunities for star gazing and night sky photography are truly outstanding. The 2015 FNW inventory found that

this unit offers outstanding opportunities for primitive and unconfined recreation in a variety of different activities.

(5) Does the area have supplemental values (ecological, geological, or other features of scientific, educational, scenic or historical value)?
YES

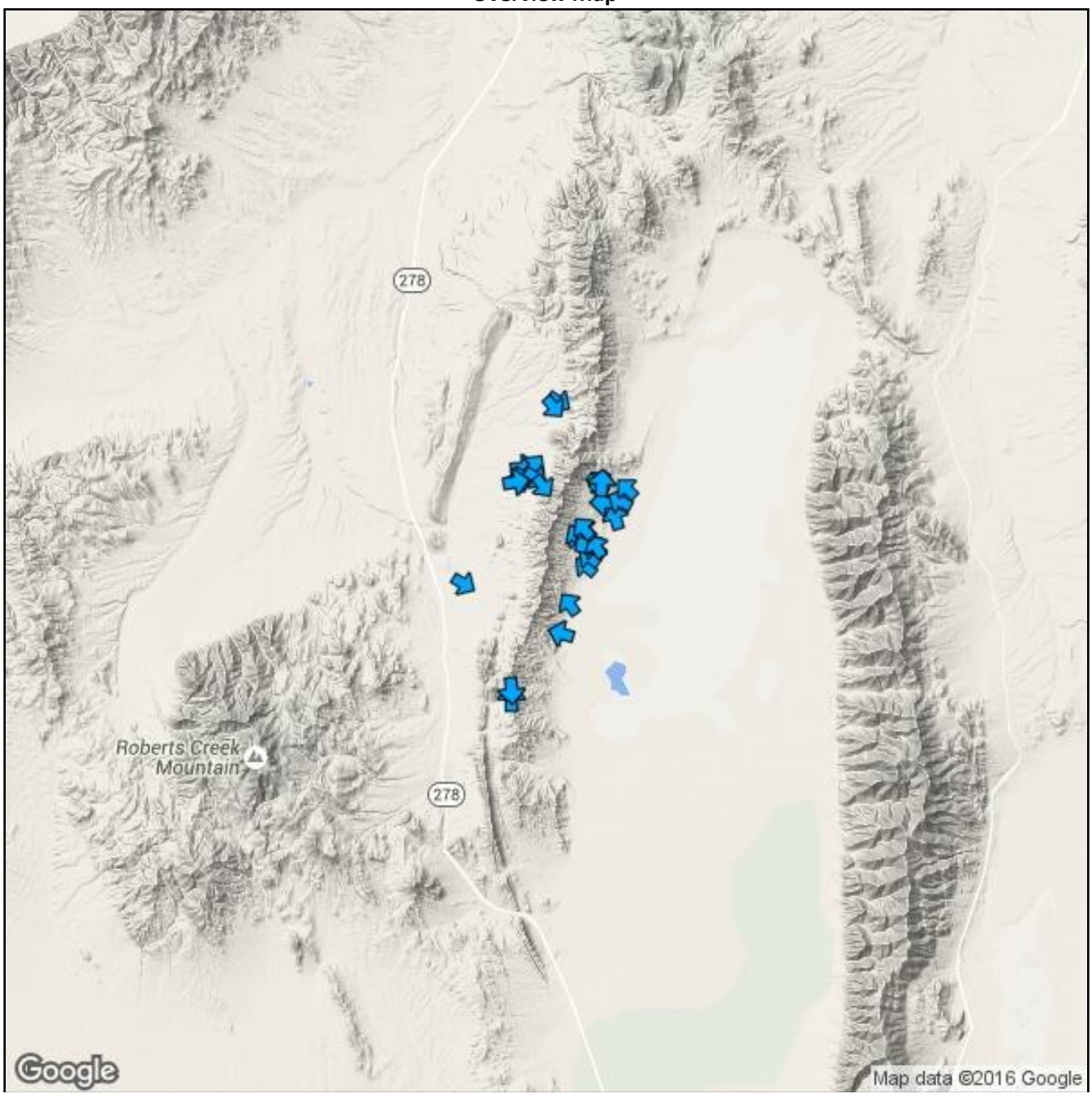
Description:
The wildness, remoteness, and natural integrity of this unit provide unparalleled opportunities for studies in natural history, geology, and ecology. The limestone ridges of the unit provide outstanding examples of sedimentary geological structures. The limestone and volcanic contact zones within the unit provide rockhounds with the opportunity to study the mineral assemblages and associated mineral intrusions.

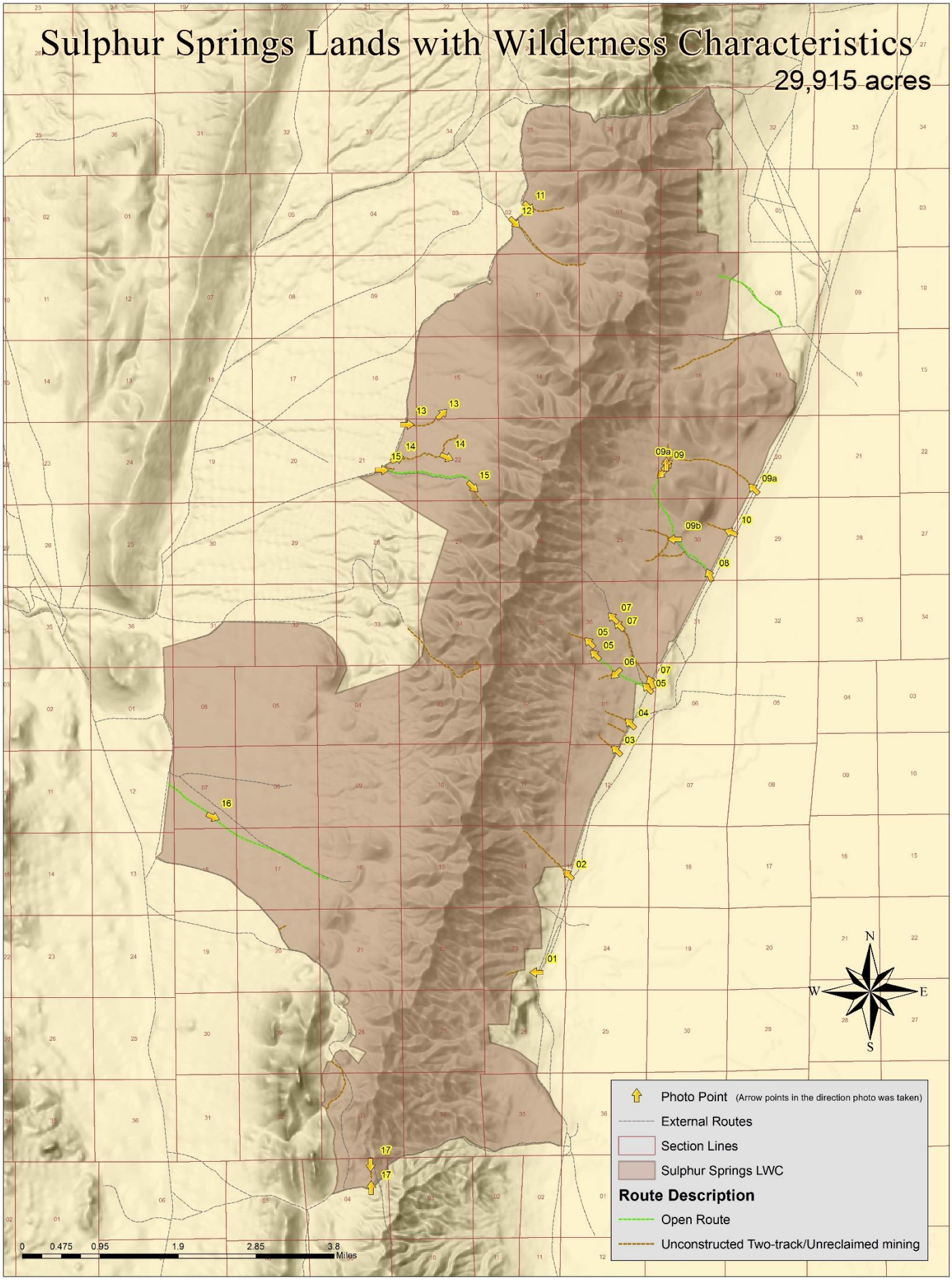
Sulphur Springs

Wilderness Characteristics Inventory

Appendix C: Route Analysis (RA)

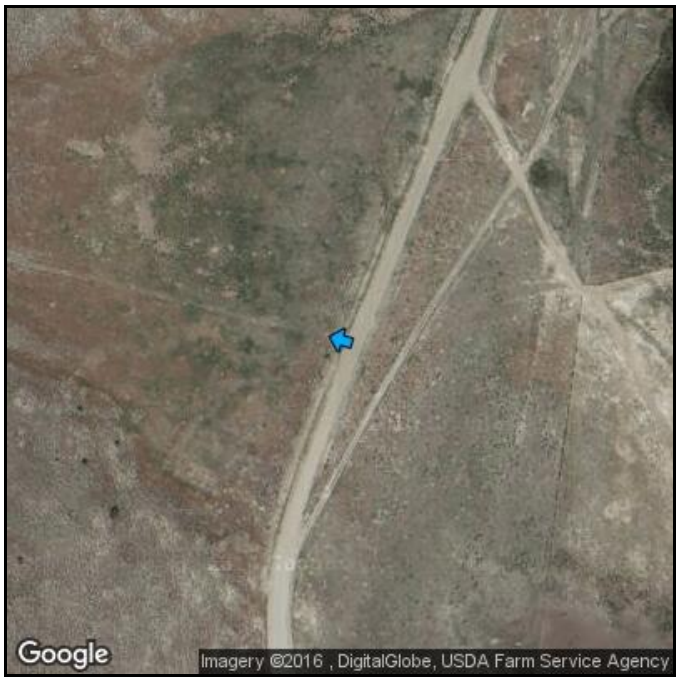
Overview Map




Sulphur Springs Lands with Wilderness Characteristics
29,915 acres
11
12
13
13
14
14
15
15
09a
09
09a
09b
10
08
07
07
05
05
06
07
05
04
03
16
02
01
17
17
N
W
E
S
0
0.475
0.95
1.9
2.85
3.8
Miles
Photo Point (Arrow points in the direction photo was taken)
External Routes
Section Lines
Sulphur Springs LWC
Route Description
Open Route
Unconstructed Two-track/Unreclaimed mining

Sulphur Spring RA: 01

Origin



Sulphur Spring RA: 01	
Sulphur Spring RA	01
Route Reference	Origin
Detail	The heaviest use on this route turns south to create the boundary of the unit. A very minor, undeveloped route branches off and enters to the unit les than 1/4 mile- that route should be closed and rehabed.
File Name	GeoJot+ 2015-10-13 13_53_09.jpg
Title	
Latitude	N 39° 56' 32"
Longitude	W 116° 04' 34"
Map Datum	WGS-84
Time Stamp	2:52:50 PM
Date Stamp	10/13/2015
Elevation	5663 ft
Photo Direction	286° WNW
Photo Direction	W
II Route Context-Historic	Unknown
II Route Context-Contemporary	Unknown
III Evidence of Const/Improve	Inconclusive
III A1 Construction	Bladed?
III A2 Improvements	None
III B Evidence of Maintenance	None
III Regular and Continuous Use	Yes
Use- Vehicular	Medium
Use- ATV/MC	Medium
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	Did not follow route to the terminus

Sulphur Spring RA: 02

Origin

Sulphur Spring RA: 02	
Sulphur Spring RA	02
Route Reference	Origin
Detail	Revegetated
File Name	GeoJot+ 2015-10-13 13_58_50.jpg
Title	
Latitude	N 39° 57' 34"
Longitude	W 116° 04' 07"
Map Datum	WGS-84
Time Stamp	2:58:30 PM
Date Stamp	10/13/2015
Elevation	5764 ft
Photo Direction	324° NW
Photo Direction	W
II Route Context-Historic	Unknown
II Route Context-Contemporary	Unknown
III Evidence of Const/Improve	None
III A1 Construction	None
III A2 Improvements	None
III B Evidence of Maintenance	None
III Regular and Continuous Use	No
Use- Vehicular	Rare
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	Rehabilitation/Naturalize the Route

Sulphur Spring RA: 03

Origin

Sulphur Spring RA: 03	
Sulphur Spring RA	03
Route Reference	Origin
Detail	
File Name	GeoJot+ 2015-10-13 14_03_51.jpg
Title	
Latitude	N 39° 58' 52"
Longitude	W 116° 03' 26"
Map Datum	WGS-84
Time Stamp	3:03:32 PM
Date Stamp	10/13/2015
Elevation	5764 ft
Photo Direction	310° NW
Photo Direction	W
II Route Context-Historic	Unknown
II Route Context-Contemporary	Unknown
III Evidence of Const/Improve	None
III A1 Construction	None
III A2 Improvements	None
III B Evidence of Maintenance	None
III Regular and Continuous Use	No
Use- Vehicular	
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	Did not follow route to the terminus

Sulphur Spring RA: 04

Origin

Sulphur Spring RA: 04	
Sulphur Spring RA	04
Route Reference	Origin
Detail	Revegetated
File Name	GeoJot+ 2015-10-13 14_07_07.jpg
Title	
Latitude	N 39° 59' 09"
Longitude	W 116° 03' 14"
Map Datum	WGS-84
Time Stamp	3:06:48 PM
Date Stamp	10/13/2015
Elevation	5797 ft
Photo Direction	307° NW
Photo Direction	W
II Route Context-Historic	Unknown
II Route Context-Contemporary	Unknown
III Evidence of Const/Improve	None
III A1 Construction	None
III A2 Improvements	None
III B Evidence of Maintenance	None
III Regular and Continuous Use	No
Use- Vehicular	Rare
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	Did not follow route to the terminus

Sulphur Spring RA: 05

Origin

Sulphur Spring RA: 05	
Sulphur Spring RA	05
Route Reference	Origin
Detail	
File Name	GeoJot+ 2015-10-13 14_10_13.jpg
Title	
Latitude	N 39° 59' 32"
Longitude	W 116° 02' 59"
Map Datum	WGS-84
Time Stamp	3:09:54 PM
Date Stamp	10/13/2015
Elevation	5843 ft
Photo Direction	304° NW
Photo Direction	W
II Route Context-Historic	Unknown
II Route Context-Contemporary	Unknown
III Evidence of Const/Improve	Inconclusive
III A1 Construction	Bladed?
III A2 Improvements	None
III B Evidence of Maintenance	None
III Regular and Continuous Use	Yes
Use- Vehicular	Medium
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	N/A

Sulphur Spring RA: 05
Route Detail
GeoJot+ 2015-10-13 14_19_28.jpg
N 39° 59' 53"
W 116° 03' 42"
317° NW
3:19:09 PM
10/13/2015

Google
Imagery ©2016 , DigitalGlobe, USDA Farm Service Agency

Google
Map data ©2016 Google

Sulphur Spring RA: 05	
Sulphur Spring RA	05
Route Reference	Route Detail
Detail	Trees encroaching on route- not suitable for vehicles beyond this point
File Name	GeoJot+ 2015-10-13 14_19_28.jpg
Title	
Latitude	N 39° 59' 53"
Longitude	W 116° 03' 42"
Map Datum	WGS-84
Time Stamp	3:19:09 PM
Date Stamp	10/13/2015
Elevation	6148 ft
Photo Direction	317° NW
Photo Direction	NW
II Route Context-Historic	Unknown
II Route Context-Contemporary	Unknown
III Evidence of Const/Improve	None
III A1 Construction	None
III A2 Improvements	None
III B Evidence of Maintenance	None
III Regular and Continuous Use	Yes
Use- Vehicular	Low
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	Rehab/Revegetate route beyond this point

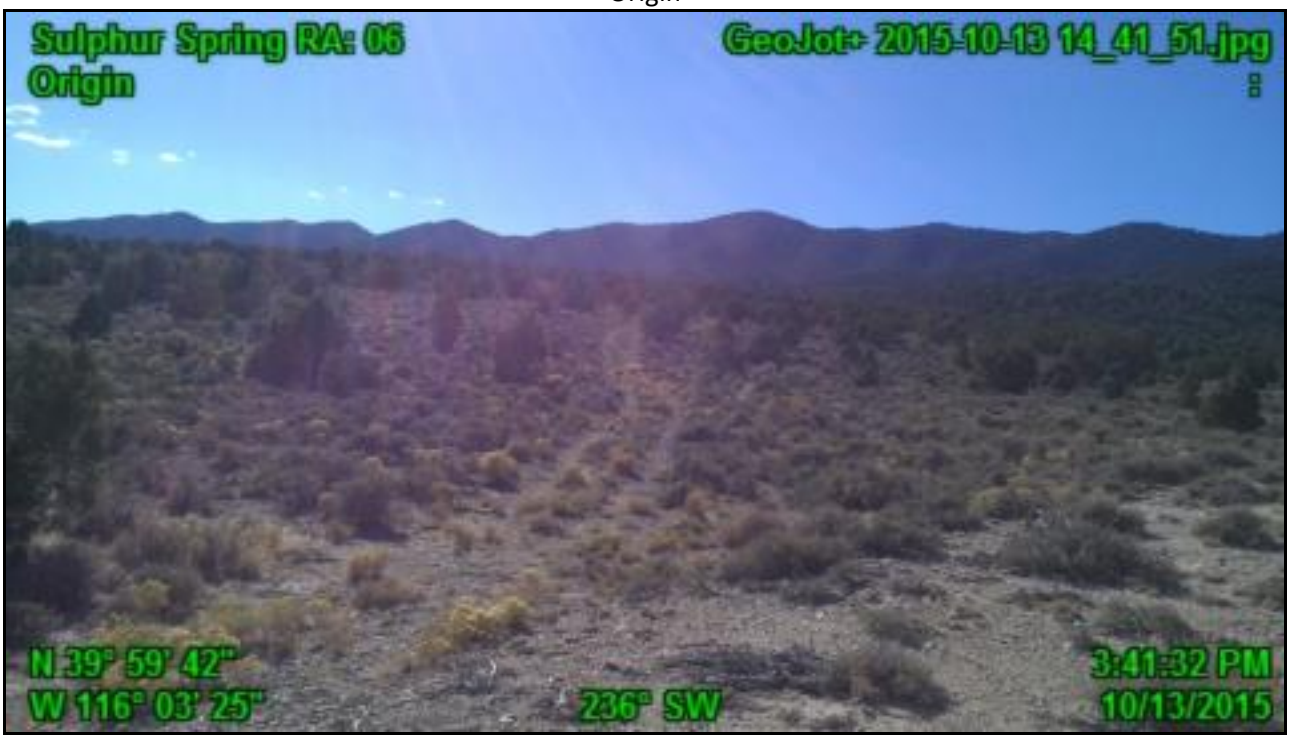
Sulphur Spring RA: 05

Route Detail

Sulphur Spring RA: 05	
Sulphur Spring RA	05
Route Reference	Route Detail
Detail	
File Name	GeoJot+ 2015-10-13 14_25_48.jpg
Title	
Latitude	N 40° 00' 01"
Longitude	W 116° 03' 47"
Map Datum	WGS-84
Time Stamp	3:25:29 PM
Date Stamp	10/13/2015
Elevation	6270 ft
Photo Direction	326° NW
Photo Direction	NW
II Route Context-Historic	Wood Cutting
II Route Context-Contemporary	Recreation
III Evidence of Const/Improve	None
III A1 Construction	None
III A2 Improvements	None
III B Evidence of Maintenance	None
III Regular and Continuous Use	No
Use- Vehicular	Rare virtually no use beyond this point
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	Did not follow route to the terminus

Sulphur Spring RA: 06

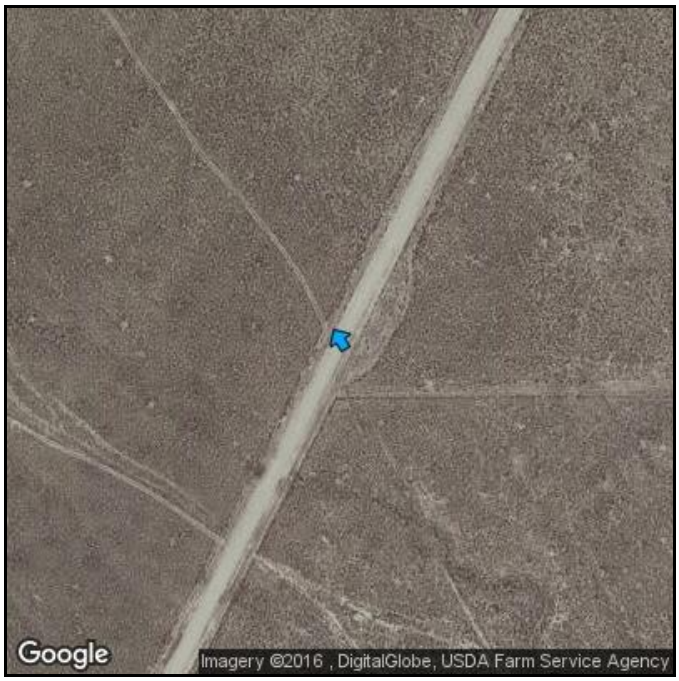
Origin



Sulphur Spring RA: 06	
Sulphur Spring RA	06
Route Reference	Origin
Detail	Revegetated
File Name	GeoJot+ 2015-10-13 14_41_51.jpg
Title	
Latitude	N 39° 59' 42"
Longitude	W 116° 03' 25"
Map Datum	WGS-84
Time Stamp	3:41:32 PM
Date Stamp	10/13/2015
Elevation	6060 ft
Photo Direction	236° SW
Photo Direction	SW
II Route Context-Historic	Unknown
II Route Context-Contemporary	Unknown
III Evidence of Const/Improve	None
III A1 Construction	None
III A2 Improvements	None
III B Evidence of Maintenance	None
III Regular and Continuous Use	No
Use- Vehicular	
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	Rehabilitation/Naturalize the Route

Sulphur Spring RA: 07

Origin



Sulphur Spring RA: 07	
Sulphur Spring RA	07
Route Reference	Origin
Detail	Route has no known purpose
File Name	GeoJot+ 2015-10-13 14_48_08.jpg
Title	
Latitude	N 39° 59' 35"
Longitude	W 116° 02' 57"
Map Datum	WGS-84
Time Stamp	3:47:49 PM
Date Stamp	10/13/2015
Elevation	5823 ft
Photo Direction	329° NNW
Photo Direction	NW
II Route Context-Historic	Unknown
II Route Context-Contemporary	Unknown
III Evidence of Const/Improve	None
III A1 Construction	None
III A2 Improvements	None
III B Evidence of Maintenance	None
III Regular and Continuous Use	Yes
Use- Vehicular	Low
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	N/A

Sulpher Spring RA: 07

Route Detail

Sulphur Spring RA: 07	
Sulpher Spring RA	07
Route Reference	Route Detail
Detail	Trees encroaching on route- not suitable for vehicles beyond this point
File Name	GeoJot+ 2015-10-13 14_56_08.jpg
Title	
Latitude	N 40° 00' 12"
Longitude	W 116° 03' 23"
Map Datum	WGS-84
Time Stamp	3:55:49 PM
Date Stamp	10/13/2015
Elevation	6053 ft
Photo Direction	316° NW
Photo Direction	NW
II Route Context-Historic	Unknown
II Route Context-Contemporary	Unknown
III Evidence of Const/Improve	None
III A1 Construction	None
III A2 Improvements	None
III B Evidence of Maintenance	None
III Regular and Continuous Use	No
Use- Vehicular	Rare
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	N/A

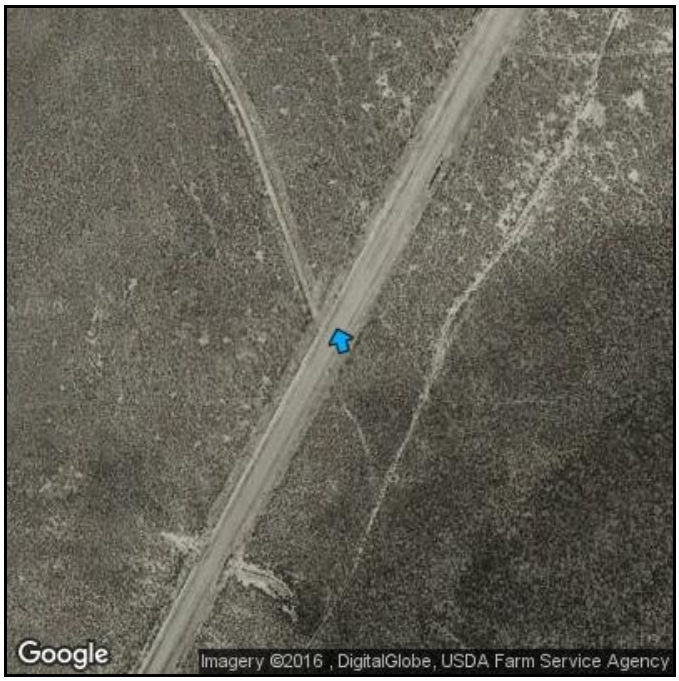
Sulpher Spring RA: 07

Route Detail

Sulphur Spring RA: 07	
Sulpher Spring RA	07
Route Reference	Route Detail
Detail	Washout
File Name	GeoJot+ 2015-10-13 15_01_48.jpg
Title	
Latitude	N 40° 00' 17"
Longitude	W 116° 03' 27"
Map Datum	WGS-84
Time Stamp	4:01:28 PM
Date Stamp	10/13/2015
Elevation	6040 ft
Photo Direction	321° NW
Photo Direction	NW
II Route Context-Historic	Unknown
II Route Context-Contemporary	Unknown
III Evidence of Const/Improve	None
III A1 Construction	None
III A2 Improvements	None
III B Evidence of Maintenance	None
III Regular and Continuous Use	No
Use- Vehicular	
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	Rehabilitation/Naturalize the Route

Sulpher Spring RA: 09

Origin [ERROR: mislabeled 08]



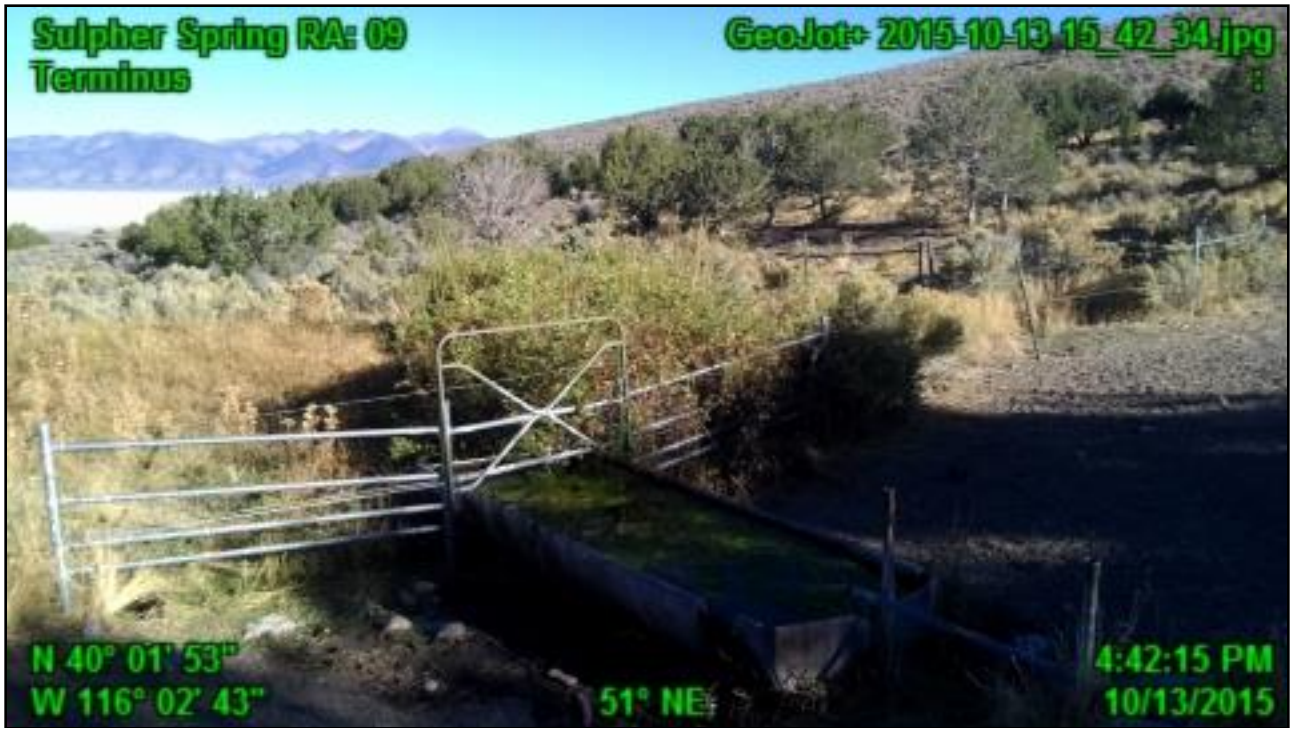
Sulphur Spring RA: 09	
Sulpher Spring RA	09
Route Reference	Origin [ERROR: mislabeled 08]
Detail	
File Name	GeoJot+ 2015-10-13 15_18_04.jpg
Title	
Latitude	N 40° 00' 43"
Longitude	W 116° 02' 08"
Map Datum	WGS-84
Time Stamp	4:17:44 PM
Date Stamp	10/13/2015
Elevation	5709 ft
Photo Direction	343° NNW
Photo Direction	NW
II Route Context-Historic	Access to Spring
II Route Context-Contemporary	Access to Spring
III Evidence of Const/Improve	Inconclusive
III A1 Construction	Bladed?
III A2 Improvements	None
III B Evidence of Maintenance	None
III Regular and Continuous Use	Yes
Use- Vehicular	Medium
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	N/A

Stock Feeding :

Stock feeding	
File Name	GeoJot+ 2015-10-13 15_38_04.jpg
Title	
Latitude	N 40° 01' 49"
Longitude	W 116° 02' 46"
Map Datum	WGS-84
Time Stamp	4:37:45 PM
Date Stamp	10/13/2015
Elevation	6230 ft
Photo Direction	124° ESE
Sign Type	
Possible Stewardship	
Notes	Not recently used
Fence Purpose	
Feature	Stock feeding

Sulpher Spring RA: 09

Terminus



Sulphur Spring RA: 09	
Sulpher Spring RA	09
Route Reference	Terminus
Detail	Water development
File Name	GeoJot+ 2015-10-13 15_42_34.jpg
Title	
Latitude	N 40° 01' 53"
Longitude	W 116° 02' 43"
Map Datum	WGS-84
Time Stamp	4:42:15 PM
Date Stamp	10/13/2015
Elevation	6243 ft
Photo Direction	51° NE
Photo Direction	E
II Route Context-Historic	Unknown
II Route Context-Contemporary	Access to Spring
III Evidence of Const/Improve	None
III A1 Construction	None
III A2 Improvements	None
III B Evidence of Maintenance	Vegetation Cutting
III Regular and Continuous Use	Yes
Use- Vehicular	Rare
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	N/A

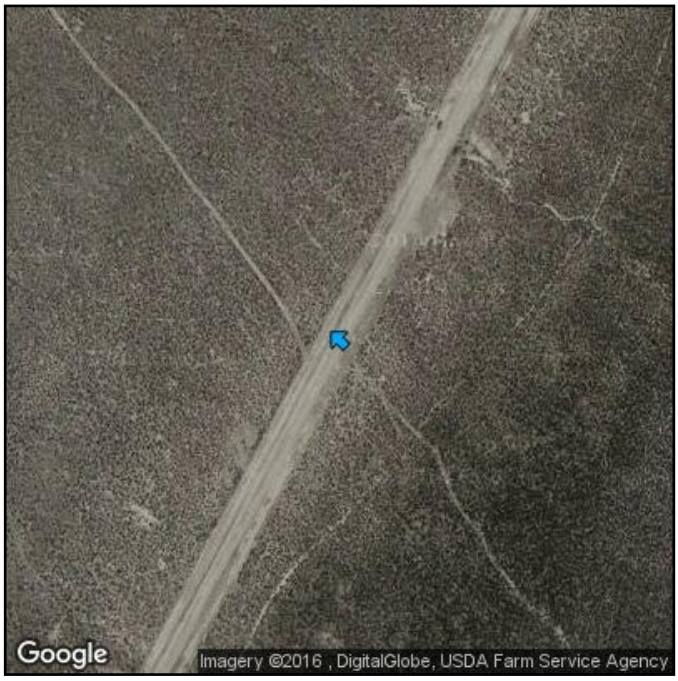
Sulpher Spring RA: 09b

Origin

Sulphur Spring RA: 09b	
Sulpher Spring RA	09b
Route Reference	Origin
Detail	Rehab/Naturalize
File Name	GeoJot+ 2015-10-13 15_23_32.jpg
Title	
Latitude	N 40° 01' 07"
Longitude	W 116° 02' 36"
Map Datum	WGS-84
Time Stamp	4:23:13 PM
Date Stamp	10/13/2015
Elevation	5945 ft
Photo Direction	270° W
Photo Direction	W
II Route Context-Historic	Unknown
II Route Context-Contemporary	No known purpose
III Evidence of Const/Improve	None
III A1 Construction	None
III A2 Improvements	None
III B Evidence of Maintenance	None
III Regular and Continuous Use	No
Use- Vehicular	Rare
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	Did not follow route to the terminus

Sulpher Spring RA: 09a

Origin



Sulpher Spring RA: 09a	
Sulpher Spring RA	09a
Route Reference	Origin
Detail	Rocky/Rough
File Name	GeoJot+ 2015-10-13 16_12_17.jpg
Title	
Latitude	N 40° 01' 38"
Longitude	W 116° 01' 30"
Map Datum	WGS-84
Time Stamp	5:11:57 PM
Date Stamp	10/13/2015
Elevation	5719 ft
Photo Direction	314° NW
Photo Direction	NW
II Route Context-Historic	former Access to spring
II Route Context-Contemporary	No longer accesses the spring
III Evidence of Const/Improve	None
III A1 Construction	None
III A2 Improvements	None
III B Evidence of Maintenance	None
III Regular and Continuous Use	No
Use- Vehicular	Rare
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	Rehabilitation/Naturalize the Route close this north access and use south access for spring

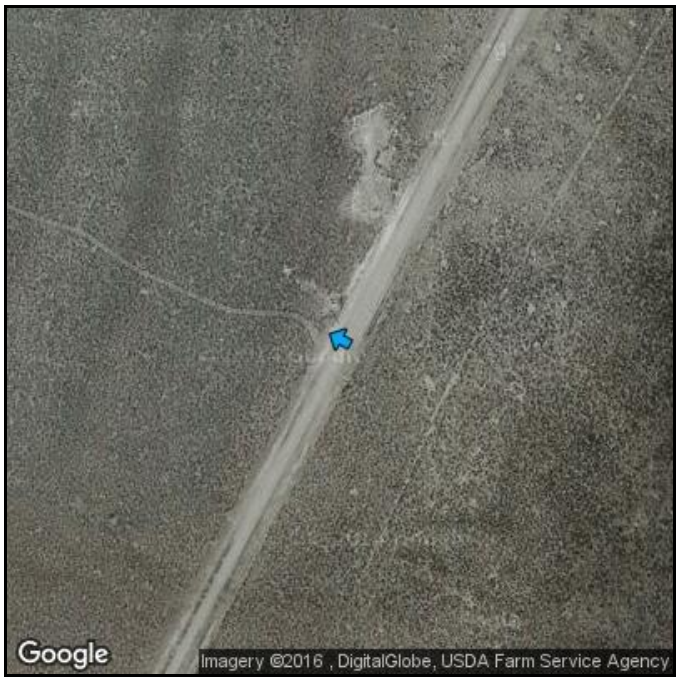
Sulpher Spring RA: 09a

Terminus

Sulphur Spring RA: 09a	
Sulpher Spring RA	09a
Route Reference	Terminus
Detail	Revegetated
File Name	GeoJot+ 2015-10-13 15_44_51.jpg
Title	
Latitude	N 40° 01' 54"
Longitude	W 116° 02' 43"
Map Datum	WGS-84
Time Stamp	4:44:32 PM
Date Stamp	10/13/2015
Elevation	6201 ft
Photo Direction	4° N
Photo Direction	N
II Route Context-Historic	Former Access to spring
II Route Context-Contemporary	Unknown
III Evidence of Const/Improve	None
III A1 Construction	None
III A2 Improvements	None
III B Evidence of Maintenance	None
III Regular and Continuous Use	No
Use- Vehicular	Rare
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	Rehabilitation/Naturalize the Route beyond this point

Sulpher Spring RA: 10

Origin



Sulpher Spring RA: 10	
Sulpher Spring RA	10
Route Reference	Origin
Detail	
File Name	GeoJot+ 2015-10-13 16_08_52.jpg
Title	
Latitude	N 40° 01' 10"
Longitude	W 116° 01' 49"
Map Datum	WGS-84
Time Stamp	5:08:32 PM
Date Stamp	10/13/2015
Elevation	5741 ft
Photo Direction	298° WNW
Photo Direction	W
II Route Context-Historic	Unknown
II Route Context-Contemporary	Unknown
III Evidence of Const/Improve	None
III A1 Construction	None
III A2 Improvements	None
III B Evidence of Maintenance	None
III Regular and Continuous Use	No
Use- Vehicular	Rare
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	Did not follow route to the terminus

Sulphur Spring RA: 11

Origin

Sulpher Spring RA: 11	
Sulphur Spring RA	11
Route Reference	Origin
Detail	Revegetated
File Name	GeoJot+ 2015-10-14 08_11_48.jpg
Title	
Latitude	N 40° 04' 39"
Longitude	W 116° 04' 35"
Map Datum	WGS-84
Time Stamp	9:11:30 AM
Date Stamp	10/14/2015
Elevation	6640 ft
Photo Direction	124° SE
Photo Direction	E
II Route Context-Historic	Unknown
II Route Context-Contemporary	No Known Purpose
III Evidence of Const/Improve	None
III A1 Construction	None
III A2 Improvements	None
III B Evidence of Maintenance	None
III Regular and Continuous Use	No
Use- Vehicular	
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	Rehabilitation/Naturalize the Route

Sulphur Spring RA: 12

Origin

Sulpher Spring RA: 12	
Sulphur Spring RA	12
Route Reference	Origin
Detail	Revegetated
File Name	GeoJot+ 2015-10-14 08_15_06.jpg
Title	
Latitude	N 40° 04' 30"
Longitude	W 116° 04' 47"
Map Datum	WGS-84
Time Stamp	9:14:47 AM
Date Stamp	10/14/2015
Elevation	6608 ft
Photo Direction	139° SE
Photo Direction	E
II Route Context-Historic	Unknown
II Route Context-Contemporary	No Known Purpose
III Evidence of Const/Improve	None
III A1 Construction	None
III A2 Improvements	None
III B Evidence of Maintenance	None
III Regular and Continuous Use	No
Use- Vehicular	
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	Rehabilitation/Naturalize the Route

Sulphur Spring RA: 13

Origin

Sulpher Spring RA: 13	
Sulphur Spring RA	13
Route Reference	Origin
Detail	
File Name	GeoJot+ 2015-10-14 08_34_37.jpg
Title	
Latitude	N 40° 02' 21"
Longitude	W 116° 06' 18"
Map Datum	WGS-84
Time Stamp	9:34:18 AM
Date Stamp	10/14/2015
Elevation	6467 ft
Photo Direction	86° E
Photo Direction	E
II Route Context-Historic	Unknown
II Route Context-Contemporary	Post-fire; Harvesting burnt wood
III Evidence of Const/Improve	None
III A1 Construction	None
III A2 Improvements	None
III B Evidence of Maintenance	None
III Regular and Continuous Use	Yes
Use- Vehicular	Low
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	Rehab/Naturalize Route

Sulphur Spring RA: 13

Terminus

Sulpher Spring RA: 13	
Sulphur Spring RA	13
Route Reference	Terminus
Detail	Wood Cutting
File Name	GeoJot+ 2015-10-14 08_40_11.jpg
Title	
Latitude	N 40° 02' 27"
Longitude	W 116° 05' 49"
Map Datum	WGS-84
Time Stamp	9:39:53 AM
Date Stamp	10/14/2015
Elevation	6627 ft
Photo Direction	37° NE
Photo Direction	NE
II Route Context-Historic	None
II Route Context-Contemporary	Wood Cutting
III Evidence of Const/Improve	None
III A1 Construction	None
III A2 Improvements	None
III B Evidence of Maintenance	None
III Regular and Continuous Use	No
Use- Vehicular	Rare
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	Rehabilitation/Naturalize the Route route relatively new to salvage burnt. Trees.

Sulphur Spring RA: 14

Origin

Sulpher Spring RA: 14	
Sulphur Spring RA	14
Route Reference	Origin
Detail	
File Name	GeoJot+ 2015-10-14 08_53_05.jpg
Title	
Latitude	N 40° 01' 59"
Longitude	W 116° 06' 26"
Map Datum	WGS-84
Time Stamp	9:52:46 AM
Date Stamp	10/14/2015
Elevation	6473 ft
Photo Direction	73° ENE
Photo Direction	E
II Route Context-Historic	None
II Route Context-Contemporary	burnt tree salvage
III Evidence of Const/Improve	None
III A1 Construction	None
III A2 Improvements	None
III B Evidence of Maintenance	None
III Regular and Continuous Use	No
Use- Vehicular	Low
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	Rehab/Naturalize Route

Sulphur Spring RA: 14

Terminus atv only beyond this point

Sulpher Spring RA: 14	
Sulphur Spring RA	14
Route Reference	Terminus atv only beyond this point
Detail	
File Name	GeoJot+ 2015-10-14 08_59_58.jpg
Title	
Latitude	N 40° 02' 01"
Longitude	W 116° 05' 45"
Map Datum	WGS-84
Time Stamp	9:59:40 AM
Date Stamp	10/14/2015
Elevation	6686 ft
Photo Direction	121° ESE
Photo Direction	SE
II Route Context-Historic	None
II Route Context-Contemporary	Wood Cutting salvage, post fire
III Evidence of Const/Improve	None
III A1 Construction	None
III A2 Improvements	None
III B Evidence of Maintenance	None
III Regular and Continuous Use	No
Use- Vehicular	Rare
Use- ATV/MC	Rare
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	Rehabilitation/Naturalize the Route

Sulphur Spring RA: 15

Origin

Sulpher Spring RA: 15	
Sulphur Spring RA	15
Route Reference	Origin
Detail	
File Name	GeoJot+ 2015-10-14 09_14_39.jpg
Title	
Latitude	N 40° 01' 53"
Longitude	W 116° 06' 39"
Map Datum	WGS-84
Time Stamp	10:14:20 AM
Date Stamp	10/14/2015
Elevation	6463 ft
Photo Direction	80° E
Photo Direction	E
II Route Context-Historic	Unknown
II Route Context-Contemporary	Access to canyon
III Evidence of Const/Improve	None
III A1 Construction	Inconclusive
III A2 Improvements	None
III B Evidence of Maintenance	None
III Regular and Continuous Use	Yes
Use- Vehicular	Medium
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	N/A

Sulpher Spring RA: 15

Route Detail

Sulpher Spring RA: 15	
Sulpher Spring RA	15
Route Reference	Route Detail
Detail	Not suitible for vehicles beyond this point
File Name	GeoJot+ 2015-10-14 09_26_43.jpg
Title	
Latitude	N 40° 01' 42"
Longitude	W 116° 05' 24"
Map Datum	WGS-84
Time Stamp	10:26:25 AM
Date Stamp	10/14/2015
Elevation	6821 ft
Photo Direction	142° SE
Photo Direction	SE
II Route Context-Historic	Unknown
II Route Context-Contemporary	Access to Canyon
III Evidence of Const/Improve	None
III A1 Construction	None at this point
III A2 Improvements	None
III B Evidence of Maintenance	Vegetation Cutting to this point
III Regular and Continuous Use	None beyond this point
Use- Vehicular	Rare beyond this point
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	Did not follow route to the terminus

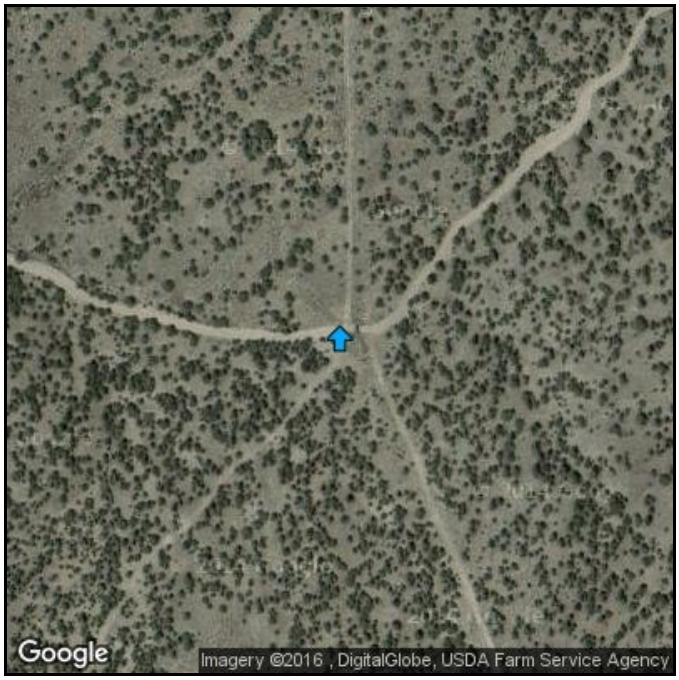
Sulpher Spring RA: 16

Route Detail

Sulpher Spring RA: 16	
Sulpher Spring RA	16
Route Reference	Route Detail
Detail	
File Name	GeoJot+ 2015-10-14 10_43_49.jpg
Title	
Latitude	N 39° 58' 13"
Longitude	W 116° 09' 02"
Map Datum	WGS-84
Time Stamp	11:43:30 AM
Date Stamp	10/14/2015
Elevation	6076 ft
Photo Direction	121° ESE
Photo Direction	SE
I Route Context-Historical	Historic Mining Access
II Route Context-Contemporary	Unknown
III Evidence of Const/Improve	Yes
III A1 Construction	Bladed?
III A2 Improvements	None
III B Evidence of Maintenance	By Machine. Cut vegetation swath along side route unknown purpose
III Regular and Continuous Use	No
Use- Vehicular	Rare
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	N/A

Sulphur Spring RA: 17

Origin



Sulpher Spring RA: 17	
Sulphur Spring RA	17
Route Reference	Origin
Detail	FenceLine route
File Name	GeoJot+ 2015-10-14 12_57_03.jpg
Title	
Latitude	N 39° 54' 16"
Longitude	W 116° 06' 53"
Map Datum	WGS-84
Time Stamp	1:56:44 PM
Date Stamp	10/14/2015
Elevation	6759 ft
Photo Direction	359° N
Photo Direction	N
II Route Context-Historic	Unknown
II Route Context-Contemporary	Fenceline route
III Evidence of Const/Improve	None
III A1 Construction	None
III A2 Improvements	None
III B Evidence of Maintenance	None
III Regular and Continuous Use	Yes
Use- Vehicular	Low
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	Rehabilitation/Naturalize the Route. Route serves no purpose. Route ends abrupt;y with no area to turn around on a very steep slope.

Sulphur Spring RA: 17

Terminus

Sulpher Spring RA: 17	
Sulphur Spring RA	17
Route Reference	Terminus
Detail	
File Name	GeoJot+ 2015-10-14 13_02_58.jpg
Title	
Latitude	N 39° 54' 32"
Longitude	W 116° 06' 53"
Map Datum	WGS-84
Time Stamp	2:02:39 PM
Date Stamp	10/14/2015
Elevation	6834 ft
Photo Direction	176° S
Photo Direction	S
II Route Context-Historic	None
II Route Context-Contemporary	Fenceline route
III Evidence of Const/Improve	None
III A1 Construction	None
III A2 Improvements	None
III B Evidence of Maintenance	None
III Regular and Continuous Use	Yes
Use- Vehicular	Low
Use- ATV/MC	
Use- Mountain Bike	
Use Stock/Wildlife	
Recommendations/Comments	Rehabilitation/Naturalize the Route. Route ends abruptly, serves no purpose. It is only driven because it has been driven before.

From: Hite, Christopher
To: mike.mcgrady1@wyo.gov
Subject: Requested information on Feb 7 federal oil and gas lease sale
Date: Friday, February 10, 2017 10:04:24 AM
Attachments: Feb 17 Wyoming Competitive Statistics.docx
SALE RESULTS Feb 2017.pdf
Sale Notice.pdf
02notice1.pdf
02notice2.pdf
02notice3.pdf
02notice4.pdf

Good morning. Mary Jo Rugwell, State Director for BLM Wyoming, has requested that I forward your the attached statistics relating to our February 7 federal oil and gas lease sale. Please let me know if you have any followup questions, or if you required additional information.

- Chris

--

Chris Hite

Chief, Branch of Fluid Minerals Adjudication (923)

BLM Wyoming State Office

P.O. Box 1828 (5353 Yellowstone Road)

Cheyenne, Wyoming 82003

chite@blm.gov 307.775.6176

Feb-17 *Wyoming Competitive Statistics*

Parcels Offered	285
Parcels Sold	278
% Parcels Sold	97.54%
Acres Offered	184,792.900
Acres Sold	183,155.020
% Acres Sold	99.11%
Average Bid/Acre	
For Acres Offered	$697.96
For Acres Sold	$704.20
Average Bid/Parcel	
For Parcels Offered	$452,555.95
For Parcels Sold	$463,951.24
Highest Bid/Acre	$16,500.00
Parcel with High	161
Highest Bid/Parcel	$18,144,000.00
Parcel with High Total Bid	127
Total Bonus Bid	$128,978,446.00
Total Rental Due	$274,912.50
Total Admin. Fees Due ($160/Lease)	$44,480.00
Total Receipts Due	$129,297,838.50

Highest Bid/Acre ***Parcel*** 161

PEAK POWDER RIVER RES LLC
1910 MAIN AVE
DURANGO, CO 813015038

Highest Bid/Parcel ***Parcel*** 127

NAVIGATION POWDER RIVER LLC
8504 KATY FREEWAY STE 419
HOUSTON, TX 77024

United States Department of the Interior
Bureau of Land Management
Wyoming State Office

Competitive Oil and Gas Lease Sale Results

Date of Sale: **February 7, 2017**

February 7, 2017 Sale Results

SERIAL	PAR	NAME	ADDRESS	CITY	ST	ZIP	Bid/Acre	ACRES	Total Bonus
WYW185674	1	PROVIDENCE OIL DEVELOPMENT LLC	102 N ELM ST	HENDERSON	KY	42420	$4.00	319.920	$1,280.00
WYW185675	2	ROBERT A SCHALLA	PO BOX 1473	BILLINGS	MT	59103	$7.00	160.000	$1,120.00
WYW185676	3	ROBERT A SCHALLA	PO BOX 1473	BILLINGS	MT	59103	$11.00	80.000	$880.00
WYW185677	4	KIRKWOOD OIL & GAS LLC	PO BOX 2850	CASPER	WY	826022850	$2.00	80.000	$160.00
WYW185678	5	TRUJILLO ANN M	PO BOX 1252	CHEYENNE	WY	820031252	$170.00	1,280.880	$217,770.00
WYW185679	6	TRUJILLO ANN M	PO BOX 1252	CHEYENNE	WY	820031252	$27.00	160.000	$4,320.00
WYW185680	7	FINLEY RESOURCES INC	1308 LAKE STREET	FORT WORTH	TX	76102	$220.00	484.790	$106,700.00
WYW185681	8	KIRKWOOD OIL & GAS LLC	PO BOX 2850	CASPER	WY	826022850	$15.00	362.700	$5,445.00
WYW185682	9	RIDGE ENERGY PARTNERS LLC	325 WERNER CT STE 325	CASPER	WY	826011303	$85.00	160.000	$13,600.00
WYW185683	10	PINE HAVEN RESOURCES LLC	4790 TABLE MESA DR STE 202	BOULDER	CO	80305	$6.00	480.000	$2,880.00
WYW185684	11	GEOSPECTRUM INC	214 W TEXAS AVE STE 1000	MIDLAND	TX	797014609	$8.00	245.790	$1,968.00
WYW185685	12	GEOSPECTRUM INC	214 W TEXAS AVE STE 1000	MIDLAND	TX	797014609	$16.00	124.200	$2,000.00
WYW185686	13	GEOSPECTRUM INC	214 W TEXAS AVE STE 1000	MIDLAND	TX	797014609	$12.00	82.030	$996.00
WYW185687	14	GEOSPECTRUM INC	214 W TEXAS AVE STE 1000	MIDLAND	TX	797014609	$6.00	37.990	$228.00
WYW185688	15	RIDGE ENERGY PARTNERS LLC	325 WERNER CT STE 325	CASPER	WY	826011303	$55.00	203.070	$11,220.00
WYW185689	16	RIDGE ENERGY PARTNERS LLC	325 WERNER CT STE 325	CASPER	WY	826011303	$110.00	1,247.190	$137,280.00
WYW185690	17	RIDGE ENERGY PARTNERS LLC	325 WERNER CT STE 325	CASPER	WY	826011303	$30.00	163.350	$4,920.00
WYW185691	18	RIDGE ENERGY PARTNERS LLC	325 WERNER CT STE 325	CASPER	WY	826011303	$30.00	2,006.340	$60,210.00
WYW185692	19	RIDGE ENERGY PARTNERS LLC	325 WERNER CT STE 325	CASPER	WY	826011303	$40.00	1,246.740	$49,880.00
WYW185693	20	RIDGE ENERGY PARTNERS LLC	325 WERNER CT STE 325	CASPER	WY	826011303	$30.00	1,513.290	$45,420.00
WYW185694	21	BMR MONTANA LLC	PO BOX 1706	LONGVIEW	TX	75606	$35.00	76.210	$2,695.00
WYW185695	22	BMR MONTANA LLC	PO BOX 1706	LONGVIEW	TX	75606	$240.00	81.410	$19,680.00
WYW185696	23	BMR MONTANA LLC	PO BOX 1706	LONGVIEW	TX	75606	$400.00	45.490	$18,400.00
WYW185697	24	CARPENTER & SONS INC	1551 THREE CROWNS DR STE 302	CASPER	WY	826043196	$22.00	230.370	$5,082.00
WYW185698	25	TRUE OIL LLC	PO BOX 2360	CASPER	WY	826022360	$230.00	844.070	$194,350.00
WYW185699	26	BMR MONTANA LLC	PO BOX 1706	LONGVIEW	TX	75606	$210.00	82.770	$17,430.00
WYW185700	27	LEON MICHAEL WILKERSON	PO BOX 344	BRIDGEPORT	TX	76426	$11.00	82.940	$913.00

February 7, 2017 Sale Results

SERIAL	PAR	NAME	ADDRESS	CITY	ST	ZIP	Bid/Acre	ACRES	Total Bonus
WYW185701	28	PINE HAVEN RESOURCES LLC	4790 TABLE MESA DR STE 202	BOULDER	CO	80305	$15.00	325.290	$4,890.00
WYW185702	29	PINE HAVEN RESOURCES LLC	4790 TABLE MESA DR STE 202	BOULDER	CO	80305	$26.00	120.320	$3,146.00
WYW185703	30	WYOTEX DRILLING VENTURES LLC	PO BOX 280969	LAKEWOOD	CO	802280969	$30.00	214.500	$6,450.00
WYW185704	31	NAVIGATION POWDER RIVER LLC	8504 KATY FREEWAY STE 419	HOUSTON	TX	77024	$180.00	1,236.810	$222,660.00
WYW185705	32	NAVIGATION POWDER RIVER LLC	8504 KATY FREEWAY STE 419	HOUSTON	TX	77024	$70.00	36.860	$2,590.00
WYW185706	33	MCL 1 OIL AND GAS WYOMING LLC	200 RIVER POINTE DR STE 260	CONROE	TX	773042817	$2,400.00	453.110	$1,089,600.00
WYW185707	34	MCL 1 OIL AND GAS WYOMING LLC	200 RIVER POINTE DR STE 260	CONROE	TX	773042817	$110.00	713.110	$78,540.00
WYW185708	35	RIDGE ENERGY PARTNERS LLC	325 WERNER CT STE 325	CASPER	WY	826011303	$150.00	162.040	$24,450.00
WYW185709	36	RC MICHAEL CO INC	1212 RAINTREE DR STE A5	FORT COLLINS	CO	80526	$110.00	75.770	$8,360.00
WYW185710	37	SHILOH EXPLORATION LLC	5470 S HOLLY ST	GREENWOOD VILLAGE	CO	801111414	$120.00	325.430	$39,120.00
WYW185711	38	PINE HAVEN RESOURCES LLC	4790 TABLE MESA DR STE 202	BOULDER	CO	80305	$13.00	576.430	$7,501.00
WYW185712	39	AZALEA OIL CO LLC	7273 LEMON GULCH WAY	CASTLE ROCK	CO	801088499	$42.00	405.040	$17,052.00
WYW185713	40	KIRKWOOD OIL & GAS LLC	PO BOX 2850	CASPER	WY	826022850	$31.00	1,130.370	$35,061.00
WYW185714	41	PINE HAVEN RESOURCES LLC	4790 TABLE MESA DR STE 202	BOULDER	CO	80305	$16.00	860.980	$13,776.00
WYW185715	42	WYOTEX DRILLING VENTURES LLC	PO BOX 280969	LAKEWOOD	CO	802280969	$60.00	796.880	$47,820.00
WYW185716	43	HANNON & ASSOCIATES INC	10217 COUNTY ROAD 120	KIOWA	CO	80117	$1,200.00	119.930	$144,000.00
WYW185717	44	MCL 1 OIL AND GAS WYOMING LLC	200 RIVER POINTE DR STE 260	CONROE	TX	773042817	$5,400.00	202.180	$1,096,200.00
WYW185718	45	MCL 1 OIL AND GAS WYOMING LLC	200 RIVER POINTE DR STE 260	CONROE	TX	773042817	$110.00	532.330	$58,630.00
WYW185719	46	KIRKWOOD OIL & GAS LLC	PO BOX 2850	CASPER	WY	826022850	$16.00	242.990	$3,888.00
WYW185720	47	PINE HAVEN RESOURCES LLC	4790 TABLE MESA DR STE 202	BOULDER	CO	80305	$6.00	445.460	$2,676.00
WYW185721	48	KIRKWOOD OIL & GAS LLC	PO BOX 2850	CASPER	WY	826022850	$60.00	487.550	$29,280.00
WYW185722	49	ANTELOPE ENERGY COMPANY LLC	1801 BROADWAY STE 1550	DENVER	CO	802023842	$75.00	281.460	$21,150.00
WYW185723	50	KIRKWOOD OIL & GAS LLC	PO BOX 2850	CASPER	WY	826022850	$65.00	121.650	$7,930.00
WYW185724	51	LEON MICHAEL WILKERSON	PO BOX 344	BRIDGEPORT	TX	76426	$65.00	82.290	$5,395.00
WYW185725	52	KIRKWOOD OIL & GAS LLC	PO BOX 2850	CASPER	WY	826022850	$15.00	326.300	$4,905.00
WYW185726	53	PINE HAVEN RESOURCES LLC	4790 TABLE MESA DR STE 202	BOULDER	CO	80305	$14.00	485.260	$6,804.00
WYW185727	54	PINE HAVEN RESOURCES LLC	4790 TABLE MESA DR STE 202	BOULDER	CO	80305	$11.00	242.480	$2,673.00

February 7, 2017 *Sale Results*

SERIAL	PAR	NAME	ADDRESS	CITY	ST	ZIP	Bid/Acre	ACRES	Total Bonus
WYW185728	55	RALPH SPECHT	(b) (6)	[redacted]	[redacted]		$85.00	122.070	$10,455.00
WYW185729	56	THE DAUBE CO	PO BOX 38	ARDMORE	OK	73402	$25.00	327.680	$8,200.00
WYW185730	57	PINE HAVEN RESOURCES LLC	4790 TABLE MESA DR STE 202	BOULDER	CO	80503	$22.00	410.030	$9,042.00
WYW185731	58	PINE HAVEN RESOURCES LLC	4790 TABLE MESA DR STE 202	BOULDER	CO	80305	$19.00	406.630	$7,733.00
WYW185732	59	KIRKWOOD OIL & GAS LLC	PO BOX 2850	CASPER	WY	826022850	$16.00	154.040	$2,480.00
WYW185733	60	KIRKWOOD OIL & GAS LLC	PO BOX 2850	CASPER	WY	826022850	$15.00	74.370	$1,125.00
WYW185734	61	PINE HAVEN REWOURCES LLC	4790 TABLE MESA DR STE 202	BOULDER	CO	80503	$65.00	244.130	$15,925.00
WYW185735	62	HERBALY EXPLORATION LLC	1420 W CANAL CT STE 150	LITTLETON	CO	801205660	$16.00	243.470	$3,904.00
WYW185736	63	LIBERTY PETROLEUM CORP	14 BOND ST STE 303	GREAT NECK	NY	110212045	$25.00	1,772.320	$44,325.00
WYW185737	64	LEON MICHAEL WILKERSON	PO BOX 344	BRIDGEPORT	TX	76426	$10.00	40.150	$410.00
WYW185738	65	TRONA ENERGY 11 LLC	3033 E 1ST AVE #404	DENVER	CO	80206	$35.00	196.880	$6,895.00
WYW185739	66	HANNON & ASSOCIATES INC	10217 COUNTY ROAD 120	KIOWA	CO	80117	$2,400.00	323.710	$777,600.00
WYW185740	67	MCL 1 OIL AND GAS WYOMING LLC	200 RIVER POINTE DR STE 260	CONROE	TX	773042817	$450.00	199.300	$90,000.00
WYW185741	68	K2T2 RESOURCES LLC	2993 S MILWAKEE CIR	DENVER	CO	80210	$240.00	166.200	$40,080.00
WYW185742	69	STROUD EXPLORATION COMPANY LLC	416 TRAVIS ST STE 600	SHREVEPORT	LA	711015501	$30.00	850.530	$25,530.00
WYW185743	70	PINE HAVEN RESOURCES LLC	4790 TABLE MESA DR STE 202	BOULDER	CO	80305	$34.00	2,547.280	$86,632.00
WYW185744	71	PINE HAVEN RESOURCES LLC	4790 TABLE MESA DR STE 202	BOULDER	CO	80305	$36.00	1,932.440	$69,588.00
WYW185745	72	PINE HAVEN RESOURCES LLC	4790 TABLE MESA DR STE 202	BOULDER	CO	80305	$70.00	1,535.740	$107,520.00
WYW185746	73	PINE HAVEN RESOURCES LLC	4790 TABLE MESA DR STE 202	BOULDER	CO	80305	$30.00	158.680	$4,770.00
WYW185747	74	PINE HAVEN RESOURCES LLC	4790 TABLE MESA DR STE 202	BOULDER	CO	80305	$28.00	440.160	$12,348.00
WYW185748	75	PINE HAVEN RESOURCES LLC	4790 TABLE MESA DR STE 202	BOULDER	CO	80305	$75.00	281.620	$21,150.00
WYW185749	76	PINE HAVEN RESOURCES LLC	4790 TABLE MESA DR STE 202	BOULDER	CO	80305	$10.00	643.080	$6,440.00
WYW185750	77	PINE HAVEN RESOURCES LLC	4790 TABLE MESA DR STE 202	BOULDER	CO	80305	$30.00	282.550	$8,490.00
WYW185751	78	HOOVER & STACY INC	PO BOX 2328	CHEYENNE	WY	820032328	$130.00	447.020	$58,240.00
WYW185752	79	PINE HAVEN RESOURCES LLC	4790 TABLE MESA DR STE 202	BOULDER	CO	80305	$70.00	689.870	$48,300.00
WYW185753	80	HOOVER & STACY INC	PO BOX 2328	CHEYENNE	WY	820032328	$27.00	692.630	$18,711.00
WYW185754	81	PINE HAVEN RESOURCES LLC	4790 TABLE MESA DR STE 202	BOULDER	CO	80305	$26.00	824.220	$21,450.00

SERIAL	PAR	NAME	ADDRESS	CITY	ST	ZIP	Bid/Acre	ACRES	Total Bonus
WYW185755	82	KIRKWOOD OIL & GAS LLC	PO BOX 2850	CASPER	WY	826022850	$70.00	202.390	$14,210.00
WYW185756	83	AZALEA OIL CO LLC	7273 LEMON GULCH WAY	CASTLE ROCK	CO	801088499	$60.00	124.450	$7,500.00
WYW185757	84	AZALEA OIL CO LLC	7273 LEMON GULCH WAY	CASTLE ROCK	CO	801088499	$25.00	41.740	$1,050.00
WYW185758	85	AZALEA OIL CO LLC	7273 LEMON GULCH WAY	CASTLE ROCK	CO	801088499	$40.00	40.690	$1,640.00
WYW185759	86	MERIT MGMT PARTNERS III LP ET AL	13727 NOEL RD STE 1200	DALLAS	TX	75240	$5,000.00	15.506	$80,000.00
WYW185760	87	HERBALY EXPLORATION LLC	1420 W CANAL CT STE 150	LITTLETON	CO	801205660	$120.00	108.158	$13,080.00
WYW185761	88	MERIT MGMT PARTNERS III LP ET AL	13727 NOEL RD STE 1200	DALLAS	TX	75240	$4,500.00	20.701	$94,500.00
WYW185762	89	MERIT MGMT PARTNERS III LP ET AL	13727 NOEL RD STE 1200	DALLAS	TX	75240	$175.00	20.415	$3,675.00
WYW185763	90	BTA OIL PRODUCERS LLC	104 S PECOS ST	MIDLAND	TX	797015021	$13.00	400.660	$5,213.00
WYW185764	91	LIBERTY PETROLEUM CORP	14 BOND ST STE 303	GREAT NECK	NY	110212045	$13.00	481.770	$6,266.00
WYW185765	92	AZALEA OIL CO LLC	7273 LEMON GULCH WAY	CASTLE ROCK	CO	801088499	$4.00	37.140	$152.00
WYW185766	93	AZALEA OIL CO LLC	7273 LEMON GULCH WAY	CASTLE ROCK	CO	801088499	$120.00	158.420	$19,080.00
WYW185767	94	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$170.00	951.930	$161,840.00
WYW185768	95	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$170.00	280.000	$47,600.00
WYW185769	96	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$6.00	160.000	$960.00
WYW185770	97	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$45.00	726.260	$32,715.00
WYW185771	98	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$2.00	336.090	$674.00
WYW185772	99	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$230.00	196.770	$45,310.00
WYW185773	100	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$160.00	280.000	$44,800.00
WYW185774	101	HOOVER & STACY INC	PO BOX 2328	CHEYENNE	WY	820032328	$25.00	202.160	$5,075.00
WYW185775	102	CARPENTER & SONS INC	1551 THREE CROWNS DR STE 302	CASPER	WY	826043196	$2.00	400.000	$800.00
WYW185776	103	CARPENTER & SONS INC	1551 THREE CROWNS DR STE 302	CASPER	WY	826043196	$12.00	280.000	$3,360.00
WYW185777	104	AZALEA OIL CO LLC	7273 LEMON GULCH WAY	CASTLE ROCK	CO	801088499	$2.00	280.000	$560.00
WYW185778	105	HOOVER & STACY INC	PO BOX 2328	CHEYENNE	WY	820032328	$25.00	160.000	$4,000.00
WYW185779	106	AZALEA OIL CO LLC	7273 LEMON GULCH WAY	CASTLE ROCK	CO	801088499	$18.00	320.000	$5,760.00
WYW185780	107	CARPENTER & SONS INC	1551 THREE CROWNS DR STE 302	CASPER	WY	826043196	$4.00	492.520	$1,972.00
WYW185781	108	HOOVER & STACY INC	PO BOX 2328	CHEYENNE	WY	820032328	$65.00	119.670	$7,800.00

February 7, 2017 Sale Results

SERIAL	PAR	NAME	ADDRESS	CITY	ST	ZIP	Bid/Acre	ACRES	Total Bonus
WYW185782	109	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$170.00	240.570	$40,970.00
WYW185783	110	PETROX RES INC	PO BOX 2600	MEEKER	CO	816412600	$22.00	880.000	$19,360.00
WYW185784	111	CARPENTER & SONS INC	1551 THREE CROWNS DR STE 302	CASPER	WY	826043196	$15.00	80.000	$1,200.00
WYW185785	112	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$110.00	440.000	$48,400.00
WYW185786	113	HOOVER & STACY INC	PO BOX 2328	CHEYENNE	WY	820032328	$160.00	80.000	$12,800.00
WYW185787	114	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$150.00	160.000	$24,000.00
WYW185788	115	CARPENTER & SONS INC	1551 THREE CROWNS DR STE 302	CASPER	WY	826043196	$2.00	747.780	$1,496.00
WYW185789	116	CARPENTER & SONS INC	1551 THREE CROWNS DR STE 302	CASPER	WY	826043196	$10.00	485.400	$4,860.00
WYW185790	117	AZALEA OIL CO LLC	7273 LEMON GULCH WAY	CASTLE ROCK	CO	801088499	$80.00	81.420	$6,560.00
WYW185791	118	AZALEA OIL CO LLC	7273 LEMON GULCH WAY	CASTLE ROCK	CO	801088499	$85.00	81.880	$6,970.00
WYW185792	119	GARY M GUERRIERI	(b) (6) [redacted]	[redacted]	[redacted]		$2.00	120.000	$240.00
WYW185793	120	AZALEA OIL CO LLC	7273 LEMON GULCH WAY	CASTLE ROCK	CO	801088499	$2.00	80.000	$160.00
WYW185794	121	AZALEA OIL CO LLC	7273 LEMON GULCH WAY	CASTLE ROCK	CO	801088499	$2.00	80.000	$160.00
WYW185795	122	AZALEA OIL CO LLC	7273 LEMON GULCH WAY	CASTLE ROCK	CO	801088499	$90.00	400.000	$36,000.00
WYW185796	123	TITAN EXPLORATION LLC	400 MADISON AVE STE 14C	NEW YORK	NY	10017	$10,000.00	1,760.200	$17,610,000.00
WYW185797	124	NAVIGATION POWDER RIVER LLC	8504 KATY FREEWAY STE 419	HOUSTON	TX	77024	$7,000.00	162.060	$1,141,000.00
WYW185798	125	NAVIGATION POWDER RIVER LLC	8504 KATY FREEWAY STE 419	HOUSTON	TX	77024	$8,000.00	320.000	$2,560,000.00
WYW185799	126	TITAN EXPLORATION LLC	400 MADISON AVE STE 14C	NEW YORK	NY	10017	$10,500.00	120.000	$1,260,000.00
WYW185800	127	NAVIGATION POWDER RIVER LLC	8504 KATY FREEWAY STE 419	HOUSTON	TX	77024	$12,000.00	1,511.710	$18,144,000.00
WYW185801	128	NAVIGATION POWDER RIVER LLC	8504 KATY FREEWAY STE 419	HOUSTON	TX	77024	$6,500.00	40.470	$266,500.00
WYW185802	129	CARLOW EXCHANGE PROPERTIES LLC	303 W WALL STE 2400	MIDLAND	TX	79701	$13,500.00	790.610	$10,678,500.00
WYW185803	130	NAVIGATION POWDER RIVER LLC	8504 KATY FREEWAY STE 419	HOUSTON	TX	77024	$11,500.00	648.300	$7,463,500.00
WYW185804	131	PEAK POWDER RIVER ACQ RES LLC	1910 MAIN AVE	DURANGO	CO	813015038	$12,000.00	207.010	$2,496,000.00
WYW185805	132	NAVIGATION POWDER RIVER LLC	8504 KATY FREEWAY STE 419	HOUSTON	TX	77024	$9,000.00	286.720	$2,583,000.00
WYW185806	133	PEAK POWDER RIVER ACQ RES LLC	1910 MAIN AVE	DURANGO	CO	813015038	$7,000.00	324.940	$2,275,000.00
WYW185807	134	NAVIGATION POWDER RIVER LLC	8504 KATY FREEWAY STE 419	HOUSTON	TX	77024	$6,000.00	485.740	$2,916,000.00
WYW185808	135	HERBALY EXPLORATION LLC	1420 W CANAL CT STE 150	LITTLETON	CO	801205660	$200.00	484.990	$97,000.00

SERIAL	PAR	NAME	ADDRESS	CITY	ST	ZIP	Bid/Acre	ACRES	Total Bonus
WYW185809	136	NAVIGATION POWDER RIVER LLC	8504 KATY FREEWAY STE 419	HOUSTON	TX	77024	$750.00	359.030	$270,000.00
WYW185810	137	STROUD EXPLORATION COMPANY LLC	416 TRAVIS ST STE 600	SHREVEPORT	LA	711015501	$75.00	491.140	$36,900.00
WYW185811	138	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$60.00	40.730	$2,460.00
WYW185812	139	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$40.00	40.710	$1,640.00
WYW185813	140	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$30.00	282.980	$8,490.00
WYW185814	141	PRIMA EXPLORATION INC	100 FILLMORE ST STE 450	DENVER	CO	802064918	$275.00	956.020	$263,175.00
WYW185815	142	KUENZLER & FLORA RSERVE CORP	3310 W AQUEDUCT AVE	LITTLETON	CO	80123	$30.00	81.720	$2,460.00
WYW185816	143	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$60.00	41.230	$2,520.00
WYW185817	144	KIRKWOOD OIL & GAS LLC	PO BOX 2850	CASPER	WY	826022850	$5.00	40.980	$205.00
WYW185818	145	KIRKWOOD OIL & GAS LLC	PO BOX 2850	CASPER	WY	826022850	$20.00	162.010	$3,260.00
WYW185819	146	HERBALY EXPLORATION LLC	1420 W CANAL CT STE 150	LITTLETON	CO	801205660	$2.00	301.680	$604.00
WYW185820	147	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$8.00	269.890	$2,160.00
WYW185821	148	WESTCLIFF RESOURCES LLC	250 EUDORA ST	DENVER	CO	802205720	$2.00	94.500	$190.00
WYW185822	149	CARPENTER & SONS INC	1551 THREE CROWNS DR STE 302	CASPER	WY	826043196	$19.00	522.180	$9,937.00
WYW185823	150	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$4.00	121.040	$488.00
WYW185824	151	AZALEA OIL CO LLC	7273 LEMON GULCH WAY	CASTLE ROCK	CO	801088499	$300.00	360.000	$108,000.00
WYW185825	152	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$4.00	313.360	$1,256.00
WYW185826	153	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$3.00	196.200	$591.00
WYW185827	154	AZALEA OIL CO LLC	7273 LEMON GULCH WAY	CASTLE ROCK	CO	801088499	$300.00	120.000	$36,000.00
WYW185828	155	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$30.00	480.830	$14,430.00
WYW185829	156	TITAN EXPLORATION LLC	400 MADISON AVE STE 14C	NEW YORK	NY	10017	$3,220.00	41.040	$135,240.00
WYW185830	157	TITAN EXPLORATION LLC	400 MADISON AVE STE 14C	NEW YORK	NY	10017	$3,250.00	41.080	$136,500.00
WYW185831	158	PEAK POWDER RIVER ACQ RES LLC	1910 MAIN AVE	DURANGO	CO	813015038	$8,500.00	892.180	$7,590,500.00
WYW185832	159	HOOVER & STACY INC	PO BOX 2328	CHEYENNE	WY	820032328	$2,700.00	40.300	$110,700.00
WYW185833	160	TITAN EXPLORATION LLC	400 MADISON AVE STE 14C	NEW YORK	NY	10017	$3,300.00	40.240	$135,300.00
WYW185834	161	PEAK POWDER RIVER ACQ RES LLC	1910 MAIN AVE	DURANGO	CO	813015038	$16,500.00	317.360	$5,247,000.00
WYW185835	162	KIRKWOOD OIL & GAS LLC	PO BOX 2850	CASPER	WY	826022850	$43.00	285.220	$12,298.00

SERIAL	PAR	NAME	ADDRESS	CITY	ST	ZIP	Bid/Acre	ACRES	Total Bonus
WYW185836	163	K2T2 RESOURCES LLC	2993 S MILWAKEE CIR	DENVER	CO	80210	$230.00	2,106.700	$484,610.00
WYW185837	164	STROUD EXPLORATION COMPANY LLC	416 TRAVIS ST STE 600	SHREVEPORT	LA	711015501	$27.00	40.820	$1,107.00
WYW185838	165	STROUD EXPLORATION COMPANY LLC	416 TRAVIS ST STE 600	SHREVEPORT	LA	711015501	$50.00	40.650	$2,050.00
WYW185839	166	HANNON & ASSOCIATES INC	10217 COUNTY ROAD 120	KIOWA	CO	80117	$450.00	2,105.360	$947,700.00
WYW185840	167	HANNON & ASSOCIATES INC	10217 COUNTY ROAD 120	KIOWA	CO	80117	$350.00	1,438.910	$503,650.00
WYW185841	168	STROUD EXPLORATION COMPANY LLC	416 TRAVIS ST STE 600	SHREVEPORT	LA	711015501	$325.00	944.850	$307,125.00
WYW185842	169	STROUD EXPLORATION COMPANY LLC	416 TRAVIS ST STE 600	SHREVEPORT	LA	711015501	$35.00	158.210	$5,565.00
WYW185843	170	HANNON & ASSOCIATES INC	10217 COUNTY ROAD 120	KIOWA	CO	80117	$120.00	39.760	$4,800.00
WYW185844	171	HANNON & ASSOCIATES INC	10217 COUNTY ROAD 120	KIOWA	CO	80117	$110.00	1,290.250	$142,010.00
WYW185845	172	HANNON & ASSOCIATES INC	10217 COUNTY ROAD 120	KIOWA	CO	80117	$120.00	80.630	$9,720.00
WYW185846	173	HANNON & ASSOCIATES INC	10217 COUNTY ROAD 120	KIOWA	CO	80117	$110.00	161.580	$17,820.00
WYW185847	174	HERBALY EXPLORATION LLC	1420 W CANAL CT STE 150	LITTLETON	CO	801205660	$35.00	39.730	$1,400.00
WYW185848	175	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$70.00	580.510	$40,670.00
WYW185849	176	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$18.00	1,956.700	$35,226.00
WYW185850	177	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$16.00	2,172.760	$34,768.00
WYW185851	178	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$23.00	2,487.210	$57,224.00
WYW185852	179	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$32.00	831.320	$26,624.00
WYW185853	180	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$15.00	1,372.880	$20,595.00
WYW185854	181	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$16.00	403.310	$6,464.00
WYW185855	182	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$14.00	2,195.660	$30,744.00
WYW185856	183	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$16.00	544.460	$8,720.00
WYW185857	184	KIRKWOOD OIL & GAS LLC	PO BOX 2850	CASPER	WY	826022850	$2.00	39.480	$80.00
WYW185858	185	TITAN EXPLORATION LLC	400 MADISON AVE STE 14C	NEW YORK	NY	10017	$1,100.00	120.000	$132,000.00
WYW185859	186	PEAK POWDER RIVER ACQ RES LLC	1910 MAIN AVE	DURANGO	CO	813015038	$5,500.00	320.000	$1,760,000.00
WYW185860	187	PEAK POWDER RIVER ACQ RES LLC	1910 MAIN AVE	DURANGO	CO	813015038	$2,500.00	171.000	$427,500.00
WYW185861	188	HERBALY EXPLORATION LLC	1420 W CANAL CT STE 150	LITTLETON	CO	801205660	$55.00	253.920	$13,970.00
WYW185862	189	HANNON & ASSOCIATES INC	10217 COUNTY ROAD 120	KIOWA	CO	80117	$350.00	2,379.060	$833,000.00

SERIAL	PAR	NAME	ADDRESS	CITY	ST	ZIP	Bid/Acre	ACRES	Total Bonus
WYW185863	190	HANNON & ASSOCIATES INC	10217 COUNTY ROAD 120	KIOWA	CO	80117	$350.00	2,430.440	$850,850.00
WYW185864	191	HANNON & ASSOCIATES INC	10217 COUNTY ROAD 120	KIOWA	CO	80117	$300.00	641.050	$192,600.00
WYW185865	192	STROUD EXPLORATION COMPANY LLC	416 TRAVIS ST STE 600	SHREVEPORT	LA	711015501	$55.00	80.000	$4,400.00
WYW185866	193	HANNON & ASSOCIATES INC	10217 COUNTY ROAD 120	KIOWA	CO	80117	$120.00	81.520	$9,840.00
WYW185867	194	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$60.00	886.600	$53,220.00
WYW185868	195	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$55.00	1,231.900	$67,760.00
WYW185869	196	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$20.00	1,512.820	$30,260.00
WYW185870	197	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$10.00	39.730	$400.00
WYW185871	198	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$20.00	2,470.800	$49,420.00
WYW185872	199	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$20.00	508.190	$10,180.00
WYW185873	200	TRUJILLO ANN M	PO BOX 1252	CHEYENNE	WY	820031252	$1,200.00	640.000	$768,000.00
WYW185874	201	TITAN EXPLORATION LLC	400 MADISON AVE STE 14C	NEW YORK	NY	10017	$2,800.00	40.540	$114,800.00
WYW185875	202	ANSCHUTZ EXPLORATION CORP	555 17TH ST STE 2400	DENVER	CO	802023941	$6,700.00	1,671.950	$11,202,400.00
WYW185876	203	TITAN EXPLORATION LLC	400 MADISON AVE STE 14C	NEW YORK	NY	10017	$3,000.00	1,560.000	$4,680,000.00
WYW185877	204	TITAN EXPLORATION LLC	400 MADISON AVE STE 14C	NEW YORK	NY	10017	$3,300.00	840.700	$2,775,300.00
WYW185878	205	MCDONALD LAND SERVICES LLC	PO BOX 590	WASHINGTON	OK	73903	$350.00	120.000	$42,000.00
WYW185879	206	PERCHERON PROFESSIONAL LLC	2000 S CO BLVD TOW 1 STE 3000	DENVER	CO	80222	$2,600.00	320.000	$832,000.00
WYW185880	207	HANNON & ASSOCIATES INC	10217 COUNTY ROAD 120	KIOWA	CO	80117	$60.00	81.220	$4,920.00
WYW185881	208	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$210.00	218.610	$45,990.00
WYW185882	209	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$20.00	2,512.990	$50,260.00
WYW185883	210	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$25.00	2,106.300	$52,675.00
WYW185884	211	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$70.00	1,541.050	$107,940.00
WYW185885	212	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$60.00	1,731.190	$103,920.00
WYW185886	213	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$130.00	1,165.120	$151,580.00
WYW185887	214	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$130.00	1,222.220	$158,990.00
	215							140.800	
	216							36.930	

SERIAL	PAR	NAME	ADDRESS	CITY	ST	ZIP	Bid/Acre	ACRES	Total Bonus
WYW185888	217	HOOVER & STACY INC	PO BOX 2328	CHEYENNE	WY	820032328	$2.00	1,099.170	$2,200.00
WYW185889	218	HOOVER & STACY INC	PO BOX 2328	CHEYENNE	WY	820032328	$2.00	365.740	$732.00
WYW185890	219	HOOVER & STACY INC	PO BOX 2328	CHEYENNE	WY	820032328	$2.00	1,050.340	$2,102.00
WYW185891	220	CARPENTER & SONS INC	1551 THREE CROWNS DR STE 302	CASPER	WY	826043196	$6.00	389.120	$2,340.00
WYW185892	221	HANNON & ASSOCIATES INC	10217 COUNTY ROAD 120	KIOWA	CO	80117	$120.00	2,118.450	$254,280.00
WYW185893	222	NAVIGATION POWDER RIVER LLC	8504 KATY FREEWAY STE 419	HOUSTON	TX	77024	$20.00	1,960.000	$39,200.00
WYW185894	223	HANNON & ASSOCIATES INC	10217 COUNTY ROAD 120	KIOWA	CO	80117	$110.00	2,520.000	$277,200.00
WYW185895	224	NAVIGATION POWDER RIVER LLC	8504 KATY FREEWAY STE 419	HOUSTON	TX	77024	$30.00	1,920.000	$57,600.00
WYW185896	225	NAVIGATION POWDER RIVER LLC	8504 KATY FREEWAY STE 419	HOUSTON	TX	77024	$30.00	1,280.000	$38,400.00
WYW185897	226	NAVIGATION POWDER RIVER LLC	8504 KATY FREEWAY STE 419	HOUSTON	TX	77024	$30.00	1,640.000	$49,200.00
WYW185898	227	NAVIGATION POWDER RIVER LLC	8504 KATY FREEWAY STE 419	HOUSTON	TX	77024	$30.00	1,840.000	$55,200.00
WYW185899	228	TRUJILLO ANN M	PO BOX 1252	CHEYENNE	WY	820031252	$1,200.00	40.080	$49,200.00
WYW185900	229	ANSCHUTZ EXPLORATION CORP	555 17TH ST STE 2400	DENVER	CO	802023941	$1,700.00	639.840	$1,088,000.00
WYW185901	230	HANNON & ASSOCIATES INC	10217 COUNTY ROAD 120	KIOWA	CO	80117	$1,300.00	968.300	$1,259,700.00
WYW185902	231	PEAK POWDER RIVER ACQ RES LLC	1910 MAIN AVE	DURANGO	CO	813015038	$120.00	1,324.670	$159,000.00
WYW185903	232	HANNON & ASSOCIATES INC	10217 COUNTY ROAD 120	KIOWA	CO	80117	$110.00	40.000	$4,400.00
WYW185904	233	HANNON & ASSOCIATES INC	10217 COUNTY ROAD 120	KIOWA	CO	80117	$100.00	800.000	$80,000.00
WYW185905	234	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$225.00	311.310	$70,200.00
WYW185906	235	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$250.00	2,519.070	$630,000.00
WYW185907	236	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$80.00	1,415.100	$113,280.00
WYW185908	237	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$25.00	67.350	$1,700.00
WYW185909	238	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$80.00	1,770.920	$141,680.00
WYW185910	239	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$2.00	2,251.620	$4,504.00
WYW185911	240	VIKING OIL CO	PO BOX 36157	DENVER	CO	80236	$2.00	1,758.480	$3,518.00
	241							314.230	
WYW185912	242	BLACK HILLS EXPL & PROD INC	1515 WYNKOOP ST STE 500	DENVER	CO	802022062	$55.00	396.680	$21,835.00
WYW185913	243	BLACK HILLS EXPL & PROD INC	1515 WYNKOOP ST STE 500	DENVER	CO	802022062	$65.00	280.000	$18,200.00

SERIAL	PAR	NAME	ADDRESS	CITY	ST	ZIP	Bid/Acre	ACRES	Total Bonus
WYW185914	244	BLACK HILLS EXPL & PROD INC	1515 WYNKOOP ST STE 500	DENVER	CO	802022062	$35.00	80.000	$2,800.00
WYW185915	245	BLACK HILLS EXPL & PROD INC	1515 WYNKOOP ST STE 500	DENVER	CO	802022062	$80.00	239.220	$19,200.00
WYW185916	246	WHITE EAGLE EXPLORATION INC	621 17TH ST STE 2635	DENVER	CO	802930901	$25.00	160.000	$4,000.00
WYW185917	247	RC MICHAEL CO INC	1212 RAINTREE DR STE A5	FORT COLLINS	CO	80526	$1,050.00	39.140	$42,000.00
WYW185918	248	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$250.00	2,248.130	$562,250.00
WYW185919	249	HAT CREEK RESOURCES LLC	2525 RIDGMAR BLVD STE 220	FORT WORTH	TX	76116	$175.00	1,925.030	$337,050.00
WYW185920	250	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$180.00	763.180	$137,520.00
WYW185921	251	BLACK HILLS EXPL & PROD INC	1515 WYNKOOP ST STE 500	DENVER	CO	802022062	$180.00	638.540	$115,020.00
WYW185922	252	HAT CREEK RESOURCES LLC	2525 RIDGMAR BLVD STE 220	FORT WORTH	TX	76116	$140.00	949.240	$133,000.00
WYW185923	253	HAT CREEK RESOURCES LLC	2525 RIDGMAR BLVD STE 220	FORT WORTH	TX	76116	$130.00	320.000	$41,600.00
WYW185924	254	HAT CREEK RESOURCES LLC	2525 RIDGMAR BLVD STE 220	FORT WORTH	TX	76116	$140.00	2,560.000	$358,400.00
WYW185925	255	HAT CREEK RESOURCES LLC	2525 RIDGMAR BLVD STE 220	FORT WORTH	TX	76116	$60.00	640.000	$38,400.00
WYW185926	256	HAT CREEK RESOURCES LLC	2525 RIDGMAR BLVD STE 220	FORT WORTH	TX	76116	$60.00	1,440.000	$86,400.00
WYW185927	257	NORTHSTAR ENERGY CO LLC	999 18TH ST STE 1150 SOUTH	DENVER	CO	80202	$50.00	318.470	$15,950.00
WYW185928	258	BLACK HILLS EXPL & PROD INC	1515 WYNKOOP ST STE 500	DENVER	CO	802022062	$150.00	1,360.000	$204,000.00
WYW185929	259	BLACK HILLS EXPL & PROD INC	1515 WYNKOOP ST STE 500	DENVER	CO	802022062	$160.00	640.000	$102,400.00
WYW185930	260	BLACK HILLS EXPL & PROD INC	1515 WYNKOOP ST STE 500	DENVER	CO	802022062	$200.00	480.000	$96,000.00
WYW185931	261	CARPENTER & SONS INC	1551 THREE CROWNS DR STE 302	CASPER	WY	826043196	$2.00	315.940	$632.00
WYW185932	262	RED WILLOW GREAT PLAINS LLC	14933 HWY 172 BOX 369	IGNACIO	CO	81137	$30.00	805.020	$24,180.00
WYW185933	263	HOOVER & STACY INC	PO BOX 2328	CHEYENNE	WY	820032328	$2.00	1,770.340	$3,542.00
WYW185934	264	HOOVER & STACY INC	PO BOX 2328	CHEYENNE	WY	820032328	$2.00	2,366.040	$4,734.00
WYW185935	265	HOOVER & STACY INC	PO BOX 2328	CHEYENNE	WY	820032328	$2.00	2,514.020	$5,030.00
WYW185936	266	HOOVER & STACY INC	PO BOX 2328	CHEYENNE	WY	820032328	$2.00	1,103.480	$2,208.00
WYW185937	267	HOOVER & STACY INC	PO BOX 2328	CHEYENNE	WY	820032328	$2.00	2,071.400	$4,144.00
	268							40.000	
	269							40.000	
	270							685.920	

SERIAL	PAR	NAME	ADDRESS	CITY	ST	ZIP	Bid/Acre	ACRES	Total Bonus
	271							380.000	
WYW185938	272	PACER ENERGY ACQUISITIONS LLC	PO BOX 1714	GILLETTE	WY	827171714	$85.00	850.320	$72,335.00
WYW185939	273	PACER ENERGY ACQUISITIONS LLC	PO BOX 1714	GILLETTE	WY	827171714	$80.00	160.000	$12,800.00
WYW185940	274	KIRKWOOD OIL & GAS LLC	PO BOX 2850	CASPER	WY	826022850	$2.00	1,721.490	$3,444.00
WYW185941	275	UNITED NATURAL GAS LLC	475 17TH ST SUITE 540	DENVER	CO	802024011	$2.00	2,527.160	$5,056.00
WYW185942	276	UNITED NATURAL GAS LLC	475 17TH ST SUITE 540	DENVER	CO	802024011	$90.00	1,591.410	$143,280.00
WYW185943	277	KIRKWOOD OIL & GAS LLC	PO BOX 2850	CASPER	WY	826022850	$2.00	2,361.320	$4,724.00
WYW185944	278	KIRKWOOD OIL & GAS LLC	PO BOX 2850	CASPER	WY	826022850	$2.00	1,760.000	$3,520.00
WYW185945	279	KIRKWOOD OIL & GAS LLC	PO BOX 2850	CASPER	WY	826022850	$2.00	719.160	$1,440.00
WYW185946	280	NAVIGATION PETROLUEM LLC	8584 KATY FREEWAY STE 419	HOUSTON	TX	77024	$120.00	320.680	$38,520.00
WYW185947	281	ANSCHUTZ CORP	555 17TH ST STE 2400	DENVER	CO	802023941	$3,500.00	323.600	$1,134,000.00
WYW185948	282	RED WILLOW GREAT PLAINS LLC	14933 HWY 172 BOX 369	IGNACIO	CO	81137	$1,100.00	40.000	$44,000.00
WYW185949	283	DODSON EXPLORATION CO LLC	PO BOX 2038	EVERGREEN	CO	804372038	$20.00	327.680	$6,560.00
WYW185950	284	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$12,500.00	40.610	$512,500.00
WYW185951	285	BROWN MAURICE W	516 S GREELEY HWY	CHEYENNE	WY	820072852	$10,500.00	205.450	$2,163,000.00

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Wyoming State Office
P.O. Box 1828
Cheyenne, WY 82003-1828
www.blm.gov/wy

In Reply Refer To:
3120
(923Hite)
PHONE NO: (307) 775-6176
FAX NO: (307) 775-6203

January 06, 2017

INFORMATION NOTICE

The following information updates information provided on page iii (Section titled "How long will the sale last?") of the February 7, 2017, *Notice of Competitive Oil and Gas Lease Sale*.

There are a large number of parcels scheduled to be offered at this sale, and we anticipate above-average bidder interest in many of the parcels. As bidding activity increases, the auction process for each parcel will take longer, and we may not be able to complete the auction by noon.

If all the parcels are not offered by noon, we will take a lunch break from 12:00 p.m. to 1:00 p.m. Additionally, constraints upon the availability of the sale venue, a 4:00 p.m. payment deadline for all purchases made at the sale, and the availability of the auctioneers and other support staff members require us to set a cutoff time for the sale. If the sale ends before all of the parcels are offered, the remaining parcels will be offered with the parcels posted in the August 1, 2017, *Notice of Competitive Oil and Gas Lease Sale* (BLM Wyoming's Third Quarter 2017 sale).

The Section titled "How long will the sale last?", on page iii of the February 7, 2017, *Notice of Competitive Oil and Gas Lease Sale*, is hereby modified, as follows:

How long will the sale last?

We begin the sale at 8:00 a.m. and it continues until all of the parcels in this Notice have been offered - or until 2:30 p.m., whichever comes first. The length of the sale depends on the number of parcels we are offering and the pace of the bidding. We will take a 15-minute mid-morning break to give you a chance to stretch, get refreshments, or make phone calls. Normally, the sale is done by noon. However, we anticipate that this sale may go into the afternoon. If that happens, we will take a lunch break from 12:00 p.m. to 1:00 p.m. After the lunch break, the sale will resume at 1:00 p.m. and continue until no later than 2:30 p.m. Any parcels listed in this Notice that are not offered by 2:30 p.m. will be offered with the parcels posted in the August 1, 2017, *Notice of Competitive Oil and Gas Lease Sale* (BLM Wyoming's Third Quarter 2017 sale).

Please address any questions you may have regarding the information in this Notice to me at the letterhead address or you may contact me by phone at 307-775-6176.

Chris Hite
Chief, Branch of Fluid Minerals Adjudication

Distribution
SD
ASD
District Managers
Field Office Managers
DSD, Minerals and Lands
Chief, Branch of Fluid Minerals, Lands, and Appraisal
Chief, Branch of Fluid Minerals Adjudication
Public Information Desk
WO-310, Attn: Jennifer Spencer
Premier Data Services
Travis Bargsten
Merry Gamper

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Wyoming State Office
P.O. Box 1828
Cheyenne, WY 82003-1828
www.blm.gov/wy

In Reply Refer To:
3120
(923Hite)
PHONE NO: (307) 775-6176
FAX NO: (307) 775-6203

January 9, 2017

INFORMATION NOTICE

The following information applies to parcels WY-1702-041, WY-1702-195, WY-1702-212, and WY-1702-239 on the February 7, 2017, *Notice of Competitive Oil and Gas Lease Sale*.

The acreage for the parcels listed below has been corrected as follows:

WY-1702-041 – the acreage is corrected from 860.96 acres to **860.98** acres.
WY-1702-212 – the acreage is corrected from 1721.19 acres to **1731.19** acres.
WY-1702-239 – the acreage is corrected from 2249.62 acres to **2251.72** acres.

Lots 32 and 33 in Section 31 of parcel WY-1702-195 are deleted. The land is closed to oil and gas leasing because it is within the Fortification Creek Wilderness Study Area. The land description and acreage of parcel WY-1702-195 is as follows:

WY-1702-195 **1231.90** Acres
T.0520N, R.0750W, 06th PM, WY
Sec. 017 LOTS 2,8.9;
017 LOTS 4,5,11 (EXCL 12.28 AC IN RR ROW WYW0119068);
018 LOTS 5-8,11-14,20;
019 LOTS 5,6,12;
020 LOTS 2,4,5,11;
021 LOT 12;
030 LOTS 25,28,29;
031 LOTS 16,21,24,25,28,30,31,34;
032 LOT 6;
034 LOT 13;

Please address any questions you may have regarding the information in this Notice to me at the letterhead address or you may contact me by phone at 307-775-6176.

Chris Hite
Chief, Branch of Fluid Minerals Adjudication

Distribution
SD
ASD
District Managers
Field Office Managers
DSD, Minerals and Lands
Chief, Branch of Fluid Minerals, Lands, and Appraisal
Chief, Branch of Fluid Minerals Adjudication
Public Information Desk
WO 310, Attn: Jennifer Spencer
Premier Data Services
Travis Bargsten
Merry Gamper

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Wyoming State Office
P.O. Box 1828
Cheyenne, WY 82003-1828
www.blm.gov/wy

In Reply Refer To:

3120
(923Hite)
PHONE NO: (307) 775-6176
FAX NO: (307) 775-6203

January 19, 2017

INFORMATION NOTICE

The following information applies to parcel WY-1702-127 on the February 7, 2017, *Notice of Competitive Oil and Gas Lease Sale.*

Part of the land in parcel WY-1702-127 is within an approved Communitization Agreement (CA). CA WYW181241 and CA WYW185340 are located within the listed parcel area for WY-1702-127 and were approved after the posting of the February 7, 2017 *Notice of Competitive Oil and Gas Lease Sale*. A reconfiguration of the area being offered for lease sale is necessary to separate the land within each CA boundary from the land outside the CA boundary. Therefore, the land description, acreage, and applicable lease notices and stipulations for parcel WY-1702-127 have been modified, in order to include only the land outside either CA boundary. Additionally, two new parcels have been created from the original parcel area, each of which contains land within the boundary of one of the newly-approved CAs. The new parcels have been assigned parcel numbers WY-1702-284 and WY-1702-285 and will be offered for sale with the parcels listed in the February 7, 2017 *Notice of Competitive Oil and Gas Lease Sale*.

The land description, acreage, and applicable lease notices and stipulations for parcel WY-1702-127 is as follows:

WY-1702-127 1511.710 Acres
T.0420N, R.0730W, 06th PM, WY
Sec. 001 LOTS 7,9,10,14,16-18;
015 LOTS 5,6,11-14;
023 LOTS 1-16;
024 LOTS 3-6,11-14;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

The land description, acreage, and applicable lease notices and stipulations for new parcel WY-1702-284 is as follows:

WY-1702-284 40.610 Acres
T.0420N, R.0730W, 06th PM, WY
Sec. 011 LOTS 2;
Campbell County
Buffalo FO
COMMUNITIZATION AGREEMENT WYW181241
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
The land within this lease is committed to Communitization Agreement (CA) WYW181241, Turner Formation, effective February 27, 2015, which includes the entire area of this lease. The successful bidder should contact the CA operator to determine their rights under this CA. The CA operator may require the successful bidder to pay a proportionate cost of the well, including drilling, completing, equipping, and operating the well as a condition of participating in the CA.
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_PD
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

The land description, acreage, and applicable lease notices and stipulations for new parcel WY-1702-285 is as follows:

WY-1702-285 205.450 Acres
T.0420N, R.0730W, 06th PM, WY
Sec. 012 LOTS 7,10-13;
Campbell County
Buffalo FO
COMMUNITIZATION AGREEMENT WYW185340
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
The land within this lease is committed to Communitization Agreement (CA) WYW185340, Turner Formation, effective March 12, 2015, which includes the entire area of this lease. The successful bidder should contact the CA operator to determine their rights under this CA. The CA operator may require the successful bidder to pay a proportionate cost of the well, including drilling, completing, equipping, and operating the well as a condition of participating in the CA.
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_RN

Please address any questions you may have regarding the information in this Notice to me at the letterhead address or you may contact me by phone at 307-775-6176.

Chris Hite
Chief, Branch of Fluid Minerals Adjudication

Distribution
SD
ASD
District Managers
Field Office Managers
DSD, Minerals and Lands
Chief, Branch of Fluid Minerals, Lands, and Appraisal
Chief, Branch of Fluid Minerals Adjudication
Public Information Desk
WO-310, Attn: Jennifer Spencer
Premier Data Services
Travis Bargsten
Merry Gamper

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Wyoming State Office
P.O. Box 1828
Cheyenne, WY 82003-1828
www.blm.gov/wy

In Reply Refer To:
3120
(923Hite)
PHONE NO: (307) 775-6176
FAX NO: (307) 775-6203

JAN 2 3 2017

CORRECTED NOTICE

INFORMATION NOTICE

This Information Notice corrects an error identified in the Information Notice dated January 9, 2017.

The acreage for parcel WY-1702-239 is incorrect in the January 9th Information Notice. The correct acreage is 2251.62 acres, instead of 2251.72 acres.

Please address any questions you may have regarding the information in this Notice to me at the letterhead address or you may contact me by phone at 307-775-6176.

Chris Hite
Chief, Branch of Fluid Minerals Adjudication

Distribution
SD
ASD
District Managers
Field Office Managers
DSD, Minerals and Lands
Chief, Branch of Fluid Minerals, Lands, and Appraisal
Chief, Branch of Fluid Minerals Adjudication
Public Information Desk
WO 310, Attn: Jennifer Spencer
Premier Data Services
Travis Bargsten
Merry Gamper

Notice of Competitive Oil and Gas Lease Sale

February 7, 2017

BLM

Wyoming State Office – Oil and Gas

NATIONAL SYSTEM OF PUBLIC LANDS
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Wyoming State Office
5353 Yellowstone Road
Cheyenne, Wyoming 82009
P.O. Box 1828
Cheyenne, Wyoming 82003-1828
http://www.blm.gov/wy

November 9, 2016

Notice of Competitive Oil and Gas Lease Sale

We wish to announce that in accordance with 43 CFR Part 3120, we will offer for competitive sale certain land in the States of Wyoming and Nebraska for Federal oil and gas leasing. This notice describes-

- The time and place of the sale;
- How the sale will be conducted;
- How to participate in the bidding process;
- The sale process;
- How long the sale will last;
- The conditions of the sale;
- How to file a noncompetitive offer after the sale;
- How to file a presale noncompetitive offer; and
- How to file a protest for land offered in this Notice.

Beginning on page 1 of this Notice is a list of the land we are offering at this sale. The land is described by parcel number and legal land description. They are listed in Range and Township order by state and land type and will be offered in that sequence. Below each parcel we have included any stipulations, lease notices, special conditions, or restrictions that will be made a part of the lease at the time we issue it. We have also identified those parcels where the United States owns less than 100 percent interest in the oil and gas mineral rights, have pending presale noncompetitive offers to lease, and are not available for noncompetitive offers to lease if they receive no bid at this sale. For your convenience, we are also including copies of the stipulations, lease notices, etc. affecting the parcels in this sale.

Both this Sale Notice and the results list will be available on our public Internet site at: http://www.blm.gov/wy. This Notice also is available on the BLM home page at: http://www.blm.gov.

Oil and gas forms are available on the Internet at:
http://www.blm.gov/noc/st/en/business/eForms.html.

When and where will the sale take place?

When: The competitive sale will begin at 8:00 a.m. on Tuesday, **February 7, 2017**. The sale room and receiving room will open one hour earlier so you can register and get your bidding number.

Where: We will hold the sale at The Radisson, 204 West Fox Farm Road (I-80 and US85), Cheyenne, Wyoming. A block of rooms at special rates has been reserved for sale participants at The Radisson. For room reservations, contact The Radisson at (307) 638-4466. When making room reservations, please state that you are attending the **BLM Oil and Gas Auction.**

Access: The sale room is accessible to persons with disabilities. If you need an auxiliary aid or service to participate in the sale, such as sign language interpreter or materials in an alternate format, contact **Corey Murzyn at (307) 775-6183** or **Donna O'Donnell at (307) 775-6164** by **January 24, 2017**.

How will the sale be conducted?

The sale will be conducted by oral auction. You must make your bids verbally. The winning bid is the highest verbal bid equal to or exceeding the national minimum acceptable bid.

How do I participate in the bidding process?

To participate in the bidding process, you must fill out a registration form identifying the lessee's name and address that will be shown on the lease form and get a bidder number. If you are bidding for more than one party, you must register and obtain a separate bidder number for each company or individual you represent. We will begin registering bidders at 7:00 a.m. on the day of the sale in the receiving room. You must display your bidder number to the auctioneer when you make a bid.

When you register to bid, you will be required to show a valid government-issued photo identification (ID) to verify your identity. If you do not provide a valid photo ID, you will not be allowed to register as a bidder and participate in the auction.

You will also be asked to sign a statement to confirm that any bid you cast will represent a good-faith intention to acquire an oil and gas lease and that you understand that any winning bid will constitute a legally binding commitment to accept the lease and pay monies owed, whether or not a lease is subsequently issued. Further, you will acknowledge that you understand it is a crime under 18 U.S.C. 1001 and 43 U.S.C. 1212 to knowingly and willfully make any false, fictitious or fraudulent statements or representations regarding your qualifications; bidder registration and intent to bid; acceptance of a lease; or payment of monies owed; and that any such offense may

result in a fine or imprisonment for not more than 5 years or both. You will also acknowledge that you understand that it is a crime under 30 U.S.C. 195 (a) and (b) to organize or participate in any scheme to defeat provisions of the mineral leasing regulations. Any person who knowingly violates this provision will be punished by a fine of not more than $500,000, imprisonment for not more than 5 years, or both.

If you, or the party you represent, owe the United States any monies which were due the day of a previous oil and gas lease auction conducted by any BLM office—the minimum monies owed the day of sale—you will not be allowed to register to bid at this lease sale. The Mineral Leasing Act sets out that leases be issued to a "responsible qualified bidder." (30 U.S.C. 226(b)(1)(A)) Any bidder, or party represented by a bidding agent, who does not pay the minimum monies owed the day of the sale is considered as not meeting the qualifications to hold a lease—that is, is not considered a "responsible qualified bidder"—and will be barred from participating in any oil and gas lease auction until that debt to the United States is settled. In addition, if you or the party you represent defaults at any three sales conducted by any BLM office, you or the party you represent will be barred permanently from participating in any other BLM oil and gas lease sale auction.

What is the sale process?

Starting at 8:00 a.m. on the day of the sale-

- The auctioneer will offer the parcels in the order they are shown in this Notice, beginning on page 1;
- All bids are on a per-acre basis for the entire acreage in the parcel; and
- The decision of the auctioneer is final. However, if you believe the auctioneer has made an error or not acknowledged your bid, you must immediately make your concerns known to the auctioneer. Once the auctioneer has opened the bidding on the next parcel available for an oil and gas lease, the decisions made on the previous parcels offered are final.

The minimum bid BLM can accept is $2 per acre or fraction of an acre. If a parcel contains fractional acreage, round it up to the next whole acre. For example, a parcel of 100.51 acres requires a minimum bid of $202 ($2 x 101 acres).

How long will the sale last?

We begin the sale at 8:00 a.m. and it continues until all of the parcels in this Notice have been offered. The length of the sale depends on the number of parcels we are offering and the pace of the bidding. We usually take a 15-minute break at 9:30 a.m. to give you a chance to stretch, get refreshments or make phone calls. Normally, the sale is done by noon. However, there are times when the sale goes into the afternoon. When that happens, we will take a lunch break.

What conditions apply to the lease sale?

- **Parcel withdrawal or sale cancellation:** We reserve the right to withdraw any or all parcels before the sale begins. If we withdraw a parcel(s), and time permits, we will post a notice in the Wyoming State Office Public Room before the day of the sale. We will announce withdrawn parcels before beginning the sale. If we cancel the sale, we will notify you as soon as possible.

- **Fractional interests:** If the United States owns less than 100 percent of the oil and gas mineral interest for the land in a parcel we will show that information with the parcel. When we issue the lease, it will be for the percentage or fraction of interest the United States owns. However, you must calculate your bonus bid and advance rental payment on the gross acreage in the parcel, not the United States net interest. For example, if a parcel contains 200 acres and the United States owns 50 percent of the oil and gas mineral interest, the minimum bonus bid will be $400 ($2 X 200 acres) and the advance annual rental will be $300 ($1.50 X 200 acres) for the first 5-years and $400 ($2 X 200 acres) for the remainder of the lease term. Conversely, your chargeable acreage and royalty on production will be calculated on the United States net oil and gas mineral interest.

- **Payment due on the day of the sale:** You cannot withdraw a bid. Your bid is a legally binding contract. For **each parcel** you are the successful high bidder, you must pay the minimum bonus bid of $2 per acre or fraction of an acre; the first years' advance annual rental of $1.50 per acre or fraction of an acre; and a non-refundable administrative fee of $160. These are monies you owe the United States, whether or not a lease is issued. You must pay these monies at the sale site, either during or immediately following the sale, or by 4 p.m. at the BLM Wyoming State Office, 5353 Yellowstone Road in Cheyenne.

  The minimum monies owed the day of the sale for a winning bid are monies owed to the United States, whether or not a lease is issued. (43 CFR 3120.5-2(b) and 43 CFR 3120.5-3(a)). If payment of minimum monies owed the day of the sale is not received by the date and time above, the Bureau of Land Management will issue a bill for the monies owed. If payment is not received by the bill due date, a demand letter will be sent to you that will include additional fees. If payment is not received as requested by the demand letter, the United States will pursue collection by all available methods, and when appropriate, collect late fees, civil penalties, interest, administrative charges and penalties on past due amounts. "All available methods" include, but are not limited to, referral to collection agencies and credit reporting bureaus, salary or administrative offset; offset of Federal and State payments, including goods or services, Federal and State tax refund offset, and retirement payment offset. Debts may be sent to the Internal Revenue Service for inclusion as income to you on form 1099C, Cancellation of Debt. (Federal Claims Collection Act of 1966, as amended; Debt Collection Improvement Act of 1996; and 31 CFR 285, Debt Collection Authorities Under the Debt Collection act of 1966.)

- **Remaining payments:** If your bonus bid was more than $2 per acre or fraction of an acre and you didn't pay the full amount on the day of the sale, you must pay the balance of your bonus bid by **4:00 p.m. on February 22, 2017,** which is the 10th working day following the sale. Payment must be made to the proper BLM office (CFR §3120.5-2(c)). **If you do not pay in full by this date or if you make payment to any other office or entity other than the BLM Wyoming State Office (i.e. ONRR), you lose the right to the lease and you will forfeit the money you paid on the day of the sale.** If you forfeit a parcel, we may offer it at a later sale.

- **Forms of payment:** You may pay by personal check, certified check, money order, Electronic Funds Transfer (EFT), Automated Clearing House (ACH), or credit card (Visa, MasterCard, American Express or Discover Card only). We cannot accept cash. If you plan to make your payment using a credit card, you should contact your bank prior to the sale and let them know you will be making a substantial charge against your account. ***Please note, we will not accept credit or debit card payments for an amount equal to or greater than $24,999.99. We also will not accept aggregated smaller amounts to bypass this requirement.*** An amount owed that exceeds the maximum dollar amount for a credit card payment transaction may not be split into two or more payment transactions in the same day by using one or multiple credit cards. Additionally, an amount owed that exceeds the maximum dollar amount for a credit card payment transaction may not be split into two or more transactions over multiple days by using one or more credit cards. The BLM does not have Personal Identification Number (PIN) equipment for the purpose of processing PIN authorized debit cards. All debit card transactions will be processed as credit cards and the dollar value limits will apply. If you pay by check, please make your check payable to: **Department of the Interior-BLM**. If a check you have sent to us in the past has been returned for insufficient funds, we may ask that you give us a guaranteed payment, such as a certified check. If you pay by credit card and the transaction is refused, we will try to notify you early enough so that you can make other payment arrangements. ***However, we cannot grant you any extension of time to pay the money that is due the day of the sale.***

- **Bid form:** On the day of the sale, if you are the successful bidder, you must give us a properly completed and signed competitive bid form (Form 3000-2, Oct. 1989, or later edition, copy included) with your payment. This form is a legally binding offer by the prospective lessee to accept a lease and all its terms and conditions. Once the form is signed, you cannot change it. ***We will not accept any bid form that has information crossed out or is otherwise altered.***

  Your completed bid form certifies that:

  (1) You and the prospective lessee are qualified to hold an oil and gas lease under our regulations at 43 CFR 3102.5-2; and

  (2) Both of you have complied with 18 U.S.C. 1860, a law that prohibits unlawful combinations, intimidation of and collusion among bidders.

- **Federal acreage limitations**: Qualified individuals, associations, or corporations may only participate in a competitive lease sale and purchase Federal oil and gas leases from this office if such purchase will not result in exceeding the State limit of 246,080 acres of public domain land and 246,080 acres of acquired land (30 U.S.C. 184(d)). For the purpose of chargeable acreage limitations, you are charged with your proportionate share of the lease acreage holdings of partnerships or corporations in which you own an interest greater than 10 percent. Lease acreage committed to a unit agreement, communitization agreement or development contract that you hold, own or control and acreage in leases for which royalty (including compensatory royalty or royalty-in-kind) was paid in the preceding calendar year is excluded from chargeability for acreage limitation purposes.

  The acreage limitations and certification requirements apply for competitive oil and gas lease sales, noncompetitive lease offers, transfer of interest by assignment of record title or operating rights, and options to acquire interest in leases regardless of whether an individual, association, or corporation has received, under 43 CFR 3101.2-4, additional time to divest excess acreage acquired through merger or acquisition.

- **Lease terms:** A lease issued as a result of this sale will have a primary term of 10 years. It will continue beyond its primary term as long as oil or gas is produced in paying quantities on or for the benefit of the lease. Advance rental at $1.50 per acre or fraction of an acre for the first 5 years ($2 per acre after that) is due on or before the anniversary date each year until production begins. Once a lease is producing, you must pay a royalty of 12.5 percent of the value or the amount of production removed or sold from the lease. You will find other lease terms on our standard lease form (Form 3100-11, June 1988 or later edition, copy included).

- **Stipulations:** Stipulations are part of the lease and supersede any inconsistent provisions of the lease form.

- **Lease Issuance:** After we receive the bid form, all money due, and, if appropriate, your unit joinder information, we can issue the lease. Usually, a lease is effective the first day of the month following the month in which we sign it. If you want your lease to be effective the first day of the month in which we sign it, you must ask us in writing to do this. We have to receive your request before we sign the lease.

- **Legal Land Descriptions:** We prepared this Notice with land status information from our Legacy Rehost 2000 (LR2000) case recordation system. We are providing you with the following information to assist you in understanding the legal descriptions given for each parcel:

    - Township and range contains additional zeros. For example, T. 37 N., R. 62 W., is shown as, T.<u>0</u>37<u>0</u>N, R.<u>0</u>62<u>0</u>W (additional zeros underlined).

- Section numbers contain additional leading zeros. For example, section 4 is shown as Sec. 004.

- Lots, aliquot parts, tracts, and exceptions to survey for each section are described separately.

- Railroad rights-of-way exclusions are described as to only the land affected.

- LR2000 will code a ½ township as a 2 in the database. This 2 will appear as the last digit in the number. For example, T. 14½ N., will appear as T.0142N.

- **Cellular Phone Usage:** You are restricted from using cellular phones in the sale room during the oral auction. You must confine your cellular phone usage to the hallway or terrace area outside the sale room when the auction is taking place.

- **Other Conditions of the Sale:** At the time the sale begins, we will make any rules regarding sale procedures that we feel are necessary for the proper conduct of the sale.

NONCOMPETITIVE OFFERS TO LEASE

What parcels are available for noncompetitive offers to lease?

Unless stated in this Notice, parcels that do not receive a bid at the competitive sale are available for noncompetitive offers to lease beginning the first business day following the day of the sale. If not withdrawn, these parcels are available for noncompetitive offers to lease for a period of two years following the day of the sale.

How do I file a noncompetitive offer to lease after the sale?

If you want to file a noncompetitive offer to lease on an unsold parcel, you must give us-

- Three copies of form 3100-11, *Offer to Lease and Lease for Oil and Gas* properly completed and signed. **(Note: Computer generated forms are available on the Internet at: http://www.blm.gov/noc/st/en/business/eForms.html).** You must describe the land in your offer as specified in our regulations at 43 CFR §3110.5; and

- Your payment for the total of the $415 filing fee and, except for noncompetitive

future interest lease offers, the first year's advance rental computed at $1.50 per acre or fraction of an acre. Remember to round up any fractional acreage when you calculate the rental amount.

For your convenience, a drop box will be available at the sale site on the day of the sale to receive your noncompetitive offers to lease. We consider all offers filed the day of a sale and the first business day after it, for any of the unsold parcels, to be filed as of 9:00 a.m. the first business day following the day of the sale. If a parcel receives more than one offer, we will hold a drawing to pick the winner (see 43 CFR 1822.17). We have identified those parcels that have pending presale offers. A noncompetitive presale offer to lease has priority over any other noncompetitive offer to lease filed after the sale.

How do I file a noncompetitive presale offer?

Under our regulations at 43 CFR 3110.1(a), you may file a noncompetitive presale offer to lease for land that-

- Is available; and
- Has not been under lease during the previous one-year period; or
- Has not been included in a competitive lease sale within the previous two-year period.

Your noncompetitive presale offer to lease must be filed prior to the official posting of this sale Notice. If your presale offer was timely filed, was complete and we do not receive a bid for the parcel that contains the land in your offer, it has priority over any other noncompetitive offer to lease for that parcel filed after the sale. Your presale offer to lease is your consent to the terms and conditions of the lease, including any additional stipulations. If you want to file a presale offer, follow the guidance listed above for filing a noncompetitive offer after the sale and the regulations at 43 CFR 3110.1(a).

How can I find out the results of this sale?

We will post the sale results in our Public Room. You can buy ($5) a printed copy of the results list by contacting our Public Information Section at (307) 775-6256. Both this Sale Notice and the results list will be available on our public Internet site at: http://www.blm.gov/wy. This Notice also is available on the BLM home page at: http://www.blm.gov.

May I protest BLM's decision to offer the land in this Notice for lease?

Yes, under regulation 43 CFR 3120.1-3, you may protest the inclusion of a parcel listed in this sale notice. All protests must meet the following requirements:

- We must receive a protest no later than 4:00 p.m. local time on **December 9, 2016**, the 60th calendar day prior to the date of the sale. If our office is not open

on the 60th day prior to the date of the sale, a protest received on the next day our office is open to the public will be considered timely filed. The protest must also include any statement of reasons to support the protest. We will dismiss a late-filed protest or a protest filed without a statement of reasons.

- A protest must state the interest of the protesting party in the matter.

- The protest document must be signed. Unsigned protest documents will be dismissed.

- A protest must reference the parcel number identified in **this** sale notice. Use of any other parcel number will result in the protest being dismissed.

- You may file a protest either by mail in hardcopy form or by telefax. You may not file a protest by electronic mail. A protest filed by fax must be sent to 307-775-6203. A protest sent to a fax number other than the fax number identified or a protest filed by electronic mail will be dismissed.

- If the party signing the protest is doing so on behalf of an association, partnership or corporation, the signing party must reveal the relationship between them. For example, unless an environmental group authorizes an individual member of its group to act for it, the individual cannot make a protest in the group's name.

- Any protests, including names and street addresses, you submit will be made available for public review. Individual respondents may request confidentiality. If you wish to withhold your personal identifiable information from public review or from disclosure under the Freedom of Information Act, you must state this prominently at the beginning of your written comment. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, will be made available for public inspection in their entirety.

If BLM receives a timely protest of a parcel advertised on this Sale Notice, how does it affect bidding on the parcel?

We will announce receipt of any protests at the beginning of the sale. We will also announce a decision to either withdraw the parcel or proceed with offering it at the sale.

If I am the high bidder at the sale for a protested parcel, when will BLM issue my lease?

We will make every effort to decide the protest within 60 days after the sale. We will issue no lease for a protested parcel until the State Director makes a decision on the protest. If the State Director denies the protest, we will issue your lease concurrently with that decision.

If I am the successful bidder of a protested parcel, may I withdraw my bid and receive a refund of my first year's rental and bonus bid?

No. In accordance with BLM regulations (43 CFR 3120.5-3) you may not withdraw your bid.

If BLM upholds the protest, how does that affect my competitive bid?

If we uphold a protest and withdraw the parcel from leasing, we will refund your first year's rental, bonus bid and administrative fee. If the decision upholding the protest results in additional stipulations, we will offer you an opportunity to accept or reject the lease with the additional stipulations prior to lease issuance. If you do not accept the additional stipulations, we will reject your bid and we will refund your first year's rental, bonus bid and administrative fee.

If BLM's decision to uphold the protest results in additional stipulations, may I appeal that decision?

Yes, you may. Note, an appeal from the State Director's decision must meet the requirements of Title 43 CFR §4.411 and Part 1840.

May I appeal BLM's decision to deny my protest?

Yes, you may. Note, an appeal from the State Director's decision must meet the requirements of Title 43 CFR §4.411 and Part 1840.

May I withdraw my bid if the protestor files an appeal?

No. If the protestor appeals our decision to deny the protest, you may not withdraw your bid. We will issue your lease concurrently with the decision to deny the protest. If resolution of the appeal results in lease cancellation, we will authorize refund of the bonus bid, rentals and administrative fee if—

- There is no evidence that the lessee(s) derived any benefit from possession of the lease during the time they held it; and,

- There is no indication of bad faith or other reasons not to refund the rental, bonus bid and administrative fee.

You may review the decision to offer the land for lease and the supporting National Environmental Policy Act documents in our Public Room. Our Public Room hours are from 9 a.m. to 4 p.m. Monday through Friday, except on Federal Holidays.

How do I file an Expression of Interest (EOI)?

- An Expression of Interest (EOI) is an informal nomination to request that certain land be included in an oil and gas competitive lease sale. Regulations pertaining to competitive oil and gas leasing can be found in Title 43 CFR 3120.

- This request must be made in writing (no specific form required) and either **mailed or faxed** to 307-775-6203 at the BLM Wyoming State Office.

- No filing fee or rental is required with an EOI.

- Make sure your EOI contains a complete legal land description.

- Effective July 24, 2009, if you are nominating any split-estate land (private surface/Federal minerals), your EOI must include the name and address of the current private surface owner(s).

  Information regarding leasing of Federal minerals overlain with private surface, referred to as "Split Estate," is available on the following Washington Office website at: http://www.blm.gov/bmp/Split_Estate.htm. A Split Estate brochure is available at this site. The brochure outlines the rights, responsibilities, and opportunities of private surface owners and oil and gas operators in the planning, lease sale, permitting/development, and operations/production phases of the oil and gas program.

- As directed by Washington Office (WO) Instruction Memorandum (IM) 2014-004, the BLM will publish EOI submissions received on or after January 1, 2014, on the website of the BLM State Office where the nominated parcel is located. EOI submitters who consider their name and address confidential should not include that information in their EOI. The BLM no longer requires submitters to provide this information for contact purposes; however, the BLM will make this information available to the public. For more information please review WO-IM 2014-004 at http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/2014.html

When are the next competitive oil and gas lease sales scheduled?

We have tentatively scheduled our next four competitive lease sales for May 2, 2017, August 1, 2017, November 7, 2017, and February 6, 2018.

Whom should I contact if I have a question?

If you have questions on BLM stipulations, lease notices, etc., please contact the appropriate BLM Field Office for assistance. We have included a map that depicts the boundary of each of our Field

Offices and a list of their addresses and telephone numbers. If you have questions on the Bureau of Reclamation's stipulations or restrictions, etc., for parcels under their surface management jurisdiction, please contact Gene Zinkowich, Bureau of Reclamation, Great Plains Region, P.O. Box 36900, Billings, MT 59107-6900, (telephone number 406-247-7716). For general information about the competitive oil and gas lease sale process, this Notice, or to receive copies of the bid receipt and lease form, please contact **Corey Murzyn at (307) 775-6183** or **Donna O'Donnell at (307) 775-6164.**

Chris Hite
Chief, Branch of Fluid Minerals Adjudication

WY-1702-001 319.920 Acres

T.0410N, R.0600W, 06th PM, WY
Sec. 006 LOTS 6,7;
006 E2SW,SE;
Weston County
Newcastle FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
TLS (1) Feb 1 to Jul 31; (2) as mapped on the Newcastle Field Office GIS database; (3) protecting nesting Raptors.

WY-1702-002 160.000 Acres

T.0340N, R.0660W, 06th PM, WY
Sec. 027 S2SW;
028 S2SE;
Niobrara County
Newcastle FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

WY-1702-003 80.000 Acres

T.0340N, R.0660W, 06th PM, WY
Sec. 032 SENE;
033 NWNW;
Niobrara County
Newcastle FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

WY-1702-004 80.000 Acres

T.0430N, R.0660W, 06th PM, WY
Sec. 012 E2NE;
Weston County
Newcastle FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
TLS (1) Feb 1 to Jul 31; (2) as mapped on the Newcastle Field Office GIS database; (3) protecting nesting Raptors.

WY-1702-005 1280.880 Acres

T.0410N, R.0670W, 06th PM, WY
Sec. 001 LOTS 2-4;
010 E2,S2NW,S2SW;
013 NE,N2SE,SWSE;
024 W2;
027 NWSW;
033 NENE;
Weston, Converse and Niobrara Counties
Newcastle FO
Casper FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_NSO_PHMAL
WY_SW_TLS_PHMAL
WY_SW_TLS_PHMAWCA
WY_SW_CSU_PHMA
TLS (1) Mar 15 to Jul 15; (2) as mapped on the Casper Field Office GIS database; (3) no surface use to seasonally protect Greater Sage-grouse breeding, nesting and early brood-rearing habitats (independent of habitat suitability) inside designated PHMAs (Core only).
TLS (1) Feb 1 to Jul 31; (2) as mapped on the Newcastle Field Office GIS database; (3) protecting nesting Raptors.

WY-1702-006 160.000 Acres

T.0410N, R.0670W, 06th PM, WY
Sec. 004 SE;
Weston County
Newcastle FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_PHMAL
WY_SW_TLS_PHMAWCA
WY_SW_CSU_PHMA

WY-1702-007 484.790 Acres

T.0370N, R.0680W, 06th PM, WY
Sec. 003 LOTS 3,4;
003 SWNE,S2NW;
004 LOTS 1-3;
009 NW;
Converse County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_CSU_PHMA
TLS (1) Mar 15 to Jul 15; (2) as mapped on the Casper Field Office GIS database; (3) no surface use to seasonally protect Greater Sage-grouse breeding, nesting and early brood-rearing habitats (independent of habitat suitability) inside designated PHMAs (Core only).

WY-1702-008 362.700 Acres

T.0410N, R.0680W, 06th PM, WY
Sec. 006 LOTS 7;
007 LOTS 1-4;
007 E2W2;
Weston County
Newcastle FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_PHMAL
WY_SW_TLS_PHMAWCA
WY_SW_CSU_PHMA
TLS (1) May 1 to Jun 30; (2) as mapped on the Newcastle Field Office GIS database; (3) protecting big game during parturition.

WY-1702-009 160.000 Acres

T.0450N, R.0680W, 06th PM, WY
Sec. 007 E2NE;
032 S2SE;
Weston County
Newcastle FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_PHMAL
WY_SW_TLS_PHMAWCA
WY_SW_CSU_PHMA

WY-1702-010 480.000 Acres

T.0470N, R.0680W, 06th PM, WY
Sec. 008 SE;
009 S2;
Weston County
Newcastle FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_NSO_PHMAL
WY_SW_TLS_PHMAL
WY_SW_TLS_PHMAWCA
WY_SW_CSU_PHMA

WY-1702-011 245.790 Acres

T.0490N, R.0680W, 06th PM, WY
Sec. 010 LOTS 1,2,5-8;
Crook County
Newcastle FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_PHMAL
WY_SW_TLS_PHMAWCA
WY_SW_CSU_PHMA
TLS (1) Mar 1 to Jun 30; (2) as mapped on the Newcastle Field Office GIS database; (3) protecting nesting Sharp-tailed grouse.
CSU (1) Surface occupancy or use within 1/4 mile or visual horizon of the trail, whichever is closer, may be restricted or prohibited unless the operator and surface managing agency arrive at an acceptable plan for mitigation of anticipated impacts; (2) entire lease; (3) protecting cultural and scenic values of the Deadwood Road (48CK420).

WY-1702-012 124.200 Acres

T.0490N, R.0680W, 06th PM, WY
Sec. 010 LOTS 3,4,9;
Crook County
Newcastle FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_PHMAL
WY_SW_TLS_PHMAWCA
WY_SW_CSU_PHMA
TLS (1) Mar 1 to Jun 30; (2) as mapped on the Newcastle Field Office GIS database; (3) protecting nesting Sharp-tailed grouse.

WY-1702-013 82.030 Acres

T.0490N, R.0680W, 06th PM, WY
Sec. 015 LOTS 2,4;
Crook County
Newcastle FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_NSO_PHMAL
WY_SW_TLS_PHMAL
WY_SW_TLS_PHMAWCA
WY_SW_CSU_PHMA
TLS (1) Mar 1 to Jun 30; (2) as mapped on the Newcastle Field Office GIS database; (3) protecting nesting Sharp-tailed grouse.
TLS (1) Feb 1 to Jul 31; (2) as mapped on the Newcastle Field Office GIS database; (3) protecting nesting Raptors.
CSU (1) Surface occupancy or use within 1/4 mile or visual horizon of the trail, whichever is closer, may be restricted or prohibited unless the operator and surface managing agency arrive at an acceptable plan for mitigation of anticipated impacts; (2) entire lease; (3) protecting cultural and scenic values of the Deadwood Road (48CK420).

WY-1702-014 37.990 Acres

T.0540N, R.0680W, 06th PM, WY
Sec. 031 LOTS 10;
Crook County
Newcastle FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
TLS (1) Feb 1 to Jul 31; (2) as mapped on the Newcastle Field Office GIS database; (3) protecting nesting Raptors.

WY-1702-015 203.070 Acres

T.0430N, R.0690W, 06th PM, WY
Sec. 015 LOTS 3,6,10,11;
017 LOTS 12;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_BGCWEC
WY_BFO_TLS_EC
WY_BFO_CSU_H
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_BGCW
WY_BFO_CSU_EC
WY_BFO_CSU_ECWC
WY_BFO_CSU_RN

WY-1702-016 1247.190 Acres

T.0440N, R.0690W, 06th PM, WY
Sec. 010 LOTS 14-16;
011 LOTS 5-7,12,13;
012 LOTS 7-9;
013 LOTS 3;
014 LOTS 1,2,7,8;
015 LOTS 2-7;
017 LOTS 1;
020 LOTS 7,8;
027 LOTS 10-12;
029 LOTS 1-3;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_EC
WY_BFO_TLS_BGCWEC
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_EC
WY_BFO_CSU_BGCW
WY_BFO_CSU_ECWC
WY_BFO_CSU_RN

WY-1702-017 163.350 Acres

T.0440N, R.0690W, 06th PM, WY
Sec. 019 LOTS 9-12;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_FQM
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB

WY-1702-018 2006.340 Acres

T.0450N, R.0690W, 06th PM, WY
Sec. 011 LOTS 1-4,7,8,13,14;
012 LOTS 3-6;
001 LOTS 5,6,11-20;
002 LOTS 5-8;
003 LOTS 13-16;
004 LOTS 5-20;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_SW_CSU_PHMA
WY_BFO_NSO_Slopes50
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_GSGRH
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA

WY-1702-019 1246.740 Acres

T.0460N, R.0690W, 06th PM, WY
Sec. 023 LOTS 1-4,6-16;
024 LOTS 1-16;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_CSU_FQM
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_PD
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR

WY-1702-020 1513.290 Acres

T.0460N, R.0690W, 06th PM, WY
Sec. 033 LOTS 2-7,10-13;
034 LOTS 1-9,14,15;
034 SWNE;
035 LOTS 1-16;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_SW_CSU_PHMA
WY_BFO_TLS_PHMAWCA
WY_BFO_TLS_PHMAC
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_GSGRH
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR

WY-1702-021 76.210 Acres

T.0520N, R.0690W, 06th PM, WY
Sec. 007 LOTS 16;
018 LOTS 6;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_CSU_FQM
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR

WY-1702-022 81.410 Acres

T.0520N, R.0690W, 06th PM, WY
Sec. 021 LOTS 1,8;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_CSU_FQM
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA

WY-1702-023 45.490 Acres

T.0520N, R.0690W, 06th PM, WY
Sec. 021 LOTS 4;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB

WY-1702-024 230.370 Acres

T.0530N, R.0690W, 06th PM, WY
Sec. 013 LOTS 3-6;
024 LOTS 3;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB

WY-1702-025 844.070 Acres

T.0530N, R.0690W, 06th PM, WY
Sec. 029 LOTS 1-7,11-14;
030 LOTS 5-10;
032 LOTS 3,4,9-11;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA

WY-1702-026 82.770 Acres

T.0530N, R.0690W, 06th PM, WY
Sec. 032 LOTS 8,12;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR

WY-1702-027 82.940 Acres

T.0540N, R.0690W, 06th PM, WY
Sec. 009 LOTS 1;
010 LOTS 3;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_CSU_PHMA
WY_BFO_TLS_PHMAL
WY_BFO_TLS_PHMAWCA
WY_BFO_TLS_STG
WY_BFO_CSU_GSGRH
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB

WY-1702-028 325.290 Acres

T.0540N, R.0690W, 06th PM, WY
Sec. 017 LOTS 1,2,8,9;
018 LOTS 5,6,12,13;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_NSO_PHMAL
WY_SW_CSU_PHMA
WY_BFO_NSO_Slopes50
WY_BFO_TLS_PHMAWCA
WY_BFO_TLS_PHMAL
WY_BFO_TLS_STG
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SLR
WY_BFO_CSU_GSGRH
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_STG
WY_BFO_CSU_RN

WY-1702-029 120.320 Acres

T.0540N, R.0690W, 06th PM, WY
Sec. 029 LOTS 11-13;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_CSU_PHMA
WY_BFO_TLS_PHMAL
WY_BFO_TLS_PHMAWCA
WY_BFO_TLS_STG
WY_BFO_CSU_GSGRH
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB

WY-1702-030 214.500 Acres

T.0540N, R.0690W, 06th PM, WY
Sec. 031 LOTS 5,12,13,20;
032 LOTS 4,5;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_CSU_PHMA
WY_BFO_TLS_PHMAL
WY_BFO_TLS_PHMAWCA
WY_BFO_TLS_STG
WY_BFO_CSU_R500F
WY_BFO_CSU_GSGRH
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB

WY-1702-031 1236.810 Acres

T.0410N, R.0700W, 06th PM, WY
Sec. 006 LOTS 8,17,19-23;
018 LOTS 5,6,11-14,19,20;
019 LOTS 5-20;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_PD
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN
CSU (1) Surface use or occupancy shall not be allowed by oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) on this Federal oil and gas lease to conduct any oil and gas operation, including drilling for, removing, or disposing of oil and/or gas contained in Federal coal leases WYW-119554, WYW-154001 & WYW-179011 unless a plan for mitigation of anticipated impacts is developed between the oil and gas and the coal lessees, and the plan is approved by the Authorized Officer; (2) as mapped on High Plains District GIS database; (3) for the purpose of protecting the first in time valid existing rights of the coal lessee, the Authorized Officer reserves the right to alter or modify any oil and gas operations on the lands described in these leases ensuring: a.) the orderly development of the coal resource by surface and/or underground mining methods; b.) coal mine worker safety; and/or c.) coal production rates or recovery of the coal resource. The oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) of this Federal oil and gas lease shall not hold the United States as lessor, coal lessee(s), sub-lessee(s), and/or coal operator(s) liable for any damage or loss of the oil and gas resource, including the venting of coal bed methane gas, caused by coal exploration or mining operations conducted on Federal coal WYW-119554, WYW-154001 & WYW-179011.

WY-1702-032 36.860 Acres

T.0420N, R.0700W, 06th PM, WY
Sec. 031 LOTS 16;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_FQM
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
CSU (1) Surface use or occupancy shall not be allowed by oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) on this Federal oil and gas lease to conduct any oil and gas operation, including drilling for, removing, or disposing of oil and/or gas contained in the Federal coal lease WYW-179011 unless a plan for mitigation of anticipated impacts is developed between the oil and gas and the coal lessees, and the plan is approved by the Authorized Officer; (2) as mapped on High Plains District GIS database; (3) for the purpose of protecting the first in time valid existing rights of the coal lessee, the Authorized Officer reserves the right to alter or modify any oil and gas operations on the lands described in this lease ensuring: a.) the orderly development of the coal resource by surface and/or underground mining methods; b.) coal mine worker safety; and/or c.) coal production rates or recovery of the coal resource. The oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) of this Federal oil and gas lease shall not hold the United States as lessor, coal lessee(s), sub-lessee(s), and/or coal operator(s) liable for any damage or loss of the oil and gas resource, including the venting of coal bed methane gas, caused by coal exploration or mining operations conducted on Federal coal WYW-179011.

WY-1702-033 453.110 Acres

T.0440N, R.0700W, 06th PM, WY
Sec. 005 LOTS 11,19,20;
008 LOTS 1,2,7-10,15,16;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA

WY-1702-034 713.110 Acres

T.0450N, R.0700W, 06th PM, WY
Sec. 014 LOTS 1-10,15,16;
022 LOTS 9,10,15,16;
023 LOTS 16;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_NSO_PHMAL
WY_SW_TLS_GHMAL
WY_SW_CSU_PHMA
WY_BFO_NSO_SSRN
WY_BFO_TLS_PHMAWCA
WY_BFO_TLS_PHMAC
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_GSGRH
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_RN

WY-1702-035 162.040 Acres

T.0460N, R.0700W, 06th PM, WY
Sec. 004 LOTS 9-12;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_RN

WY-1702-036 75.770 Acres

T.0480N, R.0700W, 06th PM, WY
Sec. 002 LOTS 7,8;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA

WY-1702-037 325.430 Acres

T.0480N, R.0700W, 06th PM, WY
Sec. 026 LOTS 11,14;
035 LOTS 2,7,9,10,15,16;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_Slopes50
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-038 576.430 Acres

T.0480N, R.0700W, 06th PM, WY
Sec. 033 LOTS 1,2,7,8;
034 LOTS 4,5;
035 LOTS 3-6,11-14;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-039 405.040 Acres

T.0490N, R.0700W, 06th PM, WY
Sec. 018 LOTS 7-9,12-15,17-19;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-040 1130.370 Acres

T.0500N, R.0700W, 06th PM, WY
Sec. 003 LOTS 5-20;
004 LOTS 5-18;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_SW_TLS_GHMAL
WY_BFO_NSO_Slopes50
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA

WY-1702-041 860.960 Acres

T.0520N, R.0700W, 06th PM, WY
Sec. 033 LOTS 5-10,12-14;
034 LOTS 1,2,7-15;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_NSO_GHMAL
WY_SW_TLS_GHMAL
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-042 796.880 Acres

T.0530N, R.0700W, 06th PM, WY
Sec. 009 LOTS 1-9;
010 LOTS 12-14,17-24;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_NSO_PHMAL
WY_SW_TLS_GHMAL
WY_BFO_TLS_PHMAL
WY_BFO_TLS_PHMAWCA
WY_BFO_TLS_NSSRN
WY_SW_CSU_PHMA
WY_BFO_CSU_FQM
WY_BFO_CSU_GSGRH
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-043 119.930 Acres

T.0410N, R.0710W, 06th PM, WY
Sec. 026 LOTS 2,7,10;
Campbell and Converse Counties
Buffalo FO
Casper FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_RN
CSU (1) Surface use or occupancy shall not be allowed by oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) on this Federal oil and gas lease to conduct any oil and gas operation, including drilling for, removing, or disposing of oil and/or gas contained in Federal coal leases WYW-128322 & WYW-178457 unless a plan for mitigation of anticipated impacts is developed between the oil and gas and the coal lessees, and the plan is approved by the Authorized Officer; (2) as mapped on High Plains District GIS database; (3) for the purpose of protecting the first in time valid existing rights of the coal lessee, the Authorized Officer reserves the right to alter or modify any oil and gas operations on the lands described in these leases ensuring: a.) the orderly development of the coal resource by surface and/or underground mining methods; b.) coal mine worker safety; and/or c.) coal production rates or recovery of the coal resource. The oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) of this Federal oil and gas lease shall not hold the United States as lessor, coal lessee(s), sub-lessee(s), and/or coal operator(s) liable for any damage or loss of the oil and gas resource, including the venting of coal bed methane gas, caused by coal exploration or mining operations conducted on Federal coal leases WYW-128322 & WYW-178457.

WY-1702-044 202.180 Acres

T.0440N, R.0710W, 06th PM, WY
Sec. 010 LOTS 11;
031 LOTS 13,14,19,20;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_RN

WY-1702-045 532.330 Acres

T.0450N, R.0710W, 06th PM, WY
Sec. 004 LOTS 9;
005 LOTS 5,12;
017 LOTS 1,2,7,8,11,12;
019 LOTS 5,6,9,10;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_RN

WY-1702-046 242.990 Acres

T.0460N, R.0710W, 06th PM, WY
Sec. 007 LOTS 7,8;
018 LOTS 13;
032 LOTS 1,2,7;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-047 445.460 Acres

T.0480N, R.0710W, 06th PM, WY
Sec. 002 LOTS 15,17;
005 LOTS 15;
009 LOTS 2,3,13-15;
018 LOTS 6-8;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

Special Lease Notice:

There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.

WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

CSU (1) Surface use or occupancy shall not be allowed by oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) on this Federal oil and gas lease to conduct any oil and gas operation, including drilling for, removing, or disposing of oil and/or gas contained in the Federal coal lease WYW-78633 unless a plan for mitigation of anticipated impacts is developed between the oil and gas and the coal lessees, and the plan is approved by the Authorized Officer; (2) as mapped on High Plains District GIS database; (3) for the purpose of protecting the first in time valid existing rights of the coal lessee, the Authorized Officer reserves the right to alter or modify any oil and gas operations on the lands described in this lease ensuring: a.) the orderly development of the coal resource by surface and/or underground mining methods; b.) coal mine worker safety; and/or c.) coal production rates or recovery of the coal resource. The oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) of this Federal oil and gas lease shall not hold the United States as lessor, coal lessee(s), sub-lessee(s), and/or coal operator(s) liable for any damage or loss of the oil and gas resource, including the venting of coal bed methane gas, caused by coal exploration or mining operations conducted on Federal coal WYW-78633.

WY-1702-048 487.550 Acres

T.0480N, R.0710W, 06th PM, WY
Sec. 012 LOTS 15;
013 LOTS 1;
023 LOTS 7-10;
024 LOTS 1-3;
025 LOTS 1,2;
026 LOTS 10;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_TLS_SSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_RN
CSU (1) Surface use or occupancy shall not be allowed by oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) on this Federal oil and gas lease to conduct any oil and gas operation, including drilling for, removing, or disposing of oil and/or gas contained in the Federal coal lease WYW-0317682 unless a plan for mitigation of anticipated impacts is developed between the oil and gas and the coal lessees, and the plan is approved by the Authorized Officer; (2) as mapped on High Plains District GIS database; (3) for the purpose of protecting the first in time valid existing rights of the coal lessee, the Authorized Officer reserves the right to alter or modify any oil and gas operations on the lands described in this lease ensuring: a.) the orderly development of the coal resource by surface and/or underground mining methods; b.) coal mine worker safety; and/or c.) coal production rates or recovery of the coal resource. The oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) of this Federal oil and gas lease shall not hold the United States as lessor, coal lessee(s), sub-lessee(s), and/or coal operator(s) liable for any damage or loss of the oil and gas resource, including the venting of coal bed methane gas, caused by coal exploration or mining operations conducted on Federal coal WYW-0317682.

WY-1702-049 281.460 Acres

T.0480N, R.0710W, 06th PM, WY
Sec. 014 LOTS 4,5,12;
015 LOTS 10-12;
023 LOTS 3;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
CSU (1) Surface use or occupancy shall not be allowed by oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) on this Federal oil and gas lease to conduct any oil and gas operation, including drilling for, removing, or disposing of oil and/or gas contained in the Federal coal lease WYW-3397 unless a plan for mitigation of anticipated impacts is developed between the oil and gas and the coal lessees, and the plan is approved by the Authorized Officer; (2) as mapped on High Plains District GIS database; (3) for the purpose of protecting the first in time valid existing rights of the coal lessee, the Authorized Officer reserves the right to alter or modify any oil and gas operations on the lands described in this lease ensuring: a.) the orderly development of the coal resource by surface and/or underground mining methods; b.) coal mine worker safety; and/or c.) coal production rates or recovery of the coal resource. The oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) of this Federal oil and gas lease shall not hold the United States as lessor, coal lessee(s), sub-lessee(s), and/or coal operator(s) liable for any damage or loss of the oil and gas resource, including the venting of coal bed methane gas, caused by coal exploration or mining operations conducted on Federal coal WYW-3397.

WY-1702-050 121.650 Acres

T.0480N, R.0710W, 06th PM, WY
Sec. 026 LOTS 3-5;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR

WY-1702-051 82.290 Acres

T.0480N, R.0710W, 06th PM, WY
Sec. 031 LOTS 13,14;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F
CSU (1) Surface use or occupancy shall not be allowed by oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) on this Federal oil and gas lease to conduct any oil and gas operation, including drilling for, removing, or disposing of oil and/or gas contained in the Federal coal lease WYW-078629 unless a plan for mitigation of anticipated impacts is developed between the oil and gas and the coal lessees, and the plan is approved by the Authorized Officer; (2) as mapped on High Plains District GIS database; (3) for the purpose of protecting the first in time valid existing rights of the coal lessee, the Authorized Officer reserves the right to alter or modify any oil and gas operations on the lands described in this lease ensuring: a.) the orderly development of the coal resource by surface and/or underground mining methods; b.) coal mine worker safety; and/or c.) coal production rates or recovery of the coal resource. The oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) of this Federal oil and gas lease shall not hold the United States as lessor, coal lessee(s), sub-lessee(s), and/or coal operator(s) liable for any damage or loss of the oil and gas resource, including the venting of coal bed methane gas, caused by coal exploration or mining operations conducted on Federal coal WYW-078629.

WY-1702-052 326.300 Acres

T.0480N, R.0710W, 06th PM, WY
Sec. 032 LOTS 8-11;
033 LOTS 5-8;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F
CSU (1) Surface use or occupancy shall not be allowed by oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) on this Federal oil and gas lease to conduct any oil and gas operation, including drilling for, removing, or disposing of oil and/or gas contained in the Federal coal lease WYW-0317682 unless a plan for mitigation of anticipated impacts is developed between the oil and gas and the coal lessees, and the plan is approved by the Authorized Officer; (2) as mapped on High Plains District GIS database; (3) for the purpose of protecting the first in time valid existing rights of the coal lessee, the Authorized Officer reserves the right to alter or modify any oil and gas operations on the lands described in this lease ensuring: a.) the orderly development of the coal resource by surface and/or underground mining methods; b.) coal mine worker safety; and/or c.) coal production rates or recovery of the coal resource. The oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) of this Federal oil and gas lease shall not hold the United States as lessor, coal lessee(s), sub-lessee(s), and/or coal operator(s) liable for any damage or loss of the oil and gas resource, including the venting of coal bed methane gas, caused by coal exploration or mining operations conducted on Federal coal WYW-0317682.

WY-1702-053 485.260 Acres

T.0480N, R.0710W, 06th PM, WY
Sec. 034 LOTS 4-6,9-11;
035 LOTS 1-6;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN
CSU (1) Surface use or occupancy shall not be allowed by oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) on this Federal oil and gas lease to conduct any oil and gas operation, including drilling for, removing, or disposing of oil and/or gas contained in the Federal coal lease WYW-0317682 unless a plan for mitigation of anticipated impacts is developed between the oil and gas and the coal lessees, and the plan is approved by the Authorized Officer; (2) as mapped on High Plains District GIS database; (3) for the purpose of protecting the first in time valid existing rights of the coal lessee, the Authorized Officer reserves the right to alter or modify any oil and gas operations on the lands described in this lease ensuring: a.) the orderly development of the coal resource by surface and/or underground mining methods; b.) coal mine worker safety; and/or c.) coal production rates or recovery of the coal resource. The oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) of this Federal oil and gas lease shall not hold the United States as lessor, coal lessee(s), sub-lessee(s), and/or coal operator(s) liable for any damage or loss of the oil and gas resource, including the venting of coal bed methane gas, caused by coal exploration or mining operations conducted on Federal coal WYW-0317682.

WY-1702-054 242.480 Acres

T.0490N, R.0710W, 06th PM, WY
Sec. 001 LOTS 6,11,12;
003 LOTS 5,12,13;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_H20500F

WY-1702-055 122.070 Acres

T.0490N, R.0710W, 06th PM, WY
Sec. 008 LOTS 9;
009 LOTS 8,10;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR

WY-1702-056 327.680 Acres

T.0490N, R.0710W, 06th PM, WY
Sec. 015 LOTS 16;
019 LOTS 12;
021 LOTS 4,15,16;
022 LOTS 13;
027 LOTS 2,7;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-057 410.030 Acres

T.0490N, R.0710W, 06th PM, WY
Sec. 023 LOTS 13,14,16;
025 LOTS 10-12;
026 LOTS 1,5,6,8;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-058 406.630 Acres

T.0490N, R.0710W, 06th PM, WY
Sec. 029 LOTS 16;
030 LOTS 16;
032 LOTS 1,13,14;
034 LOTS 2,3,7;
035 LOTS 4,6;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-059 154.040 Acres

T.0500N, R.0710W, 06th PM, WY
Sec. 028 LOTS 5,6 (EXCL 7.34 AC IN
028 RR ROW WYW0119068);
029 LOTS 1,2;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
CSU (1) Surface use or occupancy shall not be allowed by oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) on this Federal oil and gas lease to conduct any oil and gas operation, including drilling for, removing, or disposing of oil and/or gas contained in the Federal coal lease WYW-073289 unless a plan for mitigation of anticipated impacts is developed between the oil and gas and the coal lessees, and the plan is approved by the Authorized Officer; (2) as mapped on High Plains District GIS database; (3) for the purpose of protecting the first in time valid existing rights of the coal lessee, the Authorized Officer reserves the right to alter or modify any oil and gas operations on the lands described in this lease ensuring: a.) the orderly development of the coal resource by surface and/or underground mining methods; b.) coal mine worker safety; and/or c.) coal production rates or recovery of the coal resource. The oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) of this Federal oil and gas lease shall not hold the United States as lessor, coal lessee(s), sub-lessee(s), and/or coal operator(s) liable for any damage or loss of the oil and gas resource, including the venting of coal bed methane gas, caused by coal exploration or mining operations conducted on Federal coal WYW-073289.

WY-1702-060 74.370 Acres

T.0500N, R.0710W, 06th PM, WY
Sec. 029 LOTS 15;
029 LOTS 10 (EXCL 6.11 AC IN
029 RR ROW WYW0119068);
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA

WY-1702-061 244.130 Acres

T.0500N, R.0710W, 06th PM, WY
Sec. 034 LOTS 9-11,14-16;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA

WY-1702-062 243.470 Acres

T.0510N, R.0710W, 06th PM, WY
Sec. 034 LOTS 8-13;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA

WY-1702-063 1772.320 Acres

T.0530N, R.0710W, 06th PM, WY
Sec. 007 LOTS 5-7,10-20;
008 LOTS 1-16;
017 LOTS 1-7;
018 LOTS 5-12;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_Slopes50
WY_BFO_CSU_R500F
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F

WY-1702-064 40.150 Acres

T.0540N, R.0710W, 06th PM, WY
Sec. 014 LOTS 12;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_CSU_SE
WY_BFO_CSU_SLR

WY-1702-065 196.880 Acres

T.0570N, R.0710W, 06th PM, WY
Sec. 007 LOTS 5,6;
007 E2SW;
018 LOTS 5;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_SE
WY_BFO_CSU_SLR

WY-1702-066 323.710 Acres

T.0430N, R.0720W, 06th PM, WY
Sec. 001 LOTS 5-12;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_RN

WY-1702-067 199.300 Acres

T.0440N, R.0720W, 06th PM, WY
Sec. 015 LOTS 1,7-9,13;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_RN

WY-1702-068 166.200 Acres

T.0450N, R.0720W, 06th PM, WY
Sec. 001 LOTS 8;
024 LOTS 8;
025 LOTS 2,5;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_PD
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-069 850.530 Acres

T.0460N, R.0720W, 06th PM, WY
Sec. 002 LOTS 6-9;
004 LOTS 5,12,13,20;
014 LOTS 1,2,9,10,14-16;
023 LOTS 1,2,7,8,16;
026 LOTS 1;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_PD
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-070 2547.280 Acres

T.0470N, R.0720W, 06th PM, WY
Sec. 005 LOTS 5-8,15,16,18;
006 LOTS 8-16,23;
007 LOTS 5,12,13,16,17,20;
008 LOTS 1-14;
017 LOTS 5-16;
018 LOTS 5-13,19,20;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-071 1932.440 Acres

T.0470N, R.0720W, 06th PM, WY
Sec. 019 LOTS 10-12;
020 LOTS 4,5,7,9-16;
021 LOTS 1,5,10-15;
022 LOTS 11-15;
026 LOTS 11-14;
027 LOTS 1-16;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

Special Lease Notice:

There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.

WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-072 1535.740 Acres

T.0470N, R.0720W, 06th PM, WY
Sec. 028 LOTS 1-16;
029 LOTS 1,2,7-10,15,16;
030 LOTS 18,19;
032 LOTS 1,8,9,16;
033 LOTS 1,2,7-10,15,16;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

Special Lease Notice:

There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.

WY_SW_NSO_GHMAL
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_RN

WY-1702-073 158.680 Acres

T.0480N, R.0720W, 06th PM, WY
Sec. 002 LOTS 6,11,17,18;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

Special Lease Notice:

There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.

WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_RN

WY-1702-074 440.160 Acres

T.0480N, R.0720W, 06th PM, WY
Sec. 003 LOTS 6;
T.0490N, R.0720W, 06th PM, WY
Sec. 025 LOTS 11-14;
026 LOTS 8,9,16;
034 LOTS 6,11;
035 LOTS 1;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-075 281.620 Acres

T.0480N, R.0720W, 06th PM, WY
Sec. 010 LOTS 2;
011 LOTS 2,3,5,13,14;
012 LOTS 13;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_PD
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-076 643.080 Acres

T.0480N, R.0720W, 06th PM, WY
Sec. 014 LOTS 5,12,13;
015 LOTS 1-13;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-077 282.550 Acres

T.0480N, R.0720W, 06th PM, WY
Sec. 030 LOTS 19;
031 LOTS 19,20;
032 LOTS 13-16;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_RN

WY-1702-078 447.020 Acres

T.0490N, R.0720W, 06th PM, WY
Sec. 005 LOTS 18,19;
008 LOTS 6-8;
017 LOTS 7,10;
020 LOTS 1,2,7,8;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-079 689.870 Acres

T.0490N, R.0720W, 06th PM, WY
Sec. 010 LOTS 3,10,11,15;
012 LOTS 11;
014 LOTS 14,15;
023 LOTS 1,2,5-8,11;
024 LOTS 4,5,12;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-080 692.630 Acres

T.0490N, R.0720W, 06th PM, WY
Sec. 019 LOTS 5,9-11,14-16,19,20;
T.0490N, R.0730W, 06th PM, WY
Sec. 024 LOTS 2,7,8;
025 LOTS 7,10,14-16;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-081 824.220 Acres

T.0490N, R.0720W, 06th PM, WY
Sec. 021 LOTS 11-14;
026 LOTS 4-6;
027 LOTS 6-8,10,11;
028 LOTS 2,3,6,7,10-12,15;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-082 202.390 Acres

T.0520N, R.0720W, 06th PM, WY
Sec. 021 LOTS 1,7,8;
022 LOTS 4,5;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_TLS_STG
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_STG

WY-1702-083 124.450 Acres

T.0550N, R.0720W, 06th PM, WY
Sec. 005 LOTS 10-12;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-084 41.740 Acres

T.0550N, R.0720W, 06th PM, WY
Sec. 005 LOTS 14;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_RN

WY-1702-085 40.690 Acres

T.0550N, R.0720W, 06th PM, WY
Sec. 006 LOTS 9;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_RN

WY-1702-086 15.506 Acres

T.0550N, R.0720W, 06th PM, WY
Sec. 008 E2NE,SE OF LOT 7;
Campbell County
Buffalo FO
COMMUNITIZATION AGREEMENT WYW179228
Stipulations:
Special Lease Notice:
The land within this lease is committed to Communitization Agreement (CA) WYW179228, Minnelusa Formation, effective
May 15, 2010, which includes the entire area of this lease. The successful bidder should contact the CA operator to determine their rights under this CA. The CA operator may require the successful bidder to pay a proportionate cost of the well, including drilling, completing, equipping, and operating the well as a condition of participating in the CA.
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_RN

WY-1702-087 108.158 Acres

T.0550N, R.0720W, 06th PM, WY
Sec. 008 LOTS 9;
008 SW OF LOT 7;
008 W2NE,NW,S2 OF LOT 8;
008 W2 OF LOT 10;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-088 20.701 Acres

T.0550N, R.0720W, 06th PM, WY
Sec. 008 E2NE OF LOT 8;
008 W2NE,NW OF LOT 7;
Campbell County
Buffalo FO
COMMUNITIZATION AGREEMENT WYW179223
Stipulations:
Special Lease Notice:
The land within this lease is committed to Communitization Agreement (CA) WYW179223, Minnelusa Formation, effective May 15, 2010, which includes the entire area of this lease. The successful bidder should contact the CA operator to determine their rights under this CA. The CA operator may require the successful bidder to pay a proportionate cost of the well, including drilling, completing, equipping, and operating the well as a condition of participating in the CA.
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_RN
WY_BFO_CSU_SE
WY_BFO_CSU_H20500F

WY-1702-089 20.415 Acres

T.0550N, R.0720W, 06th PM, WY
Sec. 008 E2 OF LOT 10;
Campbell County
Buffalo FO
COMMUNITIZATION AGREEMENT WYW180131
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
The land within this lease is committed to Communitization Agreement (CA) WYW180131, Minnelusa Formation, effective May 1, 2011, which includes the entire area of this lease. The successful bidder should contact the CA operator to determine their rights under this CA. The CA operator may require the successful bidder to pay a proportionate cost of the well, including drilling, completing, equipping, and operating the well as a condition of participating in the CA
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-090 400.660 Acres

T.0550N, R.0720W, 06th PM, WY
Sec. 015 LOTS 3-10,15,16;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_CSU_FQM
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR

WY-1702-091 481.770 Acres
T.0550N, R.0720W, 06th PM, WY
Sec. 015 LOTS 11-14;
022 LOTS 3-6,11-14;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_RN

WY-1702-092 37.140 Acres
T.0550N, R.0720W, 06th PM, WY
Sec. 018 LOTS 8;
Campbell County
Buffalo FO
COMMUNITIZATION AGREEMENT WYW176025
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
The land within this lease is committed to Communitization Agreement (CA) WYW176025, Fort Union and Wasatch Formations, effective April 1, 2006, which includes the entire area of this lease. The successful bidder should contact the CA operator to determine their rights under this CA. The CA operator may require the successful bidder to pay a proportionate cost of the well, including drilling, completing, equipping, and operating the well as a condition of participating in the CA.
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SLR
WY_BFO_CSU_RN

WY-1702-093 158.420 Acres
T.0550N, R.0720W, 06th PM, WY
Sec. 021 LOTS 1,2,8,9;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-094 951.930 Acres
T.0560N, R.0720W, 06th PM, WY
Sec. 001 LOTS 6-11,14-19;
002 LOTS 5,6,11-14,19,20;
T.0570N, R.0720W, 06th PM, WY
Sec. 035 SE;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_TLS_STG
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F

WY-1702-095 280.000 Acres
T.0560N, R.0720W, 06th PM, WY
Sec. 001 SW;
002 N2SE,SWSE;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_R500F
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F

WY-1702-096 160.000 Acres
T.0560N, R.0720W, 06th PM, WY
Sec. 005 LOTS 17-20;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR

WY-1702-097 726.260 Acres

T.0560N, R.0720W, 06th PM, WY
Sec. 006 LOTS 8-25;
006 E2SW;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_Slopes50
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB

WY-1702-098 336.090 Acres

T.0560N, R.0720W, 06th PM, WY
Sec. 007 LOTS 5-10;
007 E2NW;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_Slopes50
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F

WY-1702-099 196.770 Acres

T.0560N, R.0720W, 06th PM, WY
Sec. 008 LOTS 2;
008 NE;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_Slopes50
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR

WY-1702-100 280.000 Acres

T.0560N, R.0720W, 06th PM, WY
Sec. 009 NE,SENW,E2SW;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_CSU_SLR

WY-1702-101 202.160 Acres

T.0570N, R.0720W, 06th PM, WY
Sec. 001 LOTS 6;
001 SW;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_H20500F

WY-1702-102 400.000 Acres

T.0570N, R.0720W, 06th PM, WY
Sec. 008 NE,E2SE;
009 NW;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_R500F
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR

WY-1702-103 280.000 Acres

T.0570N, R.0720W, 06th PM, WY
Sec. 009 N2SW,SESW,SE;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA

WY-1702-104 280.000 Acres

T.0570N, R.0720W, 06th PM, WY
Sec. 010 SE;
011 SENW,E2SW;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR

WY-1702-105 160.000 Acres

T.0570N, R.0720W, 06th PM, WY
Sec. 012 NW;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_SE
WY_BFO_CSU_SLR

WY-1702-106 320.000 Acres

T.0570N, R.0720W, 06th PM, WY
Sec. 014 NE,W2NW,NWSW,SESW;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_BEN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_RN

WY-1702-107 492.520 Acres

T.0570N, R.0720W, 06th PM, WY
Sec. 022 LOTS 1,2;
022 W2NE,SENW,SE;
027 NE;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_CSU_FQM
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F

WY-1702-108 119.670 Acres

T.0570N, R.0720W, 06th PM, WY
Sec. 022 LOTS 4;
027 LOTS 1;
027 NENW;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_CSU_FQM
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB

WY-1702-109 240.570 Acres

T.0570N, R.0720W, 06th PM, WY
Sec. 022 LOTS 3;
026 NWSW;
035 NWNW,S2N2;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_CSU_FQM
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F

WY-1702-110 880.000 Acres

T.0570N, R.0720W, 06th PM, WY
Sec. 024 S2S2;
025 ALL;
026 E2SE;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_NSO_BEN
WY_BFO_NSO_SSRN
WY_BFO_TLS_BEN
WY_BFO_TLS_SSRN
WY_BFO_TLS_STG
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_PD
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-111 80.000 Acres

T.0570N, R.0720W, 06th PM, WY
Sec. 026 W2NW;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_SE
WY_BFO_CSU_SLR

WY-1702-112 440.000 Acres

T.0570N, R.0720W, 06th PM, WY
Sec. 026 NESW,S2SW;
027 SESW,SE;
035 N2NE,NENW;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_PD

WY-1702-113 80.000 Acres

T.0570N, R.0720W, 06th PM, WY
Sec. 027 SENW,NESW;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_SE
WY_BFO_CSU_SLR

WY-1702-114 160.000 Acres

T.0570N, R.0720W, 06th PM, WY
Sec. 035 SW;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSPF

WY-1702-115 747.780 Acres

T.0580N, R.0720W, 06th PM, WY
Sec. 019 LOTS 9-11;
029 S2NW,SW;
030 LOTS 5-7;
030 NE,N2SE;
032 SWNW;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR

WY-1702-116 485.400 Acres

T.0580N, R.0720W, 06th PM, WY
Sec. 020 LOTS 9-12;
029 E2;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA

WY-1702-117 81.420 Acres

T.0580N, R.0720W, 06th PM, WY
Sec. 021 LOTS 9,10;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR

WY-1702-118 81.880 Acres

T.0580N, R.0720W, 06th PM, WY
Sec. 021 LOTS 11,12;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA

WY-1702-119 120.000 Acres

T.0580N, R.0720W, 06th PM, WY
Sec. 026 N2SW,SESW;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA

WY-1702-120 80.000 Acres

T.0580N, R.0720W, 06th PM, WY
Sec. 027 E2NW;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB

WY-1702-121 80.000 Acres

T.0580N, R.0720W, 06th PM, WY
Sec. 027 W2NW;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA

WY-1702-122 400.000 Acres

T.0580N, R.0720W, 06th PM, WY
Sec. 028 W2,W2SE;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB

WY-1702-123 1760.200 Acres

T.0410N, R.0730W, 06th PM, WY
Sec. 004 LOTS 3,4;
004 S2NW,SW;
005 S2NE,SE;
015 NE,N2NW;
023 NENE,S2;
024 NE,N2NW,SESE;
025 NENE,S2N2,NWNW;
026 E2NE;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-124 162.060 Acres

T.0410N, R.0730W, 06th PM, WY
Sec. 005 LOTS 1-4;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-125 320.000 Acres

T.0410N, R.0730W, 06th PM, WY
Sec. 021 S2;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_RN

WY-1702-126 120.000 Acres

T.0410N, R.0730W, 06th PM, WY
Sec. 022 SWNE,S2NW;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-127 1757.770 Acres

T.0420N, R.0730W, 06th PM, WY
Sec. 001 LOTS 7,9,10,14,16-18;
011 LOTS 2;
012 LOTS 7,10-13;
015 LOTS 5,6,11-14;
023 LOTS 1-16;
024 LOTS 3-6,11-14;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

Special Lease Notice:

There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_PD
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-128 40.470 Acres

T.0420N, R.0730W, 06th PM, WY
Sec. 003 LOTS 6;
Campbell County
Buffalo FO
COMMUNITIZATION AGREEMENT WYW184323
COMMUNITIZATION AGREEMENT WYW184328
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

Special Lease Notice:

The land within this lease is committed to Communitization Agreements (CA) WYW184323, Turner Formation, effective September 6, 2014, and WYW184328, Parkman Formation, effective October 21, 2014, which includes the entire area of this lease. The successful bidder should contact the CA operator to determine their rights under this CA. The CA operator may require the successful bidder to pay a proportionate cost of the well, including drilling, completing, equipping, and operating the well as a condition of participating in the CA.
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR

WY-1702-129 790.610 Acres

T.0420N, R.0730W, 06th PM, WY
Sec. 003 LOTS 7-9,14-17;
004 LOTS 13-20;
005 LOTS 13,14,19,20;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

Special Lease Notice:

There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-130 648.300 Acres

T.0420N, R.0730W, 06th PM, WY
Sec. 017 LOTS 1,2,7-10,15,16;
020 LOTS 1,2,7-10,15,16;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-131 207.010 Acres

T.0420N, R.0730W, 06th PM, WY
Sec. 022 LOTS 11-14,16;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_RN

WY-1702-132 286.720 Acres

T.0420N, R.0730W, 06th PM, WY
Sec. 027 LOTS 1,2,7-10,16;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-133 324.940 Acres

T.0420N, R.0730W, 06th PM, WY
Sec. 035 LOTS 1,2,7-11,16;
Campbell County
Buffalo FO
COMMUNITIZATION AGREEMENT WYW185324
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
The land within this lease is committed to Communitization Agreement (CA) WYW185324, Turner Formation, effective December 1, 2015,which includes the entire area of this lease. The successful bidder should contact the CA operator to determine their rights under this CA. The CA operator may require the successful bidder to pay a proportionate cost of the well, including drilling, completing, equipping, and operating the well as a condition of participating in the CA.
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-134 485.740 Acres

T.0430N, R.0730W, 06th PM, WY
Sec. 014 LOTS 16;
024 LOTS 5;
025 LOTS 11-14;
027 LOTS 11-14;
035 LOTS 3,4;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_RN

WY-1702-135 484.990 Acres

T.0440N, R.0730W, 06th PM, WY
Sec. 001 LOTS 6-8,11;
002 LOTS 7,10,16;
007 LOTS 5,11,12;
018 LOTS 11,12;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-136 359.030 Acres

T.0440N, R.0730W, 06th PM, WY
Sec. 006 LOTS 17;
017 LOTS 2,7,9,16;
020 LOTS 9,10,15,16;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-137 491.140 Acres

T.0460N, R.0730W, 06th PM, WY
Sec. 024 LOTS 3-6,11-14;
025 LOTS 3-6;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-138 40.730 Acres

T.0470N, R.0730W, 06th PM, WY
Sec. 002 LOTS 10;
Campbell County
Buffalo FO
GAITHER DRAW(PARKMAN SAND)UNIT
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_RN

WY-1702-139 40.710 Acres

T.0470N, R.0730W, 06th PM, WY
Sec. 010 LOTS 12;
Campbell County
Buffalo FO
GAITHER DRAW(PARKMAN SAND) UNIT
COMMUNITIZATION AGREEMENT WYW178143
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

Special Lease Notice:

The land within this lease is committed to Communitization Agreement (CA) WYW178143, Parkman Formation, effective June 14, 2008, which includes the entire area of this lease. The successful bidder should contact the CA operator to determine their rights under this CA. The CA operator may require the successful bidder to pay a proportionate cost of the well, including drilling, completing, equipping, and operating the well as a condition of participating in the CA.

WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_RN

WY-1702-140 282.980 Acres

T.0470N, R.0730W, 06th PM, WY
Sec. 015 LOTS 2-7,12;
Campbell County
Buffalo FO
COMMUNITIZATION AGREEMENT WYW184437
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

Special Lease Notice:

There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.

Special Lease Notice:

The land within this lease is committed to Communitization Agreement (CA) 184437, Parkman Formation, effective July 18, 2014, which includes the entire area of this lease. The successful bidder should contact the CA operator to determine their rights under this CA. The CA operator may require the successful bidder to pay a proportionate cost of the well, including drilling, completing, equipping, and operating the well as a condition of participating in the CA.

WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-141 956.020 Acres

T.0470N, R.0730W, 06th PM, WY
Sec. 022 LOTS 1;
024 LOTS 5,6,10-13;
025 LOTS 5,11-14;
026 LOTS 1,2,8;
027 LOTS 3-6;
035 LOTS 4,5,12,13;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-142 81.720 Acres

T.0480N, R.0730W, 06th PM, WY
Sec. 009 LOTS 9,16;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR

WY-1702-143 41.230 Acres

T.0480N, R.0730W, 06th PM, WY
Sec. 035 LOTS 9;
Campbell County
Buffalo FO
GAITHER DRAW (PARKMAN SAND) UNIT
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_RN

WY-1702-144 40.980 Acres

T.0490N, R.0730W, 06th PM, WY
Sec. 003 LOTS 15;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-145 162.010 Acres

T.0490N, R.0730W, 06th PM, WY
Sec. 014 LOTS 12;
017 LOTS 1,7,8;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_RN

WY-1702-146 301.680 Acres

T.0550N, R.0730W, 06th PM, WY
Sec. 006 TR 89;
T.0550N, R.0740W, 06th PM, WY
Sec. 001 TR 89;
007 LOTS 7;
007 SWSE;
008 LOTS 3,6;
017 LOTS 3,4;
034 N2NW;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_Slopes50
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_STG
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-147 269.890 Acres

T.0560N, R.0730W, 06th PM, WY
Sec. 001 LOTS 5,6;
001 TR 42A,42B,42C,42D,43A;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB

WY-1702-148 94.500 Acres

T.0560N, R.0730W, 06th PM, WY
Sec. 002 LOTS 6-8;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F

WY-1702-149 522.180 Acres

T.0560N, R.0730W, 06th PM, WY
Sec. 007 LOTS 5-15,19,20;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-150 121.040 Acres

T.0560N, R.0730W, 06th PM, WY
Sec. 012 TR 58A,58B,58C;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR

WY-1702-151 360.000 Acres
T.0570N, R.0730W, 06th PM, WY
Sec. 023 S2;
024 NWSW;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB

WY-1702-152 313.360 Acres
T.0570N, R.0730W, 06th PM, WY
Sec. 024 LOTS 1,4;
024 SENW,NESW;
025 LOTS 1,2;
025 W2NE;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR

WY-1702-153 196.200 Acres
T.0570N, R.0730W, 06th PM, WY
Sec. 025 LOTS 3,4;
025 SENW,W2SE;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB

WY-1702-154 120.000 Acres
T.0570N, R.0730W, 06th PM, WY
Sec. 026 N2NE,SWNE;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_CSU_R500F

WY-1702-155 480.830 Acres
T.0570N, R.0730W, 06th PM, WY
Sec. 026 W2;
035 LOTS 1,2;
035 N2SE;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA

WY-1702-156 41.040 Acres
T.0410N, R.0740W, 06th PM, WY
Sec. 007 LOTS 10;
Campbell County
Buffalo FO
COMMUNITIZATION AGREEMENT WYW180264
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
The land within this lease is committed to Communitization Agreement (CA) WYW180264, Fort Union and Wasatch Formations, effective April 1, 2005, which includes the entire area of this lease. The successful bidder should contact the CA operator to determine their rights under this CA. The CA operator may require the successful bidder to pay a proportionate cost of the well, including drilling, completing, equipping, and operating the well as a condition of participating in the CA.
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-157 41.080 Acres

T.0410N, R.0740W, 06th PM, WY
Sec. 007 LOTS 12;
Campbell County
Buffalo FO
COMMUNITIZATION AGREEMENT WYW180260
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
The land within this lease is committed to Communitization Agreement (CA) WYW180260, Fort Union and Wasatch Formations, effective April 1, 2005, which includes the entire area of this lease. The successful bidder should contact the CA operator to determine their rights under this CA. The CA operator may require the successful bidder to pay a proportionate cost of the well, including drilling, completing, equipping, and operating the well as a condition of participating in the CA.
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_RN

WY-1702-158 892.180 Acres

T.0410N, R.0740W, 06th PM, WY
Sec. 007 LOTS 9,11;
018 LOTS 5,6,8-11;
019 LOTS 5-14;
020 LOTS 1-4;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_H
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN
WY_BFO_CSU_SSPF

WY-1702-159 40.300 Acres

T.0410N, R.0740W, 06th PM, WY
Sec. 018 LOTS 7;
Campbell County
Buffalo FO
COMMUNITIZATION AGREEMENT WYW180262
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
The land within this lease is committed to Communitization Agreement (CA) WYW180262, Fort Union and Wasatch Formations, effective January 1, 2015, which includes the entire area of this lease. The successful bidder should contact the CA operator to determine their rights under this CA. The CA operator may require the successful bidder to pay a proportionate cost of the well, including drilling, completing, equipping, and operating the well as a condition of participating in the CA.
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_H
WY_BFO_CSU_FQM
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_RN

WY-1702-160 40.240 Acres

T.0410N, R.0740W, 06th PM, WY
Sec. 018 LOTS 12;
Campbell County
Buffalo FO
COMMUNITIZATION AGREEMENT WYW180263
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
The land within this lease is committed to Communitization Agreement (CA) WYW180263, Fort Union and Wasatch Formations, effective January 1, 2005, which includes the entire area of this lease. The successful bidder should contact the CA operator to determine their rights under this CA. The CA operator may require the successful bidder to pay a proportionate cost of the well, including drilling, completing, equipping, and operating the well as a condition of participating in the CA.
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_H
WY_BFO_CSU_FQM
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_RN

WY-1702-161 317.360 Acres

T.0420N, R.0740W, 06th PM, WY
Sec. 018 LOTS 5-12;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_H
WY_BFO_CSU_FQM
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_RN

WY-1702-162 285.220 Acres

T.0460N, R.0740W, 06th PM, WY
Sec. 002 LOTS 7-10,15-17;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-163 2106.700 Acres

T.0470N, R.0740W, 06th PM, WY
Sec. 007 LOTS 15-18;
008 LOTS 14;
009 LOTS 1,2,4-8,10-16;
017 LOTS 11-14;
018 LOTS 9,14-18;
019 LOTS 12,13;
020 LOTS 3-6,9-16;
028 LOTS 13;
029 LOTS 2,3;
030 LOTS 6,7,11,13,20;
032 LOTS 12;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-164 40.820 Acres

T.0470N, R.0740W, 06th PM, WY
Sec. 019 LOTS 6;
Campbell County
Buffalo FO
COMMUNITIZATION AGREEMENT WYW180259
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
The land within this lease is committed to Communitization Agreement (CA) WYW180259, Fort Union and Wasatch Formations, effective September 1, 2010, which includes the entire area of this lease. The successful bidder should contact the CA operator to determine their rights under this CA. The CA operator may require the successful bidder to pay a proportionate cost of the well, including drilling, completing, equipping, and operating the well as a condition of participating in the CA.
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_RN

WY-1702-165 40.650 Acres

T.0470N, R.0740W, 06th PM, WY
Sec. 019 LOTS 7;
Campbell County
Buffalo FO
COMMUNITIZATION AGREEMENT WYW180261
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
The land within this lease is committed to Communitization Agreement (CA) WYW180261, Fort Union and Wasatch Formations, effective September 1, 2010, which includes the entire area of this lease. The successful bidder should contact the CA operator to determine their rights under this CA. The CA operator may require the successful bidder to pay a proportionate cost of the well, including drilling, completing, equipping, and operating the well as a condition of participating in the CA.
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-166 2105.360 Acres

T.0480N, R.0740W, 06th PM, WY
Sec. 004 LOTS 5,6,11-14,19,20;
007 LOTS 7-10,15-18;
008 LOTS 1-16;
009 LOTS 1-16;
015 LOTS 3-6,11-14;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_BFO_NSO_Slopes50
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-167 1438.910 Acres

T.0480N, R.0740W, 06th PM, WY
Sec. 017 LOTS 1-16;
018 LOTS 5-20;
019 LOTS 5,6,12,18-20;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-168 944.850 Acres

T.0480N, R.0740W, 06th PM, WY
Sec. 020 LOTS 1-16;
029 LOTS 3-6;
032 LOTS 1,2,7,8;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-169 158.210 Acres

T.0480N, R.0740W, 06th PM, WY
Sec. 021 LOTS 1,2,7,8;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-170 39.760 Acres

T.0490N, R.0740W, 06th PM, WY
Sec. 003 LOTS 8;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_RN

WY-1702-171 1290.250 Acres

T.0490N, R.0740W, 06th PM, WY
Sec. 003 LOTS 13-16;
004 LOTS 5,6,11-13;
009 LOTS 1,2,7-10,15,16;
010 LOTS 1-4;
021 LOTS 1,2,7,8;
022 LOTS 3-7,10,11;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_SE
WY_BFO_CSU_PD
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-172 80.630 Acres

T.0490N, R.0740W, 06th PM, WY
Sec. 005 LOTS 8,9;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-173 161.580 Acres

T.0490N, R.0740W, 06th PM, WY
Sec. 017 LOTS 6,11,13,14;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-174 39.730 Acres

T.0500N, R.0740W, 06th PM, WY
Sec. 017 LOTS 16;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_RN

WY-1702-175 580.510 Acres

T.0510N, R.0740W, 06th PM, WY
Sec. 006 LOTS 8,9,14-17,22,23;
017 LOTS 1-8;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_Slopes50
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_RN

WY-1702-176 1956.700 Acres

T.0520N, R.0740W, 06th PM, WY
Sec. 001 LOTS 5-20;
002 LOTS 5-20;
011 LOTS 1,2,7,8;
012 LOTS 1-8;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_SW_TLS_GHMAL
WY_BFO_NSO_Slopes50
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F

WY-1702-177 2172.760 Acres

T.0520N, R.0740W, 06th PM, WY
Sec. 003 LOTS 5-19;
004 LOTS 5-12,14-19;
009 LOTS 4-6,11-14;
010 LOTS 1-16;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_NSO_GHMAL
WY_SW_TLS_GHMAL
WY_BFO_NSO_Slopes50
WY_BFO_TLS_STG
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-178 2487.210 Acres

T.0520N, R.0740W, 06th PM, WY
Sec. 005 LOTS 5-11,14-19;
006 LOTS 8-23;
007 LOTS 5-20;
008 LOTS 1-16;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_NSO_GHMAL
WY_SW_TLS_GHMAL
WY_BFO_NSO_Slopes50
WY_BFO_TLS_STG
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F
WY_BFO_CSU_STG
WY_BFO_CSU_RN

WY-1702-179 831.320 Acres

T.0520N, R.0740W, 06th PM, WY
Sec. 028 LOTS 2-4;
033 LOTS 1-3,5-11;
035 LOTS 1,2,6,7,10-13;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_SW_TLS_GHMAL
WY_BFO_NSO_Slopes50
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-180 1372.880 Acres

T.0530N, R.0740W, 06th PM, WY
Sec. 004 LOTS 17,18;
006 LOTS 17-23;
013 LOTS 6;
018 LOTS 5-20;
019 LOTS 5,6,11-14,19,20;
026 LOTS 16;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_Slopes50
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_STG
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-181 403.310 Acres

T.0530N, R.0740W, 06th PM, WY
Sec. 013 LOTS 1-5,7,11-14;
Campbell County
Buffalo FO
LONG DRAW (CBM) UNIT
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-182 2195.660 Acres

T.0530N, R.0740W, 06th PM, WY
Sec. 029 LOTS 3-6,11-14;
030 LOTS 7-10,15-18;
031 LOTS 5,6,11-14,19,20;
032 LOTS 1-16;
034 LOTS 1,2,7-16;
035 LOTS 9-11;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_SW_NSO_GHMAL
WY_SW_TLS_GHMAL
WY_BFO_NSO_Slopes50
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_STG
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_H20500F
WY_BFO_CSU_STG
WY_BFO_CSU_RN

WY-1702-183 544.460 Acres

T.0540N, R.0740W, 06th PM, WY
Sec. 030 LOTS 17;
031 LOTS 5-12,15-18;
033 LOTS 10;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_SW_TLS_GHMAL
WY_BFO_TLS_STG
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-184 39.480 Acres

T.0560N, R.0740W, 06th PM, WY
Sec. 012 LOTS 1;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SLR
WY_BFO_CSU_PD
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_RN

WY-1702-185 120.000 Acres

T.0410N, R.0750W, 06th PM, WY
Sec. 015 NWNW;
020 E2NE;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_H
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_H
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_RN

WY-1702-186 320.000 Acres

T.0430N, R.0750W, 06th PM, WY
Sec. 025 S2;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_H
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-187 171.000 Acres

T.0440N, R.0750W, 06th PM, WY
Sec. 035 LOTS 3-6;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_H
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-188 253.920 Acres

T.0470N, R.0750W, 06th PM, WY
Sec. 027 LOTS 2,7,9,10,15,16;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_RN

WY-1702-189 2379.060 Acres

T.0480N, R.0750W, 06th PM, WY
Sec. 001 LOTS 5-14,19,20;
002 LOTS 5-7,9-19;
010 LOTS 3,6,9,11,16;
011 LOTS 1-16;
012 LOTS 1-16;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-190 2430.440 Acres

T.0480N, R.0750W, 06th PM, WY
Sec. 013 LOTS 1-16;
014 LOTS 1-16;
015 LOTS 2,7,10,15;
022 LOTS 1,2,7-9,16;
023 LOTS 1-16;
026 LOTS 3,6;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-191 641.050 Acres

T.0490N, R.0750W, 06th PM, WY
Sec. 004 LOTS 3,4;
004 S2NW;
005 LOTS 1,2;
005 S2NE;
012 S2;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_Slopes50
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_RN

WY-1702-192 80.000 Acres

T.0490N, R.0750W, 06th PM, WY
Sec. 027 N2NW;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-193 81.520 Acres

T.0500N, R.0750W, 06th PM, WY
Sec. 034 LOTS 12,13;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_NSO_GHMAL
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_PD
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_RN

WY-1702-194 886.600 Acres

T.0510N, R.0750W, 06th PM, WY
Sec. 005 LOTS 5,6,11-14,19,20;
009 LOTS 1-7,10-15;
024 LOTS 15;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_NSO_SSRN
WY_SW_TLS_GHMAL
WY_BFO_TLS_SSRN
WY_BFO_TLS_EC
WY_BFO_TLS_BGCWEC
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F
WY_BFO_CSU_BGCW
WY_BFO_CSU_EC
WY_BFO_CSU_ECWC
WY_BFO_CSU_FCR
WY_BFO_CSU_RN

WY-1702-195 1235.270 Acres

T.0520N, R.0750W, 06th PM, WY
Sec. 017 LOTS 2,8,9;
017 LOTS 4,5,11 (EXCL 12.28
017 AC IN RR ROW WYW0119068);
018 LOTS 5-8,11-14,20;
019 LOTS 5,6,12;
020 LOTS 2,4,5,11;
021 LOTS 12;
030 LOTS 25,28,29;
031 LOTS 16,21,24,25,28,30-34;
032 LOTS 6;
034 LOTS 13;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_BGCWEC
WY_BFO_TLS_EC
WY_BFO_TLS_STG
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_PD
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_EC
WY_BFO_CSU_BGCW
WY_BFO_CSU_ECWC
WY_BFO_CSU_FCR
WY_BFO_CSU_STG
WY_BFO_CSU_RN

WY-1702-196 1512.820 Acres

T.0530N, R.0750W, 06th PM, WY
Sec. 001 LOTS 5,6,11,12;
004 LOTS 14;
023 LOTS 1-16;
024 LOTS 1-16;
026 LOTS 3;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

Special Lease Notice:

There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_SW_TLS_GHMAL
WY_BFO_NSO_Slopes50
WY_BFO_TLS_STG
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_PD
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F
WY_BFO_CSU_STG
WY_BFO_CSU_RN

WY-1702-197 39.730 Acres

T.0530N, R.0750W, 06th PM, WY
Sec. 026 LOTS 4;
Campbell County
Buffalo FO
COMMUNITIZATION AGREEMENT WYW182015
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

Special Lease Notice:

The land within this lease is committed to Communitization Agreement (CA) WYW182015, Fort Union and Wasatch Formations, effective February 1, 2013, which includes the entire area of this lease. The successful bidder should contact the CA operator to determine their rights under this CA. The CA operator may require the successful bidder to pay a proportionate cost of the well, including drilling, completing, equipping, and operating the well as a condition of participating in the CA.
WY_SW_TLS_GHMAL
WY_BFO_TLS_STG
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_PD
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_STG
WY_BFO_CSU_RN

WY-1702-198 2470.800 Acres

T.0540N, R.0750W, 06th PM, WY
Sec. 004 LOTS 5-20;
009 LOTS 1-12;
010 LOTS 11-14,16;
013 LOTS 9,10,15,16;
014 LOTS 11-14;
015 LOTS 1-16;
017 LOTS 10;
023 LOTS 1,2,7,8;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

Special Lease Notice:

There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_SW_TLS_GHMAL
WY_BFO_NSO_Slopes50
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_PD
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-199 508.190 Acres

T.0550N, R.0750W, 06th PM, WY
Sec. 001 LOTS 10;
028 LOTS 8;
031 LOTS 13-20;
033 LOTS 8;
035 LOTS 3-6;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

Special Lease Notice:

There is a single or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_SW_NSO_GHMAL
WY_SW_TLS_GHMAL
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-200 640.000 Acres

T.0400N, R.0760W, 06th PM, WY
Sec. 033 ALL;
Converse County
Casper FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
TLS (1) Feb 1 to Jul 31; (2) as mapped on the Casper Field Office GIS database; (3) protecting nesting Raptors.

WY-1702-201 40.540 Acres

T.0410N, R.0760W, 06th PM, WY
Sec. 005 LOTS 3;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_EWR
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_H
WY_BFO_CSU_FQM
WY_BFO_CSU_BEGE
WY_BFO_CSU_RN

WY-1702-202 1671.950 Acres

T.0410N, R.0760W, 06th PM, WY
Sec. 005 LOTS 2;
005 SENE,NESW;
006 LOTS 1-7;
006 S2NE,SENW,E2SW,SE;
007 LOTS 1-4;
007 E2,E2NW,SESW;
008 E2E2,NWNE,N2SW,SWSE;
Johnson and Campbell Counties
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_BFO_NSO_SSRN
WY_BFO_TLS_EWR
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_H
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_PD
WY_BFO_CSU_BEGE
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN
WY_BFO_CSU_SSPF

WY-1702-203 1560.000 Acres

T.0410N, R.0760W, 06th PM, WY
Sec. 013 NE,S2NW,S2;
014 NWSW,NESE;
015 N2,SW,N2SE;
023 SESE;
025 N2;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_H
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_PD
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-204 840.700 Acres

T.0410N, R.0760W, 06th PM, WY
Sec. 029 N2;
030 LOTS 1,2;
030 N2NE,SWNE,E2NW;
034 S2NW,SW;
Campbell, Johnson and Converse Counties
Casper FO
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_RN
TLS (1) Feb 1 to Jul 31; (2) as mapped on the Casper Field Office GIS database; (3) protecting nesting Raptors.

WY-1702-205 120.000 Acres

T.0430N, R.0760W, 06th PM, WY
Sec. 014 W2SE,SESE;
Campbell County
Buffalo FO
COMMUNITIZATION AGREEMENT WYW182651
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
The land within this lease is committed to Communitization Agreement (CA) WYW182651, Shannon Formation, effective June 1, 2013, which includes the entire area of this lease. The successful bidder should contact the CA operator to determine their rights under this CA. The CA operator may require the successful bidder to pay a proportionate cost of the well, including drilling, completing, equipping, and operating the well as a condition of participating in the CA.
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_H
WY_BFO_CSU_SE
WY_BFO_CSU_RN

WY-1702-206 320.000 Acres

T.0430N, R.0760W, 06th PM, WY
Sec. 015 SWNE,NW,N2SW,SESW;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_SW_TLS_GHMAL
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_RN

WY-1702-207 81.220 Acres

T.0470N, R.0760W, 06th PM, WY
Sec. 023 LOTS 4,5;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_RN

WY-1702-208 218.610 Acres

T.0510N, R.0760W, 06th PM, WY
Sec. 003 LOTS 21,23,25;
004 LOTS 21,24,25;
005 LOTS 22,23;
Campbell and Johnson Counties
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_TLS_EC
WY_BFO_TLS_BGCWEC
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_BGCW
WY_BFO_CSU_EC
WY_BFO_CSU_ECWC
WY_BFO_CSU_FCR
WY_BFO_CSU_RN

WY-1702-209 2512.990 Acres

T.0520N, R.0760W, 06th PM, WY
Sec. 001 LOTS 17,18;
002 LOTS 5-11,14-20;
011 LOTS 1-16;
012 LOTS 2-16;
012 LOT 1 (EXCL 1.90 AC IN
012 RR ROW WYW0119068);
013 LOTS 1-8;
014 LOTS 1-4,8;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_EC
WY_BFO_TLS_BGCWEC
WY_BFO_TLS_STG
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_PD
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_BGCW
WY_BFO_CSU_EC
WY_BFO_CSU_ECWC
WY_BFO_CSU_FCR
WY_BFO_CSU_RN

WY-1702-210 2106.300 Acres

T.0520N, R.0760W, 06th PM, WY
Sec. 003 LOTS 5-20;
004 LOTS 5-7,10-12;
005 LOTS 6-11;
006 LOTS 8-15,17-19;
009 LOTS 1,2;
010 LOTS 1-10,16;
Campbell and Johnson Counties
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_TLS_BGCWEC
WY_BFO_TLS_EC
WY_BFO_TLS_STG
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_EC
WY_BFO_CSU_BGCW
WY_BFO_CSU_EC
WY_BFO_CSU_ECWC
WY_BFO_CSU_FCR

WY-1702-211 1541.050 Acres

T.0520N, R.0760W, 06th PM, WY
Sec. 017 LOTS 13;
018 LOTS 5-20;
019 LOTS 5-20;
020 LOTS 3-5,12,17,20,21;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_TLS_EC
WY_BFO_TLS_BGCWEC
WY_BFO_TLS_STG
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_BGCW
WY_BFO_CSU_EC
WY_BFO_CSU_ECWC
WY_BFO_CSU_FCR
WY_BFO_CSU_RN

WY-1702-212 1721.190 Acres

T.0520N, R.0760W, 06th PM, WY
Sec. 029 LOTS 3-6,11-14,18,19,23,24;
031 LOTS 5-20;
032 LOTS 2-7,10-15,17,20,21,24;
034 LOTS 18,19,21,24;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_TLS_BGCWEC
WY_BFO_TLS_EC
WY_BFO_TLS_STG
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_PD
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_H20500F
WY_BFO_CSU_EC
WY_BFO_CSU_BGCW
WY_BFO_CSU_ECWC
WY_BFO_CSU_FCR
WY_BFO_CSU_RN

WY-1702-213 1165.120 Acres

T.0530N, R.0760W, 06th PM, WY
Sec. 011 LOTS 11;
017 LOTS 1-16;
018 LOTS 7-10,13-20;
024 LOTS 1;
Sheridan and Campbell Counties
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_BFO_NSO_Slopes50
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_STG
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_PD
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_FCR
WY_BFO_CSU_RN

WY-1702-214 1222.220 Acres

T.0530N, R.0760W, 06th PM, WY
Sec. 019 LOTS 5-20;
030 LOTS 5-14,19,20;
031 LOTS 15-18;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_BGCWEC
WY_BFO_TLS_EC
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_PD
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_BGCW
WY_BFO_CSU_EC
WY_BFO_CSU_ECWC
WY_BFO_CSU_FCR
WY_BFO_CSU_RN

WY-1702-215 140.800 Acres

T.0550N, R.0760W, 06th PM, WY
Sec. 006 LOTS 8;
018 LOTS 16,20;
019 LOTS 10;
Sheridan County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-216 36.930 Acres

T.0550N, R.0760W, 06th PM, WY
Sec. 006 LOTS 9;
Sheridan County
Buffalo FO
COMMUNITIZATION AGREEMENT WYW179033
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
The land within this lease is committed to Communitization Agreement (CA) WYW179033, Fort Union and Wasatch Formations, effective January 1, 2010, which includes the entire area of this lease. The successful bidder should contact the CA operator to determine their rights under this CA. The CA operator may require the successful bidder to pay a proportionate cost of the well, including drilling, completing, equipping, and operating the well as a condition of participating in the CA.
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_RN

WY-1702-217 1099.170 Acres

T.0560N, R.0760W, 06th PM, WY
Sec. 001 LOTS 7-10,15-18;
002 LOTS 5-20;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_H
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_PD
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-218 365.740 Acres

T.0560N, R.0760W, 06th PM, WY
Sec. 003 LOTS 5,6,11-14,19,20;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_TLS_NSSRN
WY_BFO_CSU_H
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_PD
WY_BFO_CSU_RN

WY-1702-219 1050.340 Acres

T.0570N, R.0760W, 06th PM, WY
Sec. 034 LOTS 1-12;
034 N2;
035 LOTS 3-9;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_BFO_NSO_Slopes50
WY_BFO_TLS_NSSRN
WY_BFO_CSU_H
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_PD
WY_BFO_CSU_RN

WY-1702-220 389.120 Acres

T.0580N, R.0760W, 06th PM, WY
Sec. 020 LOTS 5-8;
021 LOTS 5-8;
Campbell and Sheridan Counties
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-221 2118.450 Acres

T.0390N, R.0770W, 06th PM, WY
Sec. 001 LOTS 1-4;
001 S2N2,S2;
010 NESW,S2SW,SE;
012 ALL;
013 E2,NW,N2SW;
Converse and Natrona Counties
Casper FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
NSO (1) As mapped on the Casper Field Office GIS database (2) protecting the Pine Ridge Bald Eagle Roost.

WY-1702-222 1960.000 Acres

T.0390N, R.0770W, 06th PM, WY
Sec. 014 S2N2,S2;
015 ALL;
021 E2;
022 SWNE,W2,SE;
Converse and Natrona Counties
Casper FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
NSO (1) As mapped on the Casper Field Office GIS database (2) protecting the Pine Ridge Bald Eagle Roost.

WY-1702-223 2520.000 Acres

T.0390N, R.0770W, 06th PM, WY
Sec. 023 E2,N2NW,SENW,SW;
024 ALL;
025 ALL;
026 ALL;
Converse County
Casper FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

WY-1702-224 1920.000 Acres

T.0390N, R.0770W, 06th PM, WY
Sec. 027 ALL;
034 ALL;
035 ALL;
Converse and Natrona Counties
Casper FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
CSU (1) Surface occupancy or use within 3 miles or visual horizon of the historic trail, whichever is closer, may be restricted or prohibited unless the operator and surface managing agency arrive at an acceptable plan for mitigation of anticipated impacts; (2) as mapped on the Casper Field Office GIS database; (3) protecting cultural and scenic values of the Bozeman Trail.

WY-1702-225 1280.000 Acres

T.0400N, R.0770W, 06th PM, WY
Sec. 008 S2;
034 N2;
035 ALL;
Natrona and Converse Counties
Casper FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
NSO (1) As mapped on the Casper Field Office GIS database (2) protecting the Pine Ridge Bald Eagle Roost.

WY-1702-226 1640.000 Acres

T.0400N, R.0770W, 06th PM, WY
Sec. 017 ALL;
020 SWNE,S2;
021 E2,N2NW,SENW;
022 SWNW,SW;
Natrona County
Casper FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
NSO (1) As mapped on the Casper Field Office GIS database (2) protecting the Pine Ridge Bald Eagle Roost.

WY-1702-227 1840.000 Acres

T.0400N, R.0770W, 06th PM, WY
Sec. 026 NE,NENW,S2NW,S2;
027 ALL;
028 N2,SW,N2SE,SESE;
Converse and Natrona Counties
Casper FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
NSO (1) As mapped on the Casper Field Office GIS database (2) protecting the Pine Ridge Bald Eagle Roost.

WY-1702-228 40.080 Acres

T.0410N, R.0770W, 06th PM, WY
Sec. 001 LOTS 1;
Johnson County
Buffalo FO
COMMUNITIZATION AGREEMENT WYW180077
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
The land within this lease is committed to Communitization Agreement (CA) WYW180077, Frontier Formation, effective May 1, 2014, which includes the entire area of this lease. The successful bidder should contact the CA operator to determine their rights under this CA. The CA operator may require the successful bidder to pay a proportionate cost of the well, including drilling, completing, equipping, and operating the well as a condition of participating in the CA.
WY_BFO_TLS_NSSRN
WY_BFO_CSU_PD
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_RN

WY-1702-229 639.840 Acres

T.0410N, R.0770W, 06th PM, WY
Sec. 003 LOTS 2,3;
003 S2NW,SW,NWSE;
010 S2S2,NESE;
011 S2NE;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_PD
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-230 968.300 Acres

T.0410N, R.0770W, 06th PM, WY
Sec. 004 LOTS 3,4;
004 S2NW,SW,SESE;
005 SESE;
006 LOTS 1,4-6;
006 NWSE;
009 NENE,W2;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_BFO_CSU_PD
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F

WY-1702-231 1324.670 Acres

T.0410N, R.0770W, 06th PM, WY
Sec. 017 S2SW;
018 N2NE,SWNE,SESE;
019 LOTS 1-3;
019 W2NE,NWSE;
020 E2NE,W2,NESE;
029 NWNE,NENW;
030 LOTS 1,2;
030 NE,E2NW;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB

WY-1702-232 40.000 Acres

T.0420N, R.0770W, 06th PM, WY
Sec. 026 SWSW;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_PD
WY_BFO_CSU_RN

WY-1702-233 800.000 Acres

T.0420N, R.0770W, 06th PM, WY
Sec. 029 W2NW,SW,W2SE;
030 N2NE,SENE,E2SW,NESE;
032 SESW,N2SE;
033 SENE,NENW,SESW;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_Slopes50
WY_BFO_TLS_NSSRN
WY_BFO_CSU_PD
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_RN

WY-1702-234 311.310 Acres

T.0510N, R.0770W, 06th PM, WY
Sec. 001 LOTS 13-16;
014 W2W2;
Johnson County
Buffalo FO
KINNEY DIVIDE (CBM) UNIT
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_TLS_EC
WY_BFO_TLS_BGCWEC
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_EC
WY_BFO_CSU_BGCW
WY_BFO_CSU_ECWC
WY_BFO_CSU_FCR
WY_BFO_CSU_RN

WY-1702-235 2519.070 Acres

T.0510N, R.0770W, 06th PM, WY
Sec. 003 ALL;
004 LOTS 5,6;
004 E2,S2NW;
005 W2W2;
008 LOTS 1-3;
008 W2SW;
009 LOTS 1-4;
009 E2;
010 ALL;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.
WY_BFO_NSO_Slopes50
WY_BFO_NSO_BEGE
WY_BFO_NSO_SSRN
WY_BFO_TLS_EWR
WY_BFO_TLS_SSRN
WY_BFO_TLS_BGCWEC
WY_BFO_TLS_EC
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_BEGE
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F
WY_BFO_CSU_EC
WY_BFO_CSU_BGCW
WY_BFO_CSU_ECWC
WY_BFO_CSU_FCR
WY_BFO_CSU_RN

WY-1702-236 1415.100 Acres

T.0520N, R.0770W, 06th PM, WY
Sec. 001 LOTS 5-28;
002 LOTS 5,8,10;
003 LOTS 7,10,11,13,14;
011 LOTS 6,7;
021 LOTS 6,7;
030 S2;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_NSO_BEGE
WY_BFO_NSO_SSRN
WY_BFO_TLS_EWR
WY_BFO_TLS_SSRN
WY_BFO_TLS_EC
WY_BFO_TLS_BGCWEC
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_PD
WY_BFO_CSU_BEGE
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_H20500F
WY_BFO_CSU_BGCW
WY_BFO_CSU_EC
WY_BFO_CSU_ECWC
WY_BFO_CSU_FCR
WY_BFO_CSU_RN

WY-1702-237 67.350 Acres

T.0520N, R.0770W, 06th PM, WY
Sec. 003 LOTS 5,6,9;
Johnson County
Buffalo FO
COMMUNITIZATION AGREEMENT WYW179672
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice:
The land within this lease is committed to Communitization Agreement (CA) WYW179672, Fort Union Formation, effective April 1, 2004, which includes the entire area of this lease. The successful bidder should contact the CA operator to determine their rights under this CA. The CA operator may require the successful bidder to pay a proportionate cost of the well, including drilling, completing, equipping, and operating the well as a condition of participating in the CA.
WY_BFO_NSO_BEGE
WY_BFO_TLS_EWR
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_BEGE
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-238 1770.920 Acres

T.0530N, R.0770W, 06th PM, WY
Sec. 001 LOTS 11;
003 LOTS 5;
005 LOTS 7,8;
005 TR 50A,50B,50E,50F;
008 TR 50E,50F;
016 LOTS 1-3;
017 TR 56;
018 TR 56;
027 LOTS 2;
030 SESW;
031 LOTS 9;
031 E2NW,NESW;
032 LOTS 1-4;
032 NE,W2NW,N2SW;
033 LOTS 1-4;
033 NW,N2S2;

Sheridan and Johnson Counties
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_Slopes50
WY_BFO_NSO_SSRN
WY_BFO_TLS_EWR
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_PD
WY_BFO_CSU_BEGE
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-239 2249.620 Acres

T.0540N, R.0770W, 06th PM, WY
Sec. 017 S2SE;
018 LOTS 3,4;
018 SESW,S2SE;
019 LOTS 1-4;
019 E2,E2W2;
020 E2NE,S2NW,S2;
021 W2,W2SE;
022 NWNE;
023 N2N2,SENW;
023 S2NE (EXCL 6.87 AC IN RR
023 ROW WYW0119068);
024 N2NW;
024 S2NW (EXCL 12.07 AC IN
024 RR ROW WYW0119068);

Sheridan County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

Special Lease Notice:

There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.

WY_BFO_NSO_BEGE
WY_BFO_NSO_SSRN
WY_BFO_TLS_PHMAWCA
WY_BFO_TLS_PHMAC
WY_BFO_TLS_EWR
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_PD
WY_BFO_CSU_PHMAC
WY_BFO_CSU_GSGRH
WY_BFO_CSU_BEGE
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-240 1758.480 Acres

T.0540N, R.0770W, 06th PM, WY
Sec. 031 LOTS 1-4;
031 E2,E2W2;
032 S2NE,W2,SE;
033 W2NW,S2;
034 SW;
Sheridan County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

Special Lease Notice:

There is a single (or multiple) unplugged wellbore(s) and/or other facilities located on this parcel. For more information, please contact a Petroleum Engineer at the Buffalo Field Office at (307) 684-1100.

WY_BFO_NSO_Slopes50
WY_BFO_TLS_PHMAWCA
WY_BFO_TLS_PHMAC
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_PD
WY_BFO_CSU_PHMAC
WY_BFO_CSU_GSGRH
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-241 314.230 Acres

T.0550N, R.0770W, 06th PM, WY
Sec. 024 W2SE;
027 LOTS 5;
027 E2E2;
034 LOTS 1,2;
Sheridan County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_BEGE
WY_BFO_NSO_SSRN
WY_BFO_TLS_PHMAWCA
WY_BFO_TLS_PHMAC
WY_BFO_TLS_EWR
WY_BFO_TLS_SSRN
WY_BFO_TLS_STG
WY_BFO_TLS_NSSRN
WY_BFO_CSU_H
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_PHMAC
WY_BFO_CSU_GSGRH
WY_BFO_CSU_BEGE
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-242 396.680 Acres

T.0450N, R.0780W, 06th PM, WY
Sec. 003 N2SW;
007 LOTS 1-4;
007 E2W2;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_CSU_PHMA
WY_BFO_TLS_PHMAWCA
WY_BFO_TLS_PHMAL
WY_BFO_TLS_NSSRN
WY_BFO_CSU_H
WY_BFO_CSU_GSGRH
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-243 280.000 Acres

T.0450N, R.0780W, 06th PM, WY
Sec. 007 NENE,S2NE,SE;
Johnson County
Buffalo FO
PONDEROSA DEEP UNIT
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_CSU_PHMA
WY_BFO_TLS_PHMAL
WY_BFO_TLS_PHMAWCA
WY_BFO_TLS_NSSRN
WY_BFO_CSU_H
WY_BFO_CSU_GSGRH
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-244 80.000 Acres

T.0450N, R.0780W, 06th PM, WY
Sec. 018 N2NE;
Johnson County
Buffalo FO
PONDEROSA DEEP UNIT
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_CSU_PHMA
WY_BFO_TLS_PHMAL
WY_BFO_TLS_PHMAWCA
WY_BFO_CSU_H
WY_BFO_CSU_GSGRH

WY-1702-245 239.220 Acres

T.0450N, R.0780W, 06th PM, WY
Sec. 018 LOTS 1,4;
018 NENW,SESW,S2SE;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_CSU_PHMA
WY_BFO_TLS_PHMAWCA
WY_BFO_TLS_PHMAL
WY_BFO_CSU_GSGRH

WY-1702-246 160.000 Acres

T.0450N, R.0780W, 06th PM, WY
Sec. 019 NE;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_NSO_PHMAL
WY_SW_CSU_PHMA
WY_BFO_TLS_PHMAWCA
WY_BFO_TLS_PHMAL
WY_BFO_CSU_H
WY_BFO_CSU_GSGRH

WY-1702-247 39.140 Acres

T.0510N, R.0780W, 06th PM, WY
Sec. 006 LOTS 8;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_RN

WY-1702-248 2248.130 Acres

T.0520N, R.0780W, 06th PM, WY
Sec. 016 LOTS 1-6;
019 LOTS 5-9,11;
020 LOTS 1,7;
020 TR 82;
021 LOTS 9;
021 TR 82;
027 ALL;
028 ALL;
034 LOTS 1-4;
034 N2,N2S2;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_Slopes50
WY_BFO_NSO_BEGE
WY_BFO_NSO_SSRN
WY_BFO_TLS_PHMAWCA
WY_BFO_TLS_PHMAC
WY_BFO_TLS_EWR
WY_BFO_TLS_SSRN
WY_BFO_TLS_STG
WY_BFO_TLS_NSSRN
WY_BFO_CSU_PHMAC
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_PD
WY_BFO_CSU_GSGRH
WY_BFO_CSU_BEGE
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-249 1925.030 Acres

T.0520N, R.0780W, 06th PM, WY
Sec. 025 ALL;
026 ALL;
035 LOTS 1-4;
035 N2,N2S2;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_Slopes50
WY_BFO_NSO_SSRN
WY_BFO_TLS_EWR
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_PD
WY_BFO_CSU_BEGE
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-250 763.180 Acres

T.0520N, R.0780W, 06th PM, WY
Sec. 030 LOTS 5-9;
030 S2SE;
031 LOTS 5-11;
031 NE,N2SE;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_NSO_BEGE
WY_BFO_NSO_SSRN
WY_BFO_TLS_PHMAC
WY_BFO_TLS_PHMAWCA
WY_BFO_TLS_EWR
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_PD
WY_BFO_CSU_GSGRH
WY_BFO_CSU_PHMAC
WY_BFO_CSU_BEGE
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-251 638.540 Acres

T.0450N, R.0790W, 06th PM, WY
Sec. 001 LOTS 1-4;
001 S2N2,S2;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_CSU_PHMA
WY_BFO_TLS_PHMAWCA
WY_BFO_TLS_PHMAL
WY_BFO_TLS_NSSRN
WY_BFO_CSU_GSGRH
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-252 949.240 Acres

T.0450N, R.0790W, 06th PM, WY
Sec. 002 LOTS 1-4;
002 S2N2,S2;
003 LOTS 1-3;
003 S2N2,NESE;
Johnson County
Buffalo FO
PONDEROSA DEEP UNIT
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_CSU_PHMA
WY_BFO_NSO_H
WY_BFO_NSO_SSRN
WY_BFO_TLS_PHMAL
WY_BFO_TLS_PHMAWCA
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_H
WY_BFO_CSU_GSGRH
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_RN

WY-1702-253 320.000 Acres

T.0450N, R.0790W, 06th PM, WY
Sec. 003 SW,W2SE,SESE;
004 SENW;
Johnson County
Buffalo FO
PONDEROSA DEEP UNIT
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_CSU_PHMA
WY_BFO_NSO_H
WY_BFO_TLS_PHMAWCA
WY_BFO_TLS_PHMAL
WY_BFO_CSU_H
WY_BFO_CSU_R500F
WY_BFO_CSU_GSGRH
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB

WY-1702-254 2560.000 Acres

T.0450N, R.0790W, 06th PM, WY
Sec. 010 ALL;
011 ALL;
014 ALL;
015 ALL;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_CSU_PHMA
WY_BFO_NSO_H
WY_BFO_NSO_SSRN
WY_BFO_TLS_PHMAWCA
WY_BFO_TLS_PHMAL
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_H
WY_BFO_CSU_GSGRH
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_RN

WY-1702-255 640.000 Acres

T.0450N, R.0790W, 06th PM, WY
Sec. 013 ALL;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_CSU_PHMA
WY_BFO_TLS_PHMAL
WY_BFO_TLS_PHMAWCA
WY_BFO_CSU_H
WY_BFO_CSU_SE
WY_BFO_CSU_GSGRH
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA

WY-1702-256 1440.000 Acres

T.0450N, R.0790W, 06th PM, WY
Sec. 026 NE;
023 NW,SE;
024 S2;
025 ALL;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_CSU_PHMA
WY_BFO_NSO_H
WY_BFO_NSO_SSRN
WY_BFO_TLS_PHMAWCA
WY_BFO_TLS_PHMAL
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_H
WY_BFO_CSU_GSGRH
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-257 318.470 Acres

T.0460N, R.0790W, 06th PM, WY
Sec. 003 LOTS 1,2;
003 S2NE,SE;
Johnson County
Buffalo FO
HUMMINGBIRD DEEP UNIT
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_CSU_PHMA
WY_BFO_TLS_PHMAL
WY_BFO_TLS_PHMAWCA
WY_BFO_CSU_GSGRH
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR

WY-1702-258 1360.000 Acres

T.0460N, R.0790W, 06th PM, WY
Sec. 015 SW;
022 ALL;
027 N2,W2SE;
034 N2N2;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_NSO_PHMAL
WY_SW_CSU_PHMA
WY_BFO_TLS_PHMAL
WY_BFO_TLS_PHMAWCA
WY_BFO_CSU_H
WY_BFO_CSU_GSGRH
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F

WY-1702-259 640.000 Acres

T.0460N, R.0790W, 06th PM, WY
Sec. 026 S2;
035 W2;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_CSU_PHMA
WY_BFO_NSO_SSRN
WY_BFO_TLS_PHMAWCA
WY_BFO_TLS_PHMAL
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_H
WY_BFO_CSU_GSGRH
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-260 480.000 Acres

T.0460N, R.0790W, 06th PM, WY
Sec. 034 S2N2,S2;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_CSU_PHMA
WY_BFO_NSO_H
WY_BFO_NSO_SSRN
WY_BFO_TLS_PHMAL
WY_BFO_TLS_PHMAWCA
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_H
WY_BFO_CSU_GSGRH
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_RN

WY-1702-261 315.940 Acres

T.0440N, R.0810W, 06th PM, WY
Sec. 007 LOTS 3,4;
007 E2SW;
T.0440N, R.0820W, 06th PM, WY
Sec. 012 SE;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_H
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_VRMII
WY_BFO_CSU_H20500F

WY-1702-262 805.020 Acres

T.0510N, R.0810W, 06th PM, WY
Sec. 001 LOTS 4;
001 SWNW,W2SW;
012 W2NW,SW,W2SE;
013 N2N2;
014 N2NE,SWNE;
035 NESE;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_CSU_PHMA
WY_BFO_NSO_Slopes50
WY_BFO_NSO_SSRN
WY_BFO_TLS_PHMAWCA
WY_BFO_TLS_PHMAL
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_GSGRH
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_VRMII
WY_BFO_CSU_RN

WY-1702-263 1770.340 Acres

T.0570N, R.0810W, 06th PM, WY
Sec. 004 LOTS 5-8;
004 SENE,S2NW,NWSW,E2SE;
005 LOTS 5-8;
005 S2N2,S2;
006 LOTS 8-10;
006 SENW,E2SW;
008 N2N2,S2NE,SWNW;
009 E2,S2NW;
Sheridan County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_NSO_GHMAL
WY_SW_TLS_GHMAL
WY_BFO_NSO_Slopes50
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_PD
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_RN

WY-1702-264 2366.040 Acres

T.0570N, R.0810W, 06th PM, WY
Sec. 010 ALL;
011 ALL;
013 LOTS 1-6;
013 NW,NWSW;
014 N2,N2S2,S2SW;
015 N2NE,NENW;
Sheridan County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_TLS_NSSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-265 2514.020 Acres

T.0580N, R.0810W, 06th PM, WY
Sec. 019 LOTS 1-4;
019 S2N2,S2;
020 LOTS 1-4;
020 S2N2,S2;
029 ALL;
030 ALL;
Sheridan County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-266 1103.480 Acres

T.0580N, R.0810W, 06th PM, WY
Sec. 021 LOTS 1,2;
021 S2NE,SE;
023 S2S2;
028 ALL;
Sheridan County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_SW_TLS_GHMAL
WY_BFO_NSO_Slopes50
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN

WY-1702-267 2071.400 Acres

T.0580N, R.0810W, 06th PM, WY
Sec. 031 LOTS 1-4;
031 N2,N2S2;
032 LOTS 1-4;
032 N2,N2S2;
033 LOTS 1-12;
033 N2;
Sheridan County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SLR
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
WY_BFO_CSU_RN

WY-1702-268 40.000 Acres

T.0500N, R.0820W, 06th PM, WY
Sec. 030 NWNE;
Johnson County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_H20500F

WY-1702-269 40.000 Acres

T.0580N, R.0850W, 06th PM, WY
Sec. 023 NESE;
Sheridan County
Buffalo FO
ASH CREEK II (SHANNON SAND) UNIT
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_Slopes50
WY_BFO_CSU_SE
WY_BFO_CSU_H20500F

WY-1702-270 685.920 Acres

T.0260N, R.0890W, 06th PM, WY
Sec. 005 E2SWNW,SENW,E2NWSW,E2SW;
005 N2SE;
006 LOTS 1-4;
008 NE,E2NW,NWSE;
Carbon County
Lander FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
Special Lease Notice: This parcel contains known sites of traditional religious and cultural importance to Native American Tribes. Prior to approval of an Application for Permit to Drill (APD) or other authorizations allowing surface-disturbing activities on the lease, the BLM will require compliance with all applicable requirements of the National Historic Preservation Act, Archaeological Resources Protection Act, American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, Executive Order 13007 (Indian Sacred Sites), and Executive Order 13175 (Consultation and Coordination with Indian Tribal Governments) which may include tribal consultation with Native American Tribes at the proponent's expense.
NSO (1) No surface occupancy or use is allowed on slopes greater than 25 percent as mapped on the Lander Field Office GIS database; (2) protecting areas containing slopes greater than 25 percent.
NSO (1) No surface occupancy or use is allowed within 500 feet of perennial surface waters, riparian-wetland areas and/or playas as mapped on the Lander Field Office GIS database; (2) to protect perennial surface waters, riparian-wetland areas, and/or playas.
NSO (1) No surface occupancy or use within 200 feet of occupied pygmy rabbit habitat as mapped in the Lander Field Office GIS database; (2) for the protection of occupied pygmy rabbit habitat.
NSO (1) No surface-disturbing activities or surface occupancy is allowed within a 0.6-mile radius of the perimeter of occupied greater sage-grouse leks in Core Area as mapped on the Lander Field Office GIS database; (2) to protect occupied greater sage-grouse leks and associated seasonal habitat, life-history, or behavioral needs of greater sage-grouse in proximity to leks from habitat fragmentation and loss, and protect greater sage-grouse populations from disturbance inside designated Core Area.
TLS (1) Surface disturbing and disruptive activities within identified big game crucial winter range are prohibited Nov 15 to Apr 30; (2) as mapped on the Lander Field Office database; (3) protecting big game crucial winter range.
TLS (1) Surface-disturbing and disruptive activities are restricted or prohibited within 0.25 mile of identified mountain plover habitat Apr 10 to Jul 10; (2) as mapped on the Lander GIS database; (3) for the protection of mountain plover nesting habitat.
TLS (1) Surface disturbing and disruptive

activities are restricted or prohibited Mar 15 to Jun 30; (2) as mapped on the Lander Field Office GIS database; (3) to seasonally protect Greater Sage-Grouse breeding, nesting and early brood-rearing habitats from disruptive activities inside designated core areas.

TLS (1) Surface disturbing and disruptive activities are restricted or prohibited Dec 1 to Mar 14; (2) as mapped on the Lander Field Office GIS database; (3) to seasonally protect Greater Sage-Grouse winter concentration areas.

TLS (1) Nov 15 to Apr 30; (2) as mapped on the Rawlins Field Office GIS database; (3) protecting big game crucial winter range.

TLS (1) Feb 1 to Jul 31; (2) as mapped on the Rawlins Field Office GIS database; (3) protecting nesting Raptors.

TLS (1) Apr 10 to Jul 10; (2) as mapped on the Rawlins Field Office GIS database; (3) protecting nesting Mountain plover.

TLS (1) Mar 15 to Jun 30; (2) as mapped on the Rawlins Field Office GIS database; (3) to seasonally protect Greater Sage-Grouse breeding, nesting and early brood-rearing habitats outside designated PHMA (Core and Connectivity), within 2 miles of an occupied lek.

CSU (1) Surface occupancy or use will be restricted in areas identified as limited reclamation potential soils; (2) as mapped on the Lander Field Office GIS database; (3) for the protection of sensitive soil resources.

CSU (1) Surface occupancy or use will be restricted on slopes between 15 and 24 percent; (2) as mapped on the Lander Field Office GIS database; (3) to protect areas containing slopes between 15 and 24 percent.

CSU (1) Surface occupancy or use will be restricted to no more than an average of one oil and gas or mining locations per 640 acres using the DDCT, and the cumulative value of all applicable surface disturbances, existing or future, must not exceed 5 percent of the DDCT area, as described in the Disturbance Density Calculation Tool manual (DDCT); (2) as mapped on the Lander Field Office GIS database; (3) to protect greater sage-grouse designated Core Area from habitat fragmentation and loss.
This lease does not guarantee the lessee the right to occupy the surface of the lease for the purpose of producing oil and natural gas within Greater Sage-Grouse designated Core Area. The surface occupancy restriction criteria identified in this stipulation may preclude surface occupancy and may be beyond the ability of the lessee to meet due to existing surface disturbance on Federal, State, or private lands within designated core areas, or surface disturbance created by other land users. The BLM may require the lessee or operator to enter into a unit agreement or drilling easement to facilitate the equitable development of this and surrounding leases.

CSU (1) Surface occupancy or use will be restricted or prohibited unless the operator and surface managing agency arrive at an acceptable plan for mitigation of anticipated impacts; (2) as mapped on the Rawlins Field Office GIS database; (3) protecting the habitats of identified amphibian/reptile species.

WY-1702-271 380.000 Acres

T.0270N, R.0890W, 06th PM, WY
Sec. 027 W2NENW,W2W2,SENW,E2SW;
027 W2NWSE,SWSE;
035 W2SWSW;

Carbon County
Lander FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

Special Lease Notice: This parcel contains known sites of traditional religious and cultural importance to Native American Tribes. Prior to approval of an Application for Permit to Drill (APD) or other authorizations allowing surface-disturbing activities on the lease, the BLM will require compliance with all applicable requirements of the National Historic Preservation Act, Archaeological Resources Protection Act, American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, Executive Order 13007 (Indian Sacred Sites), and Executive Order 13175 (Consultation and Coordination with Indian Tribal Governments) which may include tribal consultation with Native American Tribes at the proponent's expense.

NSO (1) No surface occupancy or use is allowed on slopes greater than 25 percent as mapped on the Lander Field Office GIS database; (2) protecting areas containing slopes greater than 25 percent.

NSO (1) No surface occupancy or use within 200 feet of occupied pygmy rabbit habitat as mapped in the Lander Field Office GIS database; (2) for the protection of occupied pygmy rabbit habitat.

TLS (1) Surface disturbing and disruptive activities within identified big game crucial winter range are prohibited Nov 15 to Apr 30; (2) as mapped on the Lander Field Office database; (3) protecting big game crucial winter range.

TLS (1) Surface disturbing and disruptive activities are restricted or prohibited within 1 mile of bald eagle and ferruginous hawk nests and 3/4 mile of all other active raptor nests during the following time periods: Apr 1 to Aug 31 for northern goshawk, Apr 1 to Sept 15 for burrowing owl, Feb 1 to Aug 15 for bald eagles, Feb 1 to Jul 31 for all other raptors;(2) as mapped on the Lander Field Office GIS database; (3) for the protection of active raptor and/or eagle nests.

TLS (1) Surface-disturbing and disruptive activities are restricted or prohibited within 0.25 mile of identified mountain plover habitat Apr 10 to Jul 10; (2) as mapped on the Lander GIS database; (3) for the protection of mountain plover nesting habitat.

TLS (1) Surface disturbing and disruptive activities are restricted or prohibited Mar 15 to Jun 30; (2) as mapped on the Lander Field Office GIS database; (3) to seasonally protect Greater Sage-Grouse breeding, nesting and early brood-rearing habitats from disruptive activities inside designated core areas.

TLS (1) Surface disturbing and disruptive activities are restricted or prohibited Dec 1 to Mar 14; (2) as mapped on the Lander Field Office GIS database; (3) to seasonally protect Greater Sage-Grouse winter concentration areas.

TLS (1) Nov 15 to Apr 30; (2) as mapped on the Rawlins Field Office GIS database; (3) protecting big game crucial winter range.

TLS (1) Feb 1 to Jul 31; (2) as mapped on the Rawlins Field Office GIS database; (3) protecting nesting Raptors.

TLS (1) Mar 15 to Jun 30; (2) as mapped on the Rawlins Field Office GIS database; (3) to seasonally protect Greater Sage-Grouse breeding, nesting and early brood-rearing habitats outside designated PHMA (Core and Connectivity), within 2 miles of an occupied lek.

CSU (1) Surface occupancy or use will be restricted in areas identified as limited reclamation potential soils; (2) as mapped on the Lander Field Office GIS database; (3) for the protection of sensitive soil resources.

CSU (1) Surface occupancy or use will be restricted on slopes between 15 and 24 percent; (2) as mapped on the Lander Field Office GIS database; (3) to protect areas containing slopes between 15 and 24 percent.

CSU (1) Surface occupancy or use will be restricted to no more than an average of one oil and gas or mining locations per 640 acres using the DDCT, and the cumulative value of all applicable surface disturbances, existing or future, must not exceed 5 percent of the DDCT area, as described in the Disturbance Density Calculation Tool manual (DDCT); (2) as mapped on the Lander Field Office GIS database; (3) to protect greater sage-grouse designated Core Area from habitat fragmentation and loss.
This lease does not guarantee the lessee the right to occupy the surface of the lease for the purpose of producing oil and natural gas within Greater Sage-Grouse designated Core Area. The surface occupancy restriction criteria identified in this stipulation may preclude surface occupancy and may be beyond the ability of the lessee to meet due to existing surface disturbance on Federal, State, or private lands within designated core areas, or surface disturbance created by other land users. The BLM may require the lessee or operator to enter into a unit agreement or drilling easement to facilitate the equitable development of this and surrounding leases.

CSU (1) Surface occupancy or use will be restricted or prohibited unless the operator and surface managing agency arrive at an acceptable plan for mitigation of anticipated impacts; (2) as mapped on the Rawlins Field Office GIS database; (3) protecting raptor nesting habitat

CSU (1) Surface occupancy or use will be restricted or prohibited unless the operator and surface managing agency arrive at an acceptable plan for mitigation of anticipated impacts; (2) as mapped on the Rawlins Field Office GIS database; (3) protecting the habitats of identified amphibian/reptile species.

WY-1702-272 850.320 Acres

T.0380N, R.0910W, 06th PM, WY
Sec. 017 LOTS 1-4;
017 S2N2,NESE;
019 E2,E2W2;
Fremont County
Lander FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

NSO (1) No surface occupancy or use is allowed on slopes greater than 25 percent as mapped on the Lander Field Office GIS database; (2) protecting areas containing slopes greater than 25 percent.

TLS (1) Surface disturbing and disruptive activities within identified big game crucial winter range are prohibited Nov 15 to Apr 30; (2) as mapped on the Lander Field Office database; (3) protecting big game crucial winter range.

TLS (1) Surface disturbing and disruptive activities are restricted or prohibited within 1 mile of bald eagle and ferruginous hawk nests and 3/4 mile of all other active raptor nests during the following time periods: Apr 1 to Aug 31 for northern goshawk, Apr 1 to Sept 15 for burrowing owl, Feb 1 to Aug 15 for bald eagles, Feb 1 to Jul 31 for all other raptors;(2) as mapped on the Lander Field Office GIS database; (3) for the protection of active raptor and/or eagle nests.

TLS (1) Surface-disturbing and disruptive activities are restricted or prohibited within 0.25 mile of identified mountain plover habitat Apr 10 to Jul 10; (2) as mapped on the Lander GIS database; (3) for the protection of mountain plover nesting habitat.

CSU (1) Surface occupancy or use will be restricted in areas identified as limited reclamation potential soils; (2) as mapped on the Lander Field Office GIS database; (3) for the protection of sensitive soil resources.

CSU (1) Surface occupancy or use will be restricted on slopes between 15 and 24 percent; (2) as mapped on the Lander Field Office GIS database; (3) to protect areas containing slopes between 15 and 24 percent.

CSU (1) Surface use or occupancy will be restricted within designated "very high" or "high" potential fossil yield classification areas; (2) as mapped on the Lander Field Office GIS database; (3) for the protection of fossil resources.

WY-1702-273 160.000 Acres

T.0370N, R.0920W, 06th PM, WY
Sec. 017 SW;
Fremont County
Lander FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

NSO (1) No surface occupancy or use is allowed within 500 feet of perennial surface waters, riparian-wetland areas and/or playas as mapped on the Lander Field Office GIS database; (2) to protect perennial surface waters, riparian-wetland areas, and/or playas.

TLS (1) Surface-disturbing and disruptive activities are restricted or prohibited within 0.25 mile of identified mountain plover habitat Apr 10 to Jul 10; (2) as mapped on the Lander GIS database; (3) for the protection of mountain plover nesting habitat.

CSU (1) Surface occupancy or use will be restricted in areas identified as limited reclamation potential soils; (2) as mapped on the Lander Field Office GIS database; (3) for the protection of sensitive soil resources.

WY-1702-274 1721.490 Acres

T.0370N, R.0930W, 06th PM, WY
Sec. 013 S2;
019 LOTS 4;
019 W2NE,NWSE;
021 NE,S2;
023 SWSW;
024 NWNW,SENW,SW;
025 NW;
029 E2NE;
030 LOTS 1-4;
030 W2NE;

Fremont County
Lander FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

NSO (1) No surface occupancy or use is allowed on slopes greater than 25 percent as mapped on the Lander Field Office GIS database; (2) protecting areas containing slopes greater than 25 percent.

NSO (1) No surface occupancy or use is allowed within 500 feet of perennial surface waters, riparian-wetland areas and/or playas as mapped on the Lander Field Office GIS database; (2) to protect perennial surface waters, riparian-wetland areas, and/or playas.

NSO (1) No surface-disturbing activities or surface occupancy is allowed within a 0.6-mile radius of the perimeter of occupied greater sage-grouse leks in Core Area as mapped on the Lander Field Office GIS database; (2) to protect occupied greater sage-grouse leks and associated seasonal habitat, life-history, or behavioral needs of greater sage-grouse in proximity to leks from habitat fragmentation and loss, and protect greater sage-grouse populations from disturbance inside designated Core Area.

TLS (1) Surface disturbing and disruptive activities within identified big game crucial winter range are prohibited Nov 15 to Apr 30; (2) as mapped on the Lander Field Office database; (3) protecting big game crucial winter range.

TLS (1) Surface disturbing and disruptive activities are restricted or prohibited within 1 mile of bald eagle and ferruginous hawk nests and 3/4 mile of all other active raptor nests during the following time periods: Apr 1 to Aug 31 for northern goshawk, Apr 1 to Sept 15 for burrowing owl, Feb 1 to Aug 15 for bald eagles, Feb 1 to Jul 31 for all other raptors;(2) as mapped on the Lander Field Office GIS database; (3) for the protection of active raptor and/or eagle nests.

TLS (1) Surface-disturbing and disruptive activities are restricted or prohibited within 0.25 mile of identified mountain plover habitat Apr 10 to Jul 10; (2) as mapped on the Lander GIS database; (3) for the protection of mountain plover nesting habitat.

TLS (1) Surface disturbing and disruptive activities are restricted or prohibited Mar 15 to Jun 30; (2) as mapped on the Lander Field Office GIS database; (3) to seasonally protect Greater Sage-Grouse breeding, nesting and early brood-rearing habitats from disruptive activities inside designated core areas.

TLS (1) Surface disturbing and disruptive activities are restricted or prohibited Dec 1 to Mar 14; (2) as mapped on the Lander Field Office GIS database; (3) to seasonally protect Greater Sage-Grouse winter concentration areas.

CSU (1) Surface occupancy or use will be restricted in areas identified as limited reclamation potential soils; (2) as mapped on the Lander Field Office GIS database; (3) for the protection of sensitive soil resources.

CSU (1) Surface occupancy or use will be restricted on slopes between 15 and 24 percent; (2) as mapped on the Lander Field Office GIS database; (3) to protect areas containing slopes between 15 and 24 percent.

CSU (1) Surface occupancy or use will be restricted to no more than an average of one oil and gas or mining locations per 640 acres using the DDCT, and the cumulative value of all applicable surface disturbances, existing or future, must not exceed 5 percent of the DDCT area, as described in the Disturbance Density Calculation Tool manual (DDCT); (2) as mapped on the Lander Field Office GIS database; (3) to protect greater sage-grouse designated Core Area from habitat fragmentation and loss.
This lease does not guarantee the lessee the right to occupy the surface of the lease for the purpose of producing oil and natural gas within Greater Sage-Grouse designated Core Area. The surface occupancy restriction criteria identified in this stipulation may preclude surface occupancy and may be beyond the ability of the lessee to meet due to existing surface disturbance on Federal, State, or private lands within designated core areas, or surface disturbance created by other land users. The BLM may require the lessee or operator to enter into a unit agreement or drilling easement to facilitate the equitable development of this and surrounding leases.

CSU (1) Surface use or occupancy will be restricted within designated "very high" or "high" potential fossil yield classification areas; (2) as mapped on the Lander Field Office GIS database; (3) for the protection of fossil resources.

WY-1702-275 2527.160 Acres

T.0390N, R.0930W, 06th PM, WY
Sec. 001 LOTS 4;
001 SWNW,W2SW;
002 LOTS 3,4;
002 S2NW,S2;
003 LOTS 1-3;
003 S2NE,SENW,E2SW,SE;
004 LOTS 1,2;
004 S2NE,S2;
013 LOTS 1-4;
013 W2E2,W2;
014 NENE,S2NE,SE;

Fremont County
Lander FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

Special Lease Notice: This parcel contains known sites of traditional religious and cultural importance to Native American Tribes. Prior to approval of an Application for Permit to Drill (APD) or other authorizations allowing surface-disturbing activities on the lease, the BLM will require compliance with all applicable requirements of the National Historic Preservation Act, Archaeological Resources Protection Act, American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, Executive Order 13007 (Indian Sacred Sites), and Executive Order 13175 (Consultation and Coordination with Indian Tribal Governments) which may include tribal consultation with Native American Tribes at the proponent's expense.

NSO (1) No surface occupancy or use is allowed on slopes greater than 25 percent as mapped on the Lander Field Office GIS database; (2) protecting areas containing slopes greater than 25 percent.

NSO (1) No surface occupancy or use is allowed within 500 feet of perennial surface waters, riparian-wetland areas and/or playas as mapped on the Lander Field Office GIS database; (2) to protect perennial surface waters, riparian-wetland areas, and/or playas.

TLS (1) Surface disturbing and disruptive activities within identified big game crucial winter range are prohibited Nov 15 to Apr 30; (2) as mapped on the Lander Field Office database; (3) protecting big game crucial winter range.

TLS (1) Surface disturbing and disruptive activities are restricted or prohibited within 1 mile of bald eagle and ferruginous hawk nests and 3/4 mile of all other active raptor nests during the following time periods: Apr 1 to Aug 31 for northern goshawk, Apr 1 to Sept 15 for burrowing owl, Feb 1 to Aug 15 for bald eagles, Feb 1 to Jul 31 for all other raptors;(2) as mapped on the Lander Field Office GIS database; (3) for the protection of active raptor and/or eagle nests.

TLS (1) Surface-disturbing and disruptive activities are restricted or prohibited within 0.25 mile of identified mountain plover habitat Apr 10 to Jul 10; (2) as mapped on the Lander GIS database; (3) for the protection of mountain plover nesting habitat.

CSU (1) Surface occupancy or use will be restricted in areas identified as limited reclamation potential soils; (2) as mapped on the Lander Field Office GIS database; (3) for the protection of sensitive soil resources.

CSU (1) Surface occupancy or use will be restricted on slopes between 15 and 24 percent; (2) as mapped on the Lander Field Office GIS database; (3) to protect areas containing slopes between 15 and 24 percent.

CSU (1) Surface use or occupancy will be restricted within designated "very high" or "high" potential fossil yield classification areas; (2) as mapped on the Lander Field Office GIS database; (3) for the protection of fossil resources.

CSU (1) Surface occupancy or use is restricted within designated VRM Class I and II areas; as mapped on the Lander Field Office GIS database; (2) for the protection of VRM Class I and II areas.

WY-1702-276 1591.410 Acres

T.0390N, R.0930W, 06th PM, WY
Sec. 025 LOTS 1,2;
025 W2NE,NW;
029 SW;
030 LOTS 1-4;
030 E2W2,SE;
031 LOTS 1-4;
031 E2,E2W2;
Fremont County
Lander FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
NSO (1) No surface occupancy or use is allowed on slopes greater than 25 percent as mapped on the Lander Field Office GIS database; (2) protecting areas containing slopes greater than 25 percent.
TLS (1) Surface disturbing and disruptive activities are restricted or prohibited within 1 mile of bald eagle and ferruginous hawk nests and 3/4 mile of all other active raptor nests during the following time periods: Apr 1 to Aug 31 for northern goshawk, Apr 1 to Sept 15 for burrowing owl, Feb 1 to Aug 15 for bald eagles, Feb 1 to Jul 31 for all other raptors;(2) as mapped on the Lander Field Office GIS database; (3) for the protection of active raptor and/or eagle nests.
TLS (1) Surface-disturbing and disruptive activities are restricted or prohibited within 0.25 mile of identified mountain plover habitat Apr 10 to Jul 10; (2) as mapped on the Lander GIS database; (3) for the protection of mountain plover nesting habitat.
CSU (1) Surface occupancy or use will be restricted in areas identified as limited reclamation potential soils; (2) as mapped on the Lander Field Office GIS database; (3) for the protection of sensitive soil resources.
CSU (1) Surface occupancy or use will be restricted on slopes between 15 and 24 percent; (2) as mapped on the Lander Field Office GIS database; (3) to protect areas containing slopes between 15 and 24 percent.
CSU (1) Surface use or occupancy will be restricted within designated "very high" or "high" potential fossil yield classification areas; (2) as mapped on the Lander Field Office GIS database; (3) for the protection of fossil resources.

WY-1702-277 2361.320 Acres

T.0370N, R.0940W, 06th PM, WY
Sec. 013 ALL;
024 ALL;
029 S2;
030 LOTS 3,4;
031 LOTS 1-4;
032 ALL;
Fremont County
Lander FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
NSO (1) No surface occupancy or use is allowed on slopes greater than 25 percent as mapped on the Lander Field Office GIS database; (2) protecting areas containing slopes greater than 25 percent.
NSO (1) No surface occupancy or use is allowed within 500 feet of perennial surface waters, riparian-wetland areas and/or playas as mapped on the Lander Field Office GIS database; (2) to protect perennial surface waters, riparian-wetland areas, and/or playas.
TLS (1) Surface disturbing and disruptive activities within identified big game crucial winter range are prohibited Nov 15 to Apr 30; (2) as mapped on the Lander Field Office database; (3) protecting big game crucial winter range.
TLS (1) Surface-disturbing and disruptive activities are restricted or prohibited within 0.25 mile of identified mountain plover habitat Apr 10 to Jul 10; (2) as mapped on the Lander GIS database; (3) for the protection of mountain plover nesting habitat.
CSU (1) Surface occupancy or use will be restricted in areas identified as limited reclamation potential soils; (2) as mapped on the Lander Field Office GIS database; (3) for the protection of sensitive soil resources.
CSU (1) Surface occupancy or use will be restricted on slopes between 15 and 24 percent; (2) as mapped on the Lander Field Office GIS database; (3) to protect areas containing slopes between 15 and 24 percent.
CSU (1) Surface use or occupancy will be restricted within designated “very high” or “high” potential fossil yield classification areas (2) as mapped on the Lander Field Office GIS database; (3) for the protection of fossil resources.

WY-1702-278 1760.000 Acres

T.0370N, R.0940W, 06th PM, WY
Sec. 033 ALL;
034 ALL;
035 W2,SE;
Fremont County
Lander FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

NSO (1) No surface occupancy or use is allowed on slopes greater than 25 percent as mapped on the Lander Field Office GIS database; (2) protecting areas containing slopes greater than 25 percent.

NSO (1) No surface occupancy or use is allowed within 500 feet of perennial surface waters, riparian-wetland areas and/or playas as mapped on the Lander Field Office GIS database; (2) to protect perennial surface waters, riparian-wetland areas, and/or playas.

TLS (1) Surface-disturbing and disruptive activities are restricted or prohibited within 0.25 mile of identified mountain plover habitat Apr 10 to Jul 10; (2) as mapped on the Lander GIS database; (3) for the protection of mountain plover nesting habitat.

CSU (1) Surface occupancy or use will be restricted in areas identified as limited reclamation potential soils; (2) as mapped on the Lander Field Office GIS database; (3) for the protection of sensitive soil resources.

CSU (1) Surface occupancy or use will be restricted on slopes between 15 and 24 percent; (2) as mapped on the Lander Field Office GIS database; (3) to protect areas containing slopes between 15 and 24 percent.

CSU (1) Surface use or occupancy will be restricted within designated “very high” or “high” potential fossil yield classification areas; (2) as mapped on the Lander Field Office GIS database; (3) for the protection of fossil resources.

WY-1702-279 719.160 Acres

T.0390N, R.0940W, 06th PM, WY
Sec. 002 S2NE,SENW;
004 LOTS 1-4;
004 S2N2,NESW,SE;
027 S2SW;
Fremont County
Lander FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

NSO (1) No surface occupancy or use is allowed on slopes greater than 25 percent as mapped on the Lander Field Office GIS database; (2) protecting areas containing slopes greater than 25 percent.

NSO (1) No surface occupancy or use is allowed within 500 feet of perennial surface waters, riparian-wetland areas and/or playas as mapped on the Lander Field Office GIS database; (2) to protect perennial surface waters, riparian-wetland areas, and/or playas.

TLS (1) Surface disturbing and disruptive activities within identified big game crucial winter range are prohibited Nov 15 to Apr 30; (2) as mapped on the Lander Field Office database; (3) protecting big game crucial winter range.

TLS (1) Surface-disturbing and disruptive activities are restricted or prohibited within 0.25 mile of identified mountain plover habitat Apr 10 to Jul 10; (2) as mapped on the Lander GIS database; (3) for the protection of mountain plover nesting habitat.

CSU (1) Surface occupancy or use will be restricted in areas identified as limited reclamation potential soils; (2) as mapped on the Lander Field Office GIS database; (3) for the protection of sensitive soil resources.

CSU (1) Surface occupancy or use will be restricted on slopes between 15 and 24 percent; (2) as mapped on the Lander Field Office GIS database; (3) to protect areas containing slopes between 15 and 24 percent.

CSU (1) Surface use or occupancy will be restricted within a 2-mile buffer of RHT (Regional Historic Trails) & EHs (Early Highways); (2) as mapped on the Lander Field Office GIS database; (3) for the protection of the RHT&EHs and their settings.

CSU (1) Surface use or occupancy will be restricted within designated "very high" or "high" potential fossil yield classification areas; (2) as mapped on the Lander Field Office GIS database; (3) for the protection of fossil resources.

CSU (1) Surface occupancy or use is restricted within designated VRM Class I and II areas; as mapped on the Lander Field Office GIS database; (2) for the protection of VRM Class I and II areas.

WYOMING ACQUIRED

WY-1702-280 320.680 Acres

T.0410N, R.0700W, 06th PM, WY
Sec. 018 LOTS 7-10,15-18;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_CSU_R500F
WY_BFO_CSU_SE
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_H20500F
CSU (1) Surface use or occupancy shall not be allowed by oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) on this Federal oil and gas lease to conduct any oil and gas operation, including drilling for, removing, or disposing of oil and/or gas contained in the Federal coal lease WYW-176095 unless a plan for mitigation of anticipated impacts is developed between the oil and gas and the coal lessees, and the plan is approved by the Authorized Officer; (2) as mapped on High Plains District GIS database; (3) for the purpose of protecting the first in time valid existing rights of the coal lessee, the Authorized Officer reserves the right to alter or modify any oil and gas operations on the lands described in this lease ensuring: a.) the orderly development of the coal resource by surface and/or underground mining methods; b.) coal mine worker safety; and/or c.) coal production rates or recovery of the coal resource. The oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) of this Federal oil and gas lease shall not hold the United States as lessor, coal lessee(s), sub-lessee(s), and/or coal operator(s) liable for any damage or loss of the oil and gas resource, including the venting of coal bed methane gas, caused by coal exploration or mining operations conducted on Federal coal WYW-176095.

WY-1702-281 323.600 Acres

T.0420N, R.0710W, 06th PM, WY
Sec. 022 LOTS 3-6,11-14;
Campbell County
Buffalo FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_CSU_FQM
WY_BFO_CSU_R500F
WY_BFO_CSU_SSWLA
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLR
WY_BFO_CSU_RN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN

WY-1702-282 40.000 Acres

T.0390N, R.0730W, 06th PM, WY
Sec. 002 NESW;
Converse County
Casper FO
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3

WY-1702-283 327.680 Acres

T.0490N, R.0730W, 06th PM, WY
Sec. 010 LOTS 13,14;
015 LOTS 1,2,5-8;
Campbell County
Buffalo FO
US OWNS 50% MINERAL INTEREST
Stipulations:
Lease Notice No. 1
Lease Notice No. 2
Lease Notice No. 3
Lease Stipulation No. 1
Lease Stipulation No. 2
Lease Stipulation No. 3
WY_BFO_NSO_SSRN
WY_BFO_TLS_SSRN
WY_BFO_TLS_NSSRN
WY_BFO_CSU_SSWLR
WY_BFO_CSU_SSWLB
WY_BFO_CSU_SSWLA
WY_BFO_CSU_RN

Number of Parcels - 283

Total Acreage – 184,784.250

Total Number of Parcels with Presale Offers - 0
Parcel Number of Parcels with Presale Offers - 0

Total Acreage With Presale Offers - 0

Any portion of the listed lands may be deleted upon determination that such lands are not available for leasing.

INDEX OF APPLIED GREATER SAGE-GROUSE STIPULATIONS AND STIPULATIONS FROM THE BUFFALO FIELD OFFICE RESOURCE MANAGEMENT PLAN

STIPULATION CODE	STIPULATION LANGUAGE
WY_BFO_CSU_BEGE	CSU (1) Prior to surface disturbance within 1.0 mile of consistently used bald and golden eagle winter roosts and riparian corridors a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the Authorized Officer's satisfaction that wintering eagles will not be disturbed (as defined by the Bald and Golden Eagle Protection Act). Bald or golden eagles will not be agitated or bothered to a degree that causes or is likely to cause physical injury, or a decrease in productivity by substantially interfering with normal breeding, feeding, or sheltering behavior; (2) as mapped on the Buffalo Field Office GIS database or determined by field evaluation, in coordination with the Wyoming Game and Fish Department and/or US Fish and Wildlife Service; (3) protecting bald and golden eagle winter roosting habitat.
WY_BFO_CSU_BGCW	CSU (1) Prior to surface disturbance within Wyoming Game and Fish Department designated big game crucial winter range, a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the Authorized Officer's satisfaction that the function and suitability of crucial big game winter ranges will not be impaired; (2) as mapped by the Wyoming Game and Fish Department; (3) ensuring the function and suitability of crucial big game winter range.
WY_BFO_CSU_C100F	CSU (1) Prior to surface disturbance or disruptive activities near an entrance to a significant cave a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the BLM Authorized Officer's satisfaction that the action will not destroy, disturb, deface, mar, alter, remove, or harm any significant cave or alter the free movement of any animal or plant life into or out of any significant cave; (2) as mapped by the BLM; (3) protecting significant cave resources (any material or substance occurring naturally in caves, such as animal life, plant life, paleontological deposits, sediments, minerals, speleogens, and speleothems).

STIPULATION CODE	STIPULATION LANGUAGE
WY_BFO_CSU_CLBA	CSU (1) Surface use or occupancy shall not be allowed by oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) on this Federal oil and gas lease to conduct any oil and gas operation, including drilling for, removing, or disposing of oil and/or gas contained in Federal coal lease(s) unless a plan for mitigation of anticipated impacts is developed between the oil and gas and the coal lessees, and the Plan is approved by the BLM Authorized Officer; (2) on areas identified as highly likely to be considered in a Coal Lease By Application as mapped by the US Office of Surface Mining, Wyoming Department of Environmental Quality, US Geological Survey, and/or BLM; (3) protecting the first in time valid existing rights of the coal lessee, the BLM Authorized Officer reserves the right to alter or modify any oil and gas operations on the lands described in this lease ensuring the orderly development of the coal resource by surface and/or underground mining methods, coal mine worker safety, and/or coal production rates or recovery of the coal resource. The oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) of this Federal oil and gas lease shall not hold the United States as lessor, coal lessee(s), sub-lessee(s), and/or coal operator(s) liable for any damage or loss of the oil and gas resource, including the venting of coalbed natural gas, caused by coal exploration or mining operations conducted on Federal coal lease.
WY_BFO_CSU_EC	CSU (1) Prior to surface disturbance within Wyoming Game and Fish Department designated elk calving areas a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the Authorized Officer’s satisfaction that the function and suitability of elk calving areas will not be impaired; (2) as mapped by the Wyoming Game and Fish Department; (3) ensuring the function and suitability of elk calving areas.
WY_BFO_CSU_ECWC	CSU (1) Fluid mineral production and byproducts shall be piped out of, and permanent above ground facilities will be located outside of, Wyoming Game and Fish Department designated elk crucial winter range and calving areas unless a mitigation plan (Plan) is submitted by the applicant and approved by the BLM as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the Authorized Officer’s satisfaction that the function and suitability of elk crucial winter range and elk calving areas will not be impaired; (2) as mapped by the Wyoming Game and Fish Department; (3) ensuring the function and suitability of elk crucial winter range and elk calving areas.

STIPULATION CODE	STIPULATION LANGUAGE
WY_BFO_CSU_FCR	CSU (1) Surface-disturbing and disruptive activities shall only be approved with adequate mitigation to ensure compliance with the Fortification Creek Resources Management Plan Amendment (BLM 2011) performance standards. Prior to surface disturbance within the Fortification Creek Planning Area a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate); (2) within the Fortification Creek Planning Area (Map 3-36); (3) protecting the viability of the Fortification elk herd and facilitating ecosystem reconstruction in the stabilization of disturbed areas.
WY_BFO_CSU_FQM	CSU (1) Prior to surface disturbance within 0.25 mile of naturally occurring water bodies containing native or desirable non-native fish species a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the Authorized Officer's satisfaction that there will not be a local decline in fish abundance or range as a result of the lease operations. Examples of a few of the items to consider are as follows. Spill prevention measures must be used to ensure hydrocarbons and other potentially toxic substances used for lease activities are prevented from entering the watercourse. Sediment control measures must be used to ensure increased sediment contributions are avoided; (2) as mapped by the Wyoming Game and Fish Department and/or BLM; (3) protecting native and desirable non-native fish populations and habitat.
WY_BFO_CSU_GSGRH	CSU (1) All applicable surface disturbances (existing or future, and not limited to fluid mineral disturbances) must be restored, as described in the Buffalo Field Office Resource Management Plan, to the approval of the BLM Authorized Officer; (2) Greater Sage-Grouse Core Population Areas and Connectivity Corridors (Priority Habitat) as mapped on the Buffalo Field Office GIS database; (3) to restore functional Greater Sage-Grouse habitat to support core Greater Sage-Grouse populations.
WY_BFO_CSU_H	CSU (1) Prior to surface disturbance within 3 miles of the Pumpkin Buttes, Cantonment Reno, Dull Knife Battle, and Crazy Woman Battle historic properties, contributing and unevaluated segments of the Bozeman Trail, all rock art sites, all rock shelter sites, and all Native American burials, a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator may not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan or approved it with conditions after consultation with the State Historic Preservation Office, applicable Indian tribes, and other interested parties. The Plan must demonstrate to the Authorized Officer's satisfaction that there will be no adverse effects to National Register of Historic Places eligible or listed historic properties (i.e., the infrastructure will either not be visible or will result in a weak contrast rating); (2) as mapped on the Buffalo Field Office GIS database; (3) ensuring the setting of historic properties.

STIPULATION CODE	STIPULATION LANGUAGE
WY_BFO_CSU_H20500F	CSU (1) Prior to surface disturbance within 500 feet of springs, reservoirs not associated with coal bed natural gas projects, water wells, and perennial streams a site-specific construction, stabilization, and reclamation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the BLM Authorized Officer's satisfaction how the operator will meet the following performance standards. Storm water and surface runoff will be controlled to minimize erosion (rilling, gullying, piping, mass wasting) and offsite siltation during construction, use/operations, and reclamation. Offsite areas will be protected from accelerated soil erosion. The original landform and site productivity will be partially restored during interim reclamation and fully restored as a result of final reclamation; (2) as mapped by the US Geological Survey's National Hydrologic Inventory and/or as determined by a BLM evaluation of the area; (3) ensuring protection of surface waters and associated riparian habitats by meeting the standards outlined in, Chapter 6 of the BLM's Oil and Gas Gold Book, as revised, and the 2015 Buffalo Field Office Resource Management Plan Record of Decision.
WY_BFO_CSU_PD	CSU (1) Prior to surface disturbance within active prairie dog colonies on BLM-administered surface a special status species occupancy survey must be conducted and a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the Authorized Officer's satisfaction that activities with active prairie dog colonies on BLM surface would not adversely impact suitable habitat for special status species dependent upon prairie dog colonies; (2) as mapped or determined on the Buffalo Field Office GIS database or from field evaluation, in coordination with the US Fish and Wildlife Service and Wyoming Game and Fish Department; (3) conserving special status species wildlife and the prairie dog colonies on which they depend.
WY_BFO_CSU_PHMAC	CSU (1) Surface occupancy or use will be restricted. The cumulative value of all applicable surface disturbances, existing or future, must not exceed 5 percent of the Disturbance Density Calculation Tool (DDCT) area, as described in the DDCT manual; (2) as mapped on the Buffalo Field Office GIS database; (3) to protect Greater Sage-Grouse designated Priority Habitat Management Areas (Connectivity only) from habitat fragmentation and loss. This lease does not guarantee the lessee the right to occupy the surface of the lease for the purpose of producing oil and natural gas within Greater Sage-Grouse designated PHMAs (Connectivity only). The surface occupancy restriction criteria identified in this stipulation may preclude surface occupancy and may be beyond the ability of the lessee to meet due to existing surface disturbance on Federal, State, or private lands within designated PHMAs (Connectivity only) or surface disturbance created by other land users. The BLM may require the lessee or operator to enter into a unit agreement or drilling easement to facilitate the equitable development of this and surrounding leases.

STIPULATION CODE	STIPULATION LANGUAGE
WY_BFO_CSU_R500F	CSU (1) Prior to surface disturbance within 500 feet of riparian systems, wetlands, and aquatic habitats a site-specific construction, stabilization, and reclamation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the BLM Authorized Officer's satisfaction how the operator will meet the following performance standards. Storm water and surface runoff will be controlled to minimize erosion (rilling, gullying, piping, mass wasting) and offsite siltation during construction, use/operations, and reclamation. Offsite areas will be protected from accelerated soil erosion. The original landform and site productivity will be partially restored during interim reclamation and fully restored as a result of final reclamation; (2) as mapped by the US Geological Survey's National Hydrologic Inventory and/or as determined by a BLM evaluation of the area; (3) ensuring protection of surface waters and associated riparian habitats by meeting the standards outlined in, Chapter 6 of the BLM's Oil and Gas Gold Book, as revised, and the 2015 Buffalo Field Office Resource Management Plan Record of Decision.
WY_BFO_CSU_RN	CSU (1) Prior to surface disturbance within US Fish and Wildlife Service recommended spatial buffers of raptor nests a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the Authorized Officer's satisfaction that nesting raptors will not be disturbed. Nesting raptors will not be agitated or bothered to a degree that causes or is likely to cause physical injury, a decrease in productivity by substantially interfering with normal breeding, feeding, or sheltering behavior, or nest abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior; (2) as mapped on the Buffalo Field Office GIS database or determined by the BLM from field evaluation in coordination with the Wyoming Game and Fish Department and/or US Fish and Wildlife Service; (3) ensuring raptor productivity.

STIPULATION CODE	STIPULATION LANGUAGE
WY_BFO_CSU_SE	CSU (1) Prior to surface disturbance on soils with a severe erosion hazard rating a site-specific construction, stabilization, and reclamation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the BLM Authorized Officer's satisfaction how the operator will meet the following performance standards. The disturbed area will be stabilized with no evidence of accelerated erosion features. The disturbed area shall be managed to ensure soil characteristics approximate an appropriate reference site with regard to erosional features to maintain soil productivity and sustainability. Sufficient viable topsoil is maintained for ensuring successful final reclamation. At locations where interim reclamation will be completed, this will be accomplished by respreading all salvaged topsoil over the areas of interim reclamation. The original landform and site productivity will be partially restored during interim reclamation and fully restored as a result of final reclamation; (2) as mapped by the Natural Resources Conservation Service Soil Survey Geographic Database (SSURGO) Order 3 soil survey and/or as determined by a BLM evaluation of the area; (3) ensuring successful reclamation and erosion control on soils with a severe erosion hazard rating in order to meet the standards outlined in Chapter 6 the BLM's Oil and Gas Gold Book, as revised, and the 2015 Buffalo Field Office Resource Management Plan Record of Decision.
WY_BFO_CSU_Slopes25to50	CSU (1) Prior to surface disturbance on slopes greater than 25% and less than 50% a site-specific construction, stabilization, and reclamation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The Plan must include designs approved and stamped by a licensed engineer. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the BLM Authorized Officer's satisfaction how the operator will meet the following performance standards. Slope stability is maintained preventing slope failure or mass wasting. The disturbed area will be stabilized with no evidence of accelerated erosion features. The disturbed area shall be managed to ensure soil characteristics approximate an appropriate reference site with regard to erosional features to maintain soil productivity and sustainability. Sufficient viable topsoil is maintained for ensuring successful final reclamation. At locations where interim reclamation will be completed, this will be accomplished by respreading all salvaged topsoil over the areas of interim reclamation. The original landform and site productivity will be partially restored during interim reclamation and fully restored as a result of final reclamation; (2) as mapped by the US Geological Survey (USGS) 1:24,000 scale topographic maps, USGS Digital Elevation Models, and/or as determined by a BLM evaluation of the area; (3) ensuring successful reclamation and erosion control on slopes greater than 25% and less than 50% in order to meet the standards outlined in Chapter 6 of the BLM's Oil and Gas Gold Book, as revised, and the 2015 Buffalo Field Office Resource Management Plan Record of Decision.

STIPULATION CODE	STIPULATION LANGUAGE
WY_BFO_CSU_SLR	CSU (1) Prior to surface disturbance on limited reclamation potential areas a site-specific construction, stabilization, and reclamation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The Plan must include designs approved and stamped by a licensed engineer. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the BLM Authorized Officer's satisfaction how the operator will meet the following performance standards. The disturbed area will be stabilized with no evidence of accelerated erosion features. The disturbed area shall be managed to ensure soil characteristics approximate an appropriate reference site with regard to erosional features to maintain soil productivity and sustainability. Slope stability is maintained preventing slope failure and erosion. Sufficient viable topsoil is maintained for ensuring successful final reclamation. At locations where interim reclamation will be completed, this will be accomplished by respreading all salvaged topsoil over the areas of interim reclamation. The original landform and site productivity will be partially restored during interim reclamation and fully restored as a result of final reclamation; (2) as mapped by the Natural Resources Conservation Service Soil Survey Geographic Database (SSURGO) Order 3 soil survey and as determined by a BLM evaluation of the area; (3) ensuring successful reclamation and erosion control on limited reclamation potential areas in order to meet the standards outlined in, Chapter 6 of the BLM's Oil and Gas Gold Book, as revised, and the 2015 Buffalo Field Office Resource Management Plan Record of Decision.
WY_BFO_CSU_SSP	CSU (1) Prior to surface disturbance within Ute ladies'-tresses orchid habitat flowering season survey(s) must be conducted and a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the Authorized Officer's satisfaction that Ute ladies'-tresses orchids will not be harmed and that the habitat on which they depend will be conserved; (2) as mapped or determined by the US Fish and Wildlife Service, Wyoming Natural Diversity Database, the Buffalo Field Office GIS database, or from field evaluation; (3) conserving Ute ladies'-tresses orchids and the habitat on which they depend.
WY_BFO_CSU_SSPF	CSU (1) Prior to surface disturbance within special status plant species habitats, flowering season surveys must be conducted and a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the Authorized Officer's satisfaction that special status plant species will not be harmed and that the habitat on which they depend will be conserved; (2) as mapped or determined by the US Fish and Wildlife Service, Wyoming Natural Diversity Database, the Buffalo Field Office GIS database, or from field evaluation; (3) conserving special status plant species and the habitat on which they depend.

STIPULATION CODE	STIPULATION LANGUAGE
WY_BFO_CSU_SSWLA	CSU (1) Prior to surface disturbance within 1,640 feet (500 meters) of perennial water, vernal pools, playas, and wetlands appropriate surveys must be conducted and a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator may not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan or approved it with conditions. The Plan must demonstrate to the Authorized Officer's satisfaction that special status amphibian species will not be disturbed to a degree that causes or is likely to cause physical injury, a decrease in productivity by substantially interfering with normal breeding, sheltering, or hibernation behavior, or site abandonment by substantially interfering with normal breeding, sheltering, or hibernation behavior; (2) as mapped on the Buffalo Field Office GIS database or determined by field evaluation, in coordination with the Wyoming Game and Fish Department and/or US Fish and Wildlife Service; (3) ensuring production of special status amphibian species breeding, sheltering, and hibernation habitat.
WY_BFO_CSU_SSWLB	CSU (1) Prior to surface disturbance within 1,640 feet (500 meters) of cave entrances, mature forest, and rock outcrops appropriate surveys must be conducted and a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator may not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan or approved it with conditions. The Plan must demonstrate to the Authorized Officer's satisfaction that special status bat species will not be disturbed to a degree that causes or is likely to cause physical injury, a decrease in productivity by substantially interfering with normal breeding, nursery, roosting, or hibernation behavior, or site abandonment by substantially interfering with normal breeding, nursery, roosting, or hibernation behavior; (2) as mapped on the Buffalo Field Office GIS database or determined by field evaluation, in coordination with the Wyoming Game and Fish Department and/or US Fish and Wildlife Service; (3) ensuring protection of special status bat species breeding, nursery, roosting, and hibernation habitat.
WY_BFO_CSU_SSWLH	CSU (1) Prior to surface disturbance within special status species wildlife habitat an occupancy survey must be conducted and a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the Authorized Officer's satisfaction that special status wildlife species will not be harmed (any act which actually kills or injures wildlife including habitat modification or degradation that substantially impairs essential behavioral patterns) and that the habitat on which they depend will be conserved; (2) as mapped or determined by the US Fish and Wildlife Service, Wyoming Game and Fish Department, Wyoming Natural Diversity Database, or BLM from field evaluation; (3) conserving special status species wildlife and the habitat on which they depend (BLM 2008 -6840 manual).

STIPULATION CODE	STIPULATION LANGUAGE
WY_BFO_CSU_SSWLR	CSU (1) Prior to surface disturbance within 1,640 feet (500 meters) of south facing rock outcrops, perennial water, vernal pools, playas, and wetlands appropriate surveys must be conducted and a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator may not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan or approved it with conditions. The Plan must demonstrate to the Authorized Officer's satisfaction that special status reptile species will not be disturbed to a degree that causes or is likely to cause physical injury, a decrease in productivity by substantially interfering with normal breeding, basking, sheltering, or hibernation behavior, or site abandonment by substantially interfering with normal breeding, basking, sheltering, or hibernation behavior; (2) as mapped on the Buffalo Field Office GIS database or determined by field evaluation, in coordination with the Wyoming Game and Fish Department and/or US Fish and Wildlife Service; (3) ensuring production of special status reptile species breeding, basking, sheltering, and hibernation habitat.
WY_BFO_CSU_STG	CSU (1) Prior to surface disturbance within 0.25 mile of the perimeter of occupied sharp-tailed grouse leks a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the Authorized Officer's satisfaction that the function and suitability of sharp-tailed grouse breeding habitat will not be impaired (result in physical injury, a decrease in productivity by substantially interfering with normal breeding, feeding, or sheltering behavior, or lek abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior); (2) as mapped by the Wyoming Game and Fish Department; (3) ensuring the function and suitability of sharp-tailed grouse breeding habitat.
WY_BFO_CSU_TCP	CSU (1) Prior to surface disturbance within 3 miles of traditional cultural properties a mitigation plan (Plan) must be submitted by the applicant. The Plan must be approved or approved with conditions by the BLM Authorized Officer prior to surface-disturbing activities after consultation with the State Historic Preservation Office, applicable Indian tribes, and other interested parties. The Plan must demonstrate there will be no adverse effects to National Register of Historic Places eligible or listed historic properties (i.e., proposed infrastructure is either not visible or will result in a weak contrast rating); (2) as mapped on the Buffalo Field Office GIS database; (3) ensuring the setting of traditional cultural properties.

STIPULATION CODE	STIPULATION LANGUAGE
WY_BFO_CSU_VRMII	CSU (1) Prior to surface disturbance within Visual Resource Management (VRM) Class 2 areas, a site-specific plan must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the plan (with conditions, as appropriate). The plan must demonstrate to the BLM Authorized Officer's satisfaction how the operator will meet the following performance standards. A visual contrast rating must demonstrate that VRM Class 2 objectives will be met. Where required by the BLM Authorized Officer, a visual simulation must be prepared and must demonstrate that VRM Class 2 objectives will be met through practices such as siting of permanent facilities. Where present and feasible, existing surface disturbances shall be utilized. New surface disturbances shall be minimized to the extent practicable. All permanent above-ground facilities (such as production tanks or other production facilities) not having specific coloration requirements for safety must be painted or designed using a BLM-approved color; (2) as mapped on the Buffalo Field Office GIS database; (3) protecting VRM Class 2 areas.
WY_BFO_CSU_WHSRMA	CSU (1) Prior to surface disturbance within Special Recreation Management Areas (SRMAs) available for leasing (Weston Hills) a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the Authorized Officer's satisfaction that the proposed action is consistent with the prescribed management for the SRMA; (2) as mapped or determined by BLM; (3) ensuring the recreational opportunities and setting of the SRMA.
WY_BFO_NSO_BEGE	NSO (1) Within 0.5 miles from the edge of consistently used bald or golden eagle winter roosts and Clear Creek, Crazy Woman Creek, Piney Creek, Powder River, and Tongue River, consistently used riparian corridors, as mapped on the Buffalo Field Office GIS database or determined by field evaluation, in coordination with the Wyoming Game and Fish Department and/or US Fish and Wildlife Service; (2) protecting wintering bald and golden eagles.
WY_BFO_NSO_BEN	NSO (1) Within 0.5 mile of bald eagle nests as mapped on the Buffalo Field Office GIS database or determined by field evaluation, in coordination with the Wyoming Game and Fish Department and/or US Fish and Wildlife Service; (2) ensuring productivity of bald eagles.
WY_BFO_NSO_BGHMA	NSO (1) Within Wyoming Game and Fish Department Big Game Habitat Management Areas (Ed O. Taylor, Kerns, Bud Love, and Amsden Creek) as mapped by the Wyoming Game and Fish Department; (2) ensuring the function and suitability of Wyoming Game and Fish Department Big Game Habitat Management Areas.
WY_BFO_NSO_H	NSO (1) Within the Pumpkin Buttes, Cantonment Reno, Dull Knife Battle, and Crazy Woman Battle historic properties, contributing and unevaluated segments of the Bozeman Trail, all rock art sites, all rock shelter sites, all Native American burials; as mapped on the Buffalo Field Office GIS database; (2) protecting historic properties.
WY_BFO_NSO_HIP	NSO (1) No surface occupancy or use is allowed on lands containing paleontological resources of high quality or importance as mapped on the Buffalo Field Office GIS database; (2) protecting paleontological resources of high quality or importance.

STIPULATION CODE	STIPULATION LANGUAGE
WY_BFO_NSO_PBACEC	NSO (1) Within the Pumpkin Buttes Area of Critical Environmental Concern as mapped or determined by BLM; (2) protecting the relevant and important values.
WY_BFO_NSO_Slopes50	NSO (1) On slopes greater than 50% as mapped by the US Geological Survey 1:24,000 scale topographic maps, US Geological Survey Digital Elevation Models, and/or as determined by a BLM evaluation of the area; (2) preventing mass slope failure and accelerated erosion.
WY_BFO_NSO_SSF	NSO (1) Within 0.25 mile of any waters containing special status fish species as mapped on the Buffalo Field Office GIS database or from field evaluation, in consultation with the Wyoming Game and Fish Department; (2) protecting special status fish populations and habitat.
WY_BFO_NSO_SSP	NSO (1) Within special status species plant populations as mapped on the Buffalo Field Office GIS database, or determined by BLM from field evaluation, in coordination with the Wyoming Natural Diversity Database and/or US Fish and Wildlife Service; (2) protecting special status species plant populations.
WY_BFO_NSO_SSRN	NSO (1) Within a species specific spatial buffer of special status species raptor nests using US Fish and Wildlife Service Wyoming Ecological Service's recommendations (Appendix Q (p. 633) or www.fws.gov/wyominges/Pages/Species/Species_SpeciesConcern/Raptors.html) as mapped on the Buffalo Field Office GIS database or determined by field evaluation, in coordination with the Wyoming Game and Fish Department and/or US Fish and Wildlife Service; (2) protecting nest sites of special status raptors.
WY_BFO_NSO_TCP	NSO (1) On lands containing traditional cultural properties as mapped on the Buffalo Field Office GIS database; (2) protecting traditional cultural properties.
WY_BFO_TLS_BEN	TLS (1) Surface-disturbing and disruptive activities are prohibited or restricted from Feb 1 to Aug 15 within 1.0 mile of active bald eagle nests; (2) as mapped on the Buffalo Field Office GIS database or determined by field evaluation, in coordination with the Wyoming Game and Fish Department and/or US Fish and Wildlife Service; (3) ensuring productivity of bald eagles.
WY_BFO_TLS_BGCWEC	TLS (1) Surface-disturbing and disruptive activities are prohibited or restricted from Nov 15 to Apr 30 within big-game crucial winter range, or from May 1 to Jun 15 within elk calving areas (Wyoming Game and Fish Department 2009); (2) as mapped by the Wyoming Game and Fish Department and evaluated by the BLM; (3) ensuring the function and suitability of crucial big game winter ranges.
WY_BFO_TLS_EC	TLS (1) Surface-disturbing and disruptive activities are prohibited or restricted from May 1 to Jun 15 within elk calving areas (Wyoming Game and Fish Department 2009); (2) as mapped by the Wyoming Game and Fish Department and evaluated by the BLM; (3) ensuring the function and suitability of elk calving areas.
WY_BFO_TLS_EWR	TLS (1) Surface-disturbing and disruptive activities are prohibited or restricted from Nov 1 to Apr 1 within 1.0 mile from the edge of consistently used eagle winter roosts and the following consistently used riparian corridors: Clear Creek, Crazy Woman Creek, Piney Creek, Powder River, and Tongue River; (2) as mapped on the Buffalo Field Office GIS database or determined by field evaluation, in coordination with the Wyoming Game and Fish Department and/or US Fish and Wildlife Service; (3) protecting roosting eagles.

STIPULATION CODE	STIPULATION LANGUAGE
WY_BFO_TLS_NSSRN	TLS (1) Surface-disturbing and disruptive activities are prohibited or restricted within the US Fish and Wildlife Service Wyoming Ecological Service's recommended spatial buffers and dates of active non-special status species raptor nests. (Appendix Q (p. 633) or www.fws.gov/wyominges/Pages/Species/Species_SpeciesConcern/Raptors.html); (2) as mapped on the Buffalo Field Office GIS database or determined by BLM from field evaluation in coordination with the Wyoming Game and Fish Department and/or US Fish and Wildlife Service; (3) ensuring raptor nest productivity.
WY_BFO_TLS_PHMAC	TLS (1) Mar 15 to Jun 30; (2) as mapped on the Buffalo Field Office GIS database; (3) no surface use to seasonally protect Greater Sage-Grouse breeding, nesting and early brood-rearing habitats (independent of habitat suitability) inside Priority Habitat Management Areas (Connectivity only), within 4 miles of an occupied lek.
WY_BFO_TLS_PHMAL	TLS (1) Mar 15 to Jun 30; (2) as mapped on the Buffalo Field Office GIS database; (3) no surface use to seasonally protect Greater Sage-Grouse breeding, nesting and early brood-rearing habitats (independent of habitat suitability) inside designated Priority Habitat Management Areas (Core only). Where credible data support different timeframes for this restriction, dates may be expanded by 14 days prior or subsequent to the above dates.
WY_BFO_TLS_PHMAWCA	TLS (1) Dec 1 to Mar 14; (2) as mapped on the Buffalo Field Office GIS database; (3) to seasonally protect Greater Sage-Grouse winter concentration areas in designated Priority Habitat Management Areas (Core and Connectivity), and outside designated PHMAs (Core and Connectivity) when supporting wintering Greater Sage-Grouse that attend leks within designated PHMAs (Core only).
WY_BFO_TLS_SSRN	TLS (1) Surface-disturbing and disruptive activities are prohibited or restricted within US Fish and Wildlife Service recommended spatial buffers and dates (Appendix Q (p. 633) or www.fws.gov/wyominges/Pages/Species/Species_SpeciesConcern/Raptors.html) of active raptor nests of special status species; (2) as mapped on the Buffalo Field Office GIS database or determined by field evaluation, in coordination with the Wyoming Game and Fish Department and/or US Fish and Wildlife Service; (3) ensuring productivity of nesting special status raptors.
WY_BFO_TLS_STG	TLS (1) Surface-disturbing and disruptive activities are prohibited or restricted from Apr 1 to Jul 15 (Wyoming Game and Fish Department 2009) within 2 miles of the perimeter of occupied sharp-tailed grouse leks; (2) as mapped by the Wyoming Game and Fish Department and evaluated by the BLM; (3) ensuring the function and suitability of sharp-tailed grouse nesting habitat.
WY_NFO_CSU_PHMAC	CSU (1) Surface occupancy or use will be restricted. The cumulative value of all applicable surface disturbances, existing or future, must not exceed 5 percent of the Disturbance Density Calculation Tool (DDCT) area, as described in the DDCT manual; (2) as mapped on the Newcastle Field Office GIS database; (3) to protect Greater Sage-Grouse designated Priority Habitat Management Areas (Connectivity only) from habitat fragmentation and loss. This lease does not guarantee the lessee the right to occupy the surface of the lease for the purpose of producing oil and natural gas within Greater Sage-Grouse designated PHMAs (Connectivity only). The surface occupancy restriction criteria identified in this stipulation may preclude surface occupancy and may be beyond the ability of the lessee to meet due to existing surface disturbance on Federal, State, or private lands within designated PHMAs (Connectivity only) or surface disturbance created by other land users. The BLM may require the lessee or operator to enter into a unit agreement or drilling easement to facilitate the equitable development of this and surrounding leases.

STIPULATION CODE	STIPULATION LANGUAGE
WY_NFO_TLS_PHMAC	TLS (1) Mar 15 to Jun 30; (2) as mapped on the Newcastle Field Office GIS database; (3) no surface use to seasonally protect Greater Sage-Grouse breeding, nesting and early brood-rearing habitats (independent of habitat suitability) inside Priority Habitat Management Areas (Connectivity only), within 4 miles of an occupied lek.
WY_SW_CSU_PHMA	CSU (1) Surface occupancy or use will be restricted to no more than an average of one disturbance location per 640 acres using the Disturbance Density Calculation Tool (DDCT), and the cumulative value of all applicable surface disturbances, existing or future, must not exceed 5 percent of the DDCT area, as described in the DDCT manual; (2) as mapped on the applicable Field Office GIS database; (3) to protect Greater Sage-Grouse designated Priority Habitat Management Areas (Core only) from habitat fragmentation and loss. This lease does not guarantee the lessee the right to occupy the surface of the lease for the purpose of producing oil and natural gas within Greater Sage-Grouse designated PHMAs (Core only). The surface occupancy restriction criteria identified in this stipulation may preclude surface occupancy and may be beyond the ability of the lessee to meet due to existing surface disturbance on Federal, State, or private lands within designated PHMAs (Core only) or surface disturbance created by other land users. The BLM may require the lessee or operator to enter into a unit agreement or drilling easement to facilitate the equitable development of this and surrounding leases.
WY_SW_NSO_GHMAL	NSO (1) As mapped on the applicable Field Office GIS database; (2) to protect occupied Greater Sage-Grouse leks and associated seasonal habitat, life-history, or behavioral needs of Greater Sage-Grouse in proximity to leks from habitat fragmentation and loss, and protect Greater Sage-Grouse populations from disturbance within a 0.25-mile radius of the perimeter of occupied Greater Sage-Grouse leks outside designated Priority Habitat Management Areas (Core and Connectivity).
WY_SW_NSO_PHMAL	NSO (1) As mapped on the applicable Field Office GIS database; (2) to protect occupied Greater Sage-Grouse leks and associated seasonal habitat, life-history, or behavioral needs of Greater Sage-Grouse in proximity to leks from habitat fragmentation and loss, and protect Greater Sage-Grouse populations from disturbance within a 0.6-mile radius of the perimeter of occupied Greater Sage-Grouse leks inside designated Priority Habitat Management Areas (Core and Connectivity).
WY_SW_TLS_GHMAL	TLS (1) Mar 15 to Jun 30; (2) as mapped on the applicable Field Office GIS database; (3) no surface use to seasonally protect Greater Sage-Grouse breeding, nesting and early brood-rearing habitats outside designated Priority Habitat Management Areas (Core and Connectivity), within 2 miles of an occupied lek.
WY_SW_TLS_PHMAL	TLS (1) Mar 15 to Jun 30; (2) as mapped on the applicable Field Office GIS database; (3) no surface use to seasonally protect Greater Sage-Grouse breeding, nesting and early brood-rearing habitats (independent of habitat suitability) inside designated Priority Habitat Management Areas (Core only).
WY_SW_TLS_PHMAWCA	TLS (1) Dec 1 to Mar 14; (2) as mapped on the applicable Field Office GIS database; (3) no surface use to seasonally protect Greater Sage-Grouse winter concentration areas in designated Priority Habitat Management Areas (Core only), and outside designated PHMAs (Core only) when supporting wintering Greater Sage-Grouse that attend leks within designated PHMAs (Core only).

BLM Offices in Wyoming

Wyoming State Office
5353 Yellowstone Road
P.O. Box 1828
Cheyenne, WY 82003-1828

Telephone: 307-775-6256
FAX: 307-775-6129
Office Hours: 7:45 a.m. - 4:30 p.m.
Public Room Hours: 9:00 a.m. - 4:00 p.m.
www.blm.gov/wy

Wyoming
High Desert District

Kemmerer
Field Office
430 North Highway 189
Kemmerer, WY 83101-9711
(307) 828-4500
Fax: (307) 828-4539

Pinedale
Field Office
1625 West Pine St.
P.O. Box 768
Pinedale, WY 82941-0768
(307) 367-5300
Fax: (307) 367-5329

Rawlins
Field Office
1300 N. Third St.
Rawlins, WY
82301-2407
(307) 328-4200
Fax: (307) 328-4224

Rock Springs
Field Office
280 Highway 191 N.
Rock Springs, WY
82901-3447
(307) 352-0256
Fax: (307) 352-0329

Wyoming
High Plains District

Buffalo
Field Office
1425 Fort St.
Buffalo, WY
82834-2436
(307) 684-1100
Fax: (307) 684-1122

Casper
Field Office
2987 Prospector Drive
Casper, WY
82604-2968
(307) 261-7600
Fax: (307) 261-7587

Newcastle
Field Office
1101 Washington Blvd.
Newcastle, WY 82701-2968
(307) 746-6600
Fax: (307) 746-6639

Wyoming State Office
Reservoir
Management Group
2987 Prospector Drive
Casper, WY
82604-2968
(307) 261-7600
Fax: (307) 261-7539

Wyoming
Wind River/Bighorn
Basin District

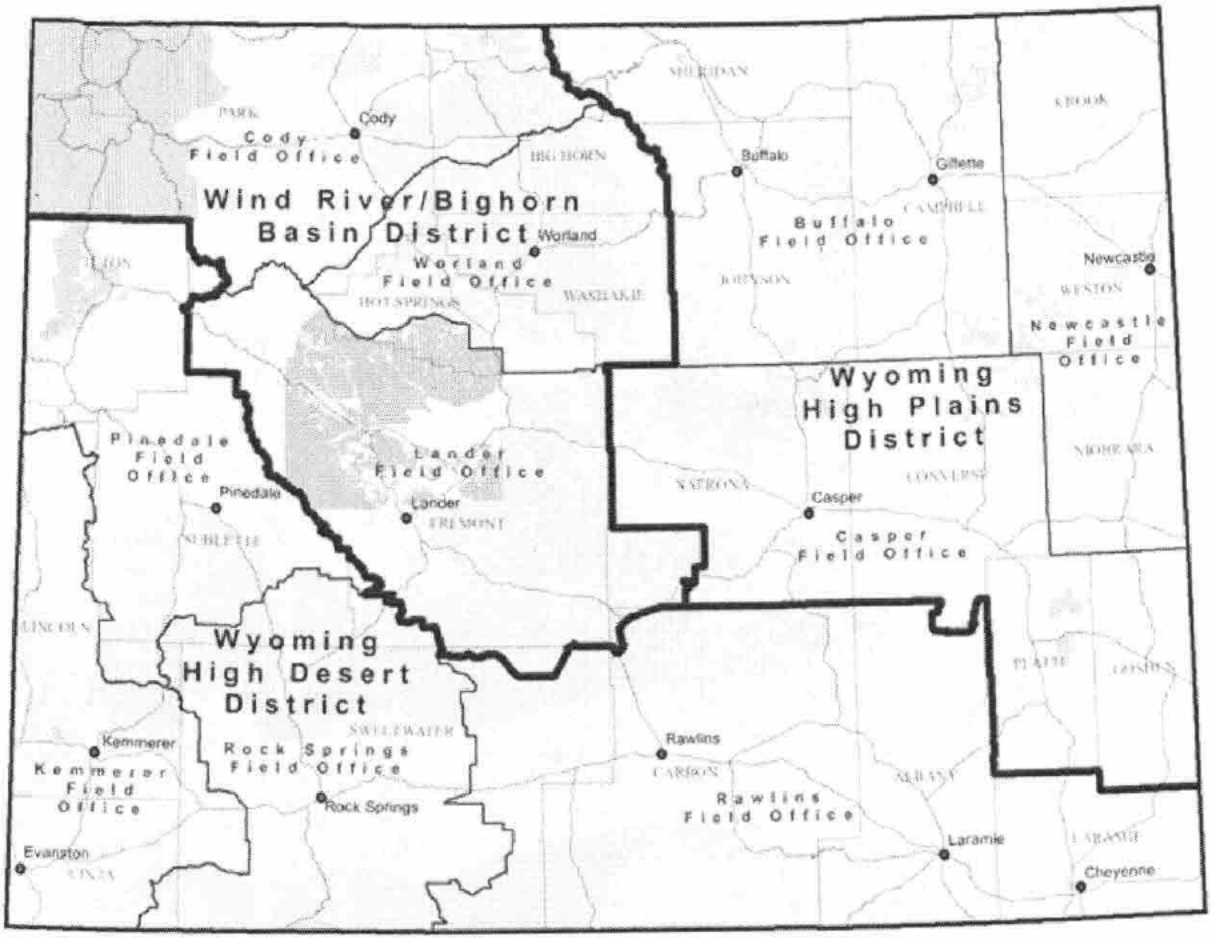
Cody
Field Office
1002 Blackburn St. Cody,
WY 82414
(307) 578-5900
Fax: (307) 578-5939

Lander
Field Office
1335 Main
Lander, WY
82520-2654
(307) 332-8400
Fax: (307) 332-2318

Worland
Field Office
101 South 23rd St.
Worland, WY 82401-3743
(307) 347-5100
Fax: (307) 347-5228

WYNF-0007 (10/16)

Wyoming Districts and Field Offices



Campbell	105,748.080 ac.
Carbon	1,065.920 ac.
Converse	11,523.240 ac.
Crook	490.010 ac.
Fremont	11,690.860 ac.
Johnson	30,961.260 ac.
Natrona	2,920.000 ac.
Niobrara	240.000 ac.
Sheridan	17,301.380 ac.
Weston	2,843.500 ac.

Enhanced Bidder Registration Form

Bidder Registration Form
Competitive Oil and Gas Lease Sale

By completing this form, I certify that the undersigned, or the principal party whom the undersigned is acting on behalf of, is in compliance with the applicable regulations and leasing authorities governing a bid and subsequent lease. I certify that any bid submitted by the undersigned or on behalf of the principal party is a good faith statement of intention by the undersigned or the principal party to acquire an oil and gas lease on the offered lands. Further, I acknowledge that if a bid is declared the high bid, it will constitute a legally binding commitment to execute the Bureau of Land Management's Form 3000-2, Competitive Oil and Gas or Geothermal Resources Lease Bid, and to accept the lease.

In addition, if a bid is declared the high bid, the undersigned or the principal party will pay to the Bureau of Land Management (BLM) by the close of official business hours on the day of the auction, or such other time as may be specified by the authorized officer, an amount at least equal to the minimum monies owed the day of sale for that bid, as set out in applicable regulations. The undersigned and the principal party acknowledge that these monies are due to the Bureau of Land Management as a result of winning the auction. Further, the undersigned and the principal party understand that if payment is not received by the due date, the BLM will issue a bill for monies owed, and if payment is not received, the United States will pursue collection by all appropriate methods, and as appropriate, will assess late fees, civil penalties, interest, administrative charges, and penalties on past due amounts (Federal Claims Collection Act of 1966, as amended; The Debt Collection Improvement Act of 1996; 31 CFR part 285).

I certify that neither I nor the principal party whom I represent owes the United States any monies that were due the day of sale from any oil and gas lease auction conducted by any Bureau of Land Management office.

It is a crime under 18 U.S.C. 1001 and 43 U.S.C. 1212 for any person to knowingly and willfully make any false, fictitious, or fraudulent statements or representations as to any matter within the jurisdiction of the government. Any such offense may result in a fine or imprisonment for not more than 5 years, or both.

It is a crime under 30 U.S.C. 195 (a) and (b) to organize or participate in any scheme to defeat provisions of the mineral leasing regulations or for any person to obtain money or property by means of false statements regarding a person's ability to obtain a lease. Any person who knowingly violates this provision shall be punished by a fine of not more than $500,000, imprisonment for not more than 5 years, or both.

A separate registration is required for each company or individual you are representing.
Please fill in the company/individual name and address as it would appear on any issued lease. We will send a copy of the lease and billing notices to the name and address as shown below. (NOTE: Please use the same lessee name and address information on BLM Form 3000-2.)

Bidder Number

Lessee Name: _____

Mailing Address: _____

City: _____

State: _____ Zip Code: _____

Bidder Name: _____ Phone number: _____
(including area code)

Relationship to lessee: _____
(Self, Agent, Attorney-in-fact, President, etc.)

_____ _____
Signature Date

For BLM Use Only: Type of identification: _____

Form 3100-11
(October 2008)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Serial Number

OFFER TO LEASE AND LEASE FOR OIL AND GAS

The undersigned (page 2) offers to lease all or any of the lands in Item 2 that are available for lease pursuant to the Mineral Lands Leasing Act of 1920, as amended and supplemented (30 U.S.C. 181 et seq.), the Mineral Leasing Act for Acquired Lands of 1947, as amended (30 U.S.C. 351-359), or _____ (other).

READ INSTRUCTIONS BEFORE COMPLETING

1. Name
   Street
   City, State, Zip Code

2. This application/offer/lease is for: *(Check Only One)* ☐ PUBLIC DOMAIN LANDS ☐ ACQUIRED LANDS (percent U.S. interest _____)

Surface managing agency if other than Bureau of Land Management (BLM): _____ Unit/Project _____

Legal description of land requested: *Parcel No.: _____ *Sale Date (mm/dd/yyyy): _____

***See Item 2 in Instructions below prior to completing Parcel Number and Sale Date.**

T.	R.	Meridian	State	County

Total acres applied for _____

Amount remitted: Filing fee $ _____ Rental fee $ _____ Total $ _____

DO NOT WRITE BELOW THIS LINE

3. Land included in lease:

T.	R.	Meridian	State	County

Total acres in lease _____

Rental retained $ _____

This lease is issued granting the exclusive right to drill for, mine, extract, remove and dispose of all the oil and gas (except helium) in the lands described in Item 3 together with the right to build and maintain necessary improvements thereupon for the term indicated below, subject to renewal or extension in accordance with the appropriate leasing authority. Rights granted are subject to applicable laws, the terms, conditions, and attached stipulations of this lease, the Secretary of the Interior's regulations and formal orders in effect as of lease issuance, and to regulations and formal orders hereafter promulgated when not inconsistent with lease rights granted or specific provisions of this lease.

NOTE: This lease is issued to the high bidder pursuant to his/her duly executed bid form submitted under 43 CFR 3120 and is subject to the provisions of that bid and those specified on this form.

Type and primary term:

☐ Noncompetitive lease (ten years)

☐ Competitive lease (ten years)

☐ Other _____

THE UNITED STATES OF AMERICA

by _____
(BLM)

_____
(Title) (Date)

EFFECTIVE DATE OF LEASE _____

(Continued on page 2)

4. (a) Undersigned certifies that (1) offeror is a citizen of the United States; an association of such citizens; a municipality; or a corporation organized under the laws of the United States or of any State or Territory thereof, (2) all parties holding an interest in the offer are in compliance with 43 CFR 3100 and the leasing authorities; (3) offeror's chargeable interests, direct and indirect, in each public domain and acquired lands separately in the same State, do not exceed 246,080 acres in oil and gas leases (of which up to 200,000 acres may be in oil and gas options or 300,000 acres in leases in each leasing District in Alaska of which up to 200,000 acres may be in options, (4) offeror is not considered a minor under the laws of the State in which the lands covered by this offer are located; (5) offeror is in compliance with qualifications concerning Federal coal lease holdings provided in sec. 2(a)2(A) of the Mineral Leasing Act; (6) offeror is in compliance with reclamation requirements for all Federal oil and gas lease holdings as required by sec. 17(g) of the Mineral Leasing Act; and (7) offeror is not in violation of sec. 41 of the Act. (b) Undersigned agrees that signature to this offer constitutes acceptance of this lease, including all terms conditions, and stipulations of which offeror has been given notice, and any amendment or separate lease that may include any land described in this offer open to leasing at the time this offer was filed but omitted for any reason from this lease. The offeror further agrees that this offer cannot be withdrawn, either in whole or in part unless the withdrawal is received by the proper BLM State Office before this lease, an amendment to this lease, or a separate lease, whichever covers the land described in the withdrawal, has been signed on behalf of the United States.

This offer will be rejected and will afford offeror no priority if it is not properly completed and executed in accordance with the regulations, or if it is not accompanied by the required payments.

Duly executed this _____ day of _____ , 20 ____ _____
(Signature of Lessee or Attorney-in-fact)

Title 18 U.S.C. Section 1001 and Title 43 U.S.C. Section 1212 make it a crime for any person knowingly and willfully to make to any department or Agency of the United States any false, fictitious, or fraudulent statements or representations as to any matter within its jurisdiction.

LEASE TERMS

Sec. 1. Rentals--Rentals must be paid to proper office of lessor in advance of each lease year. Annual rental rates per acre or fraction thereof are:

(a) Noncompetitive lease, $1.50 for the first 5 years; thereafter $2.00;

(b) Competitive lease, $1.50; for the first 5 years; thereafter $2.00;

(c) Other, see attachment, or

as specified in regulations at the time this lease is issued.

If this lease or a portion thereof is committed to an approved cooperative or unit plan which includes a well capable of producing leased resources, and the plan contains a provision for allocation of production, royalties must be paid on the production allocated to this lease. However, annual rentals must continue to be due at the rate specified in (a), (b), or (c) rentals for those lands not within a participating area.

Failure to pay annual rental, if due, on or before the anniversary date of this lease (or next official working day if office is closed) must automatically terminate this lease by operation of law. Rentals may be waived, reduced, or suspended by the Secretary upon a sufficient showing by lessee.

See. 2. Royalties--Royalties must be paid to proper office of lessor. Royalties must be computed in accordance with regulations on production removed or sold. Royalty rates are:

(a) Noncompetitive lease, 12 1/2%;

(b) Competitive lease, 12 1/2 %;

(c) Other, see attachment; or

as specified in regulations at the time this lease is issued.

Lessor reserves the right to specify whether royalty is to be paid in value or in kind, and the right to establish reasonable minimum values on products after giving lessee notice and an opportunity to be heard. When paid in value, royalties must be due and payable on the last day of the month following the month in which production occurred. When paid in kind, production must be delivered, unless otherwise agreed to by lessor, in merchantable condition on the premises where produced without cost to lessor. Lessee must not be required to hold such production in storage beyond the last day of the month following the month in which production occurred, nor must lessee be held liable for loss or destruction of royalty oil or other products in storage from causes beyond the reasonable control of lessee.

Minimum royalty in lieu of rental of not less than the rental which otherwise would be required for that lease year must be payable at the end of each lease year beginning on or after a discovery in paying quantities. This minimum royalty may be waived, suspended, or reduced, and the above royalty rates may be reduced, for all or portions of this lease if the Secretary determines that such action is necessary to encourage the greatest ultimate recovery of the leased resources, or is otherwise justified.

An interest charge will be assessed on late royalty payments or underpayments in accordance with the Federal Oil and Gas Royalty Management Act of 1982 (FOGRMA) (30 U.S.C. 1701). Lessee must be liable for royalty payments on oil and gas lost or wasted from a lease site when such loss or waste is due to negligence on the part of the operator, or due to the failure to comply with any rule, regulation, order, or citation issued under FOGRMA or the leasing authority.

(Continued on page 3)

Sec. 3. Bonds - A bond must be filed and maintained for lease operations as required under regulations.

Sec. 4. Diligence, rate of development, unitization, and drainage - Lessee must exercise reasonable diligence in developing and producing, and must prevent unnecessary damage to, loss of, or waste of leased resources. Lessor reserves right to specify rates of development and production in the public interest and to require lessee to subscribe to a cooperative or unit plan, within 30 days of notice, if deemed necessary for proper development and operation of area, field, or pool embracing these leased lands. Lessee must drill and produce wells necessary to protect leased lands from drainage or pay compensatory royalty for drainage in amount determined by lessor.

Sec. 5. Documents, evidence, and inspection - Lessee must file with proper office of lessor, not later than 30 days after effective date thereof, any contract or evidence of other arrangement for sale or disposal of production. At such times and in such form as lessor may prescribe, lessee must furnish detailed statements showing amounts and quality of all products removed and sold, proceeds therefrom, and amount used for production purposes or unavoidably lost. Lessee may be required to provide plats and schematic diagrams showing development work and improvements, and reports with respect to parties in interest, expenditures, and depreciation costs. In the form prescribed by lessor, lessee must keep a daily drilling record, a log, information on well surveys and tests, and a record of subsurface investigations and furnish copies to lessor when required. Lessee must keep open at all reasonable times for inspection by any representative of lessor, the leased premises and all wells, improvements, machinery, and fixtures thereon, and all books, accounts, maps, and records relative to operations, surveys, or investigations on or in the leased lands. Lessee must maintain copies of all contracts, sales agreements, accounting records, and documentation such as billings, invoices, or similar documentation that supports costs claimed as manufacturing, preparation, and/or transportation costs. All such records must be maintained in lessee's accounting offices for future audit by lessor. Lessee must maintain required records for 6 years after they are generated or, if an audit or investigation is underway, until released of the obligation to maintain such records by lessor.

During existence of this lease, information obtained under this section will be closed to inspection by the public in accordance with the Freedom of Information Act (5 U.S.C. 552).

Sec. 6. Conduct of operations - Lessee must conduct operations in a manner that minimizes adverse impacts to the land, air, and water, to cultural, biological, visual, and other resources, and to other land uses or users. Lessee must take reasonable measures deemed necessary by lessor to accomplish the intent of this section. To the extent consistent with lease rights granted, such measures may include, but are not limited to, modification to siting or design of facilities, timing of operations, and specification of interim and final reclamation measures. Lessor reserves the right to continue existing uses and to authorize future uses upon or in the leased lands, including the approval of easements or rights-of-way. Such uses must be conditioned so as to prevent unnecessary or unreasonable interference with rights of lessee.

Prior to disturbing the surface of the leased lands, lessee must contact lessor to be apprised of procedures to be followed and modifications or reclamation measures that may be necessary. Areas to be disturbed may require inventories or special studies to determine the extent of impacts to other resources. Lessee may be required to complete minor inventories or short term special studies under guidelines provided by lessor. If in the conduct of operations, threatened or endangered species, objects of historic or scientific interest, or substantial unanticipated environmental effects are observed, lessee must immediately contact lessor. Lessee must cease any operations that would result in the destruction of such species or objects.

Sec. 7. Mining operations - To the extent that impacts from mining operations would be substantially different or greater than those associated with normal drilling operations, lessor reserves the right to deny approval of such operations.

Sec. 8. Extraction of helium - Lessor reserves the option of extracting or having extracted helium from gas production in a manner specified and by means provided by lessor at no expense or loss to lessee or owner of the gas. Lessee must include in any contract of sale of gas the provisions of this section.

Sec. 9. Damages to property - Lessee must pay lessor for damage to lessor's improvements, and must save and hold lessor harmless from all claims for damage or harm to persons or property as a result of lease operations.

Sec. 10. Protection of diverse interests and equal opportunity - Lessee must pay, when due, all taxes legally assessed and levied under laws of the State or the United States; accord all employees complete freedom of purchase; pay all wages at least twice each month in lawful money of the United States; maintain a safe working environment in accordance with standard industry practices; and take measures necessary to protect the health and safety of the public.

Lessor reserves the right to ensure that production is sold at reasonable prices and to prevent monopoly. If lessee operates a pipeline, or owns controlling interest in a pipeline or a company operating a pipeline, which may be operated accessible to oil derived from these leased lands, lessee must comply with section 28 of the Mineral Leasing Act of 1920.

Lessee must comply with Executive Order No. 11246 of September 24, 1965, as amended, and regulations and relevant orders of the Secretary of Labor issued pursuant thereto. Neither lessee nor lessee's subcontractors must maintain segregated facilities.

Sec. 11. Transfer of lease interests and relinquishment of lease - As required by regulations, lessee must file with lessor any assignment or other transfer of an interest in this lease. Lessee may relinquish this lease or any legal subdivision by filing in the proper office a written relinquishment, which will be effective as of the date of filing, subject to the continued obligation of the lessee and surety to pay all accrued rentals and royalties.

Sec. 12. Delivery of premises - At such time as all or portions of this lease are returned to lessor, lessee must place affected wells in condition for suspension or abandonment, reclaim the land as specified by lessor and, within a reasonable period of time, remove equipment and improvements not deemed necessary by lessor for preservation of producible wells.

Sec. 13. Proceedings in case of default - If lessee fails to comply with any provisions of this lease, and the noncompliance continues for 30 days after written notice thereof, this lease will be subject to cancellation unless or until the leasehold contains a well capable of production of oil or gas in paying quantities, or the lease is committed to an approved cooperative or unit plan or communitization agreement which contains a well capable of production of unitized substances in paying quantities. This provision will not be construed to prevent the exercise by lessor of any other legal and equitable remedy, including waiver of the default. Any such remedy or waiver will not prevent later cancellation for the same default occurring at any other time. Lessee will be subject to applicable provisions and penalties of FOGRMA (30 U.S.C. 1701).

Sec. 14. Heirs and successors-in-interest - Each obligation of this lease will extend to and be binding upon, and every benefit hereof will inure to the heirs, executors, administrators, successors, beneficiaries, or assignees of the respective parties hereto.

(Continued on page 4)

A. General:

1. Page 1 of this form is to be completed only by parties filing for a noncompetitive lease. The BLM will complete page 1 of the form for all other types of leases.

2. Entries must be typed or printed plainly in ink. Offeror must sign Item 4 in ink.

3. An original and two copies of this offer must be prepared and filed in the proper BLM State Office. See regulations at 43 CFR 1821.2-1 for office locations.

4. If more space is needed, additional sheets must be attached to each copy of the form submitted.

B. Special:

Item 1 - Enter offeror's name and billing address.

Item 2 - Identify the mineral status and, if acquired lands, percentage of Federal ownership of applied for minerals. Indicate the agency controlling the surface of the land and the name of the unit or project which the land is a part. The same offer may not include both Public Domain and Acquired lands. Offeror also may provide other information that will assist in establishing title for minerals. The description of land must conform to 43 CFR 3110. A single parcel number and Sale Date will be the only acceptable description during the period from the first day following the end of a competitive process until the end of that same month, using the parcel number on the List of Lands Available for Competitive Nominations or the Notice of Competitive Lease Sale, whichever is appropriate.

Payments: The amount remitted must include the filing fee and the first year's rental at the rate of $1.50 per acre or fraction thereof. The full rental based on the total acreage applied for must accompany an offer even if the mineral interest of the United States is less than 100 percent. The filing fee will be retained as a service charge even if the offer is completely rejected or withdrawn. To protect priority, it is important that the rental submitted be sufficient to cover all the land requested. If the land requested includes lots or irregular quarter-quarter sections, the exact area of which is not known to the offeror, rental should be submitted on the basis of each such lot or quarter-quarter section containing 40 acres. If the offer is withdrawn or rejected in whole or in part before a lease issues, the rental remitted for the parts withdrawn or rejected will be returned.

Item 3 - This space will be completed by the United States.

NOTICES

The Privacy Act of 1974 and the regulations in 43 CFR 2.48(d) provide that you be furnished with the following information in connection with information required by this oil and gas lease offer.

AUTHORITY: 30 U.S.C. 181 et seq.; 30 U.S.C 351-359.

PRINCIPAL PURPOSE: The information is to be used to process oil and gas offers and leases.

ROUTINE USES: (1) The adjudication of the lessee's rights to the land or resources. (2) Documentation for public information in support of notations made on land status records for the management, disposal, and use of public lands and resources. (3) Transfer to appropriate Federal agencies when consent or concurrence is required prior to granting a right in public lands or resources. (4)(5) Information from the record and/or the record will be transferred to appropriate Federal, State, local or foreign agencies, when relevant to civil, criminal or regulatory investigations or prosecutions.

EFFECT OF NOT PROVIDING INFORMATION: If all the information is not provided, the offer may be rejected. See regulations at 43 CFR 3100.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

COMPETITIVE OIL AND GAS OR GEOTHERMAL RESOURCES LEASE BID

30 U.S.C. 181 et seq.; 30 U.S.C. 351-359;
30 U.S.C.1001-1025; 42 U.S.C. 6508

FORM APPROVED
OMB NO. 1004-0074
Expires: September 30, 2006

State	Date of sale

PARCEL NUMBER	AMOUNT OF BID (*See Instructions below*)	
	TOTAL BID	PAYMENT SUBMITTED WITH BID
THE BID IS FOR (*Check one*): ☐ Oil and Gas Parcel Number _____		
☐ Geothermal Parcel Number _____ Name of Known Geothermal Resource Area (KGRA) _____		

The appropriate regulations applicable to this bid are: (1) for oil and gas leases--43 CFR 3120; (2) for National Petroleum Reserve-Alaska (NPR-A) leases--43 CFR 3132; and (3) for Geothermal resources leases--43 CFR 3220. (*See details concerning lease qualifications on reverse.*)

I CERTIFY THAT I have read and am in compliance with, and not in violation of, the lessee qualification requirements under the applicable regulations for this bid.

I CERTIFY THAT this bid is not in violation of 18 U.S.C. 1860 which prohibits unlawful combination or intimidation of bidders. I further certify that this bid was arrived at independently and is tendered without collusion with any other bidder for the purpose of restricting competition.

IMPORTANT NOTICE: Execution of this form, where the offer is the high bid, constitutes a binding lease offer, including all applicable terms and conditions. Failure to comply with the applicable laws and regulations under which this bid is made shall result in rejection of the bid and forfeiture of all monies submitted.

_____ Print or Type Name of Lessee

_____ Signature of Lessee or Bidder

_____ Address of Lessee

_____ City _____ State _____ Zip Code

INSTRUCTIONS

INSTRUCTIONS FOR OIL AND GAS BID *(Except NPR-A)*

1. Separate bid for each parcel is required. Identify parcel by the parcel number assigned in the *Notice of Competitive Lease Sale*.
2. Bid **must** be accompanied by the national minimum acceptable bid, the first year's rental and the administrative fee. The remittance **must** be in the form specified in 43 CFR 3103.1-1. The remainder of the bonus bid, if any, **must** be submitted to the proper BLM office within 10 working days after the last day of the oral auction. **Failure to submit the remainder of the bonus bid within 10 working days will result in rejection of the bid offer and forfeiture of all monies paid.**
3. If bidder is **not** the sole party in interest in the lease for which the bid is submitted, all other parties in interest may be required to furnish evidence of their qualifications upon written request by the authorized officer.
4. This bid may be executed (*signed*) before the oral auction. If signed before the oral auction, this form cannot be modified without being executed again.
5. In view of the above requirement (4), bidder may wish to leave, AMOUNT OF BID section blank so that final bid amount may be either completed by the bidder or the Bureau of Land Management at the oral auction.

INSTRUCTIONS FOR GEOTHERMAL OR NPR-A OIL AND GAS BID

1. Separate bid for each parcel is required. Identify parcel by the number assigned to a tract.
2. Bid **must** be accompanied by one-fifth of the total amount of bid. The remittance **must** be in the form specified in 43 CFR 3220.4 for a Geothermal Resources bid and 3132.2 for a NPR-A lease bid.
3. Mark envelope Bid for Geothermal Resources Lease in (*Name of KGRA*) or Bid for NPR-A Lease, as appropriate. Be sure correct parcel number of tract on which bid is submitted and date of bid opening are noted plainly on envelope. No bid may be modified or withdrawn unless such modification or withdrawal is received prior to time fixed for opening of bids.
4. Mail or deliver bid to the proper BLM office or place indicated in the *Notice of Competitive Lease Sale.*
5. If bidder is **not** the sole party in interest in the lease for which bid is submitted, all other parties in interest may be required to furnish evidence of their qualifications upon written request by the authorized officer.

Title 18 U.S.C. Section 1001 and Title 43 U.S.C. Section 1212 make it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious, or fraudulent statements or representations as to any matter within its jurisdiction.

(*Continued on page 2*)

QUALIFICATIONS

For leases that may be issued as a result of this sale under the Mineral Leasing Act (The Act) of 1920; as amended, the oral bidder must: (1) Be a citizen of the United States; an association (*including partnerships and trusts*) of such citizens; a municipality; or a corporation organized under the laws of the United States or of any State or Territory thereof; (2) Be in compliance with acreage limitation requirements wherein the bidder's interests, direct and indirect, in oil and gas leases in the State identified do not exceed 246,080 acres each in public domain or acquired lands including acreage covered by this bid, of which not more than 200,000 acres are under options. If this bid is submitted for lands in Alaska, the bidder's holdings in each of the Alaska leasing districts do not exceed 300,000 acres, of which no more than 200,000 acres are under options in each district; (3) Be in compliance with Federal coal lease holdings as provided in sec. 2(a)(2)(A) of the Act; (4) Be in compliance with reclamation requirements for all Federal oil and gas holdings as required by sec. 17 of the Act; (5) Not be in violation of sec. 41 of the Act; and (6) Certify that all parties in interest in this bid are in compliance with 43 CFR Groups 3000 and 3100 and the leasing authorities cited herein.

For leases that may be issued as a result of this sale under the Geothermal Steam Act of 1970, as amended, the bidder must: (1) Be a Citizen of the United States; an association of such citizens; a municipality; or a corporation organized under the laws of the United States or of any State or Territory thereof; and (2) Be in compliance with acreage limitation requirements wherein the bidder's interests, direct and indirect, do not exceed 51,200 acres: and (3) Certify that all parties in interest in this bid are in compliance with 43 CFR Group 3200 and the leasing authority cited herein.

For leases that may be issued as a result of this sale under the Department of the Interior Appropriations Act of 1981, the bidder must: (1) Be a citizen or national of the United States; an alien lawfully admitted for permanent residence; a private, public or municipal corporation organized under the laws of the United States or of any State or Territory thereof; an association of such Citizens, nationals, resident aliens or private, public or municipal corporations, and (2) Certify that all parties in interest in this bid are in compliance with 43 CFR Part 3130 and the leasing authorities cited herein.

NOTICE

The Privacy Act of 1974 and the regulation in 43 CFR 2.48(d) provide that you be furnished the following information in connection with information required by this bid for a Competitive Oil and Gas or Geothermal Resources Lease.

AUTHORITY: 30 U.S.C. 181 et seq.; 30 U.S.C. 351-359; 30 U.S.C. 1001-1025; 42 U.S.C. 6508

PRINCIPAL PURPOSE: The information is to be used to process your bid.

ROUTINE USES: (1) The adjudication of the bidder's right to the resources for which this bid is made. (2) Documentation for public information. (3) Transfer to appropriate Federal agencies when comment or concurrence is required prior to granting a right in public lands or resources. (4)(5) Information from the record and/or the record will be transferred to appropriate Federal, State, local or foreign agencies, when relevant to civil, criminal or regulatory investigations or prosecutions.

EFFECT OF NOT PROVIDING INFORMATION: Disclosure of the information is voluntary. If all the information is not provided, your bid may be rejected.

The Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.) requires us to inform you that:

This information is being collected in accordance with 43 CFR 3120, 43 CFR 3130, or 43 CFR 3220.
This information will be used to determine the bidder submitting the highest bid.
Response to this request is required to obtain a benefit.

BLM would like you to know that you do not have to respond to this or any other Federal agency-sponsored information collection unless it displays a currently valid OMB control number.

BURDEN HOURS STATEMENT

Public reporting burden for this form is estimated to average 2 hours per response including the time for reviewing instructions, gathering and maintaining data, and completing and reviewing the form. Direct comments regarding the burden estimate or any other aspect of this form to U.S. Department of the Interior, Bureau of Land Management, (1004-0074), Bureau Clearance Officer (WO-630), 1620 L Street, Mail Stop 401LS, Washington, D.C. 20036

LEASE NOTICE NO. 1

Under Regulation 43 CFR 3101.1-2 and terms of the lease (BLM Form 3100-11), the authorized officer may require reasonable measures to minimize adverse impacts to other resource values, land uses, and users not addressed in lease stipulations at the time operations are proposed. Such reasonable measures may include, but are not limited to, modification of siting or design of facilities, timing of operations, and specification of interim and final reclamation measures, which may require relocating proposed operations up to 200 meters, but not off the leasehold, and prohibiting surface disturbance activities for up to 60 days.

The lands within this lease may include areas not specifically addressed by lease stipulations that may contain special values, may be needed for special purposes, or may require special attention to prevent damage to surface and/or other resources. Possible special areas are identified below. Any surface use or occupancy within such special areas will be strictly controlled or, if absolutely necessary, prohibited. Appropriate modifications to imposed restrictions will be made for the maintenance and operation of producing wells.

1. Slopes in excess of 25 percent.

2. Within 500 feet of surface water and/or riparian areas.

3. Construction with frozen material or during periods when the soil material is saturated or when watershed damage is likely to occur.

4. Within 500 feet of Interstate highways and 200 feet of other existing rights-of-way (i.e., U.S. and State highways, roads, railroads, pipelines, powerlines).

5. Within 1/4 mile of occupied dwellings.

6. Material sites.

GUIDANCE:

The intent of this notice is to inform interested parties (potential lessees, permittees, operators) that when one or more of the above conditions exist, surface disturbing activities will be prohibited unless or until the permittee or the designated representative and the surface management agency (SMA) arrive at an acceptable plan for mitigation of anticipated impacts. This negotiation will occur prior to development and become a condition for approval when authorizing the action.

Specific threshold criteria (e.g., 500 feet from water) have been established based upon the best information available. However, geographical areas and time periods of concern must be delineated at the field level (i.e., "surface water and/or riparian areas" may include both intermittent and ephemeral water sources or may be limited to perennial surface water).

The referenced oil and gas leases on these lands are hereby made subject to the stipulation that the exploration or drilling activities will not interfere materially with the use of the area as a materials site/free use permit. At the time operations on the above lands are commenced, notification will be made to the appropriate agency. The name of the appropriate agency may be obtained from the proper BLM Field Office.

THIS NOTICE APPLIES TO ALL PARCELS

LEASE NOTICE NO. 2

BACKGROUND:

The Bureau of Land Management (BLM), by including National Historic Trails within its National Landscape Conservation System, has recognized these trails as national treasures. Our responsibility is to review our strategy for management, protection, and preservation of these trails. The National Historic Trails in Wyoming, which include the Oregon, California, Mormon Pioneer, and Pony Express Trails, as well as the Nez Perce Trail, were designated by Congress through the National Trails System Act (P.L. 90-543; 16 U.S.C. 1241-1251) as amended through P.L. 106-509 dated November 13, 2000. Protection of the National Historic Trails is normally considered under the National Historic Preservation Act (P.L. 89-665; 16 U.S.C. 470 et seq.) as amended through 1992 and the National Trails System Act. Additionally, Executive Order 13195, "Trails for America in the 21st Century," signed January 18, 2001, states in Section 1: "Federal agencies will...protect, connect, promote, and assist trails of all types throughout the United States. This will be accomplished by: (b) Protecting the trail corridors associated with national scenic trails and the high priority potential sites and segments of national historic trails to the degrees necessary to ensure that the values for which each trail was established remain intact." Therefore, the BLM will be considering all impacts and intrusions to the National Historic Trails, their associated historic landscapes, and all associated features, such as trail traces, grave sites, historic encampments, inscriptions, natural features frequently commented on by emigrants in journals, letters and diaries, or any other feature contributing to the historic significance of the trails. Additional National Historic Trails will likely be designated amending the National Trails System Act. When these amendments occur, this notice will apply to those newly designated National Historic Trails as well.

STRATEGY:

The BLM will proceed in this objective by conducting a viewshed analysis on either side of the designated centerline of the National Historic Trails in Wyoming, except, at this time, for the Nez Perce Trail, for the purpose of identifying and evaluating potential impacts to the trails, their associated historic landscapes, and their associated historic features. Subject to the viewshed analysis and archaeological inventory, reasonable mitigation measures may be applied. These may include, but are not limited to, modification of siting or design of facilities to camouflage or otherwise hide the proposed operations within the viewshed. Additionally, specification of interim and final reclamation measures may require relocating the proposed operations within the leasehold. Surface disturbing activities will be analyzed in accordance with the National Environmental Policy Act of 1969 (P.L. 91-190; 42 U.S.C. 4321-4347) as amended through P.L. 94-52, July 3, 1975 and P.L. 94-83, August 9, 1975, and the National Historic Preservation Act, supra, to determine if any design, siting, timing, or reclamation requirements are necessary. This strategy is necessary until the BLM determines that, based on the results of the completed viewshed analysis and archaeological inventory, the existing land use plans (Resource Management Plans) have to be amended.

The use of this lease notice is a predecisional action, necessary until final decisions regarding surface disturbing restrictions are made. Final decisions regarding surface disturbing restrictions will take place with full public disclosure and public involvement over the next several years if BLM determines that it is necessary to amend existing land use plans.

GUIDANCE:

The intent of this notice is to inform interested parties (potential lessees, permittees, operators) that when any oil and gas lease contains remnants of National Historic Trails, or is located within the viewshed of a National Historic Trails' designated centerline, surface disturbing activities will require the lessee, permittee, operator or, their designated representative, and the surface management agency (SMA) to arrive at an acceptable plan for mitigation of anticipated impacts. This negotiation will occur prior to development and become a condition for approval when authorizing the action.

THIS NOTICE APPLIES TO ALL PARCELS

LEASE NOTICE NO. 3

Greater Sage-Grouse Habitat: The lease may in part, or in total, contain important Greater sage-grouse habitats as identified by the BLM, either currently or prospectively. The operator may be required to implement specific measures to reduce impacts of oil and gas operations on the Greater sage-grouse populations and habitat quality. Such measures shall be developed during the Application for Permit to Drill (APD) on-site and environmental review process and will be consistent with the lease rights granted.

THIS NOTICE APPLIES TO ALL PARCELS

ATTACHMENT TO EACH LEASE

NOTICE TO LESSEE

Provisions of the Mineral Leasing Act (MLA) of 1920, as amended by the Federal Coal Leasing Amendments Act of 1976, affect an entity's qualifications to obtain an oil and gas lease. Section 2(a)(2)(A) of the MLA, 30 U.S.C. 201 (a)(2)(A), requires that any entity that holds and has held a Federal coal lease for 10 years beginning on or after August 4, 1976, and who is not producing coal in commercial quantities from each such lease, cannot qualify for the issuance of any other lease granted under the MLA. Compliance by coal lessees with Section 2(a)(2)(A) is explained in 43 CFR 3472.

In accordance with the terms of this oil and gas lease, with respect to compliance by the initial lessee with qualifications concerning Federal coal lease holdings, all assignees and transferees are hereby notified that this oil and gas lease is subject to cancellation if: (1) the initial lessee as assignor or as transferor has falsely certified compliance with Section 2(a)(2)(A), or (2) because of a denial or disapproval by a State Office of a pending coal action, i.e., arms-length assignment, relinquishment, or logical mining unit, the initial lessee as assignor or as transferor is no longer in compliance with Section 2(a)(2)(A). The assignee, sublessee or transferee does not qualify as a bona fide purchaser and, thus, has no rights to bona fide purchaser protection in the event of cancellation of this lease due to noncompliance with Section 2(a)(2)(A).

Information regarding assignor, sublessor or transferor compliance with Section 2(a)(2)(A) is contained in the lease case file as well as in other Bureau of Land Management records available through the State Office issuing this lease.

LEASE STIPULATION NO. 1

This lease may be found to contain historic properties and/or resources protected under the National Historic Preservation Act (NHPA), American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, Executive Order 13007, or other statutes and executive orders. The BLM will not approve any ground disturbing activities that may affect any such properties or resources until it completes its obligations (e.g., State Historic Preservation Officer (SHPO) and tribal consultation) under applicable requirements of the NHPA and other authorities. The BLM may require modification to exploration or development proposals to protect such properties, or disapprove any activity that is likely to result in adverse effects that cannot be successfully avoided, minimized or mitigated.

THIS STIPULATION APPLIES TO ALL PARCELS

LEASE STIPULATION NO. 2

ENDANGERED SPECIES ACT SECTION 7 CONSULTATION STIPULATION

The lease area may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or other special status species. BLM may recommend modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activity that will contribute to a need to list such a species or their habitat. The BLM may require modifications to or disapprove proposed activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species or result in the destruction or adverse modification of a designated or proposed critical habitat. The BLM will not approve any ground-disturbing activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act as amended, 16 U.S.C. § 1531 et seq., including completion of any required procedure for conference or consultation.

THIS STIPULATION APPLIES TO ALL PARCELS

LEASE STIPULATION NO. 3

MULTIPLE MINERAL DEVELOPMENT STIPULATION

Operations will not be approved which, in the opinion of the authorized officer, would unreasonably interfere with the orderly development and/or production from a valid existing mineral lease issued prior to this one for the same lands.

THIS STIPULATION APPLIES TO ALL PARCELS

COMMUNITIZATION AGREEMENTS

Either all, or part of the land included in the following parcels are within an approved communitization agreement:

WY-1702-086	WYW179228
WY-1702-088	WYW179223
WY-1702-089	WYW180131
WYW-1702-092	WYW176025
WY-1702-128	WYW184323 and WYW184328
WY-1702-133	WYW185324
WY-1702-139	WYW178143
WY-1702-140	WYW184437
WY-1702-156	WYW180264
WY-1702-157	WYW180260
WY-1702-159	WYW180262
WY-1702-160	WYW180263
WY-1702-164	WYW180259
WY-1702-165	WYW180261
WY-1702-197	WYW182015
WY-1702-205	WYW182651
WY-1702-216	WYW179033
WY-1702-228	WYW180077
WY-1702-237	WYW179672

The successful bidder of these parcels shall be required to join the communization agreement with the operator(s) and the owner(s) of other lease working interests in the communitization agreement.

UNIT AGREEMENTS

Before issuance of lease for lands within an approved unit, the offeror may be required to join the unit (43 CFR 3101.3-1). The following parcels are within approved units. However, any lands included in this Notice that are determined to be in a unit prior to lease issuance are subject to regulation (43 CFR 3101.3-1).

WY-1702-138	Gaither Draw (Parkman Sand) Unit
WY-1702-139	Gaither Draw (Parkman Sand) Unit
WY-1702-143	Gaither Draw (Parkman Sand) Unit
WY-1702-181	Long Draw (CBM) Unit
WY-1702-234	Kinney Divide (CBM) Unit
WY-1702-243	Ponderosa Deep Unit
WY-1702-244	Ponderosa Deep Unit
WY-1702-252	Ponderosa Deep Unit
WY-1702-253	Ponderosa Deep Unit
WY-1702-257	Hummingbird Deep Unit
WY-1702-269	Ash Creek II (Shannon Sand) Unit

NO SURFACE OCCUPANCY STIPULATION - NSO

No surface occupancy or use is allowed on the lands described below
(legal subdivision or other description).

NSO (1)

For the purpose of:

NSO (2)

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820.)

TIMING LIMITATION STIPULATION - TLS

No surface use is allowed during the following time period(s). This stipulation does not apply to operation and maintenance of production facilities.

TLS (1)

On the lands described below:

TLS (2)

For the purpose of (reasons):

TLS (3)

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820.)

CONTROLLED SURFACE USE STIPULATION - CSU

Surface occupancy or use is subject to the following special operating constraints.

CSU (1)

On the lands described below:

CSU (2)

For the purpose of:

CSU (3)

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820.)

From: Laura King
To: BLM_UT_Vernal_Comments@blm.gov
Subject: Conservation Group Scoping Comments: DOI-BLM-UT-G010-2016-0010-EIS
Date: Friday, February 10, 2017 12:01:05 PM
Attachments: Crescent Point Scoping Comments_Feb 10 2017.pdf

Dear Ms. Howard,

The Western Environmental Law Center, along with the Center for Biological Diversity, the Sierra Club, the Utah Native Plant Society, and WildEarth Guardians, submit the attached scoping comments on the Bureau of Land Management Crescent Point Energy Federal-Tribal Well Development Project, DOI-BLM-UT-G010-2016-0010-EIS.

The Conservation Groups appreciate your consideration of the information and concerns addressed in the attached scoping comments, as well as the information included in the associated exhibits, which we will send by mail. Should you have any questions or wish to discuss our concerns in greater detail, please do not hesitate to contact us.

Best,

Laura

Laura King

Staff Attorney

Western Environmental Law Center

103 Reeder's Alley

Helena, MT 59601

(406) 204-4852 (tel.)

king@westernlaw.org

www.westernlaw.org

Northwest
1216 Lincoln Street
Eugene, Oregon 97401
(541) 485-2471

Rocky Mountains
103 Reeder's Alley
Helena, Montana 59601
(406) 443-3501

Southwest
208 Paseo del Pueblo Sur #602
Taos, New Mexico 87571
(575) 751-0351

Defending the West www.westernlaw.org

Western Environmental Law Center

Comments submitted via electronic mail. Exhibits submitted via certified mail.

February 10, 2017

Bureau of Land Management
Attn: Stephanie Howard
Vernal Field Office
170 South 500 East
Vernal, Utah 84078
Email: BLM_UT_Vernal_Comments@blm.gov

RE: Conservation Group Scoping Comments Regarding the Crescent Point Energy Utah Federal-Tribal Well Development Project, DOI-BLM-UT-G010-2016-0010-EIS

Dear Ms. Howard,

The Western Environmental Law Center, along with the Center for Biological Diversity, the Sierra Club, the Utah Native Plant Society, and WildEarth Guardians ("Conservation Groups"), submit the following Scoping Comments on the Bureau of Land Management ("BLM") Crescent Point Energy Federal-Tribal Well Development Project, concerning a 155,110-acre planning area and proposing the approval of 3,925 oil and gas wells and associated infrastructure on lands and mineral estate administered by BLM's Vernal Field Office, the Bureau of Reclamation, the Bureau of Indian Affairs, the Ute Indian Tribe, and the Utah Reclamation, Mitigation, and Conservation Commission, as well as private lands.

Given the critical and fundamental role that impacts from this proposed development would have to the region's environment, and, more broadly, on climate change, we appreciate the opportunity to assist BLM at the scoping stage of NEPA analysis by providing relevant information and identifying significant issues.

The **Western Environmental Law Center** ("WELC") uses the power of the law to defend and protect the American West's treasured landscapes, iconic wildlife and rural communities. WELC combines legal skills with sound conservation biology and environmental science to address major environmental issues in the West in the most strategic and effective manner. WELC works at the national, regional, state, and local levels; and in all three branches of government. WELC integrates national policies and regional perspective with the local knowledge of our 100+ partner groups to implement smart and appropriate place-based actions.

The **Center for Biological Diversity** is a non-profit environmental organization with over 52,000 members, many of whom live and recreate in Utah and the Upper Colorado River Basin. The Center uses science, policy and law to advocate for the conservation and recovery of species on the brink of extinction and the habitats they need to survive. The Center has and continues to actively advocate for increased protections for species and their habitats in Utah, the Green River watershed, and the Upper Colorado River Basin. The lands that will be affected by the proposed project include habitat for listed, rare, and imperiled species that the Center has worked to protect including rare, endangered and threatened species like the Colorado pikeminnow, razorback sucker, bonytail, and humpback chub. The Center's board, staff, and members use the public lands in Utah, including the lands and waters that would be affected by expanded fossil fuel development authorized by this project, for quiet recreation (including hiking and camping), scientific research, aesthetic pursuits, and spiritual renewal.

The **Sierra Club** is a national nonprofit organization of approximately 695,000 members dedicated to exploring, enjoying, and protecting the wild places of the earth; to practicing and promoting the responsible use of the earth's ecosystems and resources; to educating and enlisting humanity to protect and restore the quality of the natural and human environment; and to using all lawful means to carry out these objectives. The Utah Chapter of the Sierra Club has approximately 3,400 members. Sierra Club members use the public lands in Utah, including the lands and waters that would be affected by actions under the lease sale, for quiet recreation, aesthetic pursuits, and spiritual renewal. These areas would be threatened by increased oil and gas development that could result from the proposed lease sale.

WildEarth Guardians protects and restores wild places, wildlife, and wild rivers in the American West. Through its Climate and Energy Program, Guardians works to sustain a transition from fossil fuels to clean energy in order to safeguard the American West.

The **Utah Native Plant Society** is a 501(c)(3) qualified non-profit organization incorporated in 1978. The organization has chapters throughout the state of Utah and over 400 members. Its focus includes the preservation and conservation of native plant and plant communities found in the state of Utah and the Intermountain West.

Contents

I. BLM Must Take a Hard Look at the Direct, Indirect and Cumulative Impacts of Oil and Gas Development on Certain Resource Values in the Planning Area. 3

A. The BLM Must Take a "Hard Look" at Impacts to Air Quality. 4

B. The BLM Must Take a "Hard Look" at Climate Change. 9

1. BLM Must Consider Existing, New, and Revised National Policy on Climate Change.. 14

2. BLM Must Consider Recent Climate Science and Carbon Budgeting. 17

3. Methane Emissions and Waste 26

4. Managing for Community and Ecosystem Resiliency 40

C. The BLM Must Analyze or Assess Air Pollution Impacts, Including Greenhouse Gas Emissions as Connected Actions or at a Minimum as Indirect Impacts. 42
II. BLM's Proposed Actions Must Comply with FLPMA. 43
III. The BLM Must Analyze Impacts on Endangered Fish Populations and Water Supply. 44
A. Climate Change Is Reducing Stream Flows in the Upper Colorado River Basin. 45
B. Persistent Drought Conditions and Increasing Water Demand Have Reduced Water Supply. 50
C. Population Numbers of the Endangered Fish Are Declining 51
D. The Endangered Fish Face Unaddressed Threats from Mercury and Selenium Contamination 55
E. BLM Must Consider the Risk of Spills and Sedimentation Degrading Endangered Fish Critical Habitat 58
IV. BLM Must Consult with the Fish and Wildlife Service Regarding the Project's Harmful Effects on Threatened and Sensitive Plants 60
V. Conclusion 61

I. BLM Must Take a Hard Look at the Direct, Indirect and Cumulative Impacts of Oil and Gas Development on Certain Resource Values in the Planning Area.

The National Environmental Policy Act ("NEPA"), 42 U.S.C. § 4321 *et seq*., and its implementing regulations, promulgated by the Council on Environmental Quality ("CEQ"), 40 C.F.R. §§ 1500.1 *et seq*., is our "basic national charter for the protection of the environment." 40 C.F.R. § 1500.1. Recognizing that "each person should enjoy a healthful environment," NEPA ensures that the federal government uses all practicable means to "assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings," and to "attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences," among other policies. 43 U.S.C. § 4331(b).

NEPA regulations explain, in 40 C.F.R. §1500.1(c), that:

> Ultimately, of course, it is not better documents but better decisions that count. NEPA's purpose is not to generate paperwork – even excellent paperwork – but to foster excellent action. The NEPA process is intended to help public officials make decisions that are based on understanding of environmental consequences, and take actions that protect, restore, and enhance the environment.

Thus, while "NEPA itself does not mandate particular results, but simply prescribes the necessary process," *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989), agency adherence to NEPA's action-forcing statutory and regulatory mandates helps federal agencies ensure that they are adhering to NEPA's noble purpose and policies. *See* 42 U.S.C. §§ 4321, 4331.

NEPA imposes "action forcing procedures … requir[ing] that agencies take a *hard look* at environmental consequences." *Methow Valley*, 490 U.S. at 350 (citations omitted) (emphasis added). These "environmental consequences" may be direct, indirect, or cumulative. 40 C.F.R. §§ 1502.16, 1508.7, 1508.8. A cumulative impact – particularly important here – is defined:

> the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

40 C.F.R. § 1508.7.

Federal agencies determine whether direct, indirect, or cumulative impacts are significant by accounting for both the "context" and "intensity" of those impacts. 40 C.F.R. § 1508.27. Context "means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality" and "varies with the setting of the proposed action." 40 C.F.R. § 1508.27(a). Intensity "refers to the severity of the impact" and is evaluated according to several additional elements, including, for example: unique characteristics of the geographic area such as ecologically critical areas; the degree to which the effects are likely to be highly controversial; the degree to which the possible effects are highly uncertain or involve unique or unknown risks; and whether the action has cumulatively significant impacts. *Id.* §§ 1508.27(b).

Furthermore, the Federal Land Policy and Management Act ("FLPMA"), 43 U.S.C. § 1701 et seq., directs that "the public lands be managed in a manner that will protect the quality of [critical resource] values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use." 43 U.S.C. § 1701(a)(8). This substantive mandate requires that the agency not elevate the development of oil and gas resources above other critical resource values in the planning area. To the contrary, FLPMA requires that where oil and gas development would threaten the quality of critical resources, that conservation of these resources should be the preeminent goal. As detailed below, for several critical resource values in the planning area, the proposed action conflicts with the BLM's mandate under FLMPA.

A. The BLM Must Take a "Hard Look" at Impacts to Air Quality.

The BLM must take a hard look at the air quality impacts from oil and gas development in the planning area. Much of the air pollution from oil and gas development and operations, which is specifically discussed below, also degrades visibility. Section 169A of the Clean Air Act ("CAA"), 42, U.S.C. § 7401 *et seq.* (1970) sets forth a national goal for visibility, which is the "prevention of any future, and the remedying of any existing, impairment of visibility in Class I areas which impairment results from manmade air pollution." Congress adopted the visibility provisions in the CAA to protect visibility in "areas of great scenic importance." H.R. Rep. No. 294, 95th Cong. 1st Sess. at 205 (1977). In promulgating its Regional Haze Regulations,

64 Fed. Reg. 35,714 (July 1, 1999), the U.S. Environmental Protection Agency ("EPA") provided:

> Regional haze is visibility impairment that is produced by a multitude of sources and activities which emit fine particles and their precursors and which are located across a broad geographic area. Twenty years ago, when initially adopting the visibility protection provisions of the CAA, Congress specifically recognized that the "visibility problem is caused primarily by emission into the atmosphere of SO2, oxides of nitrogen, and particulate matter, especially fine particulate matter, from inadequate[ly] controlled sources." H.R. Rep. No. 95-294 at 204 (1977). The fine particulate matter (PM) (e.g., sulfates, nitrates, organic carbon, elemental carbon, and soil dust) that impairs visibility by scattering and absorbing light can cause serious health effects and mortality in humans, and contribute to environmental effects such as acid deposition and eutrophication.

The visibility protection program under sections 169A, 169B, and 110(a)(2)(J) of the CAA is designed to protect Class I areas from impairment due to manmade air pollution. The current regulatory program addresses visibility impairment in these areas that is "reasonably attributable" to a specific source or small group of sources, such as, here, air pollution resulting from oil and gas development and operations authorized by the BLM, as well as from other reasonably foreseeable development in the Uinta Basin.

Moreover, EPA finds the visibility protection provisions of the CAA to be quite broad. Although EPA is addressing visibility protection in phases, the national visibility goal in section 169A calls for addressing visibility impairment generally, including regional haze. *See e.g., State of Maine v. Thomas*, 874 F.2d 883, 885 (1st Cir. 1989) ("EPA's mandate to control the vexing problem of regional haze emanates directly from the CAA, which 'declares as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in Class I areas which impairment results from manmade air pollution.' ") (citation omitted).

In addition to impacts from the proposed development, cumulative air quality impacts from sources in and around the proposed development area may result in serious impairments. For example, there is a tremendous concentration of oil and gas development taking place in the Uinta Basin which has already elevated ozone concentrations, impacted visibility, and seriously degraded air quality in the region. Notably, this includes the directly adjacent Monument Butte Area Oil & Gas Development Project, which involves 5,750 oil and gas wells in the Vernal Field Office. As discussed, a proposed Crescent Point project would authorize up to an additional 3,925 oil and gas wells and associated infrastructure, which cannot be sustained in light of cumulative air quality degradation in the area.

The current status of air quality in an area is a fundamental consideration for analysis in the agency's NEPA analysis. Background monitored concentrations of all pollutants should be reviewed. Given the rapidly expanding development in the area, there may be higher concentrations that should be reflected. Pollutant emissions from the Crescent Point project have the potential to affect air quality on both a local and a regional scale. In particular, elevated monitored levels for the 8-hour ozone National Ambient Air Quality Standard ("NAAQS") in

this area in recent years are very concerning. Exposure to ozone is a serious concern as it can cause or exacerbate respiratory health problems, including shortness of breath, asthma, chest pain and coughing, decreased lung function and even lead to long-term lung damage, as discussed in greater detail below. *See also,* EPA's National Ambient Air Quality Standards for Particulates and Ozone, 62 FR 38,856 (July 18, 1997). According to a recent report by the National Research Council ("NRC"): "short-term exposure to current levels of ozone in many areas is likely to contribute to premature deaths."[1] Even ozone concentrations at levels as low as 60 ppb can be considered harmful to human health and the agencies should consider this when evaluating the air impacts in the EIS.

Of note, the BLM must consider the stricter EPA ozone standards that were recently finalized. By court order, EPA's new ozone standard was required to be finalized by October 1, 2015.[2] On schedule, on October 1, 2015, EPA published a final rule to revise NAAQS for ozone to 70 parts per billion (ppb) from the current 75 ppb.[3] This decision was driven by significant recent scientific evidence that the old standard of 75 ppb did not adequately protect public health. *Id.* at 136. Although EPA faces ongoing challenges to the updated standard—including industry group and state challenges of the stricter standard, and from citizen advocacy groups alleging that the standard is not protective enough, *Murray Energy Corp. v. EPA*, No. 15-1385 (D.C. Cir.) (and consolidated case Nos. 15-1392, 15-1490, 15-1491, 15-1494)—the current 70 ppb standard is still the relevant regulation BLM should analyze, here.

Recent studies have documented decreased lung functioning and airway inflammation in young, healthy adults at ozone concentrations as low as 60 ppb, which supports an even lower standard than the 70 ppb standard adopted by EPA. *Id.* at 146. Studies have documented "significant associations with respiratory emergency department visits with children and adults" in places that met the current standard of 75 ppb, but would not have met the level of 70 ppb. *Id.* at 247. The existing standard is plainly insufficient to protect children with asthma and members of other sensitive groups. *Id.* at 146-47. These impacts will be exacerbated by the worsening impacts of climate change. *Id.* at 33. Specifically, climate change may lead to future increases in summer ozone concentrations across the United States. *Id.*

Indeed, research indicates a strong correlation between oil and gas development and increased ozone concentrations – particularly in the summer when warm, stagnant conditions

[1] National Research Council, *Link Between Ozone Air Pollution and Premature Death Confirmed,* (April 2008), available at: http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=12198.

[2] *See* http://www.epa.gov/groundlevelozone/pdfs/20141125fs-requirements.pdf; *see also Sierra Club v. EPA,* No. 13-2809 (N.D. Cal., Apr. 30, 2014).

[3] National Ambient Air Quality Standards for Ozone, EPA-HQ-OAR-2008-0699 (Oct. 1, 2015), "Internet version" available at: http://www3.epa.gov/ozonepollution/pdfs/20151001fr.pdf

yield an increase in O_3 from oil and gas emissions.[4] Particularly in areas of significant existing oil and gas development – such as the San Juan Basin in the Four Corners region, which was the focus of the research cited above, but also the Uinta Basin – summertime **"**peak incremental **O_3** concentration of 10 ppb" have been simulated. *Id.* at 1118. This study indicates a "clear potential for oil and gas development to negatively affect regional O_3 concentrations in the western United States, including several treasured national parks such as Arches and Canyonlands. "It is likely that accelerated energy development in this part of the country will worsen the existing problem."[5] Additionally, oil and gas production in the mountain West has recently been linked to *winter* ozone levels that greatly exceed the NAAQS.[6]

As the Endocrine Disruption Exchange has noted:

> In addition to the land and water contamination issues, at each stage of production and delivery tons of toxic volatile compounds, including benzene, toluene, ethylbenzene, xylene, etc., and fugitive natural gas (methane), escape and mix with nitrogen oxides from the exhaust of diesel-driven, mobile and stationary equipment to produce ground-level ozone. Ozone combined with particulate matter less than 2.5 microns produces smog (haze). Gas field produced ozone has created a serious air pollution problem similar to that found in large urban areas, and can spread up to 200 miles beyond the immediate region where gas is being produced. Ozone not only causes irreversible damage to the lungs, it is equally damaging to conifers, aspen, forage, alfalfa, and other crops commonly grown in the West. Adding to this is the dust created by fleets of diesel-driven water trucks working around the clock hauling the constantly accumulating condensate water from well pads to central evaporation pits.[7]

Increases in ground-level ozone not only impact regional haze and visibility, but can also result in dramatic impacts to human health. According to the EPA:

---

[4] *See* Marco A Rodriguez, et al., Regional Impacts of Oil and Gas Development on Ozone Formation in the Western United States, Journal of Air & Waste Management Association, Sept. 2009, at 1118 (attached as Exhibit 1).

[5] *See id.*

[6] *See* Gail Tonnesen and Richard Payton, EPA Region 8. *Winter Ozone Formation: Results from the Wyoming Upper Green River Basin Studies and Plans for the 2012, Uintah Basin Study* (seminar abstract) (Jan. 2012), available at: http://www.esrl.noaa.gov/csd/seminars/2012/TonnesenPayton.html (citing, *inter alia*, Schnell, et. al., *Rapid photochemical production ozone at high concentrations in a rural site during winter*, 2 Nature Geosci. 120-122 (2009) (attached as Exhibit 2)).

[7] The Endocrine Disruption Exchange. Undated. *Chemicals in Natural Gas Operations: Health Effects Spreadsheet and Summary*, available at: http://www.endocrinedisruption.com/chemicals.multistate.php (attached as Exhibit 3).

Breathing ground-level ozone can result in a number of health effects that are observed in broad segments of the population. Some of these effects include:

- Induction of respiratory symptoms
- Decrements in lung function
- Inflammation of airways

Respiratory symptoms can include:

- Coughing
- Throat irritation
- Pain, burning, or discomfort in the chest when taking a deep breath
- Chest tightness, wheezing, or shortness of breath

In addition to these effects, evidence from observational studies strongly indicates that higher daily ozone concentrations are associated with increased asthma attacks, increased hospital admissions, increased daily mortality, and other markers of morbidity. The consistency and coherence of the evidence for effects upon asthmatics suggests that ozone can make asthma symptoms worse and can increase sensitivity to asthma triggers.[8]

Ozone concentrations exceeding the NAAQS have been observed during the winter months in the Uinta Basin. According to the Environmental Impact Statement for the adjacent Monument Butte project, the 8-hour ozone background ambient air quality for the Uinta Basin is 208µg/m^3, or 106 ppb, which far exceeds the NAAQS standard.[9] Increased oil and gas development from the Crescent Point project, the Monument Butte project, and other projects in the Uinta Basin will exacerbate the ozone problem in the area. There is no room for growth in emissions that contribute to harmful levels of ozone pollution in the area – namely, nitrogen oxides ("NO_X"), volatile organic compounds ("VOCs") and methane ("CH_4"), which the proposed action will exacerbate. Rather than adding to the ozone burden in the region, the BLM must take significant steps to decrease emissions and bring the region back into attainment. Any increase in emissions of ozone precursors will exacerbate the negative health effects of ozone in the region, as discussed below, and is almost certain to threaten the area's compliance with EPA's ozone standard.

[8] EPA, Health Effects of Ozone in the General Population, available at: http://www.epa.gov/apti/ozonehealth/population.html (attached as Exhibit 4).

[9] *See* Monument Butte Final Environmental Impact Statement at 3-8, Table 3.2.3.2-1, available at https://eplanning.blm.gov/epl-front-office/projects/nepa/62904/75396/83265/FEIS_1_Preliminary_pages_thru_Chapter_3.pdf. The old 8-hour ozone standard of 75 ppb translates to 147 µg/m^3. The current 8-hour ozone standard of 70 ppb translates to 140 µg/m^3.

Additionally, $PM_{2.5}$ is another potential area of major health impacts in the area. $PM_{2.5}$ can become lodged deep in the lungs or can enter the blood stream, worsening the health of asthmatics and even causing premature death in people with heart and lung disease. Even $PM_{2.5}$ concentrations lower than the current NAAQS are a concern for human health. Elevated wintertime concentrations of $PM_{2.5}$ have become a serious issue, particularly for the Uinta Basin. Several very high values of $PM_{2.5}$ were recorded in Vernal, Utah starting in 2007, including six exceedances of the 24-hour $PM_{2.5}$ NAAQS and a maximum 24-hour average $PM_{2.5}$ concentration of 63 $\mu g/m^3$. [10] In 2009, there were three recorded exceedances of the 24-hour average $PM_{2.5}$ NAAQS in Roosevelt, Utah with 24-hour average concentrations reaching 42 $\mu g/m^3$ and four recorded exceedances in Vernal with 24-hour average concentrations as high as 60.9 $\mu g/m^3$.

Also critical to the BLM's analysis of air quality impacts is the relationship to human health. Logically, the required air quality mitigation measures would have a positive relationship to human health, but poor baseline air quality conditions due to direct, indirect and cumulative impacts in the planning area warrant an independent hard look analysis at human health; and, moreover, such analysis is required by NEPA and CEQ implementing regulations. The relationship between air quality and human health must be analyzed in the agency's NEPA analysis. "The agency must examine the relevant data and articulate a satisfactory explanation for its action including a 'rational connection between the facts found and the choice made.'" *Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983).

B. The BLM Must Take a "Hard Look" at Climate Change.

If we are to stem the impacts of climate change and manage for sustainable ecosystems, not only must the BLM take a hard look at greenhouse gas ("GHG") emissions from the proposed development, but its decision must be reflective of the challenges we face.

The EPA has determined that human emissions of greenhouse gases are causing global warming that is harmful to human health and welfare. *See* 74 Fed. Reg. 66,496 (Dec. 15, 2009), Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act. The D.C. Circuit has upheld this decision as supported by the vast body of scientific evidence on the subject. *See Coal. for Responsible Regulation, Inc. v. E.P.A.*, 684 F.3d 102, 120-22 (D.C. Cir. 2012). Indeed, EPA could not have found otherwise, as virtually every climatologist in the world accepts the legitimacy of global warming and the fact that human activity has resulted in atmospheric warming and planetary climate change.[11] The world's

[10] *See* Marco A Rodriguez, et al., Regional Impacts of Oil and Gas Development on Ozone Formation in the Western United States, JOURNAL OF AIR & WASTE MANAGEMENT ASSOCIATION (Sept. 2009) (attached as Exhibit 1).

[11] *See, e.g., See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *The Science of Climate Change* (1995) (attached as Exhibit 5); U.S. Climate Change Science Program, *Abrupt Climate Change* (Dec. 2008) (attached as Exhibit 6); James Hansen, et. al., *Global Surface Temperature Change*, REVIEWS OF GEOPHYSICS, 48, RG4004 (June 2010) (attached as Exhibit 7); *see also*, Richard A. Muller, *Conversion of a Climate Change Skeptic*, NEW YORK TIMES, July 28, 2012 (attached as Exhibit 8) (citing Richard A. Muller, et. al., *A New Estimate of the Average Earth*

leading minds and most respected institutions – guided by increasingly clear science and statistical evidence – agree that dramatic action is necessary to avoid planetary disaster.[12] GHG concentrations have been steadily increasing over the past century,[13] and our growing consumption of fossil fuels is pushing the world to a tipping point where, once reached, catastrophic change will be unavoidable.[14] In fact, the impacts from climate change are already being experienced, with drought and extreme weather events becoming increasingly common.[15]

Surface Temperature, Spanning 1753 to 2011 (attached as Exhibit 9); Richard A. Muller, et. al., *Decadal Variations in the Global Atmospheric Land Temperatures* (attached as Exhibit 10)).

[12] *See, e.g.,* Rob Atkinson, et. al., *Climate Pragmatism: Innovation, Resilience, and No Regrets* (July 2011) (attached as Exhibit 11); Veerabhadran Ramanathan, et. al., *The Copenhagen Accord for Limiting Global Warming: Criteria, Constraints, and Available Avenues* (Feb. 2010) (attached as Exhibit 12); UNITED NATIONS, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *Climate Change 2007: Synthesis Report* (2007) (attached as Exhibit 13); A.P. Sokolov, et. al., *Probablistic Forecast for Twenty-First-Century Climate Based on Uncertainties in Emissions (without Policy) and Climate Parameters,* MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT) (Oct. 2009) (attached as Exhibit 14); UNITED NATIONS, FRAMEWORK CONVENTION ON CLIMATE CHANGE, *Report of the Conference of the Parties* (Dec. 2011) (attached as Exhibit 15); Bill McKibben, *Global Warming's Terrifying New Math,* ROLLING STONE, July 19, 2012 (attached as Exhibit 16); Elizabeth Muller, *250 Years of Global Warming,* BERKLEY EARTH, July 29, 2012 (attached as Exhibit 17); Marika M. Holland, et. al., *Future abrupt reductions in summer Arctic sea ice,* Geophysical Research Letters, Vol. 33, L23503 (2006) (attached as Exhibit 18).

[13] *See* Randy Strait, et. al., *Final Colorado Greenhouse Gas Inventory and Reference Case Projections: 1990-2020,* CENTER FOR CLIMATE STRATEGIES (Oct. 2007) (attached as Exhibit 19); Robin Segall et. al., *Upstream Oil and Gas Emissions Measurement Project*, U.S. ENVIRONMENTAL PROTECTION AGENCY (attached as Exhibit 20); Lee Gribovicz, *Analysis of States' and EPA Oil & Gas Air Emissions Control Requirements for Selected Basins in the Western United States,* WESTERN REGIONAL AIR PARTNERSHIP (Nov. 2011) (attached as Exhibit 21).

[14] *See, e.g.,* James Hansen, *Tipping Point: Perspective of a Climatologist,* STATE OF THE WILD 2008-2009 (attached as Exhibit 22); GLOBAL CARBON PROJECT, *A framework for Internationally Co-ordinated Research on the Global Carbon Cycle,* ESSP Report No. 1 (attached as Exhibit 23); INTERNATIONAL ENERGY AGENCY, *CO_2 Emissions from Fuel Combustion,* Highlights 2011 (attached as Exhibit 24); GLOBAL CARBON PROJECT, *10 Years of Advancing Knowledge on the Global Carbon Cycle and its Management* (attached as Exhibit 25); Malte Meinshausen, et. al., *Greenhouse-gas emission targets for limiting global warming to 2° C,* NATURE, Vol. 458, April 30, 2009 (attached as Exhibit 26).

[15] *See, e.g.,* UNITED NATIONS, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* (2011) (attached as Exhibit 27); Aiguo Dai, *Increasing drought under global warming in observations and models,* NATURE: CLIMATE CHANGE (Aug. 2012) (attached as Exhibit 28); Stephen Saunders, et. al., *Hotter and Drier: The West's Changed Climate* (March 2008) (attached as Exhibit 29).

Renowned NASA climatologist Dr. James Hansen provides the analogy of loaded dice – suggesting that there still exists some variability, but that climate change is making these extreme events ever more common.[16] In turn, climatic change and GHG emissions are having dramatic impacts on plant and animal species and habitat, threatening both human and species resiliency and the ability to adapt to these changes.[17] According to experts at the Government Accountability Office ("GAO"), federal land and water resources are vulnerable to a wide range of effects from climate change, some of which are already occurring. These effects include, among others, "(1) physical effects, such as droughts, floods, glacial melting, and sea level rise; (2) biological effects, such as increases in insect and disease infestations, shifts in species distribution, and changes in the timing of natural events; and (3) economic and social effects, such as adverse impacts on tourism, infrastructure, fishing, and other resource uses."[18]

Despite the strength of these findings, the BLM has historically failed to take serious action to address climate change impacts. This type of dismissive approach fails to satisfy the guidance outlined in Department of Interior Secretarial Order 3226, discussed below, or the requirements of NEPA. "Reasonable forecasting and speculation is … implicit in NEPA, and we must reject any attempt by agencies to shirk their responsibilities under NEPA by labelling any and all discussion of future environmental effects as 'crystal ball inquiry.'" *Save Our Ecosystems v. Clark*, 747 F.2d 1240, 1246 n.9 (9th Cir. 1984 (quoting *Scientists' Inst. for Pub. Info., Inc. v. Atomic Energy Comm.*, 481 F.2d 1079, 1092 (D.C. Cir. 1973)).

As noted above, NEPA imposes "action forcing procedures … requir[ing] that agencies take a *hard look* at environmental consequences." *Methow Valley*, 490 U.S. at 350 (citations omitted) (emphasis added). These "environmental consequences" may be direct, indirect, or

---

[16] *See*, James Hansen, et. al., *Climate Variability and Climate Change: The New Climate Dice* (Nov. 2011) (attached as Exhibit 30); James Hansen, et. al., *Perception of Climate Change* (March 2012) (attached as Exhibit 31); James Hansen, et. al., *Increasing Climate Extremes and the New Climate Dice* (Aug. 2012) (attached as Exhibit 32).

[17] *See* Fitzgerald Booker, et. al., *The Ozone Component of Climate Change: Potential Effects on Agriculture and Horticultural Plant Yield, Product Quality and Interactions with Invasive Species*, J. INTEGR. PLANT BIOL. 51(4), 337-351 (2009) (attached as Exhibit 33); Peter Reich, *Quantifying plant response to ozone: a unifying theory*, TREE PHYSIOLOGY 3, 63-91 (1987) (attached as Exhibit 34).

[18] GAO Report, *Climate Change: Agencies Should Develop Guidance for Addressing the Effects on Federal Land and Water Resources* (2007) (attached as Exhibit 35); *see also* Committee on Environment and Natural Resources, National Science and Technology Council, *Scientific Assessment of the Effects of Global Climate Change on the United States* (2008) (attached as Exhibit 36); Melanie Lenart, et. al. *Global Warming in the Southwest: Projections, Observations, and Impacts* (2007) (attached as Exhibit 37) (describing impacts from temperature rise, drought, floods and impacts to water supply on the southwest).

cumulative. 40 C.F.R. §§ 1502.16, 1508.7, 1508.8. BLM is required to take a hard look at those impacts as they relate to the agency action. "Energy-related activities contribute 70% of global GHG emissions; oil and gas together represent 60% of those energy-related emissions through their extraction, processing and subsequent combustion."[19] Even if science cannot isolate each additional oil or gas well's contribution to these overall emissions, this does not obviate BLM's responsibility to consider oil and gas development in the action area from the cumulative impacts of the oil and gas sector. In other words, the BLM cannot ignore the larger relationship that oil and gas management decisions have to the broader climate crisis that we face. Here, the agency's analysis must include the full scope of GHG emissions. *See Neighbors of Cuddy Mountain v. U.S. Forest Service*, 137 F.3d 1372, 1379 (9th Cir. 1998) ("To 'consider' cumulative effects, some quantified or detailed information is required. Without such information, neither the courts nor the public, in reviewing the [agency's] decisions, can be assured that the [agency] provided the hard look that it is required to provide."). If we are to stem climate disaster – the impacts of which we are already experiencing – the agency's decisionmaking must be reflective of this reality and plan accordingly.

BLM is, at the end of the day, responsible for the management of 700 million acres of federal onshore subsurface minerals.[20] Indeed, "in 2012, the most recent year for which total U.S. GHG emissions data were available, the estimated 1,344 MMTCO2e in ultimate downstream GHG emissions from fossil fuel extraction from federal lands by private leaseholders could have accounted for approximately 21% of total U.S. GHG emissions and 24% of energy-related GHG emissions."[21] In 2010, the GAO estimated that BLM could eliminate up to 40% of methane emissions from federally authorized oil and natural gas development, the equivalent of eliminating 39.2 Bcf or 65 $MMTCO_2e$ of GHG pollution annually (the equivalent of roughly 19 coal-fired power plants).[22] Even though climate change emissions from the proposed action may look minor when viewed in isolation, when considered cumulatively with all of the other GHG emissions from BLM-managed land, they become significant and cannot be ignored.

---

[19] International Investors Group on Climate Change, *Global Climate Disclosure Framework for Oil and Gas Companies* (attached as Exhibit 38).

[20] *See* DOI-BLM, *Mineral and Surface Acreage Managed By BLM,* available at: http://www.blm.gov/wo/st/en/info/About_BLM/subsurface.html.

[21] Stratus Consulting, prepared for: The Wilderness Society, *Greenhouse Gas Emissions from Fossil Energy Extracted from Federal Lands and Waters: An Update*, December 23, 2014 (attached as Exhibit 39).

[22] GAO, *Federal Oil & Gas Leases: Opportunities Exist to Capture Vented and Flared Natural Gas, Which Would Increase Royalty Payments and Reduce Greenhouse Gases*, GAO-11-34 at 12 (Table 1) (October 2010) (attached as Exhibit 47). This GHG equivalence assumes a CH_4 warming potential of 86 (20-year warming period) as per the Intergovernmental Panel on Climate Change's Fifth Assessment Report and using EPA's GHG equivalencies calculator.

Moreover, research conducted by the National Research Council has confirmed the fact that the negative impacts of energy generation from fossil fuels are not represented in the market price for such generation.[23] In other words, failing to internalize the externalities of energy generation from fossil fuels – such as the impacts to climate change and human health – has resulted in a market failure that requires government intervention. The agency should be mindful of this cost failure as they evaluate our nation's dependence on dirty energy from oil and gas – particularly as it relates to other incompatible resource values deserving protection in the planning area. The updated social cost of carbon estimates for 2020 are $12, $42, $62 and $123 per ton of CO_2 (in 2007$).[24] The Interagency Working Group does not instruct federal agencies which discount rate to use, suggesting that the 3 percent discount rate ($42 per ton of CO_2) as the "central value," but further emphasizing "the importance and value of including all four SCC values[;]" i.e., that the agency should use the range of values in developing NEPA alternatives.[25] The BLM's analysis must meaningfully contemplate a transition to renewable energy generation; not only as an alternative which may eventually suppress demand for oil and gas resources, but also as a pathway toward mitigating climate change as it relates to agency decisionmaking on federal lands.[26]

Agency decisionmaking must be reflective of this broader reality, and the agency must account for the full lifecycle of oil and gas production—an obligation recently underscored by The White House Council on Environmental Quality in *Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and Effects of Climate Change in National Environmental Policy Act Reviews* (August 1, 2016) (attached as Exhibit 1) ["CEQ Climate Guidance"]. As discussed more fully below, BLM not only has the authority, but an

[23] *See, e.g.,* National Research Council, *Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use* (2010) (attached as Exhibit 40); Nicholas Muller, et. al., *Environmental Accounting for Pollution in the United States Economy*, AMERICAN ECONOMIC REVIEW at 1649-1675 (Aug. 2011) (attached as Exhibit 41); *see also,* Generation Investment Management, *Sustainable Capitalism,* (Jan. 2012) (advocating a paradigm shift to *Sustainable Capitalism*; "a framework that seeks to maximize long-term economic value creation by reforming markets to address real needs while considering *all* costs and stakeholders.") (attached as Exhibit 42).

[24] *See* 2013 TSD (July 2015 Revision) at 3 (attached as Exhibit 43) (including a table of revised SCC estimates from 2010-2050). To put these figures in perspective, in 2009 the British government used a range of $41-$124 per ton of CO_2, with a central value of $85 (during the same period, the 2010 TSD used a central value of $21). WRI Report at 4 (attached as Exhibit 44). The UK analysis used very different assumptions on damages, including a much lower discount rate of 1.4%. The central value supports regulation four times a stringent as the U.S. central value. *Id.*

[25] *See* 2013 TSD at 12 (attached as Exhibit 43).

[26] *See, e.g.,* INTERNATIONAL ENERGY AGENCY, *Energy Technology Perspectives 2012: Pathways to a Clean Energy System* (2012) (attached as Exhibit 45); UNITED NATIONS, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *Renewable Energy Sources and Climate Change Mitigation* (2012) (attached as Exhibit 46).

obligation to address GHG emissions and methane waste. Furthermore, the agency must consider not only the cumulative impact of the GHG emissions authorized by the proposed action, it must also consider those emissions combined with other activity in the area. As noted above, "[t]he impact of greenhouse gas emissions on climate change is precisely the kind of cumulative impacts analysis that NEPA requires agencies to conduct." *Ctr. for Biological Diversity*, 538 F.3d 1172, 1217. The agency must assess cumulative impacts, particularly, as here, the cumulative impacts of climate change. Failure to do so would "impermissibly subject[] the decisionmaking process contemplated by NEPA to 'the tyranny of small decisions.' " *Kern*, 284 F.3d at 1078 (citation omitted).

1. BLM Must Consider Existing, New, and Revised National Policy on Climate Change.

In 2014, President Obama described climate change as an "urgent and growing threat . . . that will define the contours of this century more dramatically than any other."[27] In that same year, the U.S. pledged to reduce its greenhouse gas ("GHG") emissions 26-28 percent below 2005 levels by 2020.[28] Since then, the President has also announced a new goal to cut methane emissions from the oil and gas sector by 40-45 percent below 2012 levels by 2025,[29] and set standards to reduce carbon dioxide emissions from the electricity sector by 32 percent from 2005 levels by 2030.[30] In 2015, President Obama recognized, "ultimately, if we're going to prevent large parts of this Earth from becoming not only inhospitable but uninhabitable in our lifetimes, we're going to have to keep some fossil fuels in the ground rather than burn them and release more dangerous pollution into the sky."[31] In his final State of the Union address, President Obama again noted the federal government's commitment to fighting climate change, vowing "to accelerate the transition away from old, dirtier energy sources," and making a powerful promise "to change the way we manage our oil and coal resources so that they better reflect the

[27] The White House, Remarks by the President at U.N. Climate Change Summit (Sept. 23, 2014), available at: https://www.whitehouse.gov/the-press-office/2014/09/23/remarks-president-un-climate-change-summit.

[28] U.S.-China Joint Announcement on Climate Change (Nov. 11, 2014), available at: https://www.whitehouse.gov/the-press-office/2014/11/11/us-china-joint-announcement-climate-change.

[29] The White House, Climate Action Plan: Strategy to Reduce Methane Emissions (March 2014), available at: https://www.whitehouse.gov/blog/2014/03/28/strategy-cut-methane-emissions.

[30] Environmental Protection Agency, Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64662 (Oct. 23, 2015).

[31] The White House, Statement by the President on the Keystone XL Pipeline (Nov. 6, 2015), available at: https://www.whitehouse.gov/the-press-office/2015/11/06/statement-president-keystone-xl-pipeline.

costs they impose on taxpayers and our planet."[32] These statements culminated in December, 2015 when the President joined with 194 other nations in recognizing "that climate change represents an urgent and potentially irreversible threat to human societies and the planet" and setting the goal of "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C."[33] The President ratified the Paris Agreement, along with China, on September 3, 2016.[34] The President has also recognized that "the Paris Agreement alone will not solve the climate crisis. Even if we meet every target embodied in the agreement, we'll only get to part of where we need to go."[35]

Although national policy and statements addressing climate change have accelerated in recent years—as they should given the narrowing window of time to take meaningful action—the federal government's recognition of climate change is not new. The Secretary of the United States Department of the Interior stated, in Secretarial Order 3226, *Evaluating Climate Change Impacts in Management Planning* (January 19, 2001), that "[t]here is a consensus in the international community that global climate change is occurring and that it should be addressed in governmental decision making." Order 3226 established the responsibility of agencies to "consider and analyze potential climate change impacts when undertaking long-range planning exercises, when setting priorities for scientific research and investigations, when developing multi-year management plans, and/or when making major decisions regarding potential utilization of resources under the Department's purview."

In a 2007 report entitled *Climate Change: Agencies Should Develop Guidance for Addressing the Effects on Federal Land and Water Resources*, the GAO concluded that the Department of the Interior had not provided specific guidance to implement Secretarial Order 3226, that officials were not even aware of Secretarial Order 3226, and that Secretarial Order 3226 had effectively been ignored. This report led to Secretarial Order 3289, *Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources* (September 14, 2009), which reinstated the provisions of Order 3226, and recognized that "the realities of climate change require us to change how we manage land, water, fish and

[32] President Barack Obama, State of the Union (Jan. 12, 2016), available at: https://obamawhitehouse.archives.gov/the-press-office/2016/01/12/remarks-president-barack-obama-%E2%80%93-prepared-delivery-state-union-address.

[33] United Nations Framework Convention on Climate Change, Conference of the Parties (Nov 30-Dec. 11, 2015), Adoption of the Paris Agreement, Art. 2, U.N. Doc. FCCC/CP/2015/L.9 (Dec. 12, 2015), available at: http://unfccc.int/resource/docs/2015/cop21/eng/l09.pdf ("Paris Agreement").

[34] The White House, President Obama: The United States Formally Enters the Paris Agreement (Sept. 3, 2016), available at: https://www.whitehouse.gov/blog/2016/09/03/president-obama-united-states-formally-enters-paris-agreement.

[35] The White House, Office of the Press Secretary, Remarks by the President on the Paris Agreement (Oct. 5, 2016), available at https://www.whitehouse.gov/the-press-office/2016/10/05/remarks-president-paris-agreement (last viewed Feb. 7, 2017).

wildlife, and cultural heritage and tribal lands and resources we oversee," and acknowledged that the Department of the Interior is "responsible for helping protect the nation from the impacts of climate change." A month later, in Executive Order No. 13514, *Federal Leadership in Environmental, Energy, and Economic Performance* (Oct. 5, 2009), President Obama called on all federal agencies to "measure, report, and reduce their greenhouse gas emissions from direct and indirect activities." 74 Fed. Reg. 52,117 (Oct. 8, 2009). This directive was followed by Executive Order No. 13693, *Planning for Federal Sustainability in the Next Decade* (March 25, 2015), which reaffirmed the federal government's commitment to reducing GHG emissions. 80 Fed. Reg. 15,871 (March 25, 2015).

In 2009, the Environmental Protection Agency ("EPA") issued a finding that the changes in our climate caused by elevated concentrations of greenhouse gases in the atmosphere are reasonably anticipated to endanger the public health and welfare of current and future generations. 74 Fed. Reg. 66496 (Dec. 15, 2009). In 2015, EPA acknowledged more recent scientific assessments that "highlight the urgency of addressing the rising concentrations of CO_2 in the atmosphere." 80 Fed. Reg. 64661 (Oct. 23, 2015).

Earlier this year, the White House Council on Environmental Quality ("CEQ")—the federal agency tasked with managing the federal government's implementation of NEPA—recognized the unique nature of climate change and the challenges it imposed on NEPA compliance. On August 1, 2016, CEQ released *Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* (hereafter, "Final Climate Guidance") (attached as Exhibit 4). The Final Guidance applies to all proposed federal agency actions. *Id*. at 9. In its Final Guidance, the CEQ recognized that:

> Climate change results from the incremental addition of GHG emissions from millions of individual sources, which collectively have a large impact on a global scale. CEQ recognizes that the totality of climate change impacts is not attributable to any single action, but are exacerbated by a series of actions including actions taken pursuant to decisions of the Federal Government. Therefore, a statement that emissions from a proposed Federal action represent only a small fraction of global emissions is essentially a statement about the nature of the climate change challenge, and is not an appropriate basis for deciding whether or to what extent to consider climate change impacts under NEPA. Moreover, these comparisons are also not an appropriate method for characterizing the potential impacts associated with a proposed action and its alternatives and mitigations because this approach does not reveal anything beyond the nature of the climate change challenge itself: the fact that diverse individual sources of emissions each make a relatively small addition to global atmospheric GHG concentrations that collectively have a large impact.

Id. at 10-11. CEQ's Final Guidance also explains the application of NEPA principles and practices to the analysis of GHG emissions and climate change, including: (1) that agencies quantify a proposed action's projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools; (2) that agencies use projected GHG emissions as a

proxy for assessing potential climate change effects when preparing a NEPA analysis; (3) where GHG emission tools, methodologies, or data inputs are not reasonably available, that agencies include a qualitative analysis in the NEPA document and explain the basis for determining that quantification is not reasonably available; (4) that agencies analyze foreseeable direct, indirect, and cumulative GHG emissions and climate effects; (5) that agencies consider reasonable alternatives and the short- and long-term effect and benefits in the alternatives and mitigation analysis; (6) that agencies consider alternatives that would make the actions and affected communities more resilient to the effects of a changing climate; and (7) that agencies assess the broad-scale effects of GHG emissions and climate change, either to inform programmatic decisions, or at both the programmatic and project-level. *See id.* at 4-6.

2. BLM Must Consider Recent Climate Science and Carbon Budgeting.

Since the dawn of the industrial revolution a century ago, the average global temperature has risen some 1.6 degrees Fahrenheit. Most climatologists agree that, while the warming to date is already causing environmental problems, another 0.4 degree Fahrenheit rise in temperature, representing a global average atmospheric concentration of carbon dioxide ("CO_2") of 450 parts per million ("ppm"), could set in motion unprecedented changes in global climate and a significant increase in the severity of natural disasters—and could represent the point of no return.[36] In August 2016, the atmospheric concentration of CO_2 was approximately 402.25 ppm, up from 398.93 ppm the same month a year earlier.[37]

Climate change has been intensively studied and acknowledged at the global, national, and regional scales. Climate change is being fueled by the human-caused release of greenhouse gas emissions, in particular carbon dioxide and methane. The Intergovernmental Panel on Climate Change ("IPCC") is a Nobel Prize-winning scientific body within the United Nations that reviews and assesses the most recent scientific, technical, and socio-economic information relevant to our understanding of climate change. In its most recent report to policymakers in 2014, the IPCC provided a summary of our understanding of human-caused climate change. Among other things, the IPCC summarized:[38]

- Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems.

[36] *See* David Johnston, *Have We Passed the Point of No Return on Climate Change?*, Scientific American (April 2015), available at: http://www.scientificamerican.com/article/have-we-passed-the-point-of-no-return-on-climate-change/.

[37] NOAA, Earth System Research Laboratory, *Trends in Atmospheric Carbon Dioxide*, available at: http://www.esrl.noaa.gov/gmd/ccgg/trends/.

[38] IPCC AR5, *Summary for Policymakers* (March 2014) available at: http://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf (attached as Exhibit 48).

- Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen.

- Anthropogenic greenhouse gas emissions have increased since the pre-industrial era, driven largely by economic and population growth, and are now higher than ever. This has led to atmospheric concentrations of carbon dioxide, methane, and nitrous oxide that are unprecedented in at least the last 800,000 years. Their effects, together with those of other anthropogenic drivers, have been detected throughout the climate system and are extremely likely to have been the dominant cause of the observed warming since the mid-20th century.

- In recent decades, changes in climate have caused impacts on natural and human systems on all continents and across the oceans. Impacts are due to observed climate change, irrespective of its cause, indicating the sensitivity of natural and human systems to changing climate.

- Continued emission of greenhouse gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive, and irreversible impacts for people and ecosystems. Limiting climate change would require substantial and sustained reductions in greenhouse gas emissions which, together with adaptation, can limit climate change risks.

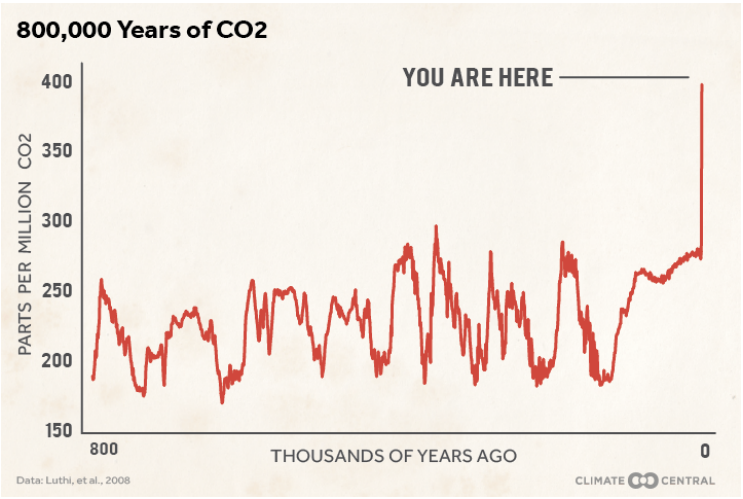
- Surface temperature is projected to rise over the 21st century under all assessed emission scenarios. It is very likely that heat waves will occur more often and last longer, and that extreme precipitation events will become more intense and frequent in many regions. The ocean will continue to warm and acidify, and global mean sea level to rise.

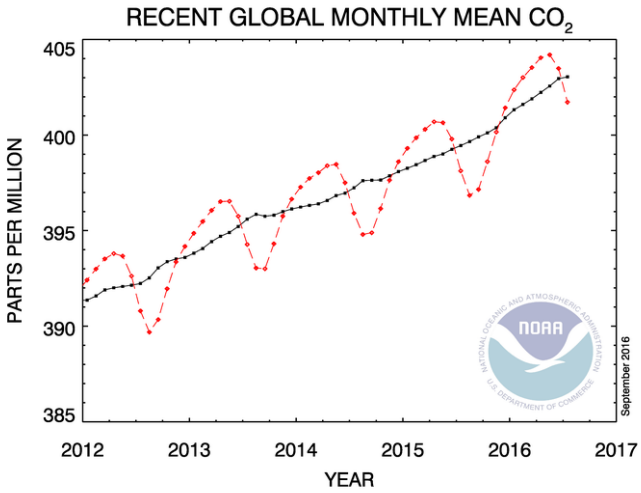
Carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are recognized as the key greenhouse gases contributing to climate change. In 2009, the EPA found that these "six greenhouse gases taken in combination endanger both the public health and the public welfare of current and future generations."[39] The D.C. Circuit has upheld this decision as supported by the vast body of scientific evidence on the subject. *See Coal. for Responsible Regulation, Inc. v. EPA.*, 684 F.3d 102, 120-22 (D.C. Cir. 2012).

According to the National Oceanic and Atmospheric Administration ("NOAA"), "[t]he combined average temperature over global land and ocean surfaces for August 2016 was the highest for August in the 137-year period of record, marking the 16th consecutive month of

[39] Environmental Protection Agency, *Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act* 74 Fed. Reg. 66,496 (Dec. 15, 2009).

record warmth for the globe." [40] The global climate crisis is happening and it may well be accelerating quickly.





The graphs show globally averaged historic and monthly mean carbon dioxide.

The IPCC in 2013 affirmed: "Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased" causing "widespread impacts on human and natural systems."[41] This is consistent with the findings of the United States' 2014 Third National Climate Assessment, stating: "That the planet has warmed is 'unequivocal,' and is corroborated through multiple lines of evidence, as is the conclusion that the causes are very likely human in origin."[42] With particular regard to the Southwest Region—which includes Colorado, New Mexico, Utah, Arizona, Nevada, and California—the National Climate Assessment included in the following overview:[43]

- Snowpack and streamflow amounts are projected to decline in parts of the Southwest, decreasing surface water supply reliability for cities, agriculture, and ecosystems.
- The Southwest produces more than half of the nation's high-value specialty

[40] NOAA, Global Analysis – August 2016, available at: https://www.ncdc.noaa.gov/sotc/global/201608.

[41] IPCC AR5, *Summary for Policymakers* (March 2014) available at: http://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf (attached as Exhibit 48).

[42] Jerry M. Melillo, *et al.*, Climate Change Impacts in the United States: The Third National Climate Assessment (2014) at 61, available at: http://nca2014.globalchange.gov (attached as Exhibit 49).

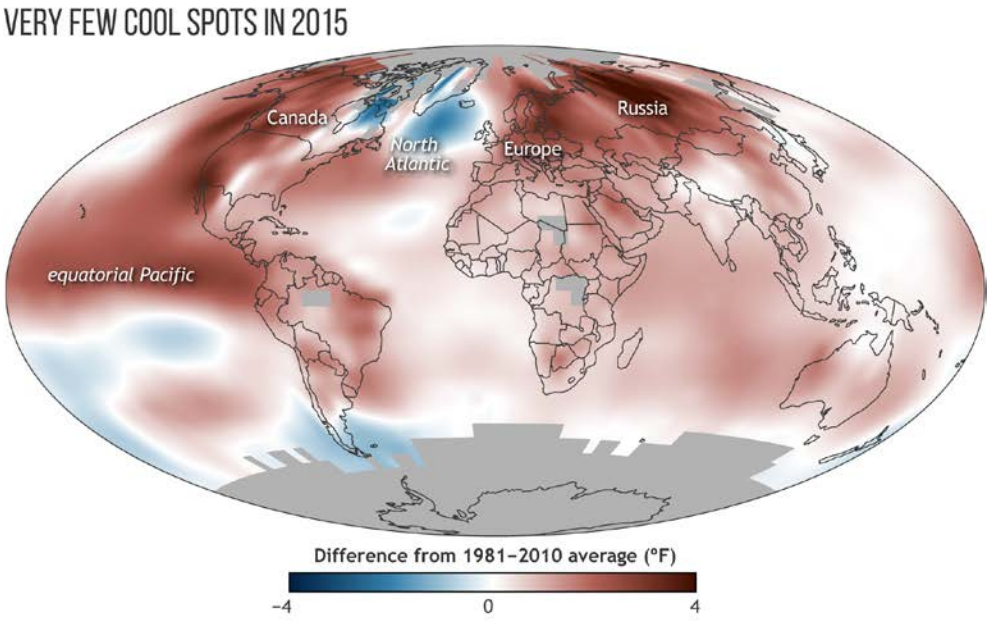
[43] *See id.* at 463-86.

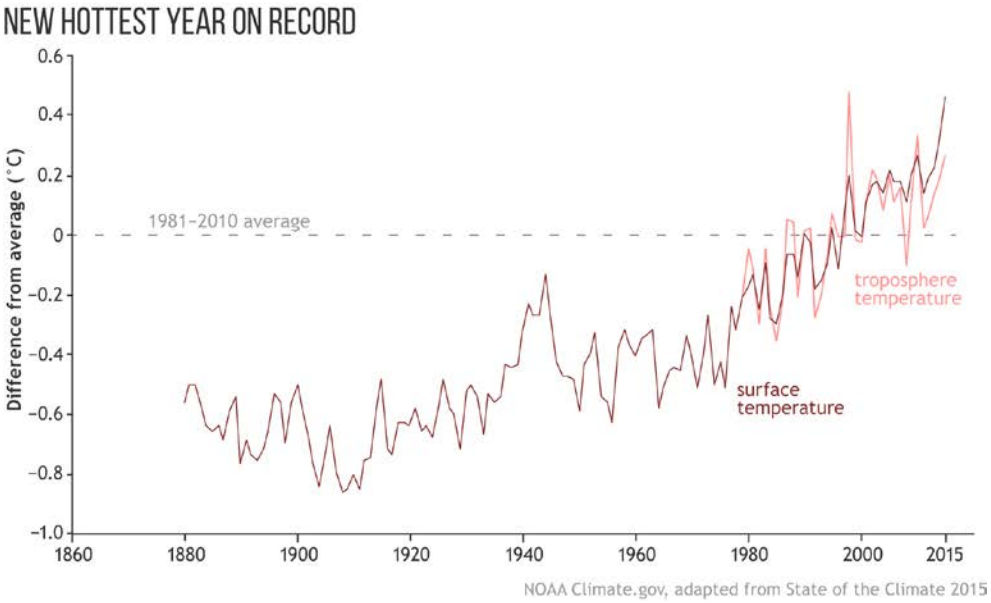
crops, which are irrigation-dependent and particularly vulnerable to extremes of moisture, cold, and heat. Reduced yields from increasing temperatures and increasing competition for scarce water supplies will displace jobs in some rural communities.

- Increased warming, drought, and insect outbreaks, all caused by or linked to climate change, have increased wildfires and impacts to people and ecosystems in the Southwest. Fire models project more wildfire and increased risks to communities across extensive areas.
- Flooding and erosion in coastal areas are already occurring even at existing sea levels and damaging some California coastal areas during storms and extreme high tides. Sea level rise is projected to increase as Earth continues to warm, resulting in major damage as wind-driven waves ride upon higher seas and reach farther inland.
- Projected regional temperature increases, combined with the way cities amplify heat, will pose increased threats and costs to public health in southwestern cities, which are home to more than 90% of the region's population. Disruptions to urban electricity and water supplies will exacerbate these health problems.

Immediate and substantial greenhouse gas reductions are required to avoid catastrophic impacts to people and communities. "Following the warmest year on record in 2014 according to most estimates, 2015 reached record warmth yet again, surpassing the previous record by more than 0.1°C."[44]

[44] American Meteorological Society, *State of the Climate in 2015*, Vol.97, No.8 (Aug. 2016), at S7 (attached as Exhibit 50).





As noted above, the Paris Agreement commits all signatories—including the United States—to a target holding long-term global average temperature "to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels."[45] As articulated by a team of international climate scientists, including Dr. James Hansen, in a 2013 report: "The widely accepted target of limiting human-made global warming to 2 degrees Celsius (3.6 degrees Fahrenheit) above preindustrial level is too high and would subject young people, future generations and nature to irreparable harm…. Observational data reveal that some climate extremes are already increasing in response to warming of several

[45] Paris Agreement at Art. 2, available at: http://unfccc.int/resource/docs/2015/cop21/eng/l09.pdf.

tenths of a degree in recent decades; these extremes would likely be much enhanced with warming of 2°C or more."[46] "Runaway climate change—in which feedback loops drive ever-worsening climate change, regardless of human activities—are now seen as a risk even at 2°C of warming."[47] Indeed, the impacts of 2°C temperature rise have been "revised upwards, sufficiently so that 2°C now more appropriately represents the threshold between 'dangerous' and 'extremely dangerous' climate change."[48]

Although the Paris Agreement has underscored that immediate action is needed to avoid 'extremely dangerous' warming, meeting the voluntary commitments adopted in Paris alone will be insufficient to meet goal of limiting temperature change to between 1.5°C and 2.0°C above pre-industrial levels. As noted by a 2015 UNEP technical report:

> The emissions gap between what the full implementation of the unconditional [intended nationally determined contributions (INDCs)] contribute and the least-cost emission level for a pathway to stay below 2°C, is estimated to be 14 $GtCO_2e$ (range: 12-17) in 2030 and 7 $GtCO_2e$ (range: 5-10) in 2025. When conditional INDCs are included as fully implemented, the emissions gap in 2030 is estimated to be 12 GtCO2e (range: 10-15) and 5 $GtCO_2e$ (range: 4-8) in 2025.[49]

In other words, far greater emissions reductions are necessary to stay below and 2.0°C, let alone aspire to 1.5°C of warming. If no further progress were made beyond the Paris Agreement, expected warming by 2100 would be 3.5°C.[50] In the alternative, if no action is taken and the status quo is maintained—a position reflected in BLM's draft EIS—estimated warming by 2100

---

[46] James Hansen, *et al., Assessing "Dangerous Climate Change": Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature*, 8 PLoS ONE 8 e81648 (2013) (attached as Exhibit 51).

[47] Greg Muttitt, *et al.*, *The Sky's Limit: Why the Paris Climate Goals Require a Managed Decline of Fossil Fuel Production*, Oil Change International (Sept. 2016) at 6 (attached as Exhibit 52); *see also* David Spratt, *Climate Reality Check: After Paris, Counting the Cost* (March 2016) at 8 (attached as Exhibit 53) ("there is an unacceptable risk that before 2°C of warming, significant "long-term" feedbacks will be triggered, in which warming produces conditions that generate more warming, so that carbon sinks such as the oceans and forests become less efficient in storing carbon, and polar warming triggers the release of significant permafrost and clathrate carbon stores. Such an outcome could render ineffective human efforts to control the level of future warming to manageable proportions.").

[48] Kevin Anderson and Alice Bows, *Beyond 'Dangerous' Climate Change: Emission Scenarios for a New World*, Phil. Trans. R. Soc. (2011) (attached as Exhibit 54).

[49] United Nations Environment Programme (UNEP), *The Emissions Gap Report 2015: A UNEP Synthesis Report* (Nov. 2015) at xviii (attached as Exhibit 55).

[50] Spratt, *Climate Reality Check* at 2 (attached as Exhibit 53).

is upwards of 4.5°C.[51]

With specific regard to United States commitments under the Paris Agreement, the U.S. INDC set specific greenhouse gas emissions reduction target for 2025 of a 26% to 28% reduction below the 2005 emission levels, producing a range in 2005 net GHG emissions from 6,323 to 7,403 $MTCO_2e$.[52] The difference between this target and the estimated 2025 emissions without INDC policies results in an 'emissions gap' ranging from 896 to 2,121 $MTCO_2e$.[53]

Both the IPCC and National Climate Assessment recognize the dominant role of fossil fuels in driving climate change:

> While scientists continue to refine projections of the future, observations unequivocally show that climate is changing and that the warming of the past 50 years is primarily due to human-induced emissions of heat-trapping gases. These emissions come mainly from burning coal, oil, and gas, with additional contributions from forest clearing and some agricultural practices.[54]
>
> ***
>
> CO_2 emissions from fossil fuel combustion and industrial processes contributed about 78% to the total GHG emission increase between 1970 and 2010, with a contribution of similar percentage over the 2000–2010 period (*high confidence*).[55]

As summarized in a recent report:

> The Paris Agreement aims to help the world avoid the worst effects of climate change and respond to its already substantial impacts. The basic climate science involved is simple: cumulative carbon dioxide (CO_2) emissions over time are the key determinant of how much global warming occurs. This gives us a finite

---

[51] *See* Climate Interactive, Climate Scorecard, available at: https://www.climateinteractive.org/programs/scoreboard/*; see also,* Andrew P. Schurer, *et al.*, *Separating Forced from Chaotic Climate Variability over the Past Millennium,* Journal of Climate, Vol. 26 (March 2013) (attached as Exhibit 56).

[52] Jeffery Greenblatt & Max Wei, *Assessment of the climate commitments and additional mitigation policies of the Unites States*, Nature Climate Change (Sept. 2016), available at: http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate3125.html (attached as Exhibit 57).

[53] *Id.* at 2; *see also* UNEP, Emissions Gap Report (attached as Exhibit 55).

[54] Third National Climate Assessment at 2 (attached as Exhibit 49).

[55] IPCC AR5 Synthesis Report at 46 (attached as Exhibit 48).

carbon budget of how much may be emitted in total without surpassing dangerous temperature limits.[56]

According to the IPCC, as of 2011, the remaining carbon budget of cumulative CO_2 emissions from all anthropogenic sources must remain below 1,000 $GtCO_2$ to provide a 66% probability of limiting warming to 2°C above pre-industrial levels.[57] For years 2012-2014, approximately 107 $GtCO_2$ was emitted, averaging approximately 36 $GtCO_2$ per year, which left us at the start of 2016 with a carbon budget of only 850 $GtCO_2$.[58] These emissions were the highest in human history and 60% higher than in 1990 (the Kyoto Protocol reference year). Of course, the Paris Agreement aim of limiting global warming to 1.5°C requires adherence to a more stringent carbon budget of only 400 $GtCO_2$ from 2011 onward, of which about 250 $GtCO_2$ remained at the start of 2016.[59] "With global annual emissions amounting to 36 $GtCO_2$ in 2015, scientists predict that at current rates global emissions will exceed the carbon budgets necessary to stay under the 1.5°C target by 2021 and the 2°C target by 2036.[60]

The potential carbon emissions from *existing* fossil fuel reserves—the known belowground stock of extractable fossil fuels—considerably exceed both 2°C and 1.5°C of warming. "Estimated total fossil carbon reserves exceed this remaining [carbon budget] by a factor of 4 to 7."[61] "For the 2°C or 1.5°C limits, respectively 68% or 85% of reserves must remain in the ground."[62] The reserves in currently operating oil and gas field alone, even with no

---

[56] *The Sky's Limit* at 6 (attached as Exhibit 52).

[57] IPCC AR5 Synthesis Report at 63-64 & Table 2.2 (attached as Exhibit 48). For an 80% probability of staying below 2°C, the budget from 2000 is 890 $GtCO_2$, with less than 430 $GtCO_2$ remaining. Malte Meinshausen *et al., Greenhouse-gas emission targets for limiting global warming to 2°C*, Nature (2009) at 1159 (attached as Exhibit 58).

[58] *See* Annual Global Carbon Emissions, available at: https://www.co2.earth/global-co2-emissions; *see also* C. Le Quéré, *et al., Global Carbon Budget 2015*, Earth Syst. Sci. Data (Dec. 2015) (attached as Exhibit 59).

[59] Dustin Mulvaney, *et al., Over-Leased: How Production Horizons of Already Leased Federal Fossil Fuels Outlast Global Carbon Budgets*, EcoShift Consulting (July 2016) (attached as Exhibit 60) at 2 (citing Joeri Rogelj, *et al., Difference between carbon budget estimates unraveled*, Nature Climate Change (2016) (attached as Exhibit 61)).

[60] Mulvaney at 2 (citing Oak Ridge National Laboratories, Carbon Dioxide Information Analysis Center (2015), available at: http://cdiac.ornl.gov/GCP/).

[61] IPCC AR5 Synthesis Report at 63 (attached as Exhibit 48).

[62] The Sky's Limit at 6 (attached as Exhibit 52); *see also* Kevin Anderson and Alice Bows, *Reframing the climate change challenge in light of post-2000 emission trends*, Phil. Trans. R. Soc. (2008) (attached as Exhibit 62) ("to provide a 93% mid-value probability of not exceeding 2°C, the concentration (of atmospheric greenhouse gases) would need to be stabilized at or

coal, would take the world beyond 1.5°C.[63]

In order for the world to stay within a carbon budget consistent with Paris Agreement goals—"holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C"[64]—significant fossil fuel resources must remain in the ground. More specifically, to meet the target of 2°C, globally "a third of oil reserves, half of gas reserves and over 80 percent of current coal reserves should remain unused from 2010-2050."[65] Studies estimate that global coal, oil and gas resources considered currently economically recoverable contain potential greenhouse gas emissions of 4,196 $GtCO_2$,[66] with other estimates as high as 7,120 $GtCO_2$.[67]

Critically, the United States carbon quota—equivalent to 11% of the global carbon budget needed for a 50% chance of limiting warming to 2°C—allocates approximately 158 $GtCO_2$ to the United States as of 2011.[68] By way of comparison, federal and non-federal fossil fuel emissions together would produce between 697 and 1,070 $GtCO_2$.[69] Regarding just federal fossil fuel resources, the United States contains enough recoverable coal, oil and gas that, if extracted and burned, would result in as much as 492 $GtCO_2$, far surpassing the entire global carbon budget for a 1.5°C target and nearly eclipsing the 2°C target—to say nothing of the United States 'share' of global emissions.[70] Unleased federal fossil fuels comprise 91% of these potential emissions, with already leased federal fossil fuels accounting for as much as 43

---

below 350 parts per million carbon dioxide equivalent (ppm CO_2e)" compared to the current level of ~485 ppm CO_2e.).

[63] The Sky's Limit at 5, 17 (attached as Exhibit 52).

[64] Paris Agreement at Art. 2, available at: http://unfccc.int/resource/docs/2015/cop21/eng/l09.pdf.

[65] Christophe McGlade & Paul Ekins, *The geographical distribution of fossil fuels unused when limiting global warming to 2°C*, Nature (Jan 2015) (attached as Exhibit 63).

[66] Michael Raupach, *et al.*, *Sharing a quota on cumulative carbon emissions*, Nature Climate Change (Sept. 2014) (attached as Exhibit 64).

[67] IPCC AR5, Mitigation of Climate Change, Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (2014) at Table 7.2 (attached as Exhibit 48).

[68] Raupach at 875 (attached as Exhibit 64).

[69] Dustin Mulvaney, *et al.*, *The Potential Greenhouse Gas Emissions from U.S. Federal Fossil Fuels*, EcoShift Consulting (Aug. 2015) at 16 (attached as Exhibit 65).

[70] *Id.*

$GtCO_2$.[71]

In 2012, "the GHG emissions resulting from the extraction of fossil fuels from federal lands by private leaseholders totaled approximately 1,344 $MMTCO_2e$."[72] Between 2003 and 2014, approximately 25% of all United States and 3-4% of global fossil fuel greenhouse gas emissions are attributable to federal minerals leased and developed by the Department of the Interior.[73] Continued leasing and development of federal fossil fuel resources commits the world to 'extremely dangerous' warming well beyond the 2°C threshold. As one study put it, "the disparity between what resources and reserves exist and what can be emitted while avoiding a temperature rise greater than the agreed 2°C limit is therefore stark."[74] In short, *any* new leasing of federal fossil fuel resources is inconsistent with a carbon budget that would seek to avoid catastrophic climate change.

Simply put, the timeframe to avoid catastrophic climate change is short, and the management of our federal minerals must confront this reality.

3. Methane Emissions and Waste

The agency must take a hard look, and take meaningful action, to address the serious issue of methane ("CH_4") emissions and waste in the oil and gas production process. Such action must include an estimate of the projected methane emission rates from drilling and production activities authorized by the proposed action. The agency is also obligated to conduct a detailed analysis of measures available to mitigate such emissions.

Methane emission rates can differ quite dramatically from one oil and gas field to the next, and, depending on the type of mitigation and emission controls employed, natural gas production emissions have been found to average 5.4%[75] and can range anywhere from 1% to 12% of production. A series of peer-reviewed studies have shown leakage rates for individual sources in the natural gas supply chain and in Western basins to be much higher than that

[71] *Id.*

[72] Stratus Consulting, *Greenhouse Gas Emissions from Fossil Energy Extracted from Federal Lands and Waters: An Update* (Dec. 2014) at 9 (attached as Exhibit 66).

[73] *See* Energy Information Administration, *Sales of Fossil Fuels Produced from Federal and Indian Lands, FY 2003 through FY 2014* (July 2015) (attached as Exhibit 67); *see also* Stratus Consulting (attached as Exhibit 66).

[74] McGlade at 188 (attached as Exhibit 63).

[75] Brandt, A. F., G. A. Heath, E. A. Kort, F. O. O'Sullivan, G. Petron, S. M. Jordaan, et al. 2014. *Methane leaks from North American natural gas systems.* Science 343:733–735 (finding average methane emissions from natural gas production of 5.4%) (attached as Exhibit 68).

estimated by EPA.[76]

Assuming a lower-bound leak rate of 1% – which is approximately one-third lower than the EPA estimate of methane emissions in the Inventory of U.S. GHG Emissions and Sinks: 1990-2011[77] – methane emissions from gas production by the proposed action could represent a meaningful contribution of emissions over the life of the developed field.[78] Assuming an upper-bound leak rate of 12%, particularly relevant, here, the high end of the rate found in a 2012 study using air sampling over the Uinta Basin,[79] methane emissions from gas could be truly significant

---

[76] *See, e.g.*, David T. Allen, et. al., *Measurements of methane emissions at natural gas production sites in the United states*, PNAS (October 29, 2013) (finding emissions as low as 1.5% of production at select sites) (attached as Exhibit 69); Mitchell, A.L., *et al.*, (2015), *Measurements of Methane Emissions from Natural Gas Gathering Facilities and Processing Plants: Measurement Results*, ENVIRON. SCI. TECHNOL., 49, at 3219-3227 (finding leakage rates from gas gathering and processing infrastructure of 8 times greater than EPA estimates) (attached as Exhibit 70); David T. Allen et al., *Methane Emissions from Process Equipment at Natural Gas Production Sites in the United States: Pneumatic Controllers*, ENVIRONMENTAL SCIENCE AND TECHNOLOGY, 636 and 638 (Dec. 9, 2014) (finding leakage rates from pneumatic controllers three times greater than EPA estimates) (attached as Exhibit 71); Lyon, *et al.*, (2016) *Aerial surveys of elevated hydrocarbon emissions from oil and gas production sites*, ENVIRON. SCI. TECHNOL., Web publication April 5, 2016 (finding high leak rates from storage tanks) (attached as Exhibit 72); Anna Karion, et. al., *Methane emissions estimate from airborn measurements over a western United States gas field*, GEOPHYSICAL RESEARCH LETTERS (Aug. 27, 2013) (finding emissions of 6 to 12 percent, on average, in the Uintah Basin) (attached as Exhibit 73); Gabrielle Pétron et al., *A new look at methane and nonmethane hydrocarbon emissions from oil and natural gas operations in the Colorado Denver-Julesburg Basin*, Journal of Geophysical Research: Atmospheres, 6836 (June 3, 2014) (finding leak rates averaging 4% in the Denver-Julesburg Basin) (attached as Exhibit 74); *see also*, Joe Romm, *Study of Best Fracked Wells Finds Low Methane Emissions But Skips Supper-Emitters*, CLIMATE PROGRESS (September 19, 2013), available at: http://thinkprogress.org/climate/2013/09/19/2646881/study-fracked-wells-methane-emissions-super-emitters/; *see also* GAO, *Federal Oil & Gas Leases: Opportunities Exist to Capture Vented and Flared Natural Gas, Which Would Increase Royalty Payments and Reduce Greenhouse Gases*, GAO-11-34 at 25 (October 2010) at 25 (using a conversion factor of .4045 $MMTCO_2e$/Bcf for vented gas) (attached as Exhibit 47).

[77] *See* U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011* (April 2013) (attached as Exhibit 75).

[78] *See* U.S. Environmental Protection Agency, *Greenhouse Gas Equivalencies Calculator*, available at: http://www.epa.gov/cleanenergy/energy-resources/calculator.html.

[79] *See* Brian Maffly, *Uinta Basin gas leakage far worse than most believe*, THE SALT LAKE TRIBUNE (Aug 05, 2013), available at: http://www.sltrib.com/sltrib/news/56692751-78/basin-carbon-emissions-gas.html.csp ("Between 6 percent and 12 percent of the Uinta Basin's natural gas production could be escaping into the atmosphere.").

indeed. Although there is substantial variability between the 1% and 12% emission leak rates – and, even without specific data from the proposed action, we can assume leakage somewhere between these two extremes – even at the low end emissions would not be trivial.

Even setting aside the issue of climate change, every ton of methane emitted to the atmosphere from oil and gas development is a ton of natural gas *lost*. Every ton of methane lost to the atmosphere is therefore a ton of natural gas that cannot be used by consumers. Methane lost from federal leases will also not yield royalties otherwise shared between federal, state, and local governments. This lost gas reflects serious inefficiencies in how BLM oil and gas leases are developed. Energy lost from oil and gas production – whether avoidable or unavoidable – reduces the ability of a lease to supply energy, increasing the pressure to drill other lands to supply energy to satisfy demand. 40 C.F.R. §§ 1502.16(e)-(f). In so doing, inefficiencies create indirect and cumulative environmental impacts by increasing the pressure to satisfy demand with new drilling. 40 C.F.R. §§ 1508.7, 1508.8(b).

a. Mineral Leasing Act's duty to prevent waste.

Conservation Groups, and in particular WELC, have been urging BLM field offices throughout the West to adopt common sense and economical measures to address the issue of vented and fugitive methane waste. The agency has expansive authority – and, indeed, the responsibility and opportunity – to prevent the waste of oil and gas resources, in particular methane, which is the primary constituent of natural gas. The Mineral Leasing Act of 1920 ("MLA") provides that "[a]ll leases of lands containing oil or gas ... shall be subject to the condition that the lessee will, in conducting his explorations and mining operations, use all reasonable precautions to prevent waste of oil or gas developed in the land...." 30 U.S.C. § 225; *see also* 30 U.S.C. § 187 ("Each lease shall contain...a provision...for the prevention of undue waste...." As the MLA's legislative history teaches, "conservation through control was the dominant theme of the debates." *Boesche v. Udall*, 373 U.S. 472, 481 (1963) (citing H.R.Rep. No. 398, 66th Cong., 1st Sess. 12-13; H.R.Rep. No. 1138, 65th Cong., 3d Sess. 19 ("The legislation provided for herein...will [help] prevent waste and other lax methods....")).

BLM's implementing regulations, reflecting these provisions, currently provide that "[t]he objective" of its MLA regulations in 43 C.F.R. Subpart 3160 "is to promote the orderly and efficient exploration, development and production of oil and gas. 43 C.F.R. § 3160.0-4. In part, "orderly and efficient" operations are ensured through unitization or communitization agreements. 43 C.F.R. §§ 3161.2, 3162.2-4(b) (BLM authority to require lessees unitization or communitization agreements); 43 C.F.R. Subpart 3180 (general rules pertaining to drilling unit agreements). Such unit agreements, because they may limit BLM authority in subsequent stages, are therefore important tools for preventing waste. *See William P. Maycock et al.*, 177 IBLA 1, 20-21 (Dec. Int. 2008) ("BLM is not required to analyze an alternative that is [n]ot feasible because it is inconsistent with the basic presumption of the Unit Agreement and BLM cannot legally compel the operator to adopt that alternative under the terms of the Unit Agreement").

Critically, subpart 3160 specifically requires BLM officials to ensure "that all [oil and gas] operations be conducted in a manner which protects other natural resources and the environmental quality, protects life and property and results in the maximum ultimate recovery

of oil and gas with minimum waste and with minimum adverse effect on the ultimate recovery of other mineral resources." 43 C.F.R. § 3161.2 (emphasis added). The lease owner and/or operator is, similarly, charged with "conducting all operations in a manner which ensures the proper handling, measurement, disposition, and site security of leasehold production; which protects other natural resources and environmental quality; which protects life and property; and which results in maximum ultimate economic recovery of oil and gas with minimum waste and with minimum adverse effect on ultimate recovery of other mineral resources." 43 C.F.R. § 3162.1(a) (emphasis added). Waste is defined as "(1) A reduction in the quantity or quality of oil and gas ultimately producible from a reservoir under prudent and proper operations; or (2) avoidable surface loss of oil or gas." 43 C.F.R. § 3160.0-5. Avoidable losses of oil or gas are currently defined as including venting or flaring without authorization, operator negligence, failure of the operator to take "all reasonable measures to prevent and/or control the loss," and an operator's failure to comply with lease terms and regulations, order, notices, and the like. *Id.*

In many respects, we think that BLM's current rules can be tightened. Regardless, it is clear that BLM's expansive authority, responsibility, and opportunity to prevent waste must permeate the agency's full planning and decisionmaking processes for oil and gas. The agency must ensure that any development authorized by the proposed action take advantage of not only proven, often economical technologies and practices to prevent methane waste, but, further, the agency's tools to ensure the orderly and efficient exploration, development, and production of oil and gas through controls placed on the very scale, pace, and nature of development. Moreover, it is clear that BLM's authority, responsibility, and opportunity extends to both existing and future oil and gas development. BLM, ultimately, manages the federal – i.e., publicly owned – onshore oil and gas resource in trust for the American people.

On November 19, 2013, a coalition of over 90 environmental, health, and sporting organizations submitted an open letter to Secretary Jewell of the U.S. Department of Interior and Administrator McCarthy of the U.S. Environmental Protection Agency calling for action to substantially reduce emissions of methane from the oil and gas industry on public and private lands, as well as from offshore oil operations. The coalition called on Secretary Jewell to reduce emissions from oil and gas operations on public lands by updating decades-old BLM rules on waste of mineral resources. Further, we asked Administrator McCarthy to directly regulate methane emissions from the oil and gas industry using existing Clean Air Act authority and to develop nationwide curbs on GHG emissions.

Notably, BLM is currently undertaking federal rulemaking pertaining to Onshore Oil and Gas Order No. 9, Waste Prevention and Use of Produced Oil and Gas for Beneficial Purposes. *See* 43 C.F.R. § 3164.1 (authorizing the Director to issue Onshore Oil and Gas Orders to implement or supplement regulations). On February 8, 2016, the BLM released a proposed rule. The agency provided:

> This proposed regulation aims to reduce the waste of natural gas from mineral leases administered by the BLM. This gas is lost during oil and gas production activities through flaring or venting of the gas, and equipment leaks. While oil and gas production technology has advanced dramatically in recent years, the BLM's requirements to minimize waste of gas have not been updated in over 30 years. The Mineral Leasing Act

> of 1920 (MLA) requires the BLM to ensure that lessees "use all reasonable precautions to prevent waste of oil or gas developed in the land . . . . " 30 U.S.C. 225. The BLM believes there are economical, cost-effective, and reasonable measures that operators should take to minimize waste, which will enhance our nation's natural gas supplies, boost royalty receipts for American taxpayers, tribes, and States, and reduce environmental damage from venting and flaring.

Waste Prevention, Production Subject to Royalties, and Resource Conservation: Proposed Rule, 81 Fed. Reg. 6616, (February 8, 2016). The BLM must consider this federal rulemaking, and the implications that this rule would have on place-based action, such as the establishment of mandatory requirements to prevent methane venting, flaring and leaks, in its decisionmaking here.

The Western Environmental Law Center and our partners also recently submitted comments on this proposed rule. These comments are incorporated herein, attached hereto as Exhibit 79, and must also be considered by the VFO when undertaking the Crescent Point planning process. *See* 40 C.F.R. § 1502.9(c)(1)(ii).

b. President Obama's Climate Action Plan and Secretarial Order 3289.

President Obama's Climate Action Plan explains that "[c]urbing emissions of methane is critical to our overall effort to address global climate change." *See* Climate Action Plan at 10. The President's call for action ties in nicely with BLM's authorities and responsibilities, beyond the MLA, to reduce methane emissions.

The starting point is the Federal Land Policy and Management Act of 1976 ("FLPMA"). Pursuant to FLPMA, the agencies must manage the public lands:

> in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition, that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use.

43 U.S.C. § 1701(a)(8) (emphasis added). The BLM, as a multiple use agency, must also manage the public lands and the oil and natural gas resource to "best meet the present and future needs of the American people" and to ensure that management "takes into account the long-term needs of future generations for…non-renewable resources, including…. minerals." 43 C.F.R. § 1702(c). Put differently, the driving force behind agency-authorized oil and gas development is the long-term, and broad, public interest – not the often short-term, and narrow, interest of oil and gas companies. The agencies duty to prevent waste must account for this driving force.

Here, BLM must ensure that these objectives and duties are adhered to through the completion of its NEPA analysis, which must, *inter alia*, "use and observe the principles of

multiple use and sustained yield" and "weigh long-term benefits to the public against short-term benefits." *See* 43 U.S.C. § 1712(c)(1), (7). Thus, the VFO has a substantive duty to consider the enduring legacy of oil and gas development in land management decisionmaking, which is to be balanced against other critical multiple use resource values.

Additionally, the BLM, as an agency within the U.S. Department of Interior, is subject to Secretarial Order 3289 (Dept. Int. Sept. 14, 2009). Secretarial Order 3289, in section 3(a), provides that BLM "must consider and analyze climate change impacts when undertaking long-range planning exercises, setting priorities for scientific research and investigations, developing multi-year management plans, and making major decisions regarding potential use of resources under the Department's purview." Section 3(a) of Secretarial Order 3289 also reinstated Secretarial Order 3226 (January 19, 2001). Secretarial Order 3226 commits the Department of the Interior to address climate change through its planning and decisionmaking processes. As the Order explains, "climate change is impacting natural resources that the Department of the Interior (Department) has the responsibility to manage and protect." Sec. Or. 3226, § 1. The Order therefore "ensures that climate change impacts are taken into account in connection with Department planning and decision making." *Id*. The Order obligates BLM to "consider and analyze potential climate change impacts" in four situations: (1) "when undertaking long-range planning exercises"; (2) "when setting priorities for scientific research and investigations"; (3) "when developing multi-year management plans, and/or" (4) "when making major decisions regarding the potential utilization of resources under the Department's purview." *Id*. § 3. The Order specifically provides that "Departmental activities covered by this Order" include "management plans and activities developed for public lands" and "planning and management activities associated with oil, gas and mineral development on public lands." *Id*. (emphasis added). BLM's oil and gas decisions are thus contemplated by and subject to section 3 of the Order.

These authorities and responsibilities can be properly exercised through effective use of NEPA. To comply with NEPA, the BLM must take a hard look at direct, indirect, and cumulative impacts, as discussed above. 40 §§ C.F.R. 1502.16(a), (b); 1508.25(c). In evaluating impacts, the agency must discuss "[e]nergy requirements and conservation potential of various alternatives and mitigation measures," "[n]atural or depletable resource requirements and conservation potential of various alternatives and mitigation measures," and "[m]eans to mitigate adverse environmental impacts (if not fully covered under 1502.14(f))." 40 C.F.R. §§ 1502.16(e), (f), (h).

We emphasize, here, the "heart" of the NEPA process: BLM's duty to consider "alternatives to the proposed action" and to "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources." 42 U.S.C. §§ 4332(2)(C)(iii), 4332(2)(E); 40 C.F.R. § 1502.14(a). Alternatives are critical because, "[c]learly, it is pointless to 'consider' environmental costs without also seriously considering action to avoid them." *Calvert Cliffs' Coordinating Comm., Inc. v. U.S. Atomic Energy Commn.*, 449 F.2d 1109, 1128 (D.C. Cir. 1971). Operating in concert with NEPA's mandate to address environmental impacts, BLM's fidelity to alternatives analysis helps "sharply defin[e] the issues and provid[e] a clear basis for choice among options by the decision maker and the public." 40 C.F.R. § 1502.14. An

agency must, accordingly, "[r]igorously explore and objectively evaluate all reasonable alternatives" and specifically "[i]nclude the alternative of no action." 40 C.F.R. §§ 1502.14(a), (d).

Finally, even where impacts are "insignificant," BLM must still consider alternatives. *Bob Marshall Alliance v. Hodel*, 852 F.2d 1223, 1229 (9th Cir. 1988) (agency's duty to consider alternatives "is both independent of, and broader than," its duty to complete an environmental analysis); *Greater Yellowstone Coalition v. Flowers*, 359 F.3d 1257, 1277 (10th Cir. 2004) (duty to consider alternatives "is 'operative even if the agency finds no significant environmental impact'").

c. Methane mitigation measures should be adopted and analyzed.

In BLM's proposed methane waste rule, there are many sources of methane emissions from oil and gas development that are identified and a few significant sources that are not included. The proposed rule also includes widely recognized methane emissions mitigation measures and best management practices ("BMPs"). The sources of methane emissions which will be present within the area of development, and the mitigation measures available, must be considered by BLM in its analysis of the proposed action.

Important sources of methane emissions include:

- Well drilling
- Well completion
- Production testing
- Pneumatic controllers
- Pneumatic pumps
- Separators and dehydrators
- Compressors
- Pipelines
- Storage tanks
- Liquids unloading
- Leaks
- Associated gas from oil wells

A key area of concern to Conservation Groups is the effectiveness of the mitigation measures adopted to ensure that the methane captured is able to make it to market for sale and not be vented or flared. Such considerations must be included in the agency's NEPA analysis. This includes, *inter alia*, how the agency will assess whether the gathering and processing investments proposed are adequate. That is, the agency is obligated to identify and describe how the infrastructure investments identified in the EIS (i.e., gathering pipelines, compressor stations and processing facilities) will be located and adequately sized to accommodate estimated levels of production of natural gas for the duration of the proposed project.

Notably, at least one BLM Field Office has already taken pioneering steps to address methane emissions and waste through mandatory mitigation measures at the RMP stage.

Specifically, in a joint Land and Resource Management Plan ("LRMP"), BLM: 1610 (CO-933), adopted by BLM Colorado's Tres Rios Field Office ("TRFO") and the San Juan National Forest ("SJNF"), the agencies broke new and essential ground in both acknowledging that significant GHG pollution would result from oil and gas development on TRFO lands, and then establishing required methane mitigation standards at the planning stage that will bind future leases and permits to drill to comply with these measures. As provided in the Final EIS for the LRMP:

> NEPA analysis is typically conducted for oil and gas leasing and when permits are issued. This FEIS is the first NEPA analysis where lands that could be made available for lease are identified and stipulated. In a subsequent analysis stage, when there is a site-specific proposal for development, additional air quality impact analysis would occur. This typically occurs when an application for a permit to drill is submitted. Based on the analysis results, additional mitigation or other equally effective options could be considered to reduce air pollution.

Final EIS at 372 (emphasis added). The TRFO set a new standard by recognizing that the climate change impacts from oil and gas industry activities are cumulative and that methane losses from business-as-usual industry practices at the field office level contribute significantly to climate change and must be mitigated. In the Final EIS, the TRFO also recognized that methane emissions represent waste of a key natural resource that belongs to all U.S. citizens, and the failure to control such waste robs the U.S. and state treasuries of royalty revenues. Accordingly, the TRFO adopted six important methane mitigation measures, which include:

- Centralized Liquid Gathering Systems and Liquid Transport Pipelines
- Reduced Emission Completions/Recompletions (green completions)
- Replacement of High-bleed Pneumatics with Low-Bleed/No-Bleed or Air-Driven Pneumatic Devices on all Existing Wells
- Installation of Low Bleed/No Bleed Pneumatic Devices on all New Wells
- Dehydrator Emissions Controls
- Electric Compression

Id. at 376.

As the VFO proceeds in the Crescent Point NEPA process, it is essential to consider the pioneering action taken by the TRFO. *See* 40 C.F.R. § 1502.9(c)(1)(ii). It is incumbent upon the VFO to confront the issues of climate change and methane emissions head-on, which must be accomplished through field office level planning and decisionmaking that is reflective of challenges we face.

Moreover, and in addition to both national rulemaking and precedent-setting action at the local field office level, BLM's Colorado State Office has recently adopted its Comprehensive Air Resources Protection Protocol ("CARPP"), which, as provided by the agency:

> [D]escribes the process and strategies the BLM will use when authorizing activities that have the potential to adversely impact air quality within the state of Colorado. This protocol also outlines specific measures that may be taken to

> address BLM-approved activities with the potential to cause significant adverse impacts to air resources … within any planning area [ ]. Further, the purposes of this protocol are to address air quality issues identified by the [BLM], or public scoping, in its analysis of potential impacts on air resources for BLM Colorado [RMPs] and [EIS']; and clarify the mechanisms and procedures that BLM will use to achieve the air resources goals, objectives, and management actions set forth in BLM Colorado RMPs.

While the BLM Colorado CARPP is not binding on the Vernal Field Office, it nevertheless provides an important state-of-the-art resource to augment the agency's analysis of GHG mitigation measures applicable to the Crescent Point project. In particular, Table V-I identifies Best Management Practices and Air Emission Reduction Strategies for Oil and Gas Development for criteria pollutants, hazardous pollutants, and methane. The CARPP must be considered by BLM in its decisionmaking regarding the Crescent Point project. *See* 40 C.F.R. § 1502.9(c)(1)(ii).

d. The capture of methane is critical due to its global warming potential.

Ensuring compliance with the agency's methane waste obligations through proper analysis and documentation in the NEPA process is important: technologies and practices change, and the BLM's duty to prevent degradation and waste cannot be excused just because the agency apparently lags behind the technological curve. The GAO's 2010 report noted that BLM's existing waste prevention guidance – Notice to Lessees and Operators ("NTL") 4a – was developed in 1980, well before many methane reduction technologies and practices were developed and understood. GAO also found that NTL-4a does not "enumerate the sources that should be reported or specify how they should be estimated."[80] Problematically, GAO noted "that [BLM] thought the industry would use venting and flaring technologies if they made economic sense," a perspective which assumes – wrongly – that markets work perfectly in the absence of necessary regulatory signals and is belied by the lack of information about the magnitude of methane waste and the documented, if still poorly understood, barriers to the deployment of GHG reduction technologies and practices. *Id*. at 20-33. Compounding the problem, GAO also "found a lack of consistency across BLM field offices regarding their understanding of which intermittent volumes of lost gas should be reported to [the Oil and Gas Operations Report]." *Id*. at 11. BLM, to its credit, conceded "existing guidance was outdated given current technologies and said that they were planning to update it by the second quarter of 2012." *Id*. at 27.

Indeed, a Report released by NRDC identified that "[c]apturing currently wasted methane for sale could reduce pollution, enhance air quality, improve human health, conserve energy resources, and bring in more than $2 billion of additional revenue each year."[81] Moreover, the

[80] *See* GAO-11-34 (2010) at 11, 27 (attached above as Exhibit 47).
[81] Susan Harvey, et al., *Leaking Profits: The U.S. Oil and Gas Industry Can Reduce Pollution, Conserve Resources, and Make Money by Preventing Methane Waste* (March 2012) (attached as Exhibit 76).

Report further identified ten technically proven, commercially available, and profitable methane emission control technologies that together can capture more than 80 percent of the methane currently going to waste. *Id.* Similar to the practices identified above, such technologies must be considered in BLM's alternatives analysis, especially since many of them are included as mandatory requirements in the proposed BLM methane waste rule.

Preventing GHG pollution and waste is particularly important in the natural gas context, where there is an absence of meaningful lifecycle analysis of the GHG pollution emitted by the production, processing, transmission, distribution, and combustion of natural gas. Although natural gas is often touted as a 'cleaner' alternative to dirty coal, as noted above, recent evidence indicates that we must first take immediate, common sense action to reduce GHG pollution from natural gas before it can be safely relied on as an effective tool to transition to a clean energy economy (a noted priority of this Administration).[82] A recent report by Climate Central addresses the leak rates estimated by various sources and the impacts of this new information on assertions that natural gas is a cleaner fuel than coal, ultimately concluding that given the losses from oil and gas sources it would be decades before switching electricity generation from coal to natural gas could bring about significant reductions in emissions.[83]

Oil and natural gas systems are the biggest contributor to methane emissions in the United States, accounting for over one quarter of all methane emissions.[84] In light of serious controversy and uncertainties regarding GHG pollution from oil and gas development, the agencies quantitative assessment should account for methane's long-term (100-year) global warming impact and, also, methane's short-term (20-year) warming impact using the latest peer-reviewed science to ensure that potentially significant impacts are not underestimated or ignored. *See* 40 C.F.R. § 1508.27(a) (requiring consideration of "[b]oth short- and long-term effects").

EPA's GHG Inventory – which BLM has historically relied upon in its analysis – assumes that methane is 21 times as potent as carbon dioxide ("CO_2") over a 100-year time horizon,[85] a global warming potential ("GWP") based on the Intergovernmental Panel on

---

[82] Robert W. Howarth, *Assessment of the Greenhouse Gas Footprint of Natural Gas from Shale Formations Obtained by High-Volume, Slick-Water Hydraulic Fracturing* (Rev'd. Jan. 26, 2011) (attached as Exhibit 77); *see also* Robert W. Howarth et al., *Venting and Leaking of Methane from Shale Gas Development: Response to Cathles et al.* (2012) (attached as Exhibit 78); Eric D. Larson, PhD, Climate Central, *Natural Gas and Climate Change* (May 2013) (attached as Exhibit 79).

[83] *See* Larson, attached above as Exhibit 79.

[84] *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011* (attached as Exhibit 75).

[85] *See* 2013 Revisions to the Greenhouse Gas Reporting Rule, 78 Fed. Reg. 19802 (proposed April 2, 2013) (EPA proposal to increase methane's GWP to 25 times CO_2).

Climate Change's ("IPCC") Second Assessment Report from 1996.[86] However, the IPCC recently updated their 100-year GWP for methane, substantially increasing the heat-trapping effect to 34.[87] A Supplementary Information Report ("SIR"), prepared for BLM's oil and gas leasing program in Montana and the Dakotas, further explains that GWP "provides a method to quantify the cumulative effect of multiple GHGs released into the atmosphere by calculating carbon dioxide equivalent (CO_2e) for the GHGs." SIR at 1-2.[88] However, substantial questions arise when you calibrate methane's GWP over the 20-year planning and environmental review horizon used in the SIR and, typically, by BLM. *See* SIR at 4-1 thru 4-45 (discussing BLM-derived reasonably foreseeable development potential in each planning area). Over this 20-year time period, the IPCC's new research has calculated that methane's GWP is 87[89] – yet another substantial increase from its earlier estimate of 72, which was still over three times as potent as otherwise assumed by the SIR.[90]

However, recent peer-reviewed science demonstrates that gas-aerosol interactions amplify methane's impact such that methane is actually 105 times as potent over a twenty year time period.[91] This information suggests that the near-term impacts of methane emissions have been significantly underestimated. *See* 40 C.F.R. § 1508.27(a) (requiring consideration of short and long term effects). Further, by extension, BLM has also significantly underestimated the near-term benefits of keeping methane emissions out of the atmosphere. 40 C.F.R. §§ 1502.16(e), (f); *id*. at 1508.27. These estimates are important given the noted importance of near

---

[86] INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *Second Assessment Report* (1996) (attached as Exhibit 52); *see also* U.S. Environmental Protection Agency, *Methane,* available at: http://www.epa.gov/outreach/scientific.html.

[87] *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *Working Group I Contribution to the IPCC Fifth Assessment Report, Climate Change 2013: The Physical Science Basis,* at 8-58 (Table 8.7) (Sept. 2013) (attached as Exhibit 80).

[88] BLM, *Climate Change, Supplementary Information Report, Montana, North Dakota and South Dakota* (2010) available at: www.blm.gov/mt/st/en/prog/energy/oil_and_gas/leasing/leasingEAs.html (attached as Exhibit 81).

[89] *See* IPCC *Physical Science Report,* Chapter 8 at 714 Table 8.7 & note b, attached above as Exhibit 80.

[90] *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Climate Change 2007: The Physical Science Basis,* Ch. 2, p. 212, Table 2.14, available at: www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html (attached as Exhibit 82).

[91] Drew Shindell et al., *Improved Attribution of Climate Forcing to Emissions*, SCIENCE 2009 326 (5953), p. 716, available at: www.sciencemag.org/cgi/content/abstract/326/5953/716 (attached as Exhibit 83).

term action to ameliorate climate change – near term action that scientists say should focus, among other things, on preventing the emission of short-lived but potent GHGs like methane while, at the same time, stemming the ongoing increase in the concentration of carbon dioxide.[92] These uncertainties necessitate analysis in the Crescent Point NEPA process. 40 C.F.R. §§ 1508.27(a), (b)(4)-(5).

Additional serious, yet unaddressed uncertainties pertain to the magnitude of methane pollution from oil and gas emissions sources. As provided in the most recent EPA Inventory of Emissions and Sinks: 1990-2011, "[f]urther research is needed in some cases to improve the accuracy of emission factors used to calculate emissions from a variety of sources;" specifically citing the lack of accuracy in emission factors applied to methane sources.[93] A lack of data reliability has resulted in notable variation in methane emissions reporting from year to year. For example, in a Technical Support Document ("TSD") prepared for EPA's mandatory GHG reporting rule for the oil and gas sector for 2012, EPA determined that several emissions sources were projected to be "significantly underestimated."[94] EPA thus provided revised emissions factors for four of the most significant underestimated sources that ranged from ten times higher (for well venting from liquids unloading) to as many as 3,500 and 8,800 times higher (for gas well venting from completions and well workovers of unconventional wells).[95] When EPA accounted for just these four revisions, it more than doubled the estimated GHG emissions from oil and gas production, from 90.2 million metric tons of CO_2 equivalent ("$MMTCO_2e$") to 198.0 $MMTCO_2e$.[96] However, these emission estimates are based on an outdated GWP of 21. Using the IPCCs new 100-year GWP for methane of 36, that is 320.5 $MMTCO_2e$, and, considering a 20-year GWP of 87, that is 792.0 $MMTCO_2e$ – or, respectively, the equivalent emissions from 90.7 or 224 coal fired power plants that is wasted annually. These upward revisions were based primarily on EPA's choice of data set, here, having replaced Energy Information Administration ("EIA") data with emissions data from an EPA and Gas Research Institute ("GRI") study. In the

---

[92] *See, e.g., Limiting Global Warming: Variety of Efforts Needed Ranging from 'Herculean' to the Readily Actionable, Scientists Say*, SCIENCE DAILY (May 4, 2010), available at: http://www.sciencedaily.com/releases/2010/05/100503161328.htm; *see also* Veerabhadran Ramanathan, et. al., *The Copenhagen Accord for Limiting Global Warming: Criteria, Constraints, and Available Avenues* (Feb. 2010) (attached as Exhibit 84).

[93] *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011*, at 1-19 (attached as Exhibit 75).

[94] U.S. Environmental Protection Agency, *Greenhouse Gas Emissions Reporting from the Petroleum and Natural Gas Industry: Background Technical Support Document*, at 8, available at: https://www.epa.gov/sites/production/files/2015-05/documents/subpart-w_tsd.pdf (attached as Exhibit 85).

[95] *Id*. at 9, Table 1; *see also Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011* (attached as Exhibit 75).

[96] *See* EPA, *GHG Emissions Reporting* at 10, Table 2 (attached as Exhibit 85).

current year, EPA relied on yet another set of data; this time from an oil and gas industry survey of well data conducted by the American Petroleum Institute ("API") and the American Natural Gas Alliance ("ANGA").[97] The API/ANGA survey was conducted in response to EPA's upward adjustments in the previous GHG inventory, noting that "[i]ndustry was alarmed by the upward adjustment," and focused specifically on emissions from liquids unloading and unconventional gas well completions and workovers.[98] Overall, the survey found that revising emissions from these two sources alone would reduce EPA oil and gas methane emissions estimates, which resulted in reported oil and gas production emissions at 100 $MMTCO_2e$ pursuant to the EPA's GHG Reporting Program.[99]

To provide a specific example of these differing data sets, EPA previously used an emissions factor of 3 thousand standard cubic feet ("Mcf") of gas emitted to the atmosphere per well completion in calculating its GHG inventory. EPA determined that this figure was significantly underestimated and that a far more accurate emissions factor was 9,175 Mcf per well.[100] The API/ANGA study suggested that this emission factor is 9,000 Mcf.[101] However, these emissions factors are simply broad, generalized estimates for well emissions across the nation, and can vary significantly from one geologic formation to the next. For example, emissions reported in the Piceance Basin are as high as 22,000 Mcf of gas per well.[102]

Despite this variability in methane pollution data, what remains clear is that inefficiencies and leakage in oil and gas production result in a huge amount of avoidable waste and emissions, and, conversely, a great opportunity for the BLM to reduce GHG emissions on our public lands. Many of these uncertainties and underestimates, as EPA has explained, are a result of the fact that emissions factors were "developed prior to the boom in unconventional well drilling (1992) and in the absence of any field data and does not capture the diversity of well completion and workover operations or the variance in emissions that can be expected from different hydrocarbon reservoirs in the country." *Mandatory GHG Reporting Rule*, 75 Fed. Reg. 18608,

---

[97] *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011*, at 3-63 (attached as Exhibit 75).

[98] API/ANGA, *Characterizing Pivotal Sources of Methane Emissions from Natural Gas Production: Summary and Analysis of API and ANGA Survey Responses*, Sept. 2012, at 1 (attached as Exhibit 86).

[99] *See* EPA, Petroleum and Natural Gas Systems: 2011 Data Summary (for 2013 GHG Reporting), at 3 (attached as Exhibit 58).

[100] *See* EPA, *GHG Emissions Reporting*, at Appendix B at 84-87 (attached as Exhibit 85).

[101] *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011*, at 3-69 (attached as Exhibit 75).

[102] *See, e.g.*, EPA, Natural Gas STAR Program, *Recommended Technologies and Practices for Wells*, available at: www.epa.gov/gasstar/tools/recommended.html.

18621 (April 12, 2010). These underestimates are also caused by the dispersed nature of oil and gas equipment – rather than a single, easily grasped source, such as a coal-fired power plant, oil and gas production consists of large numbers of wells, tanks, compressor stations, pipelines, and other equipment that, individually, may appear insignificant but, cumulatively, may very well be quite significant. While dispersed, oil and gas development is nonetheless a massive, landscape-scale industrial operation – one that just happens to not have a single roof. BLM, as the agency charged with oversight of onshore oil and gas development, therefore has an opportunity to improve our knowledge base regarding GHG emissions from oil and gas production, providing some measure of clarity to this important issue by taking the requisite "hard look" NEPA analysis as part of its decisionmaking for the proposed action.[103]

Convincing evidence also exists to support the consideration of alternatives that would attach meaningful stipulations to areas open to oil and gas development. As a prime contributor to short-term climate change over the next few decades, methane is a prime target for near-term GHG reductions. In fact, there are many proven technologies and practices already available to reduce significantly the methane emissions from oil and gas operations, as mentioned above and further detailed below. These technologies also offer opportunities for significant cost-savings from recovered methane gas. Moreover, new research indicates that tropospheric ozone and black carbon ("BC") contribute to both degraded air quality and global warming, and that emission control measures can reduce these pollutants using current technology and experience.[104] Employment of these strategies will annually avoid a substantial number of premature deaths from outdoor air pollution, as well as increase annual crop yields by millions of metric tons due to ozone reductions. Indeed, reducing methane emissions is important not only to better protect the climate, but also to prevent waste of the oil and gas resource itself and the potential loss of economic value, including royalties. BLM should evaluate these technologies, analyzing the benefits of technological implementation versus current agency requirements.

These benefits – as well as the proven, cost-effective technologies and practices that achieve these benefits – are documented by EPA's "Natural Gas STAR" program, which encourages oil and natural gas companies to cut methane waste to reduce climate pollution and recover value and consolidates the lessons learned from industry for the benefit of other companies and entities with oil and gas responsibilities such as BLM.[105] EPA has identified well over 100 proven technologies and practices to reduce methane waste from wells, tanks, pipelines, valves, pneumatics, and other equipment and thereby make operations more efficient.[106] Though

[103] In this context, the 2010 SIR, while providing a basic literature review of GHG emissions sources, is merely a starting point for BLM's responsibility to take a hard look at GHG emissions in the context of foreseeable drilling operations in the geologic formations proposed for leasing.

[104] Drew Shindell, et al., *Simultaneously Mitigating Near-Term Climate Change and Improving Human Health and Food Security*, SCIENCE 2012 335, at 183 (attached as Exhibit 88).

[105] *See generally*, EPA, Natural Gas STAR Program, available at: www.epa.gov/gasstar/.

[106] *See* EPA, Natural Gas STAR Program, *Recommended Technologies and Practices*, available at: www.epa.gov/gasstar/tools/recommended.html.

underutilized, EPA's Natural Gas STAR suggests the opportunity to dramatically reduce GHG pollution from oil and gas development, *if* its identified technologies and practices were implemented at the proper scale and supported by EPA's sister agencies, such as BLM. For calendar year 2010, EPA estimated that this program avoided 38.1 million metric tons CO_2 equivalent, and added revenue of nearly $376 million in natural gas sales (at $4.00/Mcf) – revenue which translates into additional royalties to federal and state governments for the American public.[107] BLM must consider these emission reduction strategies in its NEPA analysis, both to address impacts of the proposed action, as well as to satisfy the requirements of SO 3226, FLPMA, and the MLA.

4. Managing for Community and Ecosystem Resiliency.

Re·sil·ience is "an ability to recover from or adjust easily to misfortune or change." MERRIAM-WEBSTER COLLEGIATE DICTIONARY (11th ed. 2008). In the context of climate change and the many resultant impacts, such as the alteration to the biosphere and impairments to human health, the resiliency of our landscapes and a community's ability to respond and adapt to these changes takes on a new magnitude of importance.

Beyond mitigating climate change by reducing contributions of GHG pollution to the atmosphere, the BLM can also help promote ecological resiliency and adaptability by reducing external anthropogenic environmental stresses (like oil and gas development) as a way of best positioning public lands and the communities that rely on those public lands to withstand what is acknowledged ongoing and intensifying climate change degradation. It is crucial for the BLM to close the gap in their decisionmaking regarding the cumulative contribution of oil and gas development authorized in the proposed action, particularly given the conflict between such authorization and the agency's responsibility to manage for healthy, resilient ecosystems. Quite simply, continuing to manage our public lands in a manner that allows for the virtually unabated extraction of mineral resources is incompatible with principals of ecosystem resilience. Agency decisionmaking, both at the leasing stage and in future site-specific implementation, must be reflective of the climate challenges we now face.

The BLM must consider the resilience of our communities and their ability to adapt and respond to climate change in its NEPA analysis. Although not specifically in the context of climate change, Congress has recognized the value that farmlands play in the welfare of people

---

[107] *See* EPA, Natural Gas STAR Program, *Accomplishments*, available at: www.epa.gov/gasstar/accomplishments/index.html#three (attached as Exhibit 89). BLM should also take a look at EPA's more detailed program accomplishments to provide a measure of what BLM could itself accomplish, and to understand the nature of the problem and opportunities. Also of interest, for calendar year 2008, EPA estimated that its program avoided 46.3 million tons of CO_2 equivalent, equal to the annual GHG emissions from approximately 6 million homes per year, and added revenue of nearly $802 million in natural gas sales. To speculate, the calendar year 2009 declines are likely associated with ongoing economic and financial stagnation and the low price of natural gas that has slowed natural gas drilling and production.

and our communities. *See* 7 U.S.C.A. §§ 4201(a)(1) ("the Nation's farmland is a unique natural resource and provides food and fiber necessary for the continued welfare of the people of the United States"); (a)(3) ("continued decrease in the Nation's farmland base may threaten the ability of the United States to produce food and fiber in sufficient quantities to meet domestic needs"); and (a)(5) ("Federal actions, in many cases, result in the conversion of farmland to nonagricultural uses where alternative actions would be preferred"). Any action taken that undermines a community's welfare and capacity to provide for itself in the face of recognized changes to climate – such as the largely unabated development of oil and gas resources – fails to realize the agency's multiple use mandate under FLPMA, and, further, is indefensible pursuant to BLM's mandate to act as stewards of our public lands.

The myriad impacts that will result from the agency's decisionmaking must be considered within the context of resiliency. Although the BLM may recognize the threat of climate change, the agency's decisionmaking must also be reflective of this harm and take the many necessary and meaningful steps to ameliorate the impacts to communities, landscapes, and species. As discussed above, climate change is dramatically altering the relationship between human kind and the environment in which we live. It is incumbent on the agency to not only takes steps to stem the pace of climate change through the practical implementation of mitigation technologies but, also, to position communities in a way that allows them to adjust and recover from the climate change impacts that they are already experiencing. Such critical consideration of agency decisionmaking is required if we are to meaningfully respond to the vast scale of impacts that we face.

As recognized by the EPA in the context of the adjacent Monument Butte project, there exist climate scenarios that can and should be used to inform the climate adaptation measures considered via NEPA analysis:

> As the BLM proceeds with implementation of the selected alternative, the EPA recommends considering climate adaptation measures based on how future climate scenarios may impact the project. The National Climate Assessment (NCA), released by the U.S. Global Change Research Program contains scenarios for regions and sectors, including energy and transportation. We recommend that the BLM use NCA or other peer reviewed climate scenarios to inform implementation because this can improve resilience and preparedness for climate change. Changing climate conditions can affect a proposed project, as well as the project's ability to meet the purpose and need presented in the Final EIS. If impacts may be exacerbated by climate change, additional mitigation measures may be warranted. For example, remediation of disturbed sites may become more challenging if the project area becomes hotter and drier.

Monument Butte ROD at 134. Here, likewise, the BLM should use climate scenarios to guide mitigation measures to improve resilience and preparedness for climate change.

C. The BLM Must Analyze or Assess Air Pollution Impacts, Including Greenhouse Gas Emissions as Connected Actions or at a Minimum as Indirect Impacts.

Under NEPA, the direct, indirect, and cumulative impacts of connected actions must be analyzed in the same NEPA document. This is to ensure that potentially significant impacts are not overlooked or otherwise minimized when determining whether an action will have a significant impact on the environment. As the Tenth Circuit Court of Appeals has explained: "One of the primary reasons for requiring an agency to evaluate 'connected actions' in a single NEPA analysis is to prevent agency from minimizing the potential environmental consequences of a proposed action (and thus short-circuiting NEPA review) by segmenting or isolating an individual action that, by itself, may not have a significant environmental impact." *Citizens' Committee to Save our Canyons v. U.S. Forest Service,* 297 F.3d 1012, 1029 (10th Cir. 2002) (citations omitted).

An action is "connected" if it is "closely related" to other actions and is identified based on three factors in NEPA's implementing regulations. Actions are "connected" if they:

> (i) automatically trigger other actions which may require environmental impact statements.
> (ii) cannot or will not proceed unless other actions are taken previously or simultaneously.
> (iii) are interdependent parts of a larger action and depend on the larger action for their justification.

40 C.F.R. § 1508.25(a)(1). To determine whether actions are connected, the 10th Circuit applies the "independent utility test," which asks whether "each of the two projects *would* have taken place with or without the other" *Wilderness Workshop v. U.S. Bureau of Land Mgmt.*, 531 F. 3d 1220, 1229 (10th Cir. 2008) (emphasis added) (quoting *Great Basin Mine Watch v. Hankins*, 456 F.3d 955, 969 (9th Cir. 2006).

Here, the BLM must analyze and assess the impacts of several connected actions in terms of their air quality impacts, particularly to national ambient air quality standards ("NAAQS"), and greenhouse gas impacts, including the direct and indirect impacts of off-site trucking, refining, and greenhouse gas emissions from oil and gas combustion.

Although we believe that the impacts of off-site trucking, refining, and greenhouse gas emissions from oil and gas combustion are connected actions, the EIS must at least analyze and assess these consequences as indirect impacts. In comments on the adjacent Monument Butte project, the EPA urged the BLM to quantify indirect GHG emissions caused by the project:

> While the Final EIS estimates the direct greenhouse gas (GHG) emissions caused by the proposed project, it should also quantify indirect GHG emissions caused by the proposal and its alternatives, including emissions associated with the end use of the oil and gas due

> to the reasonably close causal relationship to the project and as provided in the [CEQ Climate Guidance] on August 1, 2016. Example tools for estimating and quantifying GHG emissions can be found on CEQ's NEPA.gov website. These emissions levels can serve as a basis for comparison of the alternatives with respect to GHG impacts.

Monument Butte ROD at 131. In response to EPA's comment, in its Record of Decision for the Monument Butte project, BLM did provide a "rough estimate of possible indirect CO2 emissions . . . for informational purposes." *Id.* Likewise, in the NEPA analysis for Crescent Point, BLM must provide an estimate of indirect CO2 emissions, as urged by EPA and as already attempted by the Vernal Field Office for the adjacent Monument Butte project. Moreover, the analysis of indirect emissions for the Crescent Point project should include, in addition to combustion emissions, emissions from off-site trucking and refining as described above.

II. BLM's Proposed Actions Must Comply with FLPMA.

The BLM has a duty to ensure compliance with federal air quality standards in accordance with the Federal Land Policy and Management Act ("FLPMA"). *See* 43 U.S.C. § 1712(c)(8). Moreover, FLPMA and BLM's own regulations explicitly provide for protection of air resources. *See* 43 U.S.C. § 1701(a)(8) (stating the public lands shall be "managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values").

FLPMA specifically states that BLM land use plans shall, "provide for compliance with applicable pollution control laws, including State and Federal air, water, noise, or other pollution standard or implementation plans." *Id*. BLM regulations further mandate that "each land use authorization" shall "require compliance with air and water quality standards established pursuant to applicable Federal or State law." 43 C.F.R. § 2920.7(b)(3). FLPMA's requirement to ensure compliance with air quality standards is, therefore, mandatory. *Cal. Coastal Comm'n v. Granite Rock Co.*, 480 U.S. 572, 587 (1987).

It does not appear that the 2008 Vernal Resource Management Plan ("RMP") is in compliance with FLPMA. As noted, FLPMA explicitly mandates that land use plans must provide for compliance with applicable federal air quality standards. *See* 43 U.S.C. § 1712(c)(8). Here, it does not appear that the Vernal RMP explicitly provides for compliance with federal air standards. In particular, the Air Quality Management Decisions in the 2008 RMP do not explicitly state that the BLM shall ensure compliance with federal air standards. *See* 2008 RMP at 70. This is of significant concern because it allows the BLM to flout compliance with the NAAQS for ozone and other pollutants. Because the NAAQS are federal air standards, the failure of the RMP to require compliance is contrary to FLPMA. BLM must also comply with its project-level obligations to ensure that all land use authorizations comply with federal air quality standards.

The BLM may not claim that it is only obligated to ensure the operator complies with state and federal air quality regulations. Such a claim violates FLPMA's plain and unambiguous language, and also appears flatly contrary to the agency's own regulations. FLPMA and applicable regulations require compliance with federal air quality standards. Although reliance

on federal and state air quality regulations may be appropriate where such standards are clearly protecting the NAAQS, where such standards are not protecting the NAAQS – such as in the Uinta Basin – the BLM has an affirmative and independent duty to protect air standards and ensure compliance with the NAAQS.

III. The BLM Must Analyze Impacts on Endangered Fish Populations and Water Supply.

The project at issue would foreseeably entail significant water depletions within the Upper Colorado River Basin, increased surface disturbance, and toxic spills from hydraulic fracturing and horizontal drilling, all of which can adversely affect endangered fish that inhabit areas within and downstream of the project. BLM must analyze in the EIS the impacts of new drilling and fracking on Upper Colorado River Basin ("Upper Basin") water supplies and the four Colorado River endangered fish—the Colorado pikeminnow, humpback chub, razorback sucker, and bonytail—and must consult with Fish and Wildlife Service regarding these effects. Such an analysis and Section 7 consultation must take into account: (a) the potential for increased water depletions from horizontal drilling, fracking, and waterflood injection within the project area; (b) climate change effects on Upper Colorado River Basin stream flows; (c) long-term drought and increased water demand which have drastically reduced water supplies; (d) mercury and selenium pollution effects on the endangered fish; and (e) declining humpback chub and Colorado pikeminnow populations and failure to meet these populations' recovery targets.

Recently, BLM recognized that it must consider many of the above factors in considering the water depletion effects of oil and gas development in its western Colorado field offices on the endangered fish.[108] The last time it consulted FWS over these depletion effects was in 2008.[109] As a result, BLM is now preparing an updated programmatic biological assessment for its western Colorado Fluid Mineral Program to take into account this new information.[110] BLM has stated the programmatic biological assessment "may consider information about new drilling techniques [i.e., horizontal drilling] and re-examine the extent and location of fluid mineral reserves by river basin. The PBA will also evaluate how climate change and contaminants (specifically selenium and mercury) are affected by water depletions associated with BLM's fluid mineral program."[111] BLM has since confirmed that it intends to formally reinitiate consultation with FWS on the 2008 biological opinion, in light of this new information, and that these issues cannot be addressed by amending the biological opinion.[112] Likewise, this new

[108] December Protest Decision at 13.

[109] *See* USFWS, Programmatic Biological Opinion for Water Depletions Associated with Bureau of Land Management's Fluid Mineral Program within the Upper Colorado River Basin in Colorado (Dec. 19, 2008) (attached as Exhibit 87).

[110] *Id.*

[111] *Id.*

[112] Tel. comm. between Jay Thompson, BLM Colorado State Office, and Wendy Park, Center for Biological Diversity (Jan. 27, 2017).

information must also be considered in a Section 7 consultation over the Crescent Point project's effects on the endangered fish in the Upper Basin's Green River sub-basin and streams downstream of the project area.

A. Climate Change Is Reducing Stream Flows in the Upper Colorado River Basin.

Anthropogenic climate change is profoundly impacting the Colorado River in ways that are altering temperature, streamflow, and the hydrologic cycle. As detailed below, changes observed to date include rising temperatures, earlier snowmelt and streamflow, decreasing snowpack, and declining runoff and streamflow. Modeling studies project that these changes will only worsen, including continued declines in streamflow and intensification of drought. Climate change is likely to have significant effects on the endangered fish species in the Colorado River basin and the Colorado River ecosystem.

Rising temperatures

The Colorado River basin has warmed significantly during the past century, with average increases in surface temperature of 1.6°F (0.9°C) over the Southwest during 1901-2010 (Hoerling et al. 2013). The greatest warming has occurred in spring and summer, and in daytime high temperatures and nighttime low temperatures (Bonfils et al. 2008, Hoerling et al. 2013). Surface temperatures in the Southwest are projected to increase steeply in this century by an average of 4.5 to 7.9° F depending on the emissions scenario, with an average of 2.5 to 3°F of warming projected for 2021-2050 alone (Cayan et al. 2013). As explained below, warming temperatures are having significant effects on streamflow, drought severity, and the hydrologic cycle in the Southwest (Barnett et al. 2008, Woodhouse et al. 2016).

Earlier snowmelt and streamflow

In much of the Colorado River basin, snowmelt, snowmelt runoff, and streamflow timing have trended earlier since the mid-1950s, in parallel with warming temperatures (Hamlet et al. 2005, Stewart et al. 2005, Barnett et al. 2008, Hoerling et al. 2013, Garfin et al. 2014). The Colorado River basin's spring pulse from 1978-2004 shifted to two weeks earlier compared to flows before 1978 (Ray et al. 2008). Although there are both natural and human influences on these hydrologic trends, studies indicate that anthropogenic greenhouse gases began to impact snow-fed streamflow timing during 1950-1999 (Barnett et al. 2008, Hidalgo et al. 2009, Hoerling et al. 2013). Modeling studies have projected that snowmelt, spring runoff, and streamflow timing will continue to shift earlier across much of the Southwest (Stewart et al. 2004, Rauscher et al. 2008, Dettinger et al. 2015).

Decreasing snowpack

The Colorado River receives most of its water from winter snowpack from the Rocky Mountains, where 15% of the total basin areas generates 85% of the river flow (Dettinger et al. 2015). Across much of the Colorado River basin, the spring snowpack is decreasing and more winter precipitation is falling as rain instead of snow (Hamlet et al. 2005, Pierce et al. 2008, Das et al. 2009). Approximately half of the observed decline in snowpack in the western United States during 1950-1999 has been attributed to the effects of anthropogenic greenhouse gases,

ozone and aerosols (Pierce et al. 2008). Modeling studies project a continued reduction of Southwest mountain snowpack during February through May during this century, largely due to the effects of rising temperatures (Cayan et al. 2013, Dettinger et al. 2015).

Declining Runoff and Streamflow

Annual runoff in the Colorado River basin appears to be declining (USBR 2011), with significant consequences for reduced streamflow. During 2001–2010, warm temperatures and dry conditions reduced average naturalized flows in the Colorado River (measured at Lees Ferry) to the second-lowest-flow decade since 1901, to12.6 million acre-feet per year compared to the 1901–2000 average of 15.0 million acre-feet per year (Hoerling et al. 2013).

Modeling studies project that runoff and streamflow will continue to decrease substantially in the Colorado River basin during this century (Ray et al. 2008, Das et al. 2011, USBR 2011, Cayan et al. 2013, Georgakakos et al. 2014, Dettinger et al. 2015). Barnett and Pierce (2009) concluded that anthropogenic climate change is likely to reduce runoff in the Colorado River basin by 10-30% by 2050. Projected reductions in runoff range from 6-7% (Christensen and Lettenmaier 2007) to 45% (Hoerling and Eischeid 2007) depending on the models and methods used in each study (see Barnett and Pierce 2009 at Table 2). In the short term, Hoerling and Eischeid (2007) predict streamflow to decrease by 25% during 2006-2030, and by 45% during 2035-2060.

Importantly, numerous studies show that warming temperatures alone will cause runoff and streamflow declines in the Colorado River basin. For example, in a recent review, Vano et al. (2014) estimated that future streamflow in the Colorado River basin will be reduced by 5% to 35% due to rising temperature alone. When precipitation change is considered, a 5% decrease in precipitation would further reduce streamflow by 10% to 15% (Vano et al. 2014).

Moreover, warming temperatures will play an increasingly important role in causing runoff to decline in the Colorado River basin, and must be factored into streamflow forecasts (Woodhouse et al. 2016). An empirical study of the influence of precipitation, temperature, and soil moisture on upper Colorado River basin streamflow over the past century found that warmer temperatures have already resulted in flows less than expected based on precipitation levels (Woodhouse et al. 2016). Consistent with past research, the study found that cool season precipitation explains most of the variability in annual streamflow. However, temperature was highly influential in determining streamflow under certain conditions. The study concluded that "[s]ince 1988, a marked increase in the frequency of warm years with lower flows than expected, given precipitation, suggests continued warming temperatures will be an increasingly important influence in reducing future UCRB water supplies." The researchers warned that "streamflow forecasts run the risk of overprediction if warming spring and early summer temperatures are not adequately considered."

According to the study's press release it is the "first to examine the instrumental historical record to see if a temperature effect [on stream flows] could be detected."[113] The study's lead author highlighted its significance: "If we have a warmer spring, we can anticipate that the flows will be less relative to the amount of snowpack[.]….What we're seeing is not just the future – it's actually now. That's not something I say lightly."[114]

Increasing Drought Severity

Historically, droughts in the Colorado River basin were primarily driven by precipitation deficits. However, studies indicate that rising temperatures have begun to play a more important role in driving droughts (Hoerling et al. 2013, Vano et al. 2014). Importantly, rising temperature superimposed on natural drought variability is expected to exacerbate the impacts of droughts (Seager et al. 2012, Cook et al. 2015). Modeling studies project that droughts in Southwest will intensify due to longer periods of dry weather and more extreme heat, leading to higher evapotranspiration and moisture loss (Seager et al. 2007, Cayan et al. 2010, Trenberth et al. 2013). In the Colorado River basin, future droughts are projected to be substantially hotter, and drought is projected to become more frequent, intense, and longer lasting than in the historical record (Garfin et al. 2014).

Reduced reservoir levels and unsustainable demand for water

Of the more than 90 reservoirs on the river and its tributaries, the two largest are Lake Mead and Lake Powell which together can store up to 85% of the total flow for the basin combined (Christensen et al. 2004). Reservoirs in the Colorado River basin are highly vulnerable to climate change, particularly because the amount of storage in reservoirs is sensitive to runoff changes (Barnett and Pierce 2008). Even small decreases in runoff have caused average reservoir levels to markedly decrease (Christensen et al. 2004). Christensen et al. (2004) predicted that climate change impacts on the hydrology of the Colorado River system would result in water demand (deliveries and evaporation) exceeding reservoir inflows (which would also be decreased), resulting in a degraded system. Likewise, Barnett and Pierce (2008) projected that a 10% reduction in runoff would result in requested water deliveries surpassing sustainable deliveries by 2040, while a 20% reduction in runoff would cause unsustainable water demands by 2025. A greater demand than supply makes the system more prone to long-term sustained droughts, as reservoirs will not have sufficient time to be naturally replenished and more water will be extracted from a dwindling supply than is sustainable (Christensen and Lettenmaier 2007). Reservoirs would spend additional time in a depleted state, weakening the system's buffering ability in years where there is low precipitation (Barnett and Pierce 2009).

***

[113] American Geophysical Union, Colorado River Flows Reduced by Warmer Spring Temperatures (March 9, 2016), available at http://news.agu.org/press-release/colorado-river-flows-reduced-by-warmer-spring-temperatures/.

[114] *Id.*

In addition to reducing the overall amount of water in the Upper Colorado River Basin, these climate change effects would worsen effects from toxic spills (discussed in more detail below) by increasing the concentration of pollutants and toxic contaminants. Climate change is also likely to exacerbate mercury pollution effects on the Colorado pikeminnow. Mercury deposited into soil from coal burning will increasingly run off into streams with increased heavy rainfall events.[115] More frequent and severe wildfire events will result in increased charring of soil, releasing mercury that can wash off into streams.[116] Warmer water conditions will hasten the conversion of mercury into toxic methylmercury.[117]

Ample evidence, including empirical research, demonstrates that climate change is already reducing stream flows in the Colorado River Basin and that flows will continue to dwindle as Colorado Basin temperatures rise. BLM must take into account these climate change effects on the endangered fish, in connection with its evaluation of the proposed Crescent Point project's water depletion effects.

References

Ault, Toby R. et al., Relative Impacts of mitigation, temperature, and precipitation on 21st-century megadrought risk in the American Southwest, Science Advances. 2016;2: e1600873 (attached as Exhibit 90).

Barnett, T. P., et al. 2008. Human-induced changes in the hydrology of the western United States. Science 319: 1080–1083 (attached as Exhibit 91).

Barnett, T.P. and D.W. Pierce. 2008. When will Lake Mead go dry? Water Resources Research 44: W03201 (attached as Exhibit 92).

Barnett, T.P. and D.W. Pierce. 2009. Sustainable water deliveries from the Colorado River in a changing climate. PNAS 106: 7334-7338 (attached as Exhibit 93).

Bonfils, C., et al. 2008. Detection and attribution of temperature changes in the mountainous western United States. Journal of Climate 21: 6404–6424 (attached as Exhibit 94).

Cayan, D.R., T. Das, D.W. Pierce, T.P. Barnett, M. Tyree, and A. Gershunov. 2010. Future dryness in the southwest US and the hydrology of the early 21st century drought. PNAS 107: 21227-21276 (attached as Exhibit 95).

Cayan, D. et al. 2013. Future climate: projected average. Pages 101–125 in G. Garfin, A. Jardine, R. Merideth, M. Black, and S. LeRoy, editors. Assessment of climate change in the southwest United States: a report prepared for the National Climate Assessment. A report by the Southwest Climate Alliance. Island Press, Washington, D.C., USA.

Christensen, N.S., Wood, A.W., Voisin, N., Lettenmaier, D.P., and R.N. Palmer. 2004. The effects of climate change on the hydrology and water resources of the Colorado River basin. Climatic change 62: 337-363 (attached as Exhibit 96).

[115] National Wildlife Federation, Swimming Upstream: Freshwater Fish in a Warming World, 19 (2013), available at http://www.nwf.org/~/media/PDFs/Global-Warming/Reports/NWF-Swimming%20Upstream-082813-B.ashx (attached as Exhibit 121).

[116] *Id*.

[117] *Id*.

Christensen, N.S. and D.P. Lettenmaier. 2007. A multimodel ensemble approach to assessment of climate change impacts on the hydrology and water resources of the Colorado River basin. Hydrology and Earth System Sciences 11: 417-1434 (attached as Exhibit 97).

Colorado River Research Group, Climate Change and the Colorado River: What We Already Know (Oct. 2016), available at http://www.coloradoriverresearchgroup.org/uploads/4/2/3/6/42362959/crrg_climate_change.pdf (attached as Exhibit 98).

Cook, B.I., T.R. Ault, and J.E. Smerdon. 2015. Unprecedented 21st century drought risk in the American Southwest and Central Plains. Sci. Adv. 1: e1400082–e1400082 (attached as Exhibit 99).

Das, T., H. G. Hidalgo, M. D. Dettinger, D. Cayan, D. W. Pierce, C. Bonfils, T. P. Barnett, G. Bala, and A. Mirin. 2009. Structure and detectability of trends in hydrological measures over the western United States. Journal of Climate 10: 871-892 (attached as Exhibit 100).

Das, T., Pierce, D.W., Cayan, D.R., Vano, J.A., and D.P. Lettenmaier. 2011. The importance of warm season warming to western US streamflow changes. Geophysical Research Letters 38(23) (attached as Exhibit 101).

Dettinger, M., B. Udall, and A. Georgakakos. 2015. Western water and climate change. Ecological Applications 25: 2069-2093 (attached as Exhibit 102).

Garfin, G., G. Franco, H. Blanco, A. Comrie, P. Gonzalez, T. Piechota, R. Smyth, and R. Waskom, 2014: Ch. 20: Southwest. Climate Change Impacts in the United States: The Third National Climate Assessment, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 462-486 (attached as Exhibit 103).

Georgakakos, A., P. Fleming, M. Dettinger, C. Peters-Lidard, T.C. Richmond, K. Reckhow, K. White, and D. Yates. 2014. Water resources. Pages 69–112 in J. M. Melillo, T. C. Richmond, and G. W. Yohe, editors. Climate change impacts in the United States: the third National Climate Assessment. U.S. Global Change Research Program, Washington, D.C., USA (attached as Exhibit 104).

Hamlet, A., P.W. Mote, M.P. Clark, and D.P. Lettenmaier. 2005. Effects of temperature and precipitation variability on snowpack trends in the western United States. Journal of Climate 18: 4545-4561 (attached as Exhibit 105).

Harding, B. L., Wood, A. W. and J.R. Prairie. 2012. The implications of climate change scenario selection for future streamflow projection in the Upper Colorado River basin. Hydrology and Earth System Sciences 16: 3989-4007 (attached as Exhibit 106).

Hidalgo, H. G., T. Das, M. D. Dettinger, D. Cayan, D.W. Pierce, T. P. Barnett, G. Bala, A. Mirin, A.W. Wood, C. Bonfils, B.D. Santer, and T. Nozawa. 2009 Detection and attribution of streamflow timing changes to climate change in the western United States. Journal of Climate 22: 3838-3855 (attached as Exhibit 107).

Hoerling, M. and J. Eischeid. 2007. Past peak water in the Southwest. Southwest Hydrology 35: 18–19 (attached as Exhibit 108).

Hoerling, M. P., M. Dettinger, K. Wolter, J. Lukas, J. Eischeid, R. Nemani, B. Liebmann, and K. E. Kunkel. 2013. Evolving weather and climate conditions of the Southwest United States. Pages 74–100 in G. Garfin, A. Jardine, M. Black, R. Merideth, J. Overpeck, and A. Ray, editors. Assessment of climate change in the Southwest United States: a report prepared for the National Climate Assessment. Island Press, Washington, D.C., USA (attached as Exhibit 109).

Pierce, D. W., T. P. Barnett, H. G. Hidalgo, T. Das, C. Bonfils, B. D. Santer, G. Bala, M. D. Dettinger, D. Cayan, A. Mirin, A. W. Wood, and T. Nozawa. 2008. Attribution of declining western U.S. snowpack to human effects. Journal of Climate 21: 6425-6444 (attached as Exhibit 110).

Rauscher, S. A., J. S. Pal, N. S. Diffenbaugh, and M. M. Benedetti. 2008. Future changes in snowmelt-driven runoff timing over the western US. Geophysical Research Letters 35: L16703, doi:10.1029/2008GL034424 (attached as Exhibit 111).

Ray, A.J., Barsugli, J.J., Averyt, K.B., Wolter, K., Hoerling, M., Doesken, N. Udall, B. and R.S. Webb. 2008. Climate change in Colorado: a synthesis to support water resources management and adaptation. Report for the Colorado Water Conservation Board. University of Colorado, Boulder (attached as Exhibit 112).

Seager, R., M. Ting, I. Held, Y. Kushnir, J. Lu, G. Vecchi, H. Huang, N. Harnik, A. Leetmaa, N. Lau, C. LI, J. Velez, and N. Naik. 2007. Model projections of an imminent transition to a more arid climate in southwestern North America. Science 316: 1181-1184 (attached as Exhibit 113).

Seager, R., M. Tang, C. Li, N. Naik, J. Nakamura, and H. Lui. 2012. Projections of declining surface-water availability for the southwestern United States. Nature Climate Change doi:10.1038/NCLIMATE1787 (attached as Exhibit 114).

Stewart, I. T., D. R. Cayan, and M. D. Dettinger. 2004. Changes in snowmelt runoff timing in western North America under a 'Business as Usual' climate change scenario. Climatic Change 62: 217-232 (attached as Exhibit 115).

Trenberth, K.E., A. Dai, G. van der Schrier, P.D. Jones, J. Barichivich, K.R. Briffa, and J. Sheffield. 2013. Global warming and changes in drought. Nature Climate Change 4: 17-22 (attached as Exhibit 116).

US Bureau of Reclamation and Colorado River Basin Water Supply and Demand Study Team. 2011. Colorado River basin Water Supply and Demand Study: Technical Report B – Water Supply Assessment. Interim Report No. 1 (attached as Exhibit 117).

U.S. Fish and wildlife Service. 2008. Programmatic Biological Opinion for Water Depletions Associated with Bureau of Land Management's Fluid Mineral Program within the Upper Colorado River basin in Colorado. USDC Colorado (attached as Exhibit 87).

Vano, J. A., Udall, B., Cayan, D. R., Overpeck, J. T., Brekke, L. D., Das, T., Hartmann, H. C., Hidalgo, H. G., Hoerling, M., McCabe, G. J., Morino, K., Webb, R. S., Werner, K. & Lettenmaier, D. P. 2014. Understanding uncertainties in future Colorado River streamflow. Bulletin of the American Meteorological Society 95: 59-78 (attached as Exhibit 119).

Woodhouse, C. A., G. T. Pederson, K. Morino, S. A. McAfee, and G. J. McCabe. 2016. Increasing influence of air temperature on upper Colorado River streamflow. Geophys. Res. Lett. 43, doi:10.1002/2015GL067613 (attached as Exhibit 120).

B. Persistent Drought Conditions and Increasing Water Demand Have Reduced Water Supply.

Compounding this threat to the endangered fish are persistent drought conditions that have diminished natural flows in the Colorado River Basin and reduced water storage that is needed to supplement Upper Basin flows. The period from 2000 to 2015 was the lowest 16-year period for natural flow in the last century, and one of the lowest 16-year periods for natural flow

in the past 1,200 years, according to paleorecords.[118] As a result, water storage in the Colorado River system reservoirs have declined "from nearly full to about half of capacity," and led to local shortages in the Upper Colorado's sub-basins.[119]

Further, population growth will increase water demand for agriculture and municipal uses, making it increasingly difficult to ensure sufficient water availability for the endangered fish, which rely on the release of stored water, especially in dry years.[120] An ever widening gap between water supply and water demand is weakening the Colorado River water supply system's reliability and ability to buffer the system in dry years.[121] According to the U.S. Geological Survey, "increased water demand and declining water availability make the restoration of endangered fish habitat extremely challenging."[122] This growing gap between supply and demand in the Upper Colorado River Basin must be taken into account.

C. Population Numbers of the Endangered Fish Are Declining

Colorado pikeminnow populations are in decline throughout the Green River and Colorado River Basin, indicating that the Recovery Plan for the endangered fish has not been effective and that the impacts of water depletions may be more severe than previously anticipated.

According to the Fish and Wildlife Service, the latest 2014 Colorado River sub-basin population number of 501 is "cause for great concern," and catch of sub-adults and adults in 2013 and 2014 "were near lowest observed in the history of the project."[123] 2015 catch numbers are within the same range, which suggests that the population estimate for 2015 will be similar to

---

[118] Bureau of Reclamation, Managing Water in the West: SECURE Water Act Section 9503(c) Report to Congress, Chapter 3, Colorado River Basin at 3-6 (2016) (attached as Exhibit 122).

[119] *Id*.

[120] *See id*. at 3-7 , 3-8.

[121] *Id*. at 3-10, 3-12.

[122] USGS, Effects of Climate Change and Land Use on Water Resources in the Upper Colorado River Basin, 5 (2010), available at https://pubs.usgs.gov/fs/2010/3123/pdf/FS10-3123.pdf (attached as Exhibit 123).

[123] USFWS, 2014-2015 Assessment of Sufficient Progress Under the Upper Colorado River Endangered Fish Recovery Program in the Upper Colorado River Basin at 23, 36 (Oct. 7, 2015) ("Sufficient Progress Memo") (noting average monthly flows significantly below 810 cfs in 15-mile reach in 2012 and 2013), available at http://www.coloradoriverrecovery.org/documents-publications/section-7-consultation/sufficientprogress/2015_Suff_Progress_Memo.pdf (attached as Exhibit 124);

the 2014 estimate.[124] FWS's latest Sufficient Progress Assessment for the Endangered Fish Recovery Program, which includes the latest population estimates for 2015, show endangered fish populations have continued to decline.[125] In the Colorado River sub-basin, Colorado pikeminnow populations have steadily declined since 2005.[126] The long-term and short-term population estimates of 596 and 446 adults fall far short of the downlisting criteria of 700 adults.[127] Recruitment rates "may not be frequent enough to support stability in the adult populations in the long term."[128] Data from 2015 showing the absence of pikeminnow smaller than 300 mm "suggests spawning success and/or recruitment has been poor the previous three years."[129] Nonnative predation and competition are a major threat to the Colorado pikeminnow population in this sub-basin.[130]

In the Green River sub-basin, pikeminnow populations have dropped since 2000.[131] The overall pattern of population declines strongly suggests a failure to meet the Recovery Program's downlisting criteria that adult point estimates for the middle Green River and lower Green River do not decline significantly over a 5-year period, and that each estimate for the Green River Subbasin exceeds 2,600 adults.[132] "The most recent interpretation (Bestgen et al. 2016; in review) of the estimates collected in 2006-2008 and 2011-2013 revealed a gradual but persistent

---

[124] *See* USFWS, Monitoring the Colorado Pikeminnow Population in the Mainstem Colorado River via Periodic Population Estimates, p. 3 (Nov. 2015), available at http://www.coloradoriverrecovery.org/documents-publications/work-plan-documents/arpts/2015/rsch/127.pdf (showing similar capture rates of pikeminnow in 2014 and 2015) (attached as Exhibit 125).

[125] USFWS, 2015-2016 Assessment of Sufficient Progress Under the Colorado River Endangered Fish Recovery Program in the Upper Colorado River Basin, and Implementation of Action Items in the January 10, 20015, Final Programmatic Biological Opinion on the Management Plan for Endnagered Fishes in the Yampa River Basin, 4-14 (Dec. 20, 2016) ("2016 Sufficient Progress Memo") (attached as Exhibit 131).

[126] *Id*. at 4.

[127] *Id*. at 4, 6.

[128] *Id*. at 4.

[129] *Id*. at 8.

[130] *See id*. at 7.

[131] *Id*. at 4.

[132] *See id.* at 10.

decline in the adult population," which is "clearly negative."[133] The average of the three most recent population estimates (2011-2013) is 1,999 adults, well below the delisting criterion of 2,600 adults.[134]

The Recovery Program has also failed to meet the downlisting criteria that recruitment of age-6, naturally-produced fish equal or exceed mean annual adult mortality. The abundance of adult recruits has failed to exceed annual adult mortality "in most years" and "appears insufficient to offset overall adult mortality since 2000."[135] Compounding this problem, population densities of age-0 fish in the middle Green River from 1994 to 2008 were "precariously low."[136] New research reveals that the "mechanisms driving frequency and strength of recruitment events was likely the strength of age-0 Colorado pikeminnow production in backwater nursery habitats.[137] Further, "multiple consecutive years of age-0 densities" are important to the strength of adult populations seven to ten years later.[138] Research by Bestgen and Hill (2015) shows that declines in summer base flows in August and September were correlated with declining densities of age-0 Colorado pikeminnow in the lower and middle reaches of the Green River.[139] The researchers recommended increased base flow magnitudes to support increased age-0 production (1,700 and 3,000 cfs in the middle Green River and 1,700 and 3,800 cfs in the lower Green River).

In 2015, releases from Flaming Gorge Dam resulted in base flow levels within these ranges, and "a significant increase in fall recruitment was observed, underscoring the value of manipulating Flaming Gorge Dam releases as a main recovery action to benefit Colorado pikeminnow recruitment in the Green River."[140] However, it is unclear to what extent Bureau of Reclamation or other water users have committed to these base flow increases, and whether they will be sustained as water supplies dwindle with increased water demand and climate change effects on stream flows. The Sufficient Progress Assessment only notes that "Reclamation's summer base flow releases [from Flaming Gorge Dam] now target a preferred flow range to improve survival of young Colorado pikeminnow."[141]

---

[133] *Id*. at 8, 10.

[134] *Id*. at 10.

[135] 2016 Sufficient Progress memo at 4.

[136] *Id*.

[137] *Id*. at 11.

[138] *Id*.

[139] *Id*.

[140] *Id*. at 11-12.

[141] *Id*. at 41.

The Yampa River portion of the Green River sub-basin population also "remains low and may be in further decline."[142] Recent studies show that Colorado pikeminnow declines in the Yampa River are linked to "persistent high densities of nonnative predators (e.g., smallmouth bass and northern pike [])," and that northern pike are outnumbering Colorado pikeminnow by three to one.[143] The weakening of the Yampa River portion of the sub-basin population makes it even more critical to ensure that habitat for the Green River portion of the Green River sub-basin population is not degraded and remains a stronghold for the species. Bestgen et al. 2016 (in review), however, "now report that the decline in adult and subadult Colorado pikminnow has spread though the entire Green River Subbasin."[144]

Humpback chub numbers are also low. The U.S. Fish and Wildlife Service is "concerned that wild populations of humpback chub in Black Rocks and Westwater Canyon of the Colorado River (near the Colorado-Utah state line) have not recovered from declines detected in the late 1990's. The reason for those population declines is uncertain."[145] After this steep reduction, the Black Rocks/Westwater population continued to decline.[146] In 2008, the population "dropped below the population size downlist criterion (MVP = 2,100 adults) for the first time."[147] In 2011 and 2012, the core population estimates were 1,846 and 1,718, respectively.[148] "Colorado State University's recent robust population analysis more clearly indicated that declines in the Westwater and Black Rock humpback chub populations are due to lapses in recruitment."[149]

The Desolation/Gray Canyons population—which inhabits the Green River—has also not met the population-size downlist criterion, and was observed to be "trending downward" based on 2006-2007 population estimates.[150] This trend has been attributed to "increased nonnative fish

---

[142] 2015 Sufficient Progress Memo at 7.

[143] *Id*. at 8; 2016 Sufficient Progress Memo at 12.

[144] *Id*. at 12.

[145] 2015 Sufficient Progress Memo at 36.

[146] *Id*. at 13.

[147] *Id*.

[148] *Id*. at 13-14; *see also* 2016 Sufficient Progress Memo at 15 (confirming numbers remain "below core criteria level" and average of 5 estimates since 2004 is 1,426 adults compared to average of 2,490 adults since 1998).

[149] *Id*. at 20.

[150] 2015 Sufficient Progress Assessment at 12.

abundance and habitat changes associated with dry weather and low river flows."[151] The project's water depletions within the Green River sub-basin, in connection with climate change effects and shrinking water supply, could exacerbate these declines. The 2014 estimate is 1,863 adults, while the average of 7 point estimates collected since 2001 is 1,711, substantially below the 2,100-adults recovery criterion.[152] Captures of recruits have been low in recent years.[153]

These declining numbers not only show that the endangered fish may be more sensitive to water depletion and other oil and gas development effects than previously assumed, but they strongly suggest that the Endangered Fish Recovery Program is not achieving recovery targets nor adequately offsetting water depletion effects as intended.

D. The Endangered Fish Face Unaddressed Threats from Mercury and Selenium Contamination

Mercury pollution is a particularly serious threat to the Colorado pikeminnow, and one that has not been addressed by the Colorado River Endangered Fish Recovery Program's efforts to offset impacts from water depletions. FWS has acknowledged that "the Service recognized the threat of heavy metal contamination (e.g., mercury) as an unaddressed threat in the 5-year review."[154] In that review, FWS specifically found that:

> Management strategies for controlling anthropogenic mercury emissions are necessary as atmospheric pollution can indirectly affect this endangered species, its critical habitat, and its recovery by ambient air exposure, deposition into aquatic habitat and bioaccumulation in diet and fish tissues.[155]

Significant new research since 2008 has demonstrated that elevated levels of mercury in Colorado pikeminnow muscle tissue, including within the Green River Basin, are at concentrations likely to cause reproductive and behavioral impairment to the fish.[156] Mercury is

---

[151] *Id*. at 23.

[152] *Id*. at 12; 2016 Sufficient Progress Assessment at 15.

[153] Sufficient Progress Assessment at 15.

[154] 2015-16 Sufficient Progress Assessment at 14.

[155] U.S. Fish and Wildlife Service, Upper Colorado River Endangered Fish Recovery Program, Colorado pikeminnow (*Ptychocheilus lucius*), 5-Year Review: Summary and Evaluation 21 (2011) (attached as Exhibit 133).

[156] *Id.* ("[T]he recovery goal revision needs to consider the impacts of mercury. . . the majority (64 %) of Colorado pikeminnow may be experiencing some reproductive impairment through mercury exposure."); U.S Fish and Wildlife Service, Biological Opinion for the Four Corners Power Plant and Navajo Mine Energy Project at 76 & Table 3 (April 8, 2015) (attached as

a potent neurotoxin shown to cause numerous reproductive and endocrine impairments in fish in laboratory experiments, including effects on production of sex hormones, gonadal development, egg production, spawning behavior, and spawning success.[157]

The published scientific literature concludes that survival, growth, reproduction, and behavior are impaired at a mercury concentration of 0.2 mg/kg wet weight in whole fish.[158] Concentrations of mercury in Colorado pikeminnow throughout the Upper Colorado basin, and in the Green River Basin in particular, are documented to be well in excess of these thresholds for reproductive impairment and population-level impacts.[159] Average mercury concentrations in Middle Green River Colorado pikeminnow muscle tissue 2008-09 averaged 0.60 mg/kg wet weight – well above the 0.2 mg/kg threshold of concern.[160]

Exhibit 137); U.S. Fish and Wildlife Service, Biological Opinion on the Approval of a Mining Plan Modification for the South Taylor/Lower Wilson Area at the Colowyo Coal Mine 7 (Aug. 27, 2015) ("Colowyo BiOp") (attached as Exhibit 134).

[157] Fish and Wildlife Service, Draft 2014-2015 Assessment of Sufficient Progress Under the Upper Colorado River Endangered Fish Recovery Program in the Upper Colorado River Basin, and of Implementation of Action Items in the December 20, 1999, 15-Mile Reach Programmatic Biological Opinion and December 4, 2009, Gunnison River Basin Programmatic Biological Opinion, 10 (Oct. 7, 2015) ("2015 Sufficient Progress Assessment").

[158] *See* Beckvar, N., T.M. Dillon, and L.B. Reads. 2005. Approaches for linking whole-body fish tissue residues of mercury or DDT to biological effects threshold. Environmental Toxicology and Chemistry 24:2094-2105 (attached as Exhibit 135).

[159] *See* Barb Osmundson and Joel Lusk, Field assessment of mercury exposure to Colorado pikeminnow within designated critical habitat (May 5, 2011) (attached as Exhibit 136).

[160] *See* Four Corners Biological Opinion at 76 & Table 3; *see generally* Beckvar, *et al.*

Figure 1. U.S. Fish and Wildlife Service, Average and range of baseline mercury (Hg mg/kg WW) and selenium (Se mg/kg WW) in Colorado pikeminnow and razorback sucker muscle tissues in the Upper Colorado River Basin.[161]

River Basin and Species	Average Hg in Muscle Tissue (min - max)	Average Se in Muscle Tissue (min - max)
San Juan River Colorado pikeminnow > 400 mm TL	0.37 (0.31 - 0.43)	0.8 (0.6 – 0.9)
San Juan River Razorback sucker > 400 mm TL	0.12 (0.04 – 0.24)	0.8 (0.4 – 1.4)
Middle Green River Colorado pikeminnow	0.77 (0.68 - 0.87)	1.0 (0.9 – 1.1)
Upper Colorado River Colorado pikeminnow	0.60 (0.31 – 1.04)	1.9 (0.9 – 2.2)
White River Colorado pikeminnow	0.95 (0.43 – 1.83)	0.9 (0.6 – 1.2)
Yampa River Colorado pikeminnow	0.49 (0.44 – 0.53)	0.6 (0.4 – 0.7)

Given these levels of mercury in fish tissue, in its most recent 5-year review,[162] latest two recovery program sufficient progress assessments, and multiple recent Biological Opinions, FWS has acknowledged that mercury contamination may be a greater threat to the endangered fish, particularly Colorado pikeminnow, than previously realized.[163] BLM's consideration of effects on endangered fish must be informed by the ongoing effects of mercury contamination and accumulation on behavior, reproduction, and survival.

Already-existing levels of selenium contamination are also adversely affecting the four listed fish and their critical habitat within the Green River Basin. Analysis of tissue samples shows that Colorado pikeminnow in the Middle Green watershed the second-highest levels of tissue selenium (1.0 mg/Kg wet weight) anywhere in the species' range.[164] Adequately understanding selenium impacts on the four endangered fish is complex, requiring conversion of whole body concentrations of the toxin to concentrations in eggs and ovaries, and consideration of the reproductive and population impacts of those concentrations.[165] Given FWS's recent conclusions that similar or lower

[161] Four Corners Biological Opinion 76 Table 3.

[162] Fish and Wildlife Service's 2015 Sufficient Progress Assessment for the Recovery Program acknowledges that population viability studies show that mercury- and selenium-related reproductive impairment is likely to influence population levels in the San Juan Basin, but no comparable analysis has yet been done for the higher levels of contamination present in Green River Basin fish.

[163] 2014-2015 Sufficient Progress Assessment at 10-11.

[164] Four Corners Biological Opinion at 76.

[165] *See, e.g.* Four Corners Biological Opinion at 96-103.

tissue selenium concentrations, however, are already affecting endangered fish in the San Juan and White/Yampa River Basins,[166] it follows that Green River selenium levels, particularly in razorback sucker, are likely to be causing adverse effects on razorback sucker young. BLM must therefore consider the effects of the proposed Crescent Point development on selenium loading to the Green River and the endangered fish therein.

E. BLM Must Consider the Risk of Spills and Sedimentation Degrading Endangered Fish Critical Habitat

The risk of spills, leaks, and sedimentation contaminating and degrading endangered fish critical habitat will increase with the addition of thousands of new oil and gas wells near the Green River. Contamination of surface and groundwater from oil and gas activities commonly occurs within the Upper Basin. Between January 2008 and July 2014, operators reported at least 135 spills or leaks that resulted in releases to surface or groundwater in the Upper Basin – many of these from facilities under BLM's jurisdiction.[167] 27 of these incidents occurred within the Utah portion of the Upper Basin. Further, since July 2014, 18 spills and leaks that resulted in the contamination of surface water, groundwater, dry drainages, irrigation canals, or stockwater ponds have occurred in Duchesne and Uintah Counties.[168] Some of these spills have involved the movement of contaminants over a mile from the point of their initial release.[169] The contamination of the Green River and its tributaries from oil and gas activities is therefore real and not hypothetical.

The potential for spills to move from tributaries into endangered fish critical habitat within main-stem rivers was shown by a 2014 spill into the Green River. On the night of May 20, 2014 an oil well operated by SW Energy on lands administered by BLM "blew out," leaking an estimated 100 barrels per hour of crude oil and production water into Salt Wash which leads to the Green River. SW Energy did not shut-in the well until 1:20 p.m. on May 22, at least 36 hours later. On May 24, flooding from a thunderstorm "overcame prevention measures" washing an unknown quantity of oil and produced water 1.5 miles from Salt Wash into the Green River and critical habitat for endangered fish.[170] The U.S. Fish and Wildlife Service's recent Biological Opinion for the Gasco Energy Inc. Field Development Project anticipates these events and the potential for more frequent spills given expanded drilling:

> There is a greater potential for impacts from pollutants, if a pipeline, well pit, or other source were to inadvertently release contaminated fluids into waterways at

---

[166] *See* Four Corners Biological Opinion 134; Colowyo Biological Opinion 44-45.

[167] Spills Data (all Upper Basin tab) (Exhibit 126); *see also* Spill Incident Reports (2008-July 2014) (Exhibit 127).

[168] *See* Spill Incident Reports (July 2014-present) (Exhibit 128).

[169] *See* Spill Incident Reports.

[170] BLM. 2014. Update: Salt Wash Oil Spill, available at http://www.blm.gov/ut/st/en/fo/moab/SaltWashSpill.html.

> points near the Green and White Rivers. Through direct or indirect discharge, these pollutants could reach the Green River and negatively impact water quality to the point of affecting native fish populations. Direct impacts will result from a discharge from a pipeline or well pit reaching the Green River in its original form or within a single release event. Indirect effects occur when discharges are released to the ground and are later released to the river after being carried by an erosion event or carried by rain or snowmelt runoff. As more well and pipeline development occurs in the project area the chance of pollutants reaching the Green River increases, thus increasing the potential of harm to native fish populations.[171]

Further, spills occurring in close proximity to the Green River or its tributaries, could expose endangered fish to potentially lethal levels of toxic substances. The project area appears to encompass or neighbor stretches of the Green River, Uintah River, Duchesne River, and White River. Given this risk and declining populations of endangered fish in the Green River sub-basin, which could be severely crippled by a single catastrophic event, it would only take one spill within the project's 80-year lifespan to detrimentally harm the endangered fish. The potential for a blowout to result in a large spill like the Salt Wash incident, and harm critical habitat, should be addressed.

It is also possible that large volumes of chemical substances escape undetected until reaching surface sediments or waters, which could result in chronic sub-lethal effects. The Gasco Biological Opinion explains that this is especially possible with smaller leaks:

> The effects of smaller leaks that may cause chronic, sub-lethal effects to fish populations may be more prevalent. While the oil and gas industry has a wide variety of methods available to detect substantial leaks or integrity breeches, the technology for detection of small "pinhole" leaks is not as advanced. This creates a significant problem in that the current available methodology may allow small leaks to go undetected for extended periods of time often evading detection until they are manifested on the surface sediments or water.[172]

The potential for leaks and spills of condensate, crude oil, fracking chemicals, and produced water must be analyzed in the EIS. Produced waters are essentially highly saline waters that rise to the surface from deep underground after completion of a well, and must be disposed. Many recent spills in the Upper Basin involve spillage of produced water. If spilled, the effects of produced water or brine can be more severe and longer-lasting than oil spills, because salts do

---

[171] Fish and Wildlife Service, Biological Opinion for the Gasco Energy Inc. Field Development Project ("Gasco BO"), Dec. 2011, p. 26, available at http://www.blm.gov/style/medialib/blm/ut/vernal_fo/planning/gasco_eis/gasco_rod.Par.56176.File.dat/Gasco%20ROD%20Attachment%205%20BO.pdf (attached as Exhibit 129).

[172] Gasco BO, p. 27.

not biodegrade or break down over time. The only way to deal with them is to remove them.[173] Increased levels of total dissolved solids in surface waters are associated with higher rates of fish mortality.[174] Further, produced waters can contain copper, iron, lead, manganese, arsenic, cadmium, nickel, zinc, chromium, selenium, and sodium bicarbonate at levels above thresholds that are harmful to aquatic organisms, including fish.[175] The project may result in the spillage of large volumes of produced waters, wastewaters, fracking fluids, or other chemicals which may be transported to or from the project site via trucks and pipelines, or stored onsite in tanks and pits.

In addition, because a great deal of oil and gas activity is already presently occurring in this area, the EIS must discuss baseline environmental conditions regarding the existing risk of spills from all past and present projects, as well as any foreseeable risks of spills from state and private future projects. According to BLM's analysis of oil and gas spills in Colorado, spills can travel as far as 1,800 feet before contaminating surface water.[176]

BLM and the Service must formally consult over the risk of spills and leaks from oil and gas activities on the endangered fish. BLM must also formally consult regarding the project's sedimentation impacts on the endangered fish.

IV. BLM Must Consult with the Fish and Wildlife Service Regarding the Project's Harmful Effects on Threatened and Sensitive Plants

The Crescent Point project will have devastating impacts to the remaining habitat and population of multiple threatened and BLM-sensitive plant species, including Uinta Basin hookless cactus (*Sclerocactus wetlandicus*) (threatened), Pariette cactus (*Sclerocactus brevispinus*) (threatened, warranted for listing as endangered), and sterile yucca (*Yucca sterilis*) (sensitive).

The Center for Native Ecosystems and the Utah Native Society have previously petitioned the BLM to consider designation of an expanded Area of Critical Environmental

[173] King, Pamela, Limited study supports findings on bigger brine spill risks, E&E News (Nov. 4, 2015).

[174] Tuckwiller, Ross, Annotated Bibliography: Potential Impacts of Energy Development on Fisheries in the Rocky Mountain West Prepared for Theodore Roosevelt Conservation Partnership Fish, Wildlife, & Energy Working Group at 17, available at http://www.trcp.org/documents/ANNOTATED_BIB.pdf (attached as Exhibit 130).

[175] *Id*. at 21-22 (extremely elevated chromium concentrations in fish exposed to produced waters), p. 23 (fish showing lesions and kidney damage after exposure to sodium bicarbonate).

[176] BLM, Grand Junction Resource Management Plan Final EIS at 6-271 (2015), available at http://www.blm.gov/co/st/en/fo/gjfo/rmp/rmp/docs.html.

Concern that would be more effective in protecting habitat for both *S. wetlandicus* and *S. brevispinus*, including areas outside the immediate drainage:[177]

> Center for Native Ecosystems and Utah Native Plant Society hereby nominate for ACEC designation all known occurrences (including all occurrences discovered prior to the adoption of the final Vernal RMP) of Pariette cactus that are outside the current boundaries of the Pariette Wetlands ACEC, plus buffers of at least 300' (or the distance recommended by Dr. Vince Tepedino, if larger). We suggest that the BLM could accomplish this by either expanding the existing Pariette Wetlands ACEC or by designation of one or more new ACECs.

Under its FLPMA obligation to give priority to the designation of ACECs, BLM must avoid actions, such as the proposed Crescent Point project, that would impair its ability to meet its ACEC obligation. BLM should refrain from allowing any additional surface disturbance within the pollinator buffer of both *S. wetlandicus* and *S. brevispinus* until it has considered and met its ACEC obligations with regard to the 2006 nomination.

Moreover, Pursuant to BLM Manual 6840, it is the responsibility of State Directors to not only inventory BLM lands to determine the occurrence of BLM special status species, but also to determine "the condition of the populations and their habitats, and how discretionary BLM actions affect those species and their habitats."[178] BLM Manual 6840 at .06 provides that "Bureau sensitive species will be managed consistent with species and habitat management objectives in land use and implementation plans to promote their conservation and to minimize the likelihood and need for listing under the ESA."

V. Conclusion

The Conservation Groups appreciate your consideration of the information and concerns addressed herein, as well as the information included in the attached exhibits. Should you have any questions or wish to discuss our concerns in greater detail, please do not hesitate to contact us.

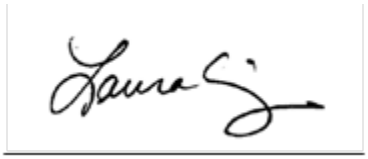
Sincerely,

Kyle Tisdel
WESTERN ENVIRONMENTAL LAW CENTER
208 Paseo del Pueblo Sur, Unit 602
Taos, New Mexico 87571

[177] *See* Supplemental Comments of Center for Native Ecosystems, The Wilderness Society, and Utah Native Plant Society on the Vernal Resource Management Plan 4-5 (Feb. 10, 2006) (attached as Exhibit 132).

[178] *Id.* at § .04.

575.751.0351
tisdel@westernlaw.org



Laura King
WESTERN ENVIRONMENTAL LAW CENTER
103 Reeder's Alley
Helena, MT 59601
406.204.4852
king@westernlaw.org

Along with:

Michael Saul
Senior Attorney, Public Lands
Center for Biological Diversity
Denver, CO
303.915.8308
msaul@biologicaldiversity.org

Katie Schaefer
Associate Attorney
Sierra Club
2101 Webster St. Suite 1300
Oakland, CA 94612
415.977.5745
katie.schaefer@sierraclub.org

Tony Frates
Conservation Co-chair
Utah Native Plant Society
P. O. Box 520041
Salt Lake City, UT 84152-0041
801.277.9240
unps@unps.org

UNPS joins these scoping comments as to issues involving plant species.

Jeremy Nichols
Climate & Energy Program Director
WildEarth Guardians
2590 Walnut Street
Denver, CO 80205

303.437.7663
jnichols@wildearthguardians.org

From:	Connie Brooks
To:	gdcook@blm.gov
Cc:	Van Elsberndb) (6) ; jdickinson@vermillionranchlp.com; emccullo@blm.gov
Subject:	Renewal request
Date:	Friday, February 10, 2017 7:16:15 PM
Attachments:	McCullough_Bridgeport Renewal.pdf

Connie Brooks

C.E. Brooks & Associates, P.C.

303 East 17th Avenue, Suite 650

Denver, CO 80203

Phone: (303) 297-9100

Fax: (303) 297-9101

connie@cebrooks.com

Dear Dave,

I am sure you were going to issue Bridgeport Allotment permit as a 10-year permit but I am closing the loop with a formal application. With the 2014 amendment to FLPMA, the renewals are a matter of course upon transfer or expiration until the NEPA analysis is done. Previously the permittee had to ask for renewal and your email indicated it expired in 2016. After the changes in the law, there is no interim direction, so we are asking for renewal just to be clear.

Thanks for your work on this.

Sincerely

Connie Brooks

C. E. BROOKS & ASSOCIATES, P.C.
303 East 17th Avenue ♦ Suite 650 ♦ Denver, Colorado ♦ 80203
(303) 297-9100 ♦ FAX: (303) 297-9101

CONSTANCE E. BROOKS

February 10, 2017

VIA E-MAIL, ORIGINAL MAILED
Ester McCullough, Field Manager emcculo@blm.gov
Dave Cook gdcook@blm.gov
Vernal Field Office
BLM Vernal Field Office
170 South 500 East
Vernal, Utah 84078

Re: Renewal Application Pursuant to National Defense Authorization Act for the Bridgeport Allotment

Dear Ms. McCullough and Mr. Cook:

This letter constitutes the application by Vermillion Ranch Limited Partnership ("Vermillion") for renewal of the 10-year term grazing permit for the Bridgeport Allotment. Congress amended the Federal Land Policy and Management Act. 43 U.S.C. §1752, in December 2014 to authorize grazing permit renewals, whether expired or terminated, under the same terms and conditions until BLM completes its renewal analysis pursuant to the rules and National Environmental Policy Act (NEPA) procedures. *See* §3023 of Pub. L. 113-29 (2015). According to Section 3023, "[t]he terms and conditions in a grazing permit or lease that has expired, or was terminated due to a grazing preference transfer, shall be continued under a new permit or lease until the date on which the Secretary concerned completes any environmental analysis and documentation for the permit or lease..." *Id*.

Vermillion accordingly asks that BLM issue the Bridgeport Allotment grazing permit as a renewal for 10 years pending completion of any environmental analysis. As provided by Congress, the renewal is to be under the current terms and conditions, including but not limited to applicable allotment management plans, coordinated resource management plans, and grazing management plans.

Thank you for your cooperation in this request.

Sincerely,

C E Brooks

From: Cook, Gerald (Dave)
To: Connie Brooks
Cc: Van Elsbernd (b) (6) ; jdickinson@vermillionranchlp.com; emccullo@blm.gov
Subject: Re: Renewal request
Date: Monday, February 13, 2017 10:23:42 AM

Connie,

Got your email, thanks. I think we are on the same page with the transfer. Also, there are some additional terms and conditions that were not included in the application. I will get those to you. The renewal will be a CX under FLPMA.

On Fri, Feb 10, 2017 at 5:15 PM, Connie Brooks <connie@cebrooks.com> wrote:

> Connie Brooks
>
> C.E. Brooks & Associates, P.C.
>
> 303 East 17th Avenue, Suite 650
>
> Denver, CO 80203
>
> Phone: (303) 297-9100
>
> Fax: (303) 297-9101
>
> connie@cebrooks.com
>
> Dear Dave,
>
> I am sure you were going to issue Bridgeport Allotment permit as a 10-year permit but I am closing the loop with a formal application. With the 2014 amendment to FLPMA, the renewals are a matter of course upon transfer or expiration until the NEPA analysis is done. Previously the permittee had to ask for renewal and your email indicated it expired in 2016. After the changes in the law, there is no interim direction, so we are asking for renewal just to be clear.
>
> Thanks for your work on this.
>
> Sincerely
>
> Connie Brooks

--

Dave Cook
Branch Chief, Range and Wildlife
Vernal Field Office

435-781-3424

gdcook@blm.gov

From: Connie Brooks
To: Cook, Gerald (Dave)
Subject: RE: Renewal request
Date: Monday, February 13, 2017 11:17:08 AM

Dear Dave,

Thanks.

Connie Brooks

From: Cook, Gerald (Dave) [mailto:gdcook@blm.gov]
Sent: Monday, February 13, 2017 8:24 AM
To: Connie Brooks
Cc: Van Elsbernd (b) (6) ; jdickinson@vermillionranchlp.com; emccullo@blm.gov
Subject: Re: Renewal request

Connie,

Got your email, thanks. I think we are on the same page with the transfer. Also, there are some additional terms and conditions that were not included in the application. I will get those to you. The renewal will be a CX under FLPMA.

On Fri, Feb 10, 2017 at 5:15 PM, Connie Brooks <connie@cebrooks.com> wrote:

Connie Brooks

C.E. Brooks & Associates, P.C.

303 East 17th Avenue, Suite 650

Denver, CO 80203

Phone: (303) 297-9100

Fax: (303) 297-9101

connie@cebrooks.com

Dear Dave,

I am sure you were going to issue Bridgeport Allotment permit as a 10-year permit but I am closing the loop with a formal application. With the 2014 amendment to FLPMA, the renewals are a matter of course upon transfer or

expiration until the NEPA analysis is done. Previously the permittee had to ask for renewal and your email indicated it expired in 2016. After the changes in the law, there is no interim direction, so we are asking for renewal just to be clear.

Thanks for your work on this.

Sincerely

Connie Brooks

--

Dave Cook

Branch Chief, Range and Wildlife

Vernal Field Office

435-781-3424

gdcook@blm.gov

From:	Nada Culver
To:	BLM_NM_FFO_RMP@blm.gov
Cc:	David Nimkin; Paul Reed (preed@archaeologysouthwest.org) (preed@archaeologysouthwest.org); Amanda Podmore
Subject:	Farmington RMP Amendment- Supplemental Scoping Comments
Date:	Monday, February 20, 2017 3:07:42 PM
Attachments:	Farmington RMP Amendment-Supplemental Scoping Comments-TWS at al. -- 2-20-17.pdf Sample Protective Measures - Attachment 2.docx National Park Stipulation Examples - Attachment 3.docx Tribal Support re Methane Regulation - Attachment 1.pdf

---

Attached please find supplemental scoping comments submitted on behalf of The Wilderness Society, National Parks Conservation Association, Archaeology Southwest and Friends of Cedar Mesa, as well as the referenced attachments. We thank you for your attention to this important matter.

Nada Culver

Senior Counsel and Director, BLM Action Center

The Wilderness Society

1660 Wynkoop, #850

Denver, CO 80202

Main: 303-650-5818

Direct: 303-225-4635

Nada_Culver@tws.org <mailto:Nada_Culver@tws.org>

The Wilderness Society * National Parks Conservation Association * Archaeology Southwest * Friends of Cedar Mesa

February 20, 2017

Via electronic mail: BLM_NM_FFO_RMP@blm.gov

Bureau of Land Management
6251 North College Blvd. Suite A
Farmington, NM 87402

Re: Supplemental Scoping Comments – Farmington Resource Management Plan Amendment

Dear Mr. Ames and Ms. Yazzie:

Thank for the opportunity to submit supplemental scoping comments on this planning process. We strongly support the inclusion of the Bureau of Indian Affairs (BIA) as joint lead in this planning effort with the Bureau of Land Management (BLM). We are hopeful this expanded effort will allow both agencies to inform their approach to leasing and development in the Farmington Field Office planning area. The checkerboard of tribal, allotted and federal lands in the planning area, with decision-making by BIA and BLM warrants this inter-agency approach. In addition, the proximity to land managed by the National Park Service (NPS) and the effects of oil and gas leasing and development on those land, including the Chaco Culture National Historical Park (NHP), makes collaboration among the three agencies of the Department of the Interior especially important. The plan is an opportunity for BLM and BIA to recognize the broader Chacoan cultural landscape and through thoughtful planning protect the integrity of this significant archaeological continuum and living cultural landscape throughout the Four Corner states.

BLM and BIA share important responsibilities for managing fluid mineral development in the planning area, so we hope to see the two agencies make the most of this joint effort to create broad, over-arching guidance for this planning area that will coordinate their management activities. The agencies' legal obligations, including under the Federal Land Policy and Management Act, National Environmental Policy Act, National Historic Preservation Act and Executive Order 13007 (regarding Indian Sacred Sites), provide a framework for managing and protecting the sensitive cultural landscape and resources in and around Chaco Culture NHP, and to do so in consultation with NPS, pueblos, tribes, local residents and the broader public. In addition, Secretarial Order No. 3317 and recently issued BLM Tribal Relations Manual 1780 and Handbook 1780-1 set the Department of the Interior and the BLM on an important new path to improve mechanisms and effectiveness of coordination.

This planning effort can and should be an example of putting these commitments into action for the benefit of all stakeholders and the greater Chaco landscape. The planning process should also recognize, provide outreach to and fully address the important concerns and perspectives of Navajo and all affiliated Pueblo tribes, including those identified in resolutions

adopted by the All Pueblo Council of Governors, tribal members living around Chaco Culture NHP and Navajo chapters. For example, evaluating and addressing the impacts to the health and economic welfare of surrounding communities can and should be an integral part of this planning process. It will also be important for the agencies to incorporate into this planning process a clear commitment and framework for ongoing coordination and consultation with pueblos, tribes and local residents over future oil and gas activity in the greater Chaco landscape.

These comments build on our earlier scoping comments and submissions, which we reference in these supplemental comments in the context of this joint effort. Many of the concepts that are under consideration of federally-managed lands and mineral resources can be applied to BIA-managed minerals to better plan for and balance oil and gas leasing and development across this landscape, accounting for affected communities and natural and cultural resources.

1. **BLM and BIA should make commitments in the plan that will improve interagency coordination, consultation and outreach.**

    a. <u>BLM and BIA must clearly articulate their respective roles and responsibilities and how the agencies will coordinate over future oil and gas management decisions.</u>

FLPMA and NEPA require that federal agencies work together to coordinate and integrate related land use planning and management decisions. Under FLPMA § 202(c), agencies must "coordinate the land use inventory, planning, and management activities of or for [public] lands with the land use planning and management of other Federal departments and agencies." Similarly, NEPA requires that agencies "integrate the NEPA process with other planning at the earliest possible time to ensure that planning and decisions reflect environmental values, to avoid delays later in the process, and to head off potential conflicts." 40 CFR § 1501.2. Interagency coordination is especially important in the Farmington Field Office (FO). Because the FO contains a National Park, as well as a checkerboard of federal, tribal and allotted lands, BLM, BIA and the Park Service each make individual management decisions that directly affect the lands and resources of the other agencies. Although BLM and BIA took an important step toward improving interagency coordination by joining as co-lead agencies, the unique jurisdictional complexity of the Farmington FO warrants additional measures and safeguards to ensure robust interagency coordination moving forward, both during this planning process and after planning is complete.

One area where BLM and BIA should improve interagency coordination is in managing oil and gas resources on tribal and allotted lands. As described in the BIA Fluid Mineral Resources Handbook, BLM and BIA both have a role in reviewing and approving leases, permits, and other site-specific authorizations, as well as satisfying resource protection laws, on tribal lands and allotments.[1] For example, in reviewing drilling permit applications, BLM has final approval

[1] *See generally* BIA Fluid Mineral Estate – Procedural Handbook (2012).

authority, but both BLM and BIA must conduct an on-site inspection together, and the agencies share the responsibility of satisfying NEPA, NHPA and the ESA. *Id* at § 3.13. In contrast, in reviewing lease proposals, BIA has final approval authority, and is primarily responsible for satisfying resource protection laws, while BLM must conduct a mineral valuation and recommend royalty and bonus lease terms.[2]

These interagency review requirements have not been consistently satisfied in the past. In a 2012 report, the Office of Inspector General (OIG) found that BLM and BIA were reviewing and approving oil, gas and other mineral leases "without a formal program backed by consistent administrative guidance and protocols."[3] OIG reported that "outdated and inconsistently applied BIA policies and procedures covering oil and gas exploration" on tribal and allotted lands. *Id*. at p. 6. Among a number of other problems, OIG reported that "field offices [were] inconsistently applying NEPA to oil and gas leases," sometimes conducting NEPA review at lease issuance and other times waiting until the APD stage of development.[4]

In light of the OIG report, as well as the unique jurisdictional complexities of the Farmington Field Office, BLM and BIA should clarify their respective obligations and establish consistent procedures for reviewing leases, permits, rights-of-way and other development authorizations on tribal and allotted lands. The joint plan, which should provide as consistent protections and measures as possible for federal, tribal and allotted lands, should explain the respective roles of the agencies in managing site-specific development proposals and specify the appropriate amount of environmental and cultural resource review under NEPA, NHPA and other applicable laws (such as the Endangered Species Act) at the various stages of the oil and gas development process. The plan would then serve as a valuable blueprint to guide future interagency coordination and ensure lawful, consistent interagency review and approval processes.

Recommendations: In the draft plan, spell out the respective obligations of the BLM and BIA in issuing and approving leases, permits and rights-of-way, including their obligations under NEPA, NHPA, and other applicable laws.

b. BLM and BIA must include a robust role for the National Park Service in future oil and gas management decisions.

BLM and BIA should also take steps to improve interagency coordination with the National Park Service. Nearby oil and gas development, and the environmental impacts associated with this development, are already affecting the resources and visitor experience within Chaco Culture NHP. To address these impacts, NPS should be actively involved in oil and gas management decisions on lands near Chaco Culture NHP. An approach that could serve as a model was used

[2] *See id.* at §§ 3.1 – 3.5.

[3] *See* Office of Inspector General, "Oil and Gas Leasing in Indian Country: An Opportunity for Economic Development (2012) at p. 1.

[4] *Id*. at p. 7-9. *See Davis v. Morton*, 469 F.2d 593, 597 (10th Cir. 1972) ("The fact Indian lands are held in trust does not take it out of NEPA's jurisdiction…We conclude approving leases on federal lands constitutes and major federal action and thus must be approved according to NEPA mandates.").

by the White River Field Office, where BLM requires that operators file site-specific noise reduction and visual resource management plans with NPS before initiating surface disturbing activities on lands near Dinosaur National Monument.[5] As another example, in the Moab Master Leasing Plan, BLM worked directly with NPS to comprehensively analyze and assign protections for the viewshed from key observation points within Arches and Canyonlands National Parks.[6] Similar measures would also make sense here where impacts from nearby oil and gas development directly affect the resources and visitor experiences of Chaco Culture NHP.[7]

Additionally, NPS possesses unique expertise that can be beneficial to the agencies as they evaluate future proposals. Not only does NPS co-administer the Chaco Archaeological Sites Protection System, along with BLM and the Navajo Nation, but it also possesses expertise in managing night sky, viewsheds and soundscape values in and around units of the National Park System. NPS has already provided BLM with some information on night skies around Chaco Culture NHP as part of recent oil and gas leasing proposals. This role should be formalized and broadened as part of the BIA-BLM planning process.

Recommendations: Working with NPS, conduct a comprehensive viewshed and soundscape analysis from Chaco Culture NHP. Assign stipulations to protect Park Resources, including stipulations that require NPS consultation before development can proceed near the Park. In the planning documents adopted by BLM and BIA, ensure that there is a robust, ongoing role for NPS in future oil and gas management decisions.

2. The agencies should take steps to improve tribal coordination and consultation, as well as public outreach and engagement.

In addition to their interagency coordination obligations, BLM and BIA share important tribal consultation and public engagement duties. NEPA, NHPA, EO 13007 and SO 3317 all require notice and outreach to tribes, allottees, residents and the public at various stages of the oil and gas development process. BLM Manual 1780 and Handbook 1780-1 have also set the Interior Department on an important new path to improving relationships and coordination with tribes and allottees.

By joining as co-lead agencies and expanding the planning area, BLM and BIA have already taken important steps toward improving tribal engagement and public outreach around Farmington. The new scoping process, where BLM and BIA met directly with tribal members and residents at community centers and Chapter Houses, brought a critical set of stakeholders to the table (in addition to satisfying key recommendations from MS-1780). It successfully set the stage for an inclusive planning process with robust tribal engagement and consultation.

---

[5] White River RMPA (2015) at Appendix A, p. 1-30.
[6] *See* Proposed Moab MLP at § 3.18.
[7] *See* Western Values Project, "Oil and Gas Development at the Doorstep of America's Best Idea" (Aug. 24, 2016) at p. 3, *available at* http://westernvaluesproject.org/wp-content/uploads/2016/08/Parks-Drilling-Report-8-24-16-.pdf.

Now, BLM and BIA should make sure that this type of outreach and engagement continues after this planning process is complete. The agencies should view this RMP Amendment as the start of an ongoing relationship and open dialogue with tribes, allottees and the public about oil and gas planning decisions in Farmington. Residual impacts to tribal communities from expanded oil and gas development can include distortions in labor markets, housing prices, public infrastructure and disruptions in social systems. This ongoing relationship should both monitor and implement outreach programs to help communities adjust to changes. As described in H-1780-1, BLM and BIA already have an existing partnership and working group related to nearby coal development decisions:

> [R]epresentatives from the BLM Arizona State Office organize quarterly coal coordination meetings with the Hopi Tribe and the Navajo Nation. Representatives from the BIA and OSM attend as well. Participants discuss on a government-to-government basis coal-related mining and environmental issues involving the DOI's management of the Arizona and New Mexico coal mines located within the Hopi and Navajo reservations.[8]

As another example, on the Wind River Indian Reservation in Wyoming, BLM, BIA and the Arapaho and Shoshone Tribes entered an MOU that, among other things, "formalize[d] a structure for future communications between the parties regarding environmental concerns arising from oil and gas operations."[9] Similarly, in the Socorro (New Mexico) RMP, BLM and the Zuni Pueblo agreed to enter into a MOU to outline consultation procedures for future actions that might affect the Zuni Salt Lake, an area of cultural significance to the Zuni.[10] A similar, formal partnership would make sense here where future site-specific development approvals will frequently require consultation, coordination and outreach to tribes, allottees and the public.

Recommendations*:* In the joint plan, establish a permanent, interagency BLM-BIA-NPS working group that meets regularly with tribes, allottees and the public to discuss and provide recommendations on ongoing minerals management decisions. Additionally, to increase transparency, make all NEPA documents (including categorical exclusions) for federal, tribal and allotted mineral development decisions (e.g., leasing, permitting, right-of-way, suspensions, MDPs) available online for public review.

3. The joint planning document should specify resource protection measures and the mechanisms needed to incorporate them into future leasing and development.

The joint plan should adopt a protection zone around Chaco Culture NHP and important outlying sites where leasing is prohibited (COA), best management practices (BMP) and other

[8] *Id*. at p. XIII-8.
[9] *See* BLM Press Release, "Tribes, BIA and BLM Collaborate on Oil and Gas Operations" (Feb. 28, 2014) *available at* https://www.blm.gov/wy/st/en/info/news_room/2014/february/28lfo-mou.html.
[10] BLM Socorro RMP (2010) at p. 7.

development conditions that protect cultural and environmental resources, as well as the health and well-being of local residents and community or avoided, and development on existing leases is avoided to the maximum extent possible. Additionally, the joint plan should adopt consistent stipulations, lease notices, conditions of approval members, to guide development (i.e., on existing leases) on public, tribal and allotted lands. In addition, the plan should evaluate and address other impacts from leasing and development.

a. The agencies should use landscape-level planning in the joint EIS and plan.

A landscape-level approach to land use planning requires that management decisions within a planning boundary, and even the boundary itself, reflect the location and distribution of connected geologic, cultural, wildlife and other related resources. *See* 81 Fed. Reg. 89,662 (2016) ("Landscape means an area of land encompassing an interacting mosaic of ecosystems and human systems characterized by a set of comment management concerns."); FLPMA §202(c). It also requires that land use planning decisions for federal lands be consistent with management on neighboring tribal and allotted lands.[11]

By expanding the planning area boundary to capture tribal and allotted lands, BLM and BIA have taken a critical step toward implementing a landscape-scale planning approach in the planning area. Without tribal and allotted lands in the decision-space, comprehensive management and protection of the network of connected cultural and archaeological sites around Chaco Culture NHP would have been effectively impossible. Likewise, a plan with decisions for only federal public (but not tribal and allotted) lands and minerals would not be able to address the significant human health concerns of local residents. Now that tribal and allotted lands are included, BLM and BIA must aim to protect cultural resources and address environmental justice concerns at a landscape-level. Below, we identify three distinct areas, each "characterized by a set of common management concerns," that BLM and BIA should manage under unique management prescriptions at a landscape-level:

i. Occupied Tribal and Allotted Lands

The planning area also contains numerous residences, schools, community centers and other properties where proximate oil and gas development raises serious human health and environmental justice concerns. Since a large proportion of lands near these places are already under lease, the plan should include detailed measures for mitigating the impacts from drilling and development on existing leases, including protections for air and water quality, as well as noise, light and dust pollution. Among other measures, the plan should:

- Apply setbacks to protect occupied properties and areas, such as schools, houses, and community centers.

[11] *See* IM 2010-117 at § I(B) (Stipulation Consistency), BLM Handbook H-1601-1 at § IF(1) (Consistency with Tribal Plans).

- Impose strict air quality emissions standards and fugitive dust control plans.

- Impose strict methane emissions standards to protect public health and livestock, as well as to avoid waste of natural gas.

- Require closed loop drilling and other strict water quality protections.

- Impose operator and agency-based air and water testing and monitoring requirements as well as strict agency-based inspection and enforcement requirements.

- Impose a strict decibel-based limit to reduce noise near homes, residences, schools, and other occupied areas.

- Limit flaring and artificial lighting.

- Limit truck traffic.

- Require unitization, communitization and master development plans across federal, tribal and allotted lands to co-locate infrastructure.

ii. Lands near Chaco Culture NHP

The first area that BLM and BIA should manage under common allocations, stipulations and development conditions is the checkerboard of federal, tribal and allotted lands within 10 miles of Chaco Culture NHP. This area is largely unleased and undeveloped, so has retained most of its cultural integrity and natural characteristics. It contains a uniquely high density of undisturbed cultural sites and is critically important to preserving the resources and visitor experience within Chaco Culture NHP, as well as the homes, ranches and traditional lifestyles of the people who live near the park. To preserve its distinct qualities and protect Park resources, the plan should:

- Close this area to new leasing across all land types, and, where closures are not possible, apply NSO stipulations.

- Require that operators obtain and submit cultural archaeological resource inventories with the BLM, BIA, New Mexico State Historic Preservation Office and interested tribes and pueblos before conducting surface disturbing activities on lease sites.

- Where cultural resources are present, invite interested tribes and tribal members to conduct site visits; condition development to address tribal concerns.

- Require that operators file viewshed and soundscape analyses with the Park Service, BLM and BIA before conducting surface-disturbing activities and, in cooperation with those agencies, develop viewshed and soundscape protection plans.

- Require that BLM and BIA consult with the National Park Service before issuing new leases and drilling permits.

- To protect dark night skies, limit flaring and artificial lighting.

- Prioritize reclamation of well pads, access roads and other oil and gas infrastructure to restore viewsheds from Chaco Culture NHP and nearby cultural sites.

- Prioritize new drilling within already-developed, less-sensitive areas using avoidance measures, such as siting, screening and mandatory unitization.

iii. *The Great North Road Corridor*

Another area that warrants a landscape-level management approach is the corridor of cultural and archaeological sites, major cultural complexes and great houses along the Great North Road (but beyond the lands within 10 miles of the Park). This corridor has seen significantly more oil and gas leasing and development than the lands directly surrounding Chaco Culture NHP, but, like the lands around the Park, it too contains a high density of connected cultural sites that would benefit from common lease stipulations and development guidelines. To protect this area, the plan should:

- Close the Great North Road ACEC to future leasing, and, outside the ACEC, only allow leasing with NSO stipulations along the corridor of the Great North Road.

- Prohibit new rights-of-way across the Great North Road and other identified Chacoan roads.

- Require that operators obtain and submit archaeological inventories with BLM and BIA before conducting surface disturbing activities on lease sites.

- Require unitization, communitization and master development plans that actively prioritize co-location of new infrastructure with existing infrastructure and reduce impacts on cultural and archaeological sites.

- Require phased leasing that prioritizes leases away from areas with low development potential and sensitive resources.

- Require that operators file viewshed and soundscape analyses with the Park Service, BLM and BIA before conducting surface-disturbing activities and, in cooperation with those agencies, develop viewshed and soundscape protection plans.

Recommendations*:* The agencies should adopt consistent management decisions and resource protections at various landscape levels across federal, tribal and allotted lands in the planning area. The agencies should manage areas with connected resources and common resource management concerns under consistent stipulations and development conditions.

b. The agencies should conduct viewshed and soundscape analysis for Chacoan great house communities.

In addition to closer collaboration with NPS, as discussed above, we encourage the agencies to support other efforts to protect Chacoan communities from indirect effects to viewsheds and soundscapes. The recent work by Ruth Van Dyke (2017; submitted to BLM and BIA separately[12]) documents considerable indirect effects to the viewshed and soundscape of the Pierre's Community. Despite the ACEC established to protect the community, Van Dyke concludes that the encroachment of oil-gas facilities has compromised the integrity of the community and the ability of the archaeological community to fully understand and assess its role in the Greater Chaco Landscape. Thus, we feel strongly that viewshed and soundscape analysis must be completed for Chacoan great house communities and protective measures put in place prior to allowing any additional leasing within the communities' boundaries.

Recommendations: Working with NPS and archaeological groups, conduct a comprehensive viewshed and soundscape analysis for all Chacoan great house communities across the Greater Chaco Landscape. The agencies should exclude known Chacoan communities from additional leasing until studies are complete. Assign stipulations to protect Park Resources, including stipulations that require NPS consultation before development can proceed near the Park. In the planning documents adopted by BLM and BIA, ensure that there is a robust, ongoing role for NPS in future oil and gas management decisions.

c. BIA has authority and obligations to proactively manage oil and gas leasing and development on tribal and allotted lands.

On tribal and allotted lands, the federal trust obligation, rather than the multiple-use mandate, guides mineral leasing and development decisions.[13] This requires that, in making mineral leasing decisions, BLM and BIA consider the "best interests" of the lessee, taking into account a multitude of social, cultural, economic and environmental factors. *See* 25 C.F.R. § 225.22(c). Importantly, where the "adverse cultural, social or environmental impacts [associated with oil

[12] Van Dyke, Ruth, 2017. Impacts of Oil and Gas Drilling on the Soundscape and Viewshed at the Chaco Outlier of Pierre's, San Juan County, New Mexico. Preliminary report, on file, SUNY, Binghamton.

[13] *See* Judith Royster, "Equivocal Obligations: The Federal-Tribal Trust Relationship and Conflicts of Interest in the Development of Mineral Resources," 71 N.D. L. Rev. 327 (1995) at § III.

and gas development] outweigh its expected benefits to the Indian mineral owners," regulations require that BLM and BIA reject or modify leasing decisions to tip the balance. *Id*.

The risks of adverse impacts to cultural, social, economic and environmental resources are especially significant in the Farmington FO. Local residents, tribal members and allottees have all expressed serious concerns about the impacts of oil and gas development on local air and water quality, as well as noise and dust from nearby operations. High levels of unemployment among tribal members offer opportunities to develop partnerships providing for job training and local hiring initiatives in a range of vocations. Additionally, resources within Chaco Culture NHP, and its web of connected sites, are of deep spiritual and cultural significance to local and Pueblo tribes. In this planning area, the risk of adverse impacts to the environment, cultural resources and local communities will require careful consideration in minerals management decisions made under the federal trust obligation.

BLM and BIA should evaluate measures similar to those that were applied to several leases that were recently in the Farmington Field Office. Those measures included NSO stipulations and a notice to lessees that "[d]ue to a high density of residences within the locale, site-specific mitigation measures, as determined through environmental analysis consistent with the National Environmental Policy Act, will be applied to development proposals. These measures that would be applied as Conditions of Approval may include, but are not limited to, measures to address impacts from increased traffic, noise, and light pollution."[14]

Recommendations*:* BIA can best comply with its obligations and exercise its authority by accounting for social, cultural and environmental resource impacts in management decisions for development on tribal and allotted minerals. BIA should consider a broad range of alternatives to address these types of impacts through this joint planning effort and capitalize on the opportunity to also address the impacts from leasing and development on lands and minerals managed by the BLM. Consideration of existing programs and initiatives through BIA's Office of Indian Energy and Economic Development[15] should be examined for its applicability to oil and gas development mitigation in the Chaco region.

d. <u>The agencies should incorporate measures to reduce wasted gas emissions.</u>

On November 15, 2016, the BLM finalized its Waste Prevention, Production Subject to Royalties, and Resource Conservation rule, also known as the "Methane Waste Rule." This rule will curb the waste of natural gas from federal and tribal lands by requiring periodic leak detection and repair (LDAR) inspections, prohibiting venting, significantly limiting flaring and establishing a number of equipment specific requirements. According to BLM's own estimates, full implementation of the rule will cut methane emissions by 45% and could result in net benefits of over $204 million annually.[16]

[14] https://eplanning.blm.gov/epl-front-office/projects/nepa/68428/95533/115792/Amendment_No_2_v1.pdf
[15] *See* https://teeic.indianaffairs.gov/er/oilgas/mitigation/justice/index.htm; https://teeic.indianaffairs.gov/er/oilgas/mitigation/socio/index.htm
[16] *See* Final Rule at: https://www.regulations.gov/document?D=BLM-2016-0001-9126

The LDAR, venting and flaring requirements are even more important in this field office given the nature of oil and gas production in the planning area. The Farmington FO sits in the middle of the highly productive San Juan Basin. The central and northern portions of the planning area contain high natural gas development potential, while the southern region is a current area of focus for oil development. Both areas present significant ongoing and potential waste issues. According to a recent study conducted by ICF International, New Mexico ranks first in the nation for wasted natural gas from federal and tribal lands, and most of that waste occurs in the San Juan Basin. While the region is responsible for only 4 percent of total U.S. natural gas production, it is responsible for 17 percent of the nation's overall natural gas waste.[17] While oil production is greater in other areas of New Mexico - for example in the Permian Basin which lies in the state's southeast corner – there is growing interest in the oil potential around Farmington. However, as BLM noted in its Analysis of the Management Situation, "the southern portion of the planning area near Lybrook and Cuba contains remote areas that lack infrastructure (such as water pipelines, oil pipelines, and gas pipelines; power lines; and resource roads, local roads, and collector roads)." and "[t]he lack of infrastructure will challenge oil and gas development…"[18] The extraordinarily high leak rate at gas wells in the region as well as the lack of gas capture infrastructure in the southern portion of the planning area indicates the need for this field office to proactively address the issue of natural gas waste. In addition, limiting methane emissions and protecting air quality are critical steps in protecting local public health and community function.

Recommendations: BLM and BIA should exercise their authority and obligation to reduce waste of gas natural gas by incorporating requirements in the joint plan, including the BLM's Methane Waste Rule.

i. *BLM and BIA have the legal authority to require waste reduction measures and have a mandate to reduce waste*.

Congress has expressed an interest in repealing the recently finalized rule. Regardless of any decisions made by Congress, BLM and BIA have mandates to reduce waste. Land use plan amendments provide the agencies with the opportunity to ensure they are fulfilling these mandates.

Under the Mineral Leasing Act (MLA) and FLPMA, the Department of the Interior has a responsibility and an obligation to put forward regulations to manage federal resources that benefit the public. The MLA provides for the Department of the Interior to manage lands for conservation and development of oil and gas, among other minerals and resources. The BLM, under the MLA, is the only federal agency with a waste prevention mandate. BLM is required to

[17] *See*: https://www.edf.org/energy/substantial-loss-natural-gas-public-lands

[18] Mancos-Gallup RMPA/EIS Analysis of the Management Situation, p.2-113. Available at: https://www.blm.gov/style/medialib/blm/nm/field_offices/farmington/farmington_planning/ffo_planning_docs/rmpa_mancos.Par.39210.File.dat/FMG_FinalAMS_20150317_508_reduced.pdf

ensure that lessees "use all reasonable precautions to prevent waste of oil or gas developed in the land." 30 U.S.C. § 225. The Federal Land Policy and Management Act (FLPMA) further provides that "the public lands be managed in a manner that will protect the quality of…environmental, air and atmospheric…values" and for BLM to manage lands for conservation. These laws are clear that the BLM has a duty and obligation to prevent loss of public resources and to consider a wide range of values in managing our public lands. BLM's authority and duty to regulate waste was recently reaffirmed by the US District Court for the district of Wyoming in an opinion denying a request for preliminary injunction of the BLM methane rule. There, Judge Skavdahl stated that the MLA and the Federal Oil and Gas Royalty Management Act (FOGRMA) "unambiguously grant BLM authority to regulate the development of federal and Indian oil and gas resources for the prevention of waste."[19]

BIA has a similar duty to minimize waste as well as an obligation to protect trust resources. The federal Indian trust responsibility is a legal obligation under which the United States must ensure the protection of tribal and individual Indian lands, assets and resources as well as treaty rights. This includes a legally enforceable fiduciary obligation on the part of the United States. In a legal opinion that remains in effect today, Department of the Interior Solicitor Leo Krulitz concluded, "[t]he trust responsibility doctrine imposes fiduciary standards on the conduct of the executive. The government has fiduciary duties of care and loyalty, to make trust property income productive…and to take affirmative action to preserve trust property."[20] Secretarial Order 3335, signed by Sally Jewel on August 20, 2014 reaffirmed these obligations and directed DOI to abide by a number of guiding principles including to "[e]nsure to the maximum extent possible that trust and restricted fee lands, trust resources and treaty and similarly recognized rights are protected." [21] Again, these responsibilities are reiterated in H-1780-1 which directs BIA to "protect and preserve Indian trust assets from loss, damage, unlawful, alienation, waste, and depletion."[22] (emphasis added).

In this situation, BIA, as trustee has a fiduciary obligation to manage the trust resources in a manner consistent with the best interests of the trust's beneficiaries. The wasted gas that is leaked, vented, and flared creates health risks, accelerates climate change, and reduces royalties collected for the beneficiaries. Permitting such practices amounts to authorizing waste of trust resources. The methane waste rule applies to tribal and some allotted lands and will go a long way in limiting waste. However, regardless of the rule, BIA has a duty to minimize waste and must ensure adequate measures are in place at the planning stage to meet its obligations.

Further support for implementing these responsibilities comes from the Navajo Nation and the All Pueblo Council of Governors. The Red Mesa Chapter of the Navajo Nation as well as the

---

[19] *State of Wyoming v. United States Department of Interior*, 2:16-cv-00280-SWS (D.Wyo. Jan. 16, 2017)
[20] Memorandum from Department of the Interior Solicitor Leo M. Krulitz to Assistant Attorney General James W. Moorman, at 2 (Nov. 21, 1978)
[21] S.O. 3335 available at: https://www.doi.gov/sites/doi.gov/files/migrated/news/pressreleases/upload/Signed-SO-3335.pdf
[22] Draft Handbook H-1780-1 at XIV.E.1.a. Found at: https://www.blm.gov/style/medialib/blm/id/cultural.Par.48432.File.dat/H-1780-1%20Review%20Draft.pdf

Northern Navajo Agency Council both passed resolutions supporting the BLM rule and the All Pueblo Council of Governors passed a resolution opposing flaring near Chaco Canyon. Additionally, the Counselor Chapter House of the Navajo Nation submitted a letter to BLM Director Neil Kornze calling on him to expedite finalization of the rule, and Russel Begaye, President of the Navajo Nation has declared his support for the rule on numerous occasions. These communications are included with these comments (compiled as Attachment 1). Each reiterates BIA's and BLM's authority to regulate waste and expresses support for the goals of the BLM methane waste rule.

ii. *The agencies should develop and include waste minimization stipulations in the joint plan*.

To ensure successful implementation of the final rule, the agencies should incorporate by reference the requirements of the methane rule as stipulations. The preliminary alternatives released by the Price Field Office for the San Rafael Desert Master Leasing Plan (MLP) do just that by addressing the issues of venting and flaring under stipulation AQ-11.[23] The stipulation explicitly calls out the requirement to eliminate venting and flaring of associated gas and to submit a waste minimization plan along with APDs:

> In the absence of a pipeline, to capture gas associated with production from an oil well, use of a combustor or other best available technologies would be required. To minimize impacts on air quality and AQRVs, as well as minimize emissions of greenhouse gases, venting or open flaring would be prohibited except in the limited circumstances identified in the BLM's methane waste prevention rule. Evaluation of all reasonable and technically feasible gas capture technologies would be required as part of operator plan approvals. In the case of an exception, a visual screen must be used to minimize sky glow, glare, and adverse visual effects on night sky resources.

While it is encouraging to see the BLM acknowledge that operators must comply with portions of the new rule, all alternatives must explicitly state that operators will comply fully with the provisions of the waste rule including but not limited to the waste minimization plan, venting prohibition, flaring limits, LDAR inspections, well drilling and testing measures and equipment specific requirements for pneumatics, storage vessels and liquids unloading. The final rule went into effect on January 17, 2017 and any alternative must reflect these new requirements. Additionally, in evaluating management alternatives, BLM and BIA must take into account the potential impact the rule will have on a number of resources including air quality and climate.

We encourage the agencies to go beyond simply referencing the rule and develop stipulations that identify specific methane capture requirements. Not only are operators required to comply with the requirements of the methane rule as of January 17, 2017, but including specific

[23] See stipulation AQ-11 at: https://eplanning.blm.gov/epl-front-office/projects/nepa/61781/93139/112240/SRD_MLP_Chapter_2_Alternatives_-_Public_Review.pdf

requirements as stipulations in the plan can be used by the agencies as part of outreach and implementation efforts around the rule. For example, BLM and BIA could develop and include the following stipulations and apply them as condition surface use (CSU) stipulations across the planning area:

- "When submitting an Application for Permit to Drill an oil well, the operator must also submit a plan to minimize waste of natural gas from that well. The plan must set forth a strategy for controlling waste from venting and flaring, and must explain how the operator plans to capture associated gas upon the start of oil production, or as soon thereafter as reasonably possible, including an explanation of why any delay in capture would be required."
- "Gas well gas may not be flared or vented, except where it unavoidably lost."
- The operator must flare rather than vent any associated oil well gas that is not captured. On a monthly basis, each operator must capture for sale or use on site a volume of gas sufficient to meet the capture percentage of 85% though 12/31/2019; 90% through 12/31/2022; 95% though 12/31/2025 and 98% starting 1/1/2026 and every month thereafter. Capture percentage means the total volume of gas captured divided by the total volume of gas produced."
- "Operators must measure all volumes of gas vented or flared from wells, facilities and equipment on a lease monthly, and report those volumes to the agency on an annual basis."
- "Operators must use pneumatic controllers and pumps with a bleed rate less than 6scf per hour."
- "Operators are required to develop and submit a comprehensive leak detection and repair (LDAR) plan along with an APD. The LDAR plan will identify the method and frequency of leak detection inspection; not to be conducted on a less than semi-annual basis. The operator will report to the agency annually the number of leaks identified, the date the leak was repaired and any leaks placed on a delay of repair list. Leaks must be repaired within 15 days unless the Authorized Official approves a request from the operator identifying the need to place the leak on the delay of repair list."

These stipulations will help to improve air quality, night skies, visual resources, reduce waste, and protect public health. Given the revenue currently being lost to the American taxpayer as a result of rampant waste of a public resource, it is clear that such measures are critical to responsible management of the federal fluid minerals program. The agencies should seize the opportunity to reduce waste and increase federal revenues through the Chaco RMPA.

iii. *Field Offices are already implementing waste prevention measures prior to finalization of the BLM rule*.

To fulfill the waste prevention mandate, some BLM field offices implemented measures intended to incentivize waste capture. For example, the Carlsbad FO in New Mexico approved long-term flaring of some gas but also determined that the flared gas was "avoidably lost" and

therefore subject to royalties. Officials in the Carlsbad FO stated that they charged royalties on flared gas because "oil production in their region boomed and operators made an economic choice to flare gas associated with their oil wells—and pay the royalties—rather than wait until gas gathering pipeline was available."[24] According to a recent GAO study, the Carlsbad FO "concluded that within their region operators could generally restrict production at their established wells without endangering the amount of oil that these wells could ultimately produce. Therefore, these officials concluded that much of the gas flared from oil wells in the region was considered avoidably lost or "wasted gas" and therefore royalties were due." In their opinion, "charging royalties on flared gas could provide a small incentive for operators to develop infrastructure for gathering gas from oil wells."[25]

The Farmington FO should follow the example of the Carlsbad FO and look for innovative ways to reduce natural gas waste. Additionally, a recent study has shown requiring waste mitigation measures like those established by the BLM methane waste rule and the Carlsbad FO are cost effective even for the most marginal wells in the San Juan Basin. Overall, the study found compliance costs represent less than 3% of annual costs for an average marginal well in the Basin and that the smallest producers would see less than 0.1% decrease in annual profit margin.[26] Developing and implementing specific waste minimization stipulations in the Chaco RMPA could be an effective waste minimization technique benefitting both for industry and the American taxpayer.

e. <u>The agencies should incorporate mitigation requirements, including compensatory mitigation, into the joint plan</u>.

BLM and BIA are subject to a broad range of authorities supporting mitigation measures to offset unavoidable impacts. The Federal Land Policy and Management Act (FLPMA) requires the BLM to manage for multiple use and sustained yield, and to avoid unnecessary or undue degradation of resources and values. *See* 43 C.F.R. §§ 1701, 1732(b). The National Environmental Policy Act (NEPA) and associated Council on Environmental Quality (CEQ) regulations require the agencies to analyze potential impacts and consider ways to avoid, minimize and mitigate impacts – in accordance with the mitigation hierarchy. 40 C.F.R. §§ 1508.8, 1502.14, 1502.16. The Department of the Interior (DOI) has issued applicable guidance through its Landscape-Scale Mitigation Policy which outlines responsibilities for the BLM and BIA, and affirms the agencies' authority to identify and plan for the extent, nature, and location of mitigation, including compensatory mitigation.[27] DOI's Landscape Mitigation Policy directs BLM and BIA to make maximum use of applicable authority to apply mitigation policies. BLM's manual and handbook on mitigation (Manual 1794, Handbook H-1794-1) acknowledge BLM's

[24] GAO-16-607; Government Accountability Office, "Interior Could Do More to Account for and Manage Natural Gas Emissions", July 2016, p. 24 Available at: http://www.gao.gov/assets/680/678285.pdf
[25] Ibid at p.25
[26] CEI Study Available at: https://media.wix.com/ugd/5fc209_59c6d0e608554ac98fd5ac9b4655fad1.pdf
[27] *See generally* U.S. Dep't of Interior, Public Land Policy Landscape-Scale Mitigation Policy § 6.5 (Oct. 23, 2015), https://www.doi.gov/sites/doi.gov/files/uploads/TRS%20and%20Chapter%20FINAL.pdf.

authority to condition land uses on mitigation and to deny approval of uses when impacts cannot be sufficiently mitigated.[28] Further, the manual provides:

> The BLM will, through the land use planning process, for resources that are considered important, scarce, sensitive, or have a protective legal mandate, identify mitigation standards. As appropriate and through application of the mitigation hierarchy, mitigation standards should seek to achieve a no net loss or net benefit outcome for such resources.[29]

The joint plan is the right vehicle for establishing an approach to mitigation for impacts from oil and gas leasing and development in this planning area.

In order to comply with its obligations to avoid, minimize and compensate for impacts, BLM should expand the discussion of mitigation and provide for additional, more protective lease stipulations and COAs applicable to a wide range of resources. For instance, lands with wilderness characteristics (LWC) will generally meet the agency's definition of important, scarce and/or sensitive resources and, hence, BLM should set out mitigation measures for impacts to lands with wilderness characteristics. The Solar Programmatic EIS, for instance, addresses options for applying compensatory mitigation for impacts to lands with wilderness characteristics through:

- Acquiring wilderness inholdings from willing sellers.
- Acquiring private lands from willing sellers adjacent to designated wilderness.
- Acquiring private lands from willing sellers within proposed wilderness or Wilderness Study Areas.
- Acquiring other lands containing important wilderness or related values, such as opportunities for solitude or a primitive, unconfined (type of) recreation.
- Restoring wilderness, for example, modifying routes or other structures that detract from wilderness character.
- Contributing mitigation monies to a "wilderness mitigation bank," if one exists, to fund activities such as the ones described above.
- Enacting management to protect lands with wilderness characteristics in the same field office or region that are not currently being managed to protect wilderness character. Areas that are to be managed to protect wilderness characteristics under this approach must be of sufficient size to be manageable, which could also include areas adjacent to current WSAs or adjacent to areas currently being managed to protect wilderness characteristics.[30]

[28] *See, e.g.*, U.S. Dep't of Interior, BLM, H-1794-1 Mitigation (P) § 1.6.E.2 (Dec. 22, 2016) (Handbook 1794-1).
[29] *Id.* § 1.6.A.1.d.
[30] U.S. Dep't of Interior, BLM, Approved Resource Management Plan Amendments / Record of Decision (ROD) for Solar Energy Development in Six Southwestern States 54-56 (Oct. 2012).

Additionally, given the international significance of cultural resources within Chaco Culture NHP and in the surrounding landscape, BLM and BIA should also identify opportunities to use landscape-level mitigation as a means of protecting and restoring the cultural values of this landscape.

Recommendations: The joint plan should incorporate similar mitigation options for lands with wilderness characteristics and other impacts to natural and cultural resources, as well as to local communities, including as discussed in further detail below.

f. <u>The agencies should conduct a health impact assessment and develop measures to address those impacts.</u>

Oil and gas development can result in impacts to the health and welfare of surrounding communities. In the planning area, these impacts can also have a differential adverse impact on low income or minority populations, creating environmental justice concerns that can and should be addressed in the plan and in any subsequent approved activities. The drilling/development and production project phases are the most likely times when these impacts can occur. In the EIS, BLM and BIA are required to analyze the potential impacts of oil and gas leasing and development. This analysis should explicitly address potential health impacts and consider measures to avoid or reduce impacts, including the differential impacts to low income or minority populations in terms of air and water quality.

Once potential health impacts are evaluated, mitigation measures to limit health impacts can be imposed through lease stipulations, COAs and BMPs to limit impacts to air quality and groundwater quantity and quality. The agencies should develop an approach to mitigate impacts that adversely affect and cause a disproportionate effect on minority or low-income populations through appropriate measures. In addition, BLM and BIA can develop are more extensive outreach campaign to provide technical and environmental health information directly to low-income and minority groups or to local agencies and representative groups. Included in these campaigns would be descriptions of existing air and groundwater monitoring programs; the nature, extent, and likelihood of existing and future airborne or groundwater releases from oil and gas facilities; and the likely characteristics of environmental and health impacts. Key information would include the extent of any likely impact on air quality, drinking water supplies, subsistence resources, and the relevant preventative measures that may be taken.

Recommendations: The agencies should conduct a thorough assessment of health impacts of the projected oil and gas development in the planning area and develop mitigation measures to address those impacts.

g. The agencies should analyze socio-economic impacts and develop measures to mitigate those impacts.

In addition to health impacts, oil and gas development can have socioeconomic impacts on local communities. For instance, the influx of construction and operations workers associated with oil and gas development and ancillary facilities in communities with low-income and minority populations could lead to the undermining of local community social structures and, consequently, could lead to a range of changes in social and community life, including increases in crime, alcoholism, and drug use. The agencies can evaluate socioeconomic impacts and include those in evaluating the costs and benefits of approving ongoing leasing and development.

As part of their outreach to local communities, BLM and BIA can provide information on the scale and time line of expected oil and gas development, and on the experience of other communities that have followed the same energy development path to local governments and directly to low-income and minority populations, together with information on planning activities that may be initiated to provide local infrastructure, public services, education, and housing.

The agencies can also work with operators to look at creative ways to mitigate impacts to local communities, such as through supporting community health screenings, especially those addressing potential health impacts related to the oil and gas industry, vocational training and other measures that can be shown to effectively mitigate harms related to oil and gas development.

Recommendations: The agencies should conduct a thorough assessment of the socioeconomic impacts of the projected oil and gas development in the planning area and develop mitigation measures to address those impacts.

h. The joint EIS and plan should quantify potential greenhouse gas emissions from oil and gas development and take climate change impacts into account.

Oil and gas production on federal public lands is extensive and the production of greenhouse gasses (GHG) resulting from the exploration, extraction, transportation and combustion of these fuels is significant. In fact, energy extracted from public lands accounts for more than one-fifth of the U.S. greenhouse gas footprint.[31] The Office of Management and Budget in cooperation with the Council of Economic Advisors, after reviewing potential climate impacts to the budget of the federal government, recently concluded "the evidence available thus far indicates the fiscal risks to the Federal Government could be very significant over the course of this century without ambitious action to reduce GHGs and adapt our communities to a

[31] *See generally* The Wilderness Society, Greenhouse Gas Emissions from Fossil Energy Extracted from Federal Lands and Waters: An Update (Dec. 23, 2014), http://wilderness.org/sites/default/files/Stratus-Report.pdf

changing climate"; and that "[w]ide-ranging impacts will impede economic production and diminish Federal revenue."[32]

Recommendations: There are significant directives in place requiring the agencies to evaluate and address climate change impacts, including in decision-making at the planning stage. The wide range of impacts from climate change has led to substantial national commitments to reduce our contribution to climate change and manage for adaptability. Therefore, the agencies should ensure the joint EIS and plan appropriately analyze GHG emissions, as described below, and consider management actions to mitigate climate change impacts.

i. *The joint plan must quantify GHG emissions and analyze climate change impacts to comply with domestic and international commitments as well as other federal requirements*.

The United States has submitted its target to cut net GHG emissions to the United Nations Framework Convention on Climate Change. This Intended Nationally Determined Contribution (INDC), as provided for in the Paris Agreement, is a formal statement of the U.S. target to reduce emissions by 26 to 28 percent below 2005 levels by 2025. In addition, to achieve a no more than 2 degrees C temperature increase, heat trapping gasses in the atmosphere must be kept at or below 450 parts per million CO2-eq., which means that industrialized nations like the U.S. will have to reduce their emissions an average of 70 to 80 percent below 2000 levels by 2050.

Additionally, on June 29, 2016, the leaders of Canada, Mexico, and the United States committed to the North American Climate, Clean Energy, and Environment Partnership. Under this agreement the countries will pursue an historic goal for North America to strive to achieve 50 percent clean power generation by 2025. "Canada, the U.S., and Mexico will work together to implement the historic Paris Agreement, supporting our goal to limit temperature rise this century to well below 2 degrees C, and pursuing efforts to limit the temperature increase to 1.5 degrees C."[33]

More specific to BLM, Secretarial Order 3289 unequivocally mandates all agencies within the Department of the Interior "analyze potential climate change impacts when undertaking long-range planning exercises, setting priorities for scientific research and investigations, developing multi-year management plans, and making major decisions regarding potential use of resources under the Department's purview." S.O. 3289 (Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources), *incorporating* S.O. 3226 (Evaluating Climate Change Impacts in Management Planning). Activities such as the Chaco RMPA must meet these requirements.

---

[32] "Climate Change: The Fiscal Risks Facing the Federal Government" See https://www.whitehouse.gov/sites/default/files/omb/reports/omb_climate_change_fiscal_risk_report.pdf

[33] See https://www.whitehouse.gov/the-press-office/2016/06/29/leaders-statement-north-american-climate-clean-energy-and-environment (presenting Leaders' Statement on a North American Climate, Clean Energy, and Environment Partnership).

In 2016, the Council on Environmental Quality (CEQ) released final guidance on considering GHG emissions and the effects of climate change in NEPA reviews (hereafter, "CEQ Guidance"), which BLM has also incorporated into its requirements for NEPA analysis through internal guidance.[34] The overarching goal of the guidance is to provide greater clarity and more consistency in how federal agencies address climate change in their NEPA reviews and to facilitate compliance with existing NEPA requirements. The CEQ Guidance recognizes that "[c]limate change is a fundamental environmental issue, and its effects fall squarely within NEPA's purview." The guidance applies to all proposed federal agency actions, "including site-specific actions, certain funding of site-specific projects, rulemaking actions, permitting decisions, and land and resource management decisions." CEQ Guidance at 9, 3.

The CEQ Guidance underscores BLM's existing legal obligations to disclose and consider the foreseeable effects that, for example, oil and gas leasing and development has on climate change. The guidance recognizes that identifying and analyzing the interactions between our changing climate and the environmental impacts from a proposed action can have a number of benefits, including identifying opportunities to reduce and mitigate GHG emissions, to improve environmental outcomes, and to help safeguard communities, infrastructure, and resources against the effects of climate change. Therefore, an analysis of climate change "should be similar to the analysis of other environmental impacts under NEPA." *Id.* at 2.

The CEQ Guidance also discusses the application of NEPA principles and practices to the analysis of GHG emissions and climate change, including: (1) that agencies quantify a proposed action's projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools; (2) that agencies use projected GHG emissions as a proxy for assessing potential climate change effects when preparing a NEPA analysis; (3) where GHG emission tools, methodologies, or data inputs are not reasonably available, that agencies include a qualitative analysis in the NEPA document and explain the basis for determining that quantification is not reasonably available; (4) that agencies analyze foreseeable direct, indirect, and cumulative GHG emissions and climate effects; (5) that agencies consider reasonable alternatives and the short- and long-term effect and benefits in the alternatives and mitigation analysis; (6) that agencies consider alternatives that would make the actions and affected communities more resilient to the effects of a changing climate; and (7) that agencies assess the broad-scale effects of GHG emissions and climate change, either to inform programmatic decisions, or at both the programmatic and project-level. *Id.* at 4-6.

[34] *See* CEQ, Memorandum for Heads of Departments and Agencies: "Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews," (Aug. 1, 2016), *available at* https://www.whitehouse.gov/sites/whitehouse.gov/files/documents/nepa_final_ghg_guidance.pdf; BLM Permanent Instruction Memorandum 2017-003: "The Council on Environmental Quality Guidance on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews," *available at* https://www.blm.gov/policy/pim-2017-003-0.

More broadly, NEPA requires all significant environmental impacts to be considered in an environmental analysis of a proposed federal action. The "twin aims" of NEPA are to "consider every significant aspect of the environmental impact of a proposed action" and to "ensure that the agency will inform the public that it has indeed considered environmental concerns in its decisionmaking process." *Baltimore Gas & Elec. Co. v. Natural Res. Def. Council,* 462 U.S. 87, 97 (1983). BLM and BIA must fully analyze the cumulative and incremental impacts of proposed decisions, including climate change impacts. *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1217 (9th Cir. 2008) ("The impact of greenhouse gas emissions on climate change is precisely the kind of cumulative impacts analysis that NEPA requires agencies to conduct.").

Further, NEPA regulations require that NEPA documents address not only the direct effects of federal proposals, but also "reasonably foreseeable" indirect and cumulative effects, defined as follows:

Indirect effects, which are caused by the action and are later in time or farther removed in distance, *but are still reasonably foreseeable*. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems. 40 C.F.R. § 1508.8(b) (emphasis added).

Cumulative impact is the impact on the environment which results from the *incremental impact of the action when added to other past, present, and reasonably foreseeable future actions* regardless of what agency (Federal or non-Federal) or person undertakes such other actions. *Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time*. 40 C.F.R. § 1508.7 (emphasis added).

Therefore, it is important for BLM and BIA to consider the indirect and cumulative impacts of, and mitigation options for, climate change when developing the joint EIS and plan.

ii. *Widely-accepted methods exist for quantifying emissions and analyzing impacts*.

There are a number of well-recognized methods available for assessing the amount of CO2-eq and methane emissions that result from oil and gas leasing and development. These methods can be used to estimate GHG emissions resulting from the management actions proposed in each alternative for the San Rafael Desert MLP. Methods such as the Greenhouse Gas Protocol and the EPA's GHG Reporting Rule can provide estimates of the GHG emissions levels from projected oil and gas leasing and development.

Additionally, the agencies should seek to quantify the potential impacts of climate change as they relate to management decision proposed in each alternative. Using the GHG emission estimates the agencies must employ one or more accepted approaches to assess climate impacts associated with potential future leasing.

There also exist reliable methods for quantifying impacts from future leasing at the planning stage. The Social Cost of Carbon (SCC) is a leading tool for quantifying the climate impacts of proposed federal actions. The SCC is an estimate, in dollars, of the long-term damage caused by a one ton increase in carbon dioxide (CO2) emissions in a given year; or viewed another way, the benefits of reducing CO2 emissions by that amount in a given year. The SCC is intended to be a comprehensive estimate of climate change damages that includes, among other costs, the changes in net agricultural productivity, risks to human health, and property damages from increased flood risks. The method was initially designed for application in rulemakings, but the courts have recognized its applicability to NEPA analyses.[35] The SCC was developed through a rigorous multi-agency process based on generally accepted research methods and years of peer-reviewed scientific and economic studies. In addition, EPA has developed a companion protocol called the Social Cost of Methane method, focusing on methane emissions. These methods provide a way to quantify the costs of GHG emissions and present them to the public. Since the benefits of the production of fossil fuel production are regularly monetized in BLM's NEPA documents, it is critical that the *impacts* also be monetized.

The White River Field Office (WRFO) along with other Colorado field offices recently quantified potential GHG emissions associated with the May 2017 lease sale.[36] In the Environmental Assessment, BLM analyzed climate in Chapter 3, "Environmental Consequences of Leasing and Potential Development." The field office estimated potential GHG emissions associated with the lease sale. While the methodology utilized by the agency does not meet the standards we present here, it highlights that this type of analysis is feasible. It is also important to note that many of the leases were located within the North Park MLP area. If the agencies choose not to quantify GHG emissions and/or not to analyze potential climate impacts at the planning stage, they must conduct additional analyses every time a lease sale moves forward.

The Moab MLP also attempted to quantify potential GHG emissions. Although CEQ guidance was released after the field office completed the FEIS, an "Indirect Greenhouse Gas Emissions" analysis was appended to the ROD.[37] Here, BLM only identified potential emissions and did not analyze potential impacts to climate. However, this shows the tools are available to complete such an analysis.

We believe that addressing these issues at the planning stage is more efficient and is necessary to identify the true cumulative climate impacts of the various alternatives. Additionally, by taking climate issues into consideration on the front-end, the agencies can develop and

---

[35] *See generally High Country Conservation Advocates v. U.S. Forest Serv.,* 52 F. Supp. 3d 1174 (D. Colo. 2014).
[36] Preliminary Environmental Assessment for the May 11, 2017 Competitive Oil & Gas Lease Sale. See: https://www.blm.gov/style/medialib/blm/co/programs/oil_and_gas/Lease_Sale/2017/may.Par.31766.File.dat/May_2017_EA_11-9-2016.pdf.
[37] *See* U.S. Dep't of Interior, BLM, Record of Decision and Moab Master Leasing Plan / Approved Resource Management Plan Amendments for the Moab and Monticello Field Offices, Appendix C – Indirect Greenhouse Gas Emissions, https://eplanning.blm.gov/epl-front-office/projects/lup/68430/94903/114626/10_Moab_MLP_ROD_Appendix-C_Indirect_Greenhouse_Gas_Emissions_508.pdf (Moab ROD)

incorporate additional stipulations as appropriate to mitigate impacts. Addressing these issues and conducting these analyses in the plan will also provide operators with greater certainty and clarity.

i. No waiver, exception or modification of no surface occupancy and other stipulations that protect important cultural, natural and community resources and values.

We strongly encourage BLM and BIA to make clear that all no surface occupancy (NSO) stipulations are not subject to waiver, exception or modification. BLM has used this approach to NSO stipulations to protect lands with wilderness characteristics[38] and roadless areas.[39] A similar commitment should be made to other protective stipulations that are designed to protect important cultural, natural and community resources and values. Without such a firm commitment, these stipulations do not provide reliable protection and cannot be cited as meaningful mitigation.

In order for the agencies to rely on mitigation to reduce potentially significant impacts, NEPA requires that the agencies make a firm commitment to the mitigation and discuss the mitigation measures "in sufficient detail to ensure that environmental consequences have been fairly evaluated . . ." *Communities., Inc. v. Busey*, 956 F.2d 619, 626 (6th Cir. 1992). NEPA also directs that the *possibility* of mitigation should not be relied upon as a means to avoid further environmental analysis. *Davis v. Mineta*, 302 F.3d 1104, 1125 (10th Cir. 2002). To provide certainty to all stakeholders BLM should not permit waiver, exception or modification of NSO stipulations which are vital for achieving the management and conservation goals of this planning effort.

In addition, where the agencies include options for waiver, exceptions or modification for stipulations other than NSO, the conditions for granting them such be narrowly tailored and require a persuasive showing from the operator. Waiver, exception and modification should neither be regularly available nor available subject to general, undefined BLM or BIA discretion upon request.

Recommendations: The agencies should not permit waiver, exception or modification of NSO and other protective stipulations. Any other use of waivers, exceptions and modifications should be narrowly tailored.

j. Sample protective measures.

In developing management prescriptions to protect resources in this field office, BLM and BIA should look to lease stipulations and development conditions adopted in other planning areas

[38] *See* White River RMP Amendment, Appendix A, Section 2.13, p. 1-17 *available at:* https://www.blm.gov/style/medialib/blm/co/programs/land_use_planning/rmp/white_river/documents/wrfo_oil_and_gas_approved.Par.55320.File.dat/02WRFO_OG_ROD-ARMPA_Apdx1_Stips_Aug2015_508c.pdf

[39] *See* San Juan National Forest Final EIS, Appendix H, p. H-53 *available at*: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5435654.pdf

with similar management concerns and resource characteristics. Attached are overviews of provisions from other planning efforts that the agencies should consider applying on federal, tribal and allotted lands, including an overview of examples for various resources (Attachment 2) and a set of examples used to protect resources and visitor experiences for National Park Service lands (Attachment 3).

4. The joint planning should include a broad range of alternatives, commensurate with the breadth of issues to be addressed.

The range of alternatives is "the heart of the environmental impact statement." 40 C.F.R. § 1502.14. "NEPA requires that federal agencies consider alternatives to recommended actions whenever those actions 'involve[ ] unresolved conflicts concerning alternative uses of available resources.' 42 U.S.C. § 4332(2)(E) (1982)." *Bob Marshall Alliance v. Hodel,* 852 F.2d 1223, 1228 (9th Cir. 1988). NEPA requires BLM to "rigorously explore and objectively evaluate" a range of alternatives to proposed federal actions. *See* 40 C.F.R. §§ 1502.14(a), 1508.25(c). "An agency must look at every reasonable alternative, with the range dictated by the nature and scope of the proposed action." *Nw. Envtl. Defense Center v. Bonneville Power Admin*., 117 F.3d 1520, 1538 (9th Cir. 1997). Whether an alternative is "reasonable" or not turns on whether it will accomplish the stated purpose for the project. *Custer County Action Ass'n v. Garvey*, 256 F.3d 1024, 1041 (10th Cir. 2001); *City of Carmel-By-The-Sea v. United States Dep't of Transp.*, 123 F.3d 1142, 1155 (9th Cir. 1997).

The stated purpose of the amendment to the Farmington RMP was to "to address issues relating to oil and gas in the Mancos Shale/Gallup Formation" including decisions regarding fluid leasable minerals, vegetation management, lands and realty, lands with wilderness characteristics and impacts of the decisions for the resources being addressed on all affected resources.[40] As noted above, addressing impacts of fluid minerals management requires mitigation, including at a landscape-level. The stated purpose of this expanded planning effort is to extend the analysis in the EIS under preparation to BIA decision-making where BIA manages mineral leasing and associated activities in the planning area. 81 Fed.Reg. 72819, 72820 (October 21, 2016). This expanded scope provides a pathway to address more impacts across the planning area.

a. <u>No leasing alternative</u>

BLM and BIA should analyze an alternative for no future leasing in the planning area. As noted above, BLM should evaluate environmentally protective alternatives.

The most fundamental requirement of FLPMA is to manage the public lands for multiple-use and sustained yield. The definition of multiple-use is broad but among other things it requires: (1) management so that the lands "are utilized in the combination that will best meet the

[40] *See* https://www.blm.gov/nm/st/en/fo/Farmington_Field_Office/ffo_planning/farmington_rmp/rmpa_mancos.html

present and future needs of the American people;" (2) "the use of some land for less that all of the resources;" and (3) "harmonious and coordinated management of the various resources without permanent impairment of the productivity of the land and the quality of the environment with consideration being given to the relative values of the resources and not necessarily to the combination of uses that will give the greatest economic return or the greatest unit output." 43 U.S.C. § 1702(c). Sustained yield is management that achieves a high level annual or regular periodic output of renewable resources in perpetuity. *Id.* § 1702(h). The Secretary of the Interior "shall manage the public lands under principles of multiple use and sustained yield . . . ." *Id.* § 1732(a).

Additionally, "[i]t is past doubt that the principle of multiple use does not require BLM to prioritize development over other uses." [1] *New Mexico Ex. Rel. Richardson v. BLM*, 565 F.3d 683, 710 (10th Cir. 2009). As noted in BLM's recent guidance on master leasing plans:

> The BLM recognizes that, in some cases, leasing of oil and gas resources may not be consistent with protection of other important resources and values, including units of the National Park System; national wildlife refuges; other specially designated areas; wildlife; and cultural, historic, and paleontological values. **Under applicable laws and policies, there is no presumed preference for oil and gas development over other uses**."[41]

As prescribed in FLPMA, when creating land use plans BLM should:

- "consider present and potential uses of the public lands";
- "consider the relative scarcity of the values involved and the availability of alternative means (including recycling) and sites for realization of those values";
- "weigh long-term benefits to the public against short-term benefits."

43 U.S.C. § 1712(c). In this planning area, where the majority of lands in the Farmington Field Office are leased, the scarcity of unleased lands and long-term benefits of preserving these remaining lands for natural and cultural resources, including lands with wilderness characteristics and the greater Chaco landscape, as well as local communities, supports consideration of a no leasing alternative. Without analyzing a no leasing alternative, the range of alternatives that could be considered for oil and gas leasing would arguably be excessively narrow. Further, the multiple uses of the lands in the planning area have already been skewed toward oil and gas leasing and development; considering less leasing and development, including a no leasing alternative, is the best way to comply with the directives of NEPA and FLPMA.

[41] Instruction Memorandum 2010-117, p. 2 (emphasis added).

b. The agencies should evaluate the use of phased approaches to leasing and development.

Phased leasing is the concept of limiting the number of parcels offered for sale in a given time period or otherwise leasing parcels in a strategic manner. BLM includes phased leasing as a "Resource Protection Measure" in its formal guidance on master leasing plans (MLP).[42] Phased development is used to manage the timing and location of oil and gas development in a given area. As stated by the BLM, phased development "refers to prescribing the sequence of drilling operations by geographic area to allow for the development of certain areas while restricting or temporarily restricting development of other areas. Subsequent development occurs as areas developed earlier are completed and reclaimed."[43]

i. *The agencies should evaluate the use of phased leasing based on development potential and existing infrastructure*.

As part of a "smart from the start" approach to energy development on public lands, BLM should limit new leasing and prioritize management for other resource values on lands with low and no oil and gas development potential. Traditionally, BLM opens low-potential areas to leasing based on its assumption that future oil and gas development will not rise to a level that threatens other resource values. As explained in a recent report by The Wilderness Society,[44] this approach to managing low potential lands needlessly leaves the door open to future resource conflicts. Even though actual drilling and development may be rare in low potential areas, industry still targets these lands for speculative leasing,[45] and, even in the absence of drilling, leases themselves often create conflicts by affecting BLM management decisions for other resources.[46] As BLM knows, issuing a lease creates "valid existing rights," which substantially limits land management opportunities.

These types of conflicts are simply unnecessary. Through a phased leasing approach and selective closures, BLM can provide durable protections for other resource values and still allow for new oil and gas exploration in low potential areas. BLM adopted this type of approach in the Dinosaur Trail MLP, where it prioritized new leasing in high potential areas and away from low potential lands around Dinosaur National Monument:

---

[42] *See* Handbook 1624-1 § V.C.2.
[43] *Id.*
[44] *See* The Wilderness Society, "No exit: How our public lands are fated for oil and gas development" (June 28, 2016) *available at* http://wilderness.org/blog/no-exit-how-our-public-lands-are-fated-oil-and-gas-development
[45] See, e.g., White River FO RMP (1996) at p. A-7 ("At any given time, most of the acreage that is available for oil and gas leasing in the WRRA is under lease…Most of the area is leased for speculative purposes and only a small percentage of leases will ever be developed.").
[46] *See, e.g.*, Bighorn Plan Proposed RMP (2015) at Appendix S at Table S-1 ("Rationale for Not Managing Lands with Wilderness Characteristics for Naturalness, Solitude, and Primitive and Unconfined Recreation, by Field Office and Unit") (declining to manage dozens of LWC units to protect their wilderness character based on the presence of existing leases).

> Leasing within the MLP would progress in phases to address other resource values and concerns. Leasing would first occur in the southern portion of the MLP, where the oil and gas occurrence potential is rated medium to high. Leasing within sage-grouse habitat, areas of low oil and gas potential, or areas adjacent to Dinosaur National Monument would occur once the BLM has completed additional analysis and planning.[47]

As another example, to head-off potential resource conflicts, the Forest Service (USFS) closed more than 1 million acres of low potential lands to new leasing in its most recent plan for the White River National Forest:

> My decision includes closing through management direction, 1,281,726 acres of the Forest to oil and gas leasing for the life of this plan. It is very important to understand the context of this part of my decision. Approximately 1,067,000 of these acres are closed because there is little or no potential for oil and gas production due to the geology of the area.[48]

Importantly, the USFS also closed areas of high development potential where other resource values outweighed the benefits of oil and gas development:

> There are a total of 198,513 acres of 'high oil and gas potential' on the White River National Forest… I chose to close through management direction approximately 61,000 acres of high potential lands on the Forest in order to maintain the natural character of the landscape and continue to protect the outstanding wildlife and recreation values of these lands.[49]

Most recently, the EIS for the California Central Coast FO Oil and Gas Leasing and Development RMP Amendment developed a preferred alternative that allows leasing only in high development potential areas and closes all low and medium potential lands to leasing.[50]

A similar approach would make sense for the Greater Chaco landscape and this planning area in general. BLM's Reasonably Foreseeable Development Scenario (RFD) predicts that, over the life of the plan, industry will target the central and northern portions of the planning area for natural gas development and the southern portion of the planning area for oil. The gas plays will be pursued if and when market conditions improve. The RFD analysis states that "A recent presentation (Currie, July 2014) at the Legislative Finance Committee meeting in July proposed a breakeven price of $4.25/mmbtu for the San Juan Basin."[51] The Energy Information Administration's (EIA) 2017 Annual Energy Outlook (AEO) projects a Henry Hub spot price of

[47] WRFO Approved RMP at 2-45.
[48] White River National Forest Oil and Gas Leasing ROD at 6.
[49] Id.
[50] *See* Draft RMPA/EIS at p. 2-12, available at https://eplanning.blm.gov/epl-front-office/projects/lup/67003/94022/113336/Ch._2_Alternatives.pdf
[51] SJB Mancos RFD at p. 21

$4.26/mmbtu by 2022, but prices don't exceed $5/mmbtu until 2030.[52] Meanwhile, interest in the oil rich areas will increase along with rising oil prices. Given that the gas rich region is already substantially leased and likely not to spur additional industry interest in the near future it makes sense to utilize a phased leasing approach based on oil development potential identified in the RFD.

According to the RFD, the area immediately surrounding Chaco Culture NHP has no oil development potential. This area is also likely to generate the greatest potential for conflict with other resource values. As a result, the agencies should close this area to leasing. Moving away from Chaco to the northeast, the RFD identifies an area of high potential. This area will likely attract the greatest interest from industry. However, it is still relatively close to Chaco, including its entrance road and significant cultural resources east of the park such as Pueblo Pintado and Bis sa'ani, and development will pose significant risks to other resource values such as viewsheds, night skies and air quality. Low potential lands should be closed or managed under no surface occupancy stipulations, so they can be managed to conserve other values. Overall, given the amount of the field office that is leased, the agencies should apply a phased leasing strategy that would only make additional lands available for leasing in areas with high potential and then only after industry has shown that more leasing is needed. A similar approach was taken in the Beaver Rim MLP, which provided that, in order to protect crucial winter range, BLM would: "[m]ake parcels in the Beaver Rim area available for leasing starting in the CSU areas outside of crucial winter range." The Beaver Rim MLP Implementation Plan elaborated on how this phased leasing would be applied:

> Areas inside of crucial winter range will be offered for lease2 only after all parcels outside crucial winter range have been offered for lease, sold, and explored **and an economic well outside of crucial winter range proves the viability of the play that would justify exploration and development within crucial winter range**. Exploration will be considered complete when a well has been drilled and completed resulting in economic production. Unsuccessful wells that do not support additional development in crucial winter range will be identified by plugging and abandoning the well.[53]

Similar standards could be part of a phased leasing strategy for this planning area to limit new leasing in vulnerable areas.

In developing a phased leasing strategy, the agencies should also take into consideration existing development and infrastructure along with development potential. As stated in the AMS, the southern portion of the planning area contains remote areas that lack infrastructure and other facilities that are necessary to develop that area.[54] As acknowledged in BLM's leasing guidance, avoiding harm to areas that are undeveloped is an important consideration in

[52] 2017 EIA AEO available at: http://www.eia.gov/outlooks/aeo/data/browser/#/?id=1-AEO2017&cases=ref2017&sourcekey=0

[53] Beaver Rim MLP Implementation Plan, p. 3 *available at:* https://eplanning.blm.gov/epl-front-office/projects/lup/18602/74278/81688/Beaver_Rim_MLP_Implementation_Plan.pdf

[54] Mancos-Gallup RMPA/EIS Analysis of the Management Situation at p. 2-113.

deciding whether to lease lands.[55] Accordingly, to prevent damage to remote, undeveloped areas, the agencies should also incorporate considerations of existing infrastructure into a phased leasing strategy.

ii. *The agencies should evaluate the use of phased development and surface disturbance caps*.

Phased development can be applied in a variety of ways: It can be based on timing - developing one area, then completing reclamation before moving to another area. It can be based on location - delaying development in areas with high cultural significance. Phased development can also be used to limit the amount of surface disturbance on a lease at any given time (applying surface disturbance caps – as a percent of a lease or unit or using an acreage figure) and requiring successful restoration before permitting additional disturbance. This concept allows development to proceed in a controlled manner and gives the agencies the flexibility and time necessary to address any problems that may arise and develop a solution before the same issue arises somewhere else.

Phased development works to limit total surface disturbance across a landscape by limiting the total amount of disturbance permitted at any given time. Phased development has been incorporated into BLM land use plans. The Beaver Rim MLP in Wyoming utilizes a surface disturbance cap approach to phased development and provides that the BLM will:

> Allow no more than 5 percent surface disturbance in the township in which the parcel is located until interim reclamation goals are achieved. Require co-location of new disturbance if technically feasible.[56]

A similar approach that limits surface disturbance and ensures successful reclamation would be especially beneficial in this planning area, given how many lands have already been leased. According to a recent study, reclamation in this region is especially important "because of the ecological sensitivity of the region to combinations of land use and climate uncertainty."[57] We encourage the agencies to implement a phased development strategy along with a surface disturbance cap for the planning area or portions of the planning area where those caps will be most beneficial to natural resources, cultural resources or local communities.

c. The proposed Greater Chaco Landscape MLP is an important tool to manage leasing and development.

Given the growing interest in the area and the potential for significant impacts on Chaco Culture NHP and the surrounding landscape, we have previously recommended that the BLM

[55] *See*, IM 2010-117, § III.C.4
[56] Lander Record of Decision and Approved RMP, Record No. 2028.
[57] T.W. Nauman et al., Disturbance automated reference toolset (DART): Assessing patterns in ecological recovery from energy development on the Colorado…, Sci Total Environ (2017), http://dx.doi.org/10.1016/j.scitotenv.2017.01.034

prepare an MLP as part of the Farmington RMP Amendment. By creating a clear "vision" for oil and gas leasing and development across the Greater Chaco Landscape and the smaller Chaco Core Protection Zone, dense with cultural and natural resources targeted for protection, future conflicts over resources can be avoided and responsible leasing and development can proceed in adjacent areas where local communities can be adequately protected. An MLP should be prepared by the Farmington FO and incorporated throughout the range of alternatives. We incorporate by reference the updated proposed Greater Chaco Landscape MLP submitted on July 16, 2015.

As described in detail in our proposal, BLM Handbook 1624-1, Chapter V, requires BLM to identify a guiding vision and framework for an MLP, identify important resources values, develop resource condition objectives, apply resource protection measures and demonstrate the effectiveness of these management techniques. Resource protection measures can include closing areas to leasing, applying no surface occupancy stipulations, requiring phased leasing and development, and incorporating other best management practices.

Given the checkerboard landscape in the Farmington FO - which contains BLM, tribal and allotted lands - it is imperative that management approaches emphasize coordinated management and development across jurisdictions. The MLP's guiding vision and framework can be applied across BLM and BIA-managed lands and minerals. We encourage both agencies to allow this collaboration to inform management decisions made for the BLM and BIA-managed lands and minerals within the proposed MLP. Such decisions should be made in a manner that provides the greatest protection for Chaco NHP resources and visitor experiences, local communities, public health, sacred sites, and other resources being considered through complementary measures applied on adjacent lands and minerals managed by BLM and BIA. Using the MLP framework will support BLM and BIA in identifying important resources, and then developing resource conservation objectives and protection measures that best address potential conflicts and apply those management decisions appropriately across jurisdictions.

In the proposed Greater Chaco Landscape MLP, we identified three distinct management areas. The "Chaco Core Protection Zone", the "Great North Road Management Area" and the "Community Protection Area". In each "zone" we recommended unique resource protection measures that reflect how future leasing and development should be managed, in light of the unique cultural, natural and community resources that are found in each "zone." This approach represents an example of how BLM and BIA can develop and implement management decisions across jurisdictional boundaries.

d. <u>The agencies should ensure a protection zone around Chaco Culture NHP Is protected from leasing</u>.

Numerous advocates, scientists and tribal and pueblo interests have emphasized the need for an area of no leasing and development around Chaco Culture NHP, and the BLM has already agreed to not issue new oil and gas leases within 10 miles of the park during this planning process. This area would go a long way toward protecting both the cultural resources

associated with the park and found in its surrounding environs, as well as the experience of visitors to Chaco Culture NHP. The agencies should incorporate the 10-mile protection zone into the joint plan. However, while the protection zone is necessary step toward protecting Chaco Culture NHP and important cultural resources in the surrounding landscape from future development, it is not sufficient. As we explain above, the agencies will need to evaluate and adopt additional measures through this joint planning process.

Beyond protection of the 10-mile zone, we ask BLM and BIA to create larger protection zones (with no new leasing) around the significant, great house communities in the RMP area; Archaeology Southwest is currently working on a list and GIS package with specific communities and will follow-up with submission to the agencies.

e. <u>The agencies should identify priority areas for relinquishment of existing leases and incentivize relinquishment as a form of avoiding, minimizing or mitigating impacts.</u>

BLM has the authority to accept lease relinquishments at any time. 43 C.F.R. § 3108.1. This relinquishment can include the entire lease or just a portion of it. *Id*. Lease relinquishments can be a tool for protecting other sensitive resources. For instance, in Instruction Memorandum 2016-143, relating to oil and gas leasing in greater sage-grouse habitat provides for relinquishment to serve as a type of mitigation, stating:

> One compensatory mitigation tool for achieving the net conservation gain mitigation standard, in addition to other restoration and preservation actions, that BLM might consider using is to request the record title owner(s) of existing Federal oil and gas leases located in SFAs, PHMAs, or other sensitive GRSG habitats to relinquish those leases as an offset to the potential impacts to GRSG and their habitats from activities arising from other implementation decisions or activities on valid existing leases located on the public lands. Lease relinquishment as a compensatory mitigation tool is a form of protection and is generally only appropriate for those leases in priority habitat with high-value GRSG habitat that also has a high potential and likelihood for development.

In this planning area, relinquishment can be an important tool to protect sensitive cultural resources or communities. The agencies should evaluate opportunities to identify priority areas for lease relinquishment, make operators aware of this tool and ensure that if leases are relinquished in these areas they are not subject to new leasing under the plan.

<u>Recommendations</u>: BLM and BIA must consider a broad range of alternatives to fulfill the opportunities for managing oil and gas leasing and development across the planning area, including analyzing and address impacts to local communities and climate change, and developing a comprehensive and strategic landscape approach that includes important protections for the Greater Chaco Landscape.

We very much appreciate the opportunity to submit supplemental scoping comments and strongly support this expanded planning effort. We look forward to continuing to participate in this planning process.

Sincerely,

Nada Culver, Senior Counsel and Director
BLM Action Center
The Wilderness Society
1660 Wynkoop Street, #850
Denver, CO 80202
303-225-4635
Nada_culver@tws.org

David Nimkin, Southwest Regional Director
National Parks Conservation Association
307 West 200 South, Suite 5000
Salt Lake City, UT 84101
801-521-0785
dnimkin@npca.org

Paul F. Reed, Preservation Archaeologist, Chaco Scholar
Archaeology Southwest
Taos, New Mexico
575-758-4049
preed@archaeologysouthwest.org

Amanda Podmore, Assistant Director
Friends of Cedar Mesa
PO Box 338
Bluff, UT 84512
435-414-0343
amanda@cedarmesafriends.org

ATTACHMENT 2

Sample Protective Measures

- ***Air Quality.*** The joint plan should include strict emissions standards and monitoring requirements designed to protect local and regional air quality. *See e.g.*, White River FO RMPA (2015) - Appendix 1 at p. 1-49 ("Lease Notice: Due to potential air quality concerns, supplementary air quality analysis may be required for any proposed development on this lease. This may include preparing a comprehensive emissions inventory, performing air quality modeling, and initiating interagency consultation with affected lands managers and air quality regulators to determine potential mitigation options for any predicted significant impacts from the proposed development."); Kremmling FO RMP (2015) - Appendix B at p. C-2 (COAs for protecting air quality); Grand Junction RMP (2015) - Appendix B at p. B-57 ("Due to potential air quality concerns, supplementary air quality analysis may be required for any proposed development of this lease…"); Moab MLP Record of Decision - Appendix A at p. A-3 (All drilling and production operations are required to adhere to the following minimum standards…"), A-4 ("A Fugitive Dust Control The joint plan would be required for mineral activities that would disturb a surface area larger than 0.25 acres or that would involve truck traffic on unpaved or untreated surfaces.").

- ***Water.*** The joint plan should adopt measures to prevent ground, surface and drinking water contamination, such as closed loop drilling to prevent against spills and leaks; should also require frequent and thorough water quality monitoring for local residents. *See, e.g.*, Moab MLP Record of Decision - Appendix A at p. A-31 ("Closed loop drilling, the use of tanks for produced water or backflow water, well integrity tests, and a water monitoring plan would be required for operations conducted within the Courthouse Wash and Salt Wash Watersheds. When needed, or as determined by the AO, the operator shall conduct reasonable tests which will demonstrate the mechanical integrity of the down hole equipment. Monitoring would occur prior to, during, and after anticipated mineral development to detect impacts on both surface water and groundwater resources."); Kremmling FO RMP (2015) - Appendix B at p. B-26 (CO-CSU-2). *See* BIA Fluid Mineral Estate Handbook at p. 62 ("Additional APD stipulations that may be addressed during the on-site include…Opening or closing drilling fluid system…"), p. 100 ("Water for use in drilling operations shall not be obtained from Indian water wells, tanks, springs, stock water reservoirs or lakes on the Indian reservation without prior permission from the Superintendent…").

- ***Noise***. The joint plan should impose a strict decibel-based limit to reduce noise near homes, residences, schools, CCNHP and other appropriate places. *See, e.g.*, Moab MLP Record of Decision - Appendix A at p. A-41, Appendix B at p. B-5 ("Minimize noise by

using best available technology, such as installation of multi-cylinder pumps, quiet design mufflers, and placement of exhaust systems to direct noise away from sensitive receptors…Where equipment is located within the proximity of sensitive receptors, noise levels will not exceed 50 decibels above background noise.").

- ***Light Pollution and Dark Night Skies*.** Minimize flaring of gas and limit the use of artificial lighting during nighttime operations for the benefit of local residents and CCNHP visitors. *See, e.g.,* Moab MLP Record of Decision - Appendix A at p. A-41.

- ***Cultural Resources.*** Given the density of cultural and archaeological sites in the area, require that operators obtain and submit an archaeological inventory before any surface disturbance is allowed on a lease site. *See e.g.*, BIA Fluid Mineral Estate Handbook at p. 102 (Archaeological Antiquities) ("Investigations by the Bureau of Indian Affairs have disclosed that sites having possible value for archaeological research are located on lands embraced in the subject lese and on adjoining lands….The lessee agrees to be responsible for obtaining an archaeological inventory for each surface disturbance and submit the content thereof to the Bureau of Indian Affairs…"); Grand Junction RMP (2015) - Appendix B at p. B-45 (CSU-29 Stipulation: "Required sub-surface inventory for deep sub-surface-disturbing activities and buried ROW in the following locations and in additional areas where high potential for subsurface resources may be identified in the future…"); Kremmling FO RMP (2015) - Appendix B at p. B-36 (CO-CSU-13), B-60 ("The lessee is hereby notified that Class III Cultural Resource Inventory may be required prior to surface-disturbing activities…The lessee is hereby notified that deep, subsurface survey may be required for subsurface-disturbing operations…"), Kremmling FO RMP (2015) - Appendix C at p. C-9 ("Surface-disturbing activities may be prohibited within 0.25 mile of traditional cultural properties or Native American tribal areas of concern in order to protect the integrity of place, setting, and/or feeling.") ; White River FO RMPA (2015) - Appendix 1 at p. 1-51 ("Lease Notice: This lease may be found to contain historic properties and/or resources protected under the National Historic Preservation Act (NHPA)…The BLM will not approve any ground-disturbing activities that may affect any such properties or resources until it completes its obligations (e.g., State Historic Preservation Officer (SHPO) and tribal consultation) under applicable requirements of the NHPA and other authorities. The BLM may require modification to exploration or development proposals to protect such properties, or disapprove any activity that is likely to result in adverse effects that cannot be successfully avoided, minimized, or mitigated."); Moab MLP Record of Decision - Appendix B ("All persons who are associated with mineral operations will be informed that they will be subject to prosecution for knowingly disturbing archaeological sites or collecting artifacts.").

- ***Human Health*.** Given the presence of numerous homes and residences within the planning area, include specific notices, stipulations and development conditions (in addition to those identified for other natural resources) designed specifically to protect the health and well-being of local residents and communities. At a minimum, these protections should address the specific concerns expressed by residents during the public scoping process, including concerns raised about noise, smell, air and water quality, truck traffic and other impacts from proximate oil and gas development. *See, e.g.,* Kremmling FO RMP (2015) - Appendix B at p. B-41 (CO-CSU-22: "Exclude oil and gas development and operations within foreground and middleground distances of BLM-managed public lands adjoining significant residential developments, communities, and municipalities.").

- ***Inspections & Enforcement.*** Include strict operator-based air and water testing and monitoring requirements as well as strict agency-based inspection and enforcement requirements for both BLM and BIA. See BIA Fluid Mineral Estate Handbook at § 4.14 (Lease Compliance) ("It is recommended that lease compliance activities be conducted on a routine basis.").

- ***Master Development The joint plans.*** To minimize surface disturbance and the density of new development, the The joint plan should require that operators submit Master Development The joint plans (MDPs) that contemplate unitization, communitization and co-location of infrastructure across tribal, allotted and federal lands. *See* BIA Fluid Mineral Estate Handbook at § 4.7(Communitization Agreements) ("The CA is prepared by the lessee/operator…The consent of the Indian mineral owner to such unit or cooperative agreement shall not be required unless such consent is specifically required in the lease."). *See, e.g.*, White River FO RMPA (2015) at p. 2-45 – 46 ("Master Development The joint plans would be required for all oil and gas activities, including exploratory drilling, within the Dinosaur Trail MLP. Specific resource protection measures would be evaluated when an operator submits a Master Development The joint plan. Examples of resource protection measures that will be considered to reduce environmental impacts within the MLP area include: The joint planned or required unitization of federal lands to eliminate redundant infrastructure, thereby reducing habitat fragmentation…").

- ***Phased Leasing and Development*.** The joint plan should consider a phased leasing approach to organize and control the rate of new drilling and development in the planning area. For example, under a phased approach, BLM and BIA could prioritize new leasing and drilling in "high potential" areas most likely to prove productive and away from "low potential" areas and sensitive resources. See, e.g., Proposed White River FO RMPA (2015) - Chapter 2 at p. 2-33 ("Alternative E proposes a phased leasing approach

with the Dinosaur Trail MLP…Leasing would first occur in the southern portion of the MLP, where oil and gas occurrence potential is rated medium to high. Leasing within sage-grouse habitat, areas of low oil and gas potential, or areas adjacent to Dinosaur National Monument would occur once the BLM has completed additional analysis and planning.").

ATTACHMENT 3

National Park-related MLP Stipulation Examples

The BLM has completed two Master Leasing Plans adjacent to national parks: the Dinosaur Trail MLP in Colorado and the Moab MLP in Utah.

- Finalized in August 2015, the Dinosaur Trail Master Leasing Plan[1] covers 357,800 acres of federal minerals in northwestern Colorado. The northern MLP boundary lies adjacent to Dinosaur National Monument, a stunning network of canyons at the confluence of the Green and Yampa Rivers.
- Finalized in December 2016, the Moab Master Leasing Plan (draft)[2] covers the area between Arches National Park and Canyonlands National Park in east-central Utah. An important center for tourism and outdoor recreation, the residents of Moab have been active participants in the Moab MLP process.

Both of these national park-adjacent MLPs contain a number of stipulations designed to protect the resources important to the national parks. In order to protect the national park visitor experience, and thus protect reliable national park-derived economies, the Dinosaur Trail and Moab MLPs included stipulations related to national park vistas, water quality, night skies, soundscapes and other resources. Examples of these stipulations are below.

National Park Visual Resources – Viewsheds

From Moab MLP (Note: multiple stipulations for the same area reflect different draft Alternatives):

Stipulation	Area	Stipulation Description
No Surface Occupancy (NSO)	Viewsheds of Arches and Canyonlands National Parks (166,380 acres)	No surface occupancy would be allowed within VRM Class II areas surrounding Arches National Park. No surface occupancy would be allowed within VRI Class II areas surrounding Arches National Park. No surface occupancy would be allowed within VRM Class II area along the northern boundary of Canyonlands National Park. No surface occupancy would be allowed within VRM Class II area along the eastern boundary of Canyonlands National Park. **Purpose:** To protect visual resources on BLM lands as well as National Park viewsheds. **Exception:** None **Modification:** General modification applies.

[1] BLM Colorado White River Field Office Resource Management Plan Amendment and Dinosaur Trail Master Leasing Plan: http://www.blm.gov/co/st/en/BLM_Programs/land_use_planning/rmp/white_river.html

[2] BLM Utah Moab Field Office Record of Decision and Approved Resource Management Plan Amendment: https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage&currentPageId=99718

		Waiver: General waiver applies.
Closed	Viewsheds of Arches and Canyonlands National Parks (188,154 acres)	VRM Class II areas surrounding Arches National Park would be closed to mineral leasing. VRI Class II areas surrounding Arches National Park would be closed to mineral leasing. VRM Class II areas on the northern boundary of Canyonlands National Park would be closed to mineral leasing. BLM lands along the entire eastern boundary of Canyonlands National Park to a distance of 3 miles from the Park boundary would be closed to mineral leasing.
NSO	Viewsheds of Arches National Park (34,243 acres)	No surface occupancy would be allowed within the viewshed from the northern side of Arches National Park that is outside the VRI Class II areas. **Purpose:** To protect visual resources on BLM lands, as well as the Arches National Park viewshed. **Exception:** None **Modification:** General modification applies. **Waiver:** General waiver applies.
NSO	Viewsheds of Canyonlands National Parks (3,800 acres)	No surface occupancy would be allowed within the viewshed from the northern boundary of Canyonlands National Park that is outside the VRM Class II area. **Purpose:** To protect Canyonlands National Park viewsheds. **Exception:** None **Modification:** General modification applies. **Waiver:** General waiver applies.

From Dinosaur Trail MLP:

Stipulation	Area	Stipulation Description
CSU	VRM Class II Areas	Site-specific Visual Resources Management and Noise Reduction Plan must be submitted to the BLM by the operator as a component of the APD or Sundry Notice – Surface Use Plan of Operations. The operator shall not initiate surface disturbing activities unless the BLM Authorized Office has approved the Plan (with conditions, as appropriate). **Purpose:** To manage lands in a manner to protect view sheds, night skies, and soundscapes within the Dinosaur Trail MLP, with emphasis on those areas in the proximity of Dinosaur National Monument (including the Visitor's Center/Headquarters and Harpers Corner Road). **Exception:** The BLM Authorized Officer may grant an exception if it is determined that the action as

		proposed in the Surface Use Plan of Operation or Master Development Plan would not result in a failure to meet the performance standards above; or, a BLM evaluation, in consultation with the National Park Service, determines that the area is not visible, cannot be heard, and night skies would not be affected as observed from key observation points on the National Monument, including along Harpers Corner Road and near the Visitor Center. **Modification:** The stipulation and performance standards identified above may be modified based on negative or positive monitoring results from similar actions on similar sites or increased national, state, or field office performance standards. **Waiver:** The BLM Authorized Officer, in consultation with the National Park Service, determines that operations (visual, noise, light) on the entire lease area would not be detectable from Dinosaur National Monument.

National Park Visual Resources – Night Skies

From the Moab MLP:

Stipulation	Area	Stipulation Description
CSU	Planning Area	Operators are required to comply with the following: 1. Minimize flaring of gas 2. Limit the use of artificial lighting during nighttime operations to only those that are determined necessary for safety 3. Utilize shielding and aiming techniques, as well as limiting the height of light poles to reduce glare and avoid light shining above horizons 4. Direct lights downward onto the task area. The bottom surface of the light fixture should be level, or if unable to be fully level, pointed as close to straight down as possible or shielded to avoid light being projected horizontally 5. Use motion sensors, timers, or manual switching for areas that require illumination but are seldom occupied 6. Reduce lamp brightness and select lights that are not broad spectrum or bluish in color. **Purpose:** To protect night skies. **Exception:** The Authorized Officer may grant an exception if actions are necessary for human health and safety. The Authorized Officer could also grant an exception if it could be demonstrated that other options could produce similar reduction in night sky light pollution to those listed above.

		Modification: General modification applies. **Waiver:** General waiver applies.

From Dinosaur Trail MLP:

Stipulation	Area	Stipulation Description
CSU	See above: National Park Visual Resources: Viewsheds	See above: National Park Visual Resources: Viewsheds
CSU	50 acres	Minimize noise and light pollution within VRM Class III areas adjacent to Dinosaur National Monument (DNM) headquarters using the best available technology such as installation of multi-cylinder pumps, hospital-grade sound reducing mufflers, and placement of exhaust systems to direct noise away from DNM. Additionally, there will be a requirement to reduce light pollution by using methods such as limiting height of light poles, timing of lighting operations (meaning limiting lighting to times of darkness associated with drilling and work over or maintenance operations), limiting wattage intensity, and constructing light shields. However, this requirement is not applicable if it affects human health and safety. Movement of operations to mitigate sound and light impacts will be required to be at least 660 feet from the DNM headquarters. **Purpose:** To protect night skies and soundscapes in the proximity of Dinosaur National Monument headquarters area that falls within VRM Class III areas. (Note: this area is not included in CSU-37.) **Exception:** An exception may be granted if a determination is made that natural barriers or view sheds will meet these mitigation objectives or if human health and safety were adversely affected. **Modification:** None. **Waiver:** None.

National Park Natural Soundscapes

From Moab MLP (Note: multiple stipulations for the same area reflect different draft Alternatives):

Stipulation	Area	Stipulation Description
CSU	Lands bordering Arches and Canyonlands National Parks (369,519 acres)	Operators are required to comply with the following within 6.1 miles (9,800 meters) of National Parks: Noise mitigation efforts would be

		implemented with a maximum decibel level of 51 decibels for production equipment (measured from the direction of the Park at a distance of 350 feet from source). These sound levels could be achieved by replacement diesel engine exhaust silencers (mufflers) noise barriers, and other noise control measures. **Purpose:** To protect the soundscapes of the National Parks. **Exception:** None **Modification:** General modification applies. **Waiver:** General waiver applies.
NSO	Lands bordering Arches and Canyonlands National Parks. (148,432 acres)	No surface occupancy would be allowed within 2.5 miles of National Park boundaries. **Purpose:** To reduce auditory impacts from mineral operations to backcountry portions of Arches and Canyonlands National Parks. **Exception:** None **Modification:** General modification applies. **Waiver:** General waiver applies.
NSO	Lands bordering Arches and Canyonlands National Parks (166,099 acres)	No surface occupancy would be allowed within 2.8 miles of National Park boundaries. **Purpose:** To further reduce auditory impacts from mineral operations to backcountry portions of Arches and Canyonlands National Parks. **Exception:** None **Modification:** General modification applies. **Waiver:** General waiver applies.
NSO	Lands bordering Arches and Canyonlands National Parks (148,432 acres)	No surface occupancy would be allowed within 2.5 miles of National Park boundaries. **Purpose:** To reduce auditory impacts from mineral operations to backcountry portions of Arches and Canyonlands National Parks. **Exception:** The Authorized Officer may grant an exception if it could be demonstrated that the project would not impact National Park soundscapes. **Modification:** General modification applies. **Waiver:** General waiver applies.

From Dinosaur Trail MLP:

Stipulation	Area	Stipulation Description
CSU	See above: National Park Visual Resources: Viewsheds	Site-specific Visual Resources Management and Noise Reduction Plan See above: National Park Visual Resources: Viewsheds
CSU	See above: National Park Visual Resources – Night Skies	Minimization requirement See above: National Park Visual Resources – Night Skies

National Park Water Quality

From Moab MLP:

Stipulation	Area	Stipulation Description
NSO	Courthouse Wash and Salt Wash Watersheds (113,715 acres)	No surface occupancy would be allowed within the Courthouse Wash and Salt Wash Watersheds. Where horizontal and directional drilling is conducted from areas adjacent to these watersheds, drilling operations would not penetrate the associated groundwater. **Purpose:** To protect the Courthouse Wash watershed (an important recharge area for the unique ecological system within Arches National Park) and the Salt Wash watershed (an important watershed which drains through Arches National Park). **Exception:** None **Modification:** General modification applies. **Waiver:** General waiver applies.

National Park-adjacent Cultural Resources

From Dinosaur Trail MLP:

Stipulation	Area	Stipulation Description
NSO	360 acres near the Mellen Hill Sites	No surface occupancy or disturbance will be allowed within and adjacent to the Mellen Hill Sites (5RB227, 5RB279, 5RB489, etc.) **Purpose:** To preserve and protect examples of cultural and historic resources to ensure that they are available for appropriate uses by present and future generations. **Exception:** None. **Modification:** None. **Waiver:** A waiver may be granted if the destruction of all the physical characteristics of a district, site, building, structure, object, traditional cultural property, historic landscape, or discrete group of thematically related properties, that represents American history, architecture, archaeology, engineering and culture (BLM Manual 8110.32 E) results in these locations no longer possessing integrity of location, design, setting, materials, workmanship, feeling and association to qualify them for nomination to the National Register of Historic Places described by Criteria (a) – (d) within 36 CFR 60.4.

THURSDAY
DECEMBER 01
2016

Volume LV
Number 48

www.navajotimes.com
One Dollar

NAVAJO TIMES
DINÉ BI NAALTSOOS

BACK TO TOP

BLM rule will cut emissions on tribal lands, save money

Earlier this fall, a group of over 200 U.S. servicemen and women, including two retired generals, released a letter calling on the Obama Administration to stop methane waste from oil and gas development on public and tribal lands.

FEATURE
GUEST
COLUMN
Tina Garnanez

And this November, the U.S. Bureau of Land Management listened to those calls by adopting a strong final rule to cut venting and flaring from oil and gas operations on tribal and public lands, while also requiring periodic inspections for and repairs of methane leaks from production facilities and equipment.

As a U.S. Army combat veteran from the Navajo Nation, I applaud and support this decision. Methane waste is a serious problem for tribes, robbing tribal governments of millions of dollars and polluting the air we breathe.

Methane is the primary component of natural gas and oftentimes, oil and gas producers will either burn off (flare) or release into the air (vent) excess methane, instead of taking the inexpensive steps to install the infrastructure to capture and sell the gas. Also, methane is colorless and odorless and can leak from equipment, including pipelines and storage tanks, without anyone noticing. This wasted methane represents millions of dollars literally disappearing into thin air.

That's money that could have gone to tribal governments for roads, bridges, hospitals, schools, and social programs. In fact, the business consulting firm ICF International found that nearly $100 million worth of natural gas is lost through venting, flaring, and from equipment leaks each and every year on tribal lands. Companies are not made to pay royalties for the gas they waste, denying tribes even more millions in royalties.

In addition to the millions of dollars we are losing, other chemicals are co-released alongside methane, which increase rates of asthma attacks in children. These chemicals are also linked to ozone pollution. In fact, tribal lands in Utah's Uintah Basin are among the worst in the country for ozone pollution, rivaling major cities like Los Angeles for poor air quality. And this ozone pollution has been directly linked to oil and gas development in the surrounding area, in a study commissioned by the oil and gas industry.

Methane emissions from oil and gas facilities were also identified by NASA as major contributors to the Delaware-sized methane 'hot spot' that is hanging over the Four Corners region of the U.S.

Not only must we take steps to ensure our oil and gas reserves are developed responsibly, but we also have a moral duty to ensure energy is not wasted when many Native Americans are without access to reliable electricity and heat.

In fact, as many as 14 percent of households on tribal lands have no access to electricity, which is 10 times higher than the U.S. average. We cannot continue to look the other way while a family lives without heat and a company flares "excess" natural gas down the road.

I served and fought to protect our country and lands, including our oil and gas resources. I am honored to be from a proud lineage of Native veterans, with a rich and deep history of U.S. military service and sacrifice. During both world wars, Native American "code talkers" were an integral parts of the effort, charged with transmitting secret tactical messages using their native languages. Their codes were never deciphered and historians agree this tactic helped America win the war in the Pacific during World War II when our own Diné language was used.

The principles of the oil and gas companies extracting our tribal resources should also align with those of the Navajo Nation and U.S. service: self-improvement, leadership, and responsibility. We must expect more for ourselves, our lands, and our resources.

The BLM's leadership in adopting commonsense reforms lives up to those values and will promote sensible energy development, ensure affordable energy, reduce air pollution, ensure a fair return for taxpayers and tribal governments, and respect our natural heritage and lands.

Tina Garnanez is a volunteer with Vet Voice Foundation and a former Army medic who served five years in the Army and deployed to Kosovo and Iraq. Garnanez is a New Mexico resident and grew up on the Navajo Nation in Shiprock.

Navajo Nation, Counselor Chapter House, P.O. Box #93, Counselor, New Mexico 87018
Phone & Fax #: (575)568-4311/0021
Email: counselor@navajochapters.org

Harry J. Wellito, Chapter President
Laura Lopez, Chapter Vice President
Marlene Thomas, Chapter Secretary/ Treasurer
Elizabeth Stoney, Land Board Member

Leonard Tsosie, Council Delegate
Samuel Sage, Community Services Coord.
Martha Aragon, Acct. Maint. Spec.

August 31, 2016

The Honorable Sally Jewell
Secretary
U.S. Department of the Interior
1849 C. Street N.W.
Washington, DC 20240

Neil Kornze
Director, U.S. Bureau of Land Management
1849 C. Street NW, Room 5665
Washington, DC 20240

Re: BLM's Proposed Rule on Waste Prevention, Production Subject to Royalties, and Resource Conservation (RIN 1004-AE14)

Dear Secretary Jewell and BLM Director Kornze,

We are writing on behalf of Counselor Chapter, Navajo Nation and our members in New Mexico to ask that you ensure that BLM issues a final methane waste rule before mid-November, 2016.

Methane waste on Federal lands has serious negative impacts on New Mexicans. It makes an outsized contribution to climate change because methane is such a powerful climate pollutant. Methane waste results in lost royalties, reducing funding for schools, health care and infrastructure. Venting and leaking of methane, along with smog-forming and hazardous co-pollutants, threatens the health of our citizens. And flaring harms the well-being of residents living near oil and gas activity, reduces recreational opportunities, and damages wildlife habitat.

Reducing methane emissions is a key piece of President Obama's climate legacy. His Climate Action Plan's Strategy to Reduce Methane Emissions sets a goal to cut methane emissions from the oil and gas sector by 40 to 45 percent from 2012 levels by 2025. The BLM waste rule is needed to achieve these reductions. The Strategy also calls on BLM to "lead by example" on public lands.

Currently, BLM land managers in New Mexico have limited tools to make sure that oil and gas companies prevent methane waste. A strong rule will help stop methane emissions from aging equipment, and will also ensure that waste prevention measures are part of every new lease and drilling permit.

Again, we urge you to make this rule a top priority and see it finalize by mid-November, 2016.

Sincerely,

Harry J. Wellito, President Laura C. Lopez, Vice-President Marlene Thomas, Secr./Treas.

Lisa McGee, WY Bar No. 6-4043
Wyoming Outdoor Council
262 Lincoln Street
Lander, WY 82520
(307) 332-7031
lisa@wyomingoutdoorcouncil.org

UNITED STATES DISTRICT COURT
DISTRICT OF WYOMING

STATE OF WYOMING, et al. Petitioners, v. UNITED STATES DEPARTMENT OF THE INTERIOR, et al. Respondents, and WYOMING OUTDOOR COUNCIL, CENTER FOR BIOLOGICAL DIVERSITY, CITIZENS FOR A HEALTHY COMMUNITY, DINÉ CITIZENS AGAINST RUINING OUR ENVIRONMENT, ENVIRONMENTAL DEFENSE FUND, ENVIRONMENTAL LAW AND POLICY CENTER, MONTANA ENVIRONMENTAL INFORMATION CENTER, NATIONAL WILDLIFE FEDERATION, NATURAL RESOURCES DEFENSE COUNCIL, SAN JUAN CITIZENS ALLIANCE, SIERRA CLUB, THE WILDERNESS SOCIETY, WESTERN ORGANIZATION OF RESOURCE COUNCILS, WILDERNESS WORKSHOP, AND WILDEARTH GUARDIANS. Applicants for Intervention.	Civil Case No. 2:16-cv-00285-SWS [Lead] [Consolidated With 2:16-cv-00280-SWS] Assigned: Hon. Scott W. Skavdahl **DECLARATION OF RUSSELL BEGAYE, PRESIDENT OF THE NAVAJO NATION**

I, Russell Begaye, President of the Navajo Nation, hereby declare as follows:

1. I am the elected President of the Navajo Nation and the Chief Executive Officer of the Navajo Nation Executive Branch. The Navajo Nation is the largest American Indian tribe within the geographic boundaries of the United States. The Navajo Nation spans more than 27,000 square miles, which is slightly larger than the State of West Virginia. The Navajo Nation has more than 300,000 enrolled members, with over 180,000 of those members physically living on the Navajo Nation.

2. The Navajo Nation possesses significant and valuable oil and gas resources. The Navajo Nation has sovereign authority over these resources which have belonged to the Navajo Nation from time immemorial. Pursuant to the Fundamental Laws of the Diné, the Navajo Nation government upholds a sacred obligation and duty to respect, preserve, and protect our resources.

3. As President of the Navajo Nation, I support the Bureau of Land Management's Rule on Waste Prevention, Production Subject to Royalties, and Resource Conservation ("BLM Methane Waste Prevention Rule"), published at 81 Federal Register 83008 and oppose efforts of certain states and industry to enjoin the rule.

4. The U.S. Bureau of Land Management (BLM) manages and regulates oil and gas drilling on the Navajo Nation. The Agency manages these resources pursuant to its trust responsibilities to the Navajo Nation. Thus, the agency must act as a trustee and manage these operations for the benefit of the Navajo Nation.

5. As President of the Navajo Nation, I believe that the BLM Methane Waste Prevention Rule assists BLM with its trust responsibilities to assure that the Navajo Nation receives royalties from development of its oil and gas resources. It would be contrary to BLM's trust responsibility to allow Navajo Nation resources to be unreasonably wasted, particularly when best practices, precautions and use of gas-capture technology can be cost-effectively employed and are not overly burdensome to the industry. Royalties from these operations are

important to the Navajo Nation, which suffers from unemployment and poverty rates significantly above nation averages.

6. Gas capture from oil and gas operations will not only provide additional revenue to the Navajo Nation, but it will also result in less air pollution from leaking, venting and flaring. Public health is a critical issue on the Navajo Nation. Venting and flaring from oil and gas operations may cause pollution that could harm Navajo people living in the vicinity of the oil and gas operations.

7. As President of the Navajo Nation, I do not believe that the BLM Methane Waste Prevention Rule will significantly impair the Navajo Nation's ability to manage its oil and gas sovereign resources. The rule will help mininiize the waste of our sovereign resources and help protect our people.

8. As President of the Navajo Nation, I oppose the efforts of certain states and industry to enjoin operation of the BLM Methane Waste Prevention Rule.

I declare under penalty of perjury that the foregoing is true and correct.

Executed this 9th day of January 2017.

Russell Begaye, President
The Navajo Nation

RELEASE

Date:
December 20, 2016

Contact:
Joe Calvello, (312) 399-3512

Veterans and tribal advocacy groups launch Navajo radio ad education effort highlighting benefits of cutting natural gas waste on tribal lands

FARMINGTON—The Native American Voter Alliance (NAVA) and the Vet Voice Foundation (VVF) launched a joint radio ad campaign today to educate Navajo citizens on the benefits of the U.S. Bureau of Land Management's (BLM) recently-adopted Methane Waste Prevention Rule.

The rule is aimed at curbing natural gas waste on public and tribal lands by reducing flaring and venting and ensuring regular monitoring and inspection to reduce leaks from equipment and infrastructure.

"Oil and gas development provides revenue for tribes, but for too long, companies have wasted our natural gas resources," said Laurie Weahkee, director of NAVA. "Protecting Mother Earth and our air is our moral obligation. We need our officials to continue to defend these commonsense rules and put an end to waste."

The ads are sponsored by NAVA and VVF and will run on radio stations in Northwestern New Mexico, including the Farmington, Aztec, and Shiprock markets, as well as parts of Northeastern Arizona.

"As a U.S. Army combat veteran, I believe that it is critical that we stop wasting our energy resources on public and tribal lands," said Garett Reppenhagen, Rocky Mountain Director of VVF. "We must work together to defend these commonsense rules to cut natural gas waste and ensure a fair return to both tribal governments and communities across the West when American energy is developed."

The ad campaign comes on the heels of the Navajo Nation Northern Agency Council voting unanimously to adopt a resolution in support of strong BLM natural gas waste rule this past Friday, December 16th by a vote of 39-to-0.

The Northern Agency Council represents 19 Navajo Chapter Houses (10 certified) from Utah, Arizona, and Nevada, including oil and gas producing regions in New Mexico's San Juan Basin and Eastern Utah. Red Mesa Chapter House President Herman Farley sponsored the resolution.

The radio buys will take place over the course of three weeks. Tina Garnanez, a volunteer with Vet Voice Foundation and a former Army medic, reads the English version of the radio ad, and McKeon Dempsey, the 2015 Miss Navajo Nation, reads the Diné version. Diné is the native language of the Navajo people.

NAVA and VVF note that by reducing natural gas waste, more royalty revenue will be generated for local, state, and tribal governments that can be put toward education and local improvement projects such as roads and bridges. Also, the BLM natural gas waste rule has important co-benefits for public health such as reducing ozone pollution that can trigger asthma attacks and worsen emphysema.

Radio ad – English version
Script
Audio clip

Radio ad – Diné version
Script
Audio clip

###

NORTHERN NAVAJO AGENCY COUNCIL RESOLUTION

NNAC-38-121616A

SUPPORTING A STRONG BLM NATURAL GAS WASTE RULE AIMED AT CUTTING METHANE WASTE OCCURRING ON FEDERAL AND TRIBAL LANDS

WHEREAS:

1. The Northern Navajo Agency Council is a recognized political subdivision of the Navajo Nation and has authority to advocate and make appropriate recommendations on behalf of the 20 Northern Navajo Agency chapters to the Navajo Nation Government, Federal, State, and local entities for appropriate action; and,
2. The Northern Agency Council supports energy development is important to the economy of the Navajo Nation; and
3. Oil and Gas royalties are an important source of revenue for the Navajo Nation and for allottees; and
4. The BLM typically does not charge royalties or charges reduced royalty rates on methane-the primary component of natural gas- that is leaked, flared, or vented; and
5. A recent National Aeronautics and Space Administration study discovered a methane plume above the Four Corners region where much of the venting, flaring, and leaking occurs; and
6. Oil and gas companies waste upwards of $100 million worth of natural gas on tribal lands alone; and
7. The BLM is proposing new rules entitled "Venting and Flaring Waste Prevention and Use of Produced Oil and Gas for Beneficial Purposes" that would modernize how the government accounts for natural gas waste on federal and tribal lands; and
8. Recent studies show that as much as ninety percent of methane wasted could be put to use; and
9. Reducing natural as waste would benefit tribal members living near energy development by also cutting toxic are pollutants such as benzene and volatile organic compounds that form ground-level ozone that can trigger asthmas attacks and harm health or seniors; and
10. Colorado saw an increase in natural as production and the number of oil and gas wells after adopting the nation's first rule to cut methane waste and pollution; and
11. Efforts to cut natural gas waste have spurred new economic development by companies working to address methane mitigation; and
12. The Secretary of the Interior has trust responsibility for managing Indian minerals and has delegated this responsibility to the Bureau of Indian Affairs (BIA), the Bureau of Land Management (BLM), the Office of Natural Resources Revenue (ONRR), and the Office of the Special Trustee for American Indians (OST); and
13. The BLM natural gas waste rule recognizes tribal sovereignty by including a provision that preserves the right for tribes to enact their own rules to cut waste that meet or exceed national standards.

NOW, THEREFORE BE IT RESOLVED THAT:

The Northern Agency Council hereby supports a strong BLM natural gas waste rule aimed at cutting methane waste occurring on federal and tribal Lands.

CERTIFICATION

We hereby certify that the foregoing resolution was duly considered by the members of the Northern Navajo Agency Council at a duly called meeting at Nenahnezad Chapter, Nenahnezad, New Mexico at which a quorum was present and that the same was passed by a vote of 39 in favor, 00 opposed, and 01 abstained this **16th day of December 2016.**

Motioned by: Bill Todachenni

Seconded by: Lena Clark

David John, Chairperson

Lee J. Zhonnie, Vice Chairperson

Nancy Begay, Secretary

RED MESA CHAPTER
Red Mesa, Navajo Nation, Utah

Resolution# RMC-07-101616

SUPPORTING A STRONG BLM NATURAL GAS WASTE RULE AIMED AT CUTTING METHANE WASTE OCCURRING ON FEDERAL AND TRIBAL LANDS

WHEREAS:

1. Pursuant to 26 N.N.C. Section 1, (1), (2) and Section 103, (B), the Red Mesa Chapter is recognized as a local government entity and delegated certain authorities and responsibilities with respect to local matters consistent wit the Navajo Nation Laws; and
2. Pursuant to 26 N.N.C. Section 4028 (a), the Red Mesa Chapter has the authority to review all matters affecting the community and make appropriate recommendations to the Navajo Nation, County, and State Government Agencies; and
3. Red Mesa Chapter supports energy development is important to the economy of the Navajo Nation; and
4. Oil and gas royalties are an important source of revenue for the Navajo Nation and for allottees; and
5. The BLM typically does not charge royalties or charges reduced royalty rates on methane- the primary component of natural gas- that is leaked, flared, or vented; and
6. A recent National Aeronautics and Space Administration study discovered a methane plume above the Four Corners region where much of the venting, flaring, and leaking occurs; and
7. Oil and gas companies waste upwards of $100 million worth of natural gas on tribal lands alone; and
8. The BLM is proposing new rules entitled "Venting and Flaring Waste Prevention and Use of Produced Oil and Gas for Beneficial Purposes" that would modernize how the government accounts for natural gas waste on federal and tribal lands; and
9. Recent studies show that as much as ninety percent of methane wasted could be put to use; and
10. Reducing natural gas waste would benefit tribal members living near energy development by also cutting toxic air pollutants such as benzene and volatile organic compounds that form ground-level ozone that can trigger asthma attacks and harm health of seniors; and
11. Colorado saw an increase in natural gas production and the number of oil and gas wells after adopting the nation's first rule to cut methane waste and pollution; and
12. Efforts to cut natural gas waste have spurred new economic development by companies working to address methane mitigation; and
13. The Secretary of the Interior has trust responsibility for managing Indian minerals and has delegated this responsibility to the Bureau of Indian Affairs (BIA), the Bureau of Land Management (BLM), the Office of Natural Resources Revenue (ONRR), and the Office of the Special Trustee for American Indians (OST); and
14. The BLM natural gas waste rule recognizes tribal sovereignty by including a provision that preserves the right for tribes to enact their own rules to cut waste that meet or exceed national standards; and
15. Red Mesa Chapter community has local gas and oil companies burning natural gas flares in the community for extended days and nights.

NOW THEREFORE BE IT RESOLVED THAT:

The Red Mesa Chapter hereby supports a strong BLM natural gas waste rule aimed at cutting methane waste occurring on federal and tribal lands.

...ge 2/2 of Resolution #07-101616)

CERTIFICATION:

We hereby certify that the foregoing resolution was duly considered by the Red Mesa Chapter of the Northern Agency at a duly called meeting in Red Mesa, Navajo Nation, Utah, at which a quorum was present and that same passes by a vote of **21** in FAVOR, **00** OPPOSED, and **03** ABSTAINED on this 16th day of October 2016.

Motioned by: Mr. Edward Tapaha Second by: Mr. Sam Dee

Herman Farley, President

Doris J. Tsinnijinnie, Vice-President

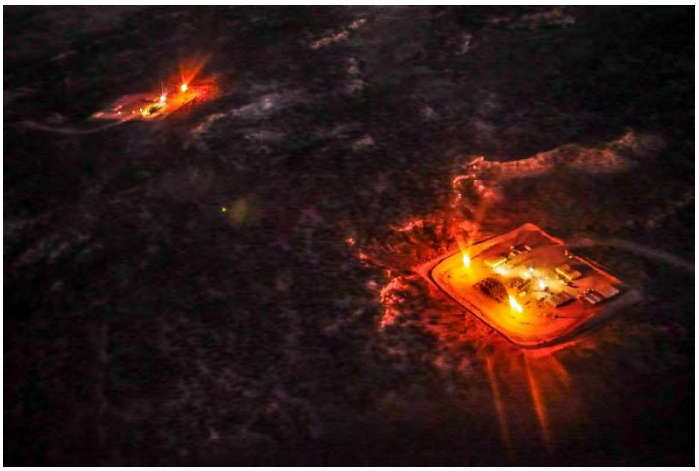
Marlene Dee-Ben, Secretary/Treasurer

Davis Filfred, Council Delegate

Cutting natural gas waste on tribal lands

An opportunity to generate revenue, create jobs, and improve air quality

Natural gas is primarily methane, a colorless odorless greenhouse gas that can escape undetected from hundreds of thousands of different sources across the oil and gas supply chain---from the well pad to processing facilities, to pipelines and everywhere in between. Industry also deliberately vents and flares natural gas during the production process.



Flaring at an oil and gas wellsite outside of Bloomfield, New Mexico

Every year the industry leaks millions of tons of methane and other dangerous pollutants into the air. These emissions could be cut in half by implementing cost-effective tools and technologies.

The U.S. Bureau of Land Management (BLM) recently adopted a rule that will cut natural gas waste on federal and tribal lands and help ensure a fair return to tribal governments, put our energy resources to good use, and clean up our air. Unfortunately, some in Congress are considering a Congressional Review Act resolution which would roll back the rule and prevent the BLM from taking future similar action – permanently harming taxpayers, tribal governments, and our air.

"The oil companies don't get paid, the tribes don't get paid and the individuals that own mineral rights here on Fort Berthold do not get paid so flaring is not a good thing."

- Three Affiliated Tribes Chairman Mark Fox, ND Minot Daily News, October 20, 2015

Economic costs

Each year, ***oil and gas companies waste $100 million*** worth of natural gas through venting, flaring, and leaks of methane on tribal lands alone.

Not only do these practices waste tribal energy resources, tribes lose ***millions of dollars in revenue*** each year, which could go towards roads and bridges, schools, or local improvement projects.

"Oil and gas companies waste upwards of $100 million worth of natural gas on tribal lands alone; and (t)he BLM is proposing new rules [...] that would modernize how the government accounts for natural gas waste on federal and tribal lands[.]"

-Resolution by Red Mesa Chapter House, Navajo Nation, October 16, 2016

Benefits to air quality

Along with methane, oil and gas operations on tribal lands also emit other toxic pollution into the air—**polluting the air we breathe and causing rates of asthma attacks in children to increase**. For instance, ozone (smog) pollution on tribal lands in the Uintah Basin of Utah are among the worst levels seen in the country. Similarly, both San Juan and Eddy counties received an "F" rating for ozone pollution by the American Lung Association. All these areas are home to some of the biggest oil and gas producing areas in the West.

Broad agreement to act

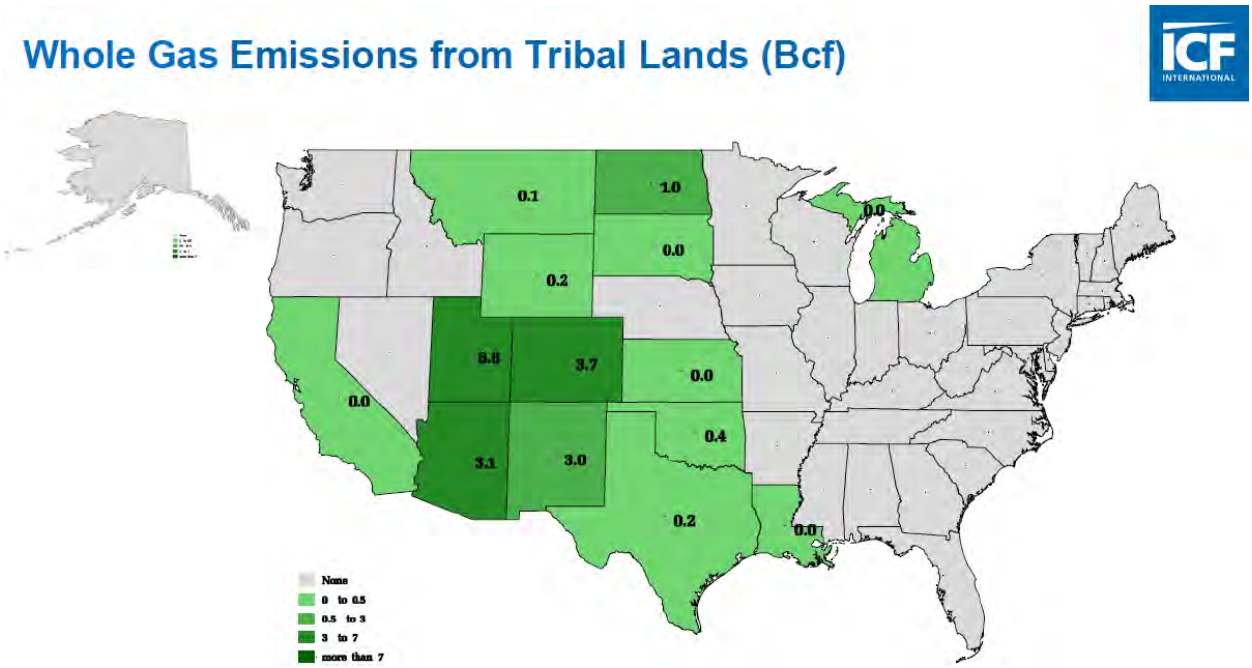
A January 2016 bipartisan Colorado College poll found that **80% of westerners support common sense rules that cut natural gas waste** on public lands.
Westerners support a strong BLM rule including tribal members, landowners, more than 60 state and local officials, Governors and U.S. Senators, public health advocates, Latino organizations, and others.

Preserving rights for tribal governments to act

The BLM rule also recognizes tribal sovereignty by including a provision that **preserves the right for tribes to enact their own rules** to cut waste that meet or exceed national standards.

"Methane waste results in lost royalties, reducing funding for schools, health care and infrastructure. Venting and leaking of methane, along with smog-forming and hazardous co-pollutants, threatens the health of our citizens."

-Letter from Navajo Nation Counselor Chapter House to Interior Secretary Sally Jewell and Bureau of Land Management Director Neil Kornze, August 31, 2016



From: Kyle Tisdel
To: blm_nm_ffo_rmp@blm.gov; anisula@blm.gov
Subject: Mancos RMPA_Scoping Comments 2.0
Date: Monday, February 20, 2017 7:57:06 PM
Attachments: Mancos RMPA_Scoping 2.0 (final).pdf

Dear Ms. Nisula,

Please find the attached Scoping Comments 2.0 submitted by Western Environmental Law Center on behalf of Conservation Groups, Amigos Bravos, Center for Biological Diversity, Chaco Alliance, Diné CARE, Gila Resources Information Project, San Juan Citizens Alliance, Sierra Club, and WildEarth Guardians. Given the federal holiday, a hard copy of comments and a disc containing the attached exhibits will be sent by certified mail tomorrow. Should you have any questions, please do not hesitate to contact me.

Regards.

_____

Kyle J. Tisdel
Attorney, Climate & Energy Program Director
Western Environmental Law Center
208 Paseo del Pueblo Sur, #602
Taos, New Mexico 87571
Ph: 575.613.8050

tisdel@westernlaw.org

www.westernlaw.org

Defending the West

_____

Northwest
1216 Lincoln Street
Eugene, Oregon 97401
(541) 485-2471

Rocky Mountains
103 Reeder's Alley
Helena, Montana 59601
(406) 443-3501

Southwest
208 Paseo del Pueblo Sur #602
Taos, New Mexico 87571
(575) 751-0351

Defending the West www.westernlaw.org

Western Environmental Law Center

February 20, 2017

Sent via Electronic Mail (scoping comments only) and Certified Mail (comments and exhibits)

U.S. Bureau of Land Management
Farmington Field Office
Attn: Amanda Nisula
6251 College Blvd., Suite A
Farmington, New Mexico 87402
Email: anisula@blm.gov
Email: blm_nm_ffo_rmp@blm.gov

Re: Scoping Comments 2.0 – Farmington Resource Management Plan Amendment

Dear RMP Amendment Project Manager:

The Western Environmental Law Center, along with Amigos Bravos, Center for Biological Diversity, Chaco Alliance, Diné Citizens Against Ruining our Environment, Gila Resources Information Project, San Juan Citizens Alliance, Sierra Club, and WildEarth Guardians (together "Conservation Groups"), submit the following Scoping Comments 2.0 regarding the Bureau of Land Management ("BLM") Farmington Field Office ("FFO") Resource Management Plan Amendment ("RMPA") and associated Environmental Impact Statement ("EIS") encompassing approximately 4 million acres, and an analysis area of approximately 6 million acres, in northwest New Mexico. The RMPA is intended to analyze impacts of additional oil and gas development in the Mancos Shale/Gallup Formation that were not anticipated in the 2002 Reasonable Foreseeable Development ("RFD") Scenario or considered in the 2003 Farmington RMP/EIS.

Given the critical and fundamental role that the RMPA plays in determining land use values for the area, and specifically the FFO's management of oil and gas resources, we appreciate the opportunity to participate in Scoping, as well as the FFO's commitment to integrate of the following concerns into the forthcoming Draft RMPA/EIS. *See* 43 C.F.R. § 1610.2; 42 U.S.C. § 4332. In announcing the RMPA process, BLM has recognized that "[a]s full-field development occurs, especially in the shale oil play, additional impacts may occur that previously were not anticipated in the RFD or analyzed in the current 2003 RMP/EIS which will require an EIS-level plan amendment and revision of the RFD for complete analysis of the Mancos Shale/Gallup Formation." 79 Fed. Reg. 10,548 (Feb. 25, 2014). Conservation Groups submitted extensive technical and legal comments and exhibits on May 28, 2014 in response to

BLM's request for scoping. Those Scoping Comments remain relevant to the agency's decisionmaking and are hereby incorporated by this reference. BLM subsequently reinitiated the scoping process for the Mancos RMPA "specific to the extension of analysis in that EIS to BIA decision-making where BIA manages mineral leasing and associated activities in the RMPA Planning Area." 81 Fed. Reg. 72,819 (Oct. 21, 2016). Conservation Groups accordingly provide the following Scoping Comments responsive to that request, as well as to provide "significant new circumstances [and] information relevant to environmental concerns and bearing on the proposed action and its impacts" which have occurred during the pendency of BLM's first scoping period, and which must be considered and included within BLM's range of alternatives for the RMPA. 40 C.F.R. §§ 1502.9 (c)(1)(ii), 1502.14.

This letter focuses on the BLM's failure to adequately analyze and disclose the direct, indirect, and landscape scale impacts of fossil fuel leasing and development authorized and made available by BLM throughout the Farmington Field Office—a planning area that is already over 90% leased for oil and gas—and in particular those impacts to the Greater Chaco region. On behalf of members and supporters that live, work, recreate, worship, and otherwise rely on the land, air, and water in Greater Chaco for their wellbeing, the Conservation Groups call on the BLM to reconsider the wisdom of the fossil fuel leasing and development considered by the Mancos RMPA. Specifically, Conservation Groups request that:

- BLM must consider and analyze a "no-leasing" alternative that would bar new fossil fuel leases in the Farmington planning area.
- BLM must take steps to reduce methane emissions from oil and gas operations, including (1) by undertaking a true hard-look analysis of methane waste and global warming potential; and (2) by adopting enforceable mitigation requirements to minimize methane emissions and waste. Such analysis is both critical and necessary to address to "methane hotspot" that plagues the region and our communities.
- BLM must address new scientific and economic information, including regarding (1) the impacts of climate change on the Farmington planning area; (2) the social burden, or cost, of carbon and methane waste that would be authorized by the RMPA; and (3) fossil fuel production and employment, including a just transition away from the regions long dependence on fossil fuel development.
- BLM must take a hard look at impacts to air, water, and human health, which must include a detailed Health Impact Assessment.

The **Western Environmental Law Center** ("WELC") uses the power of the law to defend and protect the American West's treasured landscapes, iconic wildlife and rural communities. WELC combines legal skills with sound conservation biology and environmental science to address major environmental issues in the West in the most strategic and effective manner. WELC works at the national, regional, state, and local levels; and in all three branches of government. WELC integrates national policies and regional perspective with the local knowledge of our 100+ partner groups to implement smart and appropriate place-based actions.

Amigos Bravos is a statewide river conservation organization guided by social justice principles. Amigos Bravos' mission is to protect and restore the waters of New Mexico, and ensure that those waters provide a reliable source of clean water to the communities and farmers

that depend on them, as well as a safe place to swim, fish, and go boating. Amigos Bravos works locally, statewide, and nationally to ensure that the waters of New Mexico are protected by the best policy and regulations possible.

Center for Biological Diversity ("Center") is a non-profit environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center also works to reduce greenhouse gas emissions to protect biological diversity, our environment, and public health. The Center has over one million members and activists, including those living in New Mexico who have visited these public lands in the FFO for recreational, scientific, educational, and other pursuits and intend to continue to do so in the future, and are particularly interested in protecting the many native, imperiled, and sensitive species and their habitats that may be affected by the proposed oil and gas leasing.

Chaco Alliance is a grassroots citizens group dedicated to protecting and preserving Chaco Culture National Historical Park. We are interested in all threats to the park and its surrounding landscape, especially the threat created by energy development in the area.

Diné Citizens Against Ruining our Environment ("Diné C.A.R.E.") is an all-Navajo organization comprised of a federation of grassroots community activists in Arizona, New Mexico and Utah who strive to educate and advocate for our traditional teachings derived from our Diné Fundamental Laws. Our goal is to protect all life in our ancestral homeland by empowering local and traditional people to organize, speak out, and determine the outlook of the environment through civic involvement and engagement in decision-making process relating to tribal development.

Gila Resources Information Project ("GRIP") has the mission to promote community health by protecting our environment and natural resources. GRIP achieves its mission by facilitating informed public participation in natural resource use decisions, engaging our diverse communities in education and stewardship of our natural resources, and advocating at the local, state and federal level for protection of our land, air, ecosystems and water resources. GRIP is very concerned about the environmental, community health, and cultural impacts of oil and gas development in the Greater Chaco area.

Founded in 1986, **San Juan Citizens Alliance** ("SJCA") organizes people to protect our water and air, our lands, and the character of our rural communities in the San Juan Basin. SJCA focuses on four program areas, including the *San Juan Basin Energy Reform Campaign*, which ensures proper regulation and enforcement of the oil, gas, and coal industry and transitioning to a renewable energy economy. SJCA has been active in BLM and National Forest oil and gas issues in the San Juan Basin since the early 1990s, and has commented on virtually every multi-well drilling program, lease sale, and programmatic environmental review conducted in the region by the federal land management agencies since the early 1990s. SJCA's members live, work, and recreate throughout the San Juan Basin and San Juan Mountains. SJCA's members' health, use and enjoyment of this region is directly impacted by the decisions identified in this protest.

Sierra Club was founded in 1892 and is the nation's oldest grassroots environmental organization. The Sierra Club is incorporated in California, and has approximately 600,000 members nationwide and is dedicated to the protection and preservation of the environment. The Sierra Club's mission is to explore, enjoy and protect the wild places of the earth; to practice and promote the responsible use of the earth's ecosystems and resources; and to educate and enlist humanity to protect and restore the quality of the natural and human environments. The Sierra Club has a New Mexico chapter, known as the Rio Grande chapter, with members that live in and use this area for recreation such as hiking, climbing, backpacking, camping, fishing and wildlife viewing, as well as for business, scientific, spiritual, aesthetic and environmental purposes.

WildEarth Guardians protects and restores wildlife, wild places, and wild rivers in the American West. As part of its Climate and Energy Program, Guardians works to advance clean energy and expose the true cost of fossil fuels. Guardians works to protect and restore the San Juan Basin in northwestern New Mexico in order to safeguard its cultural heritage, natural values, communities, and open spaces.

TABLE OF CONTENTS

I. BLM Must Consider Existing, New, and Revised National Policy on Climate Change Into RMP Decisionmaking. 1

A. BLM Must Consider National Policy on Climate Change in Agency Decisionmaking on the RMPA, as well as Consider Recent Climate Science and Carbon Budgeting. 4

B. Projected Enegy Demands, International Finance, and Stranded Assets 15

II. BLM Must Consider All Reasonable Alternatives. 19

A. BLM Has a Legal Obligation to Consider All Reasonable Alternatives. 19

B. BLM Must Consider a No Leasing Alternative in Response to Threats Posed by Climate Change. 23

C. BLM Must Explicitly Consider a Renewable Energy Alternative or Include Renewable Energy as a Priority Element in Each Alternative. 25

III. The FFO Must to Take a Hard Look at Greenhouse Gas Emissions and Impacts to Climate Change. 26

A. BLM Must Address Whether Alternatives Are Consistent with National Climate Goals. 31

B. BLM Must Quantify the Severity of Harm from Greenhouse Gas Emissions. 32

1. Social Cost of Carbon Protocol. 32

2. Social Cost of Methane Protocol 36

C. Expert Comments: Economic Scoping for the Mancos RMPA 37

D. The FFO Must Take a Hard Look at Natural Gas Waste and Consider Alternatives to Prevent Waste including Phasing Development to Keep Pace with Gas Capture Infrastructure. 62

E. Managing for Community and Ecosystem Resiliency. 66

F. BLM Must Ensure NEPA Documentation Addresses Mitigation for Climate Impacts Consistent with All Relevant Laws and Policies, Including Current Mitigation Guidance. 68

1. Consistent with the Mitigation Hierarchy, BLM Must Avoid, Minimize and Offset Impacts from Fossil Fuels Made Available by the RMPA, Including Climate Change-Related Impacts. 70

2. BLM Should Adopt a Mitigation Strategy as Part of the Mancos RMPA to Address Unavoidable Climate Change Impacts. 72

IV. BLM Must Take a Hard Look at the Direct, Indirect and Cumulative Impacts of Oil and Gas Leasing and Development on Resource Values in the Planning Area. 73

A. The FFO Must Take a Hard Look at Certain Impacts to Air Quality. 73

1. Air Resource Mitigation Measures 73

2. Ozone Impacts 74

3. Hazardous Air Pollutant Impacts 76
4. Visibility and Ecosystem Impacts 76
5. Air Quality Impacts on Human Health 77
B. The BLM Failed to Take a Hard Look at Impacts to Human Health 78
1. The FFO Must Conduct a Health Impact Assessment. 78
2. Health data 80
3. Cumulative impacts on human health 82
4. Ozone 82
5. Naturally Occurring Radioactive Materials 83
C. National Historic Preservation Act, San Juan County Road 7950 Improvements and BLM Authorities 84
V. Conclusion 85

I. BLM Must Consider Existing, New, and Revised National Policy on Climate Change Into RMP Decisionmaking.

The National Environmental Policy Act ("NEPA") is our "basic national charter for the protection of the environment," achieving its purpose through "action forcing procedures. . . requir[ing] that agencies take a *hard look* at environmental consequences." 40 C.F.R. § 1500.1; *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989) (citations omitted) (emphasis added). This includes the consideration of best available information and data, as well as disclosure of any inconsistencies with federal policies and plans.

In 2014, President Obama described climate change as an "urgent and growing threat . . . that will define the contours of this century more dramatically than any other."[1] In that same year, the U.S. pledged to reduce its greenhouse gas ("GHG") emissions 26-28 percent below 2005 levels by 2020.[2] Since then, the President has also announced a new goal to cut methane emissions from the oil and gas sector by 40-45 percent below 2012 levels by 2025,[3] and set standards to reduce carbon dioxide emissions from the electricity sector by 32 percent from 2005 levels by 2030.[4] In 2015, President Obama recognized, "ultimately, if we're going to prevent large parts of this Earth from becoming not only inhospitable but uninhabitable in our lifetimes, we're going to have to keep some fossil fuels in the ground rather than burn them and release more dangerous pollution into the sky."[5] In his final State of the Union address, President Obama again noted the federal government's commitment to fighting climate change, vowing "to accelerate the transition away from old, dirtier energy sources," and making a powerful promise "to change the way we manage our oil and coal resources so that they better reflect the costs they impose on taxpayers and our planet."[6] These statements culminated in December, 2015 when the President joined with 194 other nations in recognizing "that climate change represents an urgent and potentially irreversible threat to human societies and the planet" and setting the goal of "holding the increase in the global average temperature to well below 2°C above pre-industrial

---

[1] The White House, Remarks by the President at U.N. Climate Change Summit (Sept. 23, 2014), available at: https://www.whitehouse.gov/the-press-office/2014/09/23/remarks-president-un-climate-change-summit.

[2] U.S.-China Joint Announcement on Climate Change (Nov. 11, 2014), available at: https://www.whitehouse.gov/the-press-office/2014/11/11/us-china-joint-announcement-climate-change (attached as Exhibit 46).

[3] The White House, Climate Action Plan: Strategy to Reduce Methane Emissions (March 2014), available at: https://www.whitehouse.gov/blog/2014/03/28/strategy-cut-methane-emissions (attached as Exhibit 1).

[4] Environmental Protection Agency, Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64662 (Oct. 23, 2015).

[5] The White House, Statement by the President on the Keystone XL Pipeline (Nov. 6, 2015), available at: https://www.whitehouse.gov/the-press-office/2015/11/06/statement-president-keystone-xl-pipeline.

[6] President Barack Obama, State of the Union (Jan. 12, 2016), available at: https://www.whitehouse.gov/sotu.

levels and pursuing efforts to limit the temperature increase to 1.5°C."[7] The President ratified the Paris Agreement, along with China, on September 3, 2016.[8] The President has also recognized that "the Paris Agreement alone will not solve the climate crisis. Even if we meet every target embodied in the agreement, we'll only get to part of where we need to go."[9]

Although the Trump administration, in public comments and rhetoric, has suggested a different set of priorities with respect to action on climate change, this does not alter the fundamental math and science of the challenges we face. Indeed, even if the Trump administration were to back out of the United States' many commitments to reduce greenhouse gas emissions and to create a pathway that limits warming—which, to date, has not occurred—that does not absolve the agency from considering the best available information and taking a hard look at impacts, as well as to have its decisionmaking be reflective of this analysis.

It should further be recognized that while national policy and statements addressing climate change accelerated during the Obama presidency—as they should given the narrowing window of time to take meaningful action—the federal government's recognition of climate change is not new. The Secretary of the United States Department of the Interior stated, in Secretarial Order 3226, *Evaluating Climate Change Impacts in Management Planning* (January 19, 2001), that "[t]here is a consensus in the international community that global climate change is occurring and that it should be addressed in governmental decision making." Order 3226 established the responsibility of agencies to "consider and analyze potential climate change impacts when undertaking long-range planning exercises, when setting priorities for scientific research and investigations, when developing multi-year management plans, and/or when making major decisions regarding potential utilization of resources under the Department's purview."

In a 2007 report entitled *Climate Change: Agencies Should Develop Guidance for Addressing the Effects on Federal Land and Water Resources,* the GAO concluded that the Department of the Interior had not provided specific guidance to implement Secretarial Order 3226, that officials were not even aware of Secretarial Order 3226, and that Secretarial Order 3226 had effectively been ignored. This report led to Secretarial Order 3289, *Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources* (September 14, 2009), which reinstated the provisions of Order 3226, and recognized that "the realities of climate change require us to change how we manage land, water, fish and

---

[7] United Nations Framework Convention on Climate Change, Conference of the Parties (Nov 30-Dec. 11, 2015), Adoption of the Paris Agreement, Art. 2, U.N. Doc. FCCC/CP/2015/L.9 (Dec. 12, 2015), available at: http://unfccc.int/resource/docs/2015/cop21/eng/l09.pdf ("Paris Agreement") (attached as Exhibit 2).

[8] The White House, President Obama: The United States Formally Enters the Paris Agreement (Sept. 3, 2016), available at: https://www.whitehouse.gov/blog/2016/09/03/president-obama-united-states-formally-enters-paris-agreement.

[9] The White House, Office of the Press Secretary, Remarks by the President on the Paris Agreement (Oct. 5, 2016), attached as Exhibit 3, and available at https://www.whitehouse.gov/the-press-office/2016/10/05/remarks-president-paris-agreement (last viewed Oct. 26, 2016).

wildlife, and cultural heritage and tribal lands and resources we oversee," and acknowledged that the Department of the Interior is "responsible for helping protect the nation from the impacts of climate change." A month later, in Executive Order No. 13514, *Federal Leadership in Environmental, Energy, and Economic Performance* (Oct. 5, 2009), the President called on all federal agencies to "measure, report, and reduce their greenhouse gas emissions from direct and indirect activities." 74 Fed. Reg. 52,117 (Oct. 8, 2009). This directive was followed by Executive Order No. 13693, *Planning for Federal Sustainability in the Next Decade* (March 25, 2015), which reaffirmed the federal government's commitment to reducing GHG emissions. 80 Fed. Reg. 15,871 (March 25, 2015).

In 2009, the Environmental Protection Agency ("EPA") issued a finding that the changes in our climate caused by elevated concentrations of greenhouse gases in the atmosphere are reasonably anticipated to endanger the public health and welfare of current and future generations. 74 Fed. Reg. 66496 (Dec. 15, 2009). In 2015, EPA acknowledged more recent scientific assessments that "highlight the urgency of addressing the rising concentrations of CO_2 in the atmosphere." 80 Fed. Reg. 64661 (Oct. 23, 2015).

Recently, the White House Council on Environmental Quality ("CEQ")—the federal agency tasked with managing the federal government's implementation of NEPA—recognized the unique nature of climate change and the challenges it imposed on NEPA compliance. On August 1, 2016, CEQ released *Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* (hereafter, "Climate Guidance") (attached as Exhibit 4). The guidance applies to all proposed federal agency actions, "including land and resource management actions." *Id*. at 9. Notably, CEQ's guidance is intended to "facilitate compliance with existing NEPA requirements." *Id.* at 1. In other words, the Climate Guidance is meant to underscore BLM's existing legal obligations to disclose and consider the foreseeable effects that, for example, oil and gas leasing and development has on climate change. On January 12, 2017, BLM issued a Permanent Instruction Memorandum to all Washington Office and Field Officials requiring that "[a]ll relevant NEPA documents must be consistent with the CEQ guidance." IM No. 2017-003 (attached as Exhibit 26). BLM is accordingly required to incorporate Climate Guidance into its RMPA. In its Climate Guidance, the CEQ recognized that:

> Climate change results from the incremental addition of GHG emissions from millions of individual sources, which collectively have a large impact on a global scale. CEQ recognizes that the totality of climate change impacts is not attributable to any single action, but are exacerbated by a series of actions including actions taken pursuant to decisions of the Federal Government. Therefore, a statement that emissions from a proposed Federal action represent only a small fraction of global emissions is essentially a statement about the nature of the climate change challenge, and is not an appropriate basis for deciding whether or to what extent to consider climate change impacts under NEPA. Moreover, these comparisons are also not an appropriate method for characterizing the potential impacts associated with a proposed action and its alternatives and mitigations because this approach does not reveal anything beyond the nature of the climate change challenge itself: the fact that diverse

> individual sources of emissions each make a relatively small addition to global atmospheric GHG concentrations that collectively have a large impact.

Id. at 10-11. CEQ's Climate Guidance also explains the application of NEPA principles and practices to the analysis of GHG emissions and climate change, including: (1) that agencies quantify a proposed action's projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools; (2) that agencies use projected GHG emissions as a proxy for assessing potential climate change effects when preparing a NEPA analysis; (3) where GHG emission tools, methodologies, or data inputs are not reasonably available, that agencies include a qualitative analysis in the NEPA document and explain the basis for determining that quantification is not reasonably available; (4) that agencies analyze foreseeable direct, indirect, and cumulative GHG emissions and climate effects; (5) that agencies consider reasonable alternatives and the short- and long-term effect and benefits in the alternatives and mitigation analysis; (6) that agencies consider alternatives that would make the actions and affected communities more resilient to the effects of a changing climate; and (7) that agencies assess the broad-scale effects of GHG emissions and climate change, either to inform programmatic decisions, or at both the programmatic and project-level. *See id.* at 4-6.

A. BLM Must Consider National Policy on Climate Change in Agency Decisionmaking on the RMPA, as well as Consider Recent Climate Science and Carbon Budgeting.

NEPA requires BLM to consider national policy in its decisionmaking process.[10] The FFO has historically adopted a position in its decisionmaking that reflects a fundamental disconnect with regard to how our public lands are managed for energy production and national policies to limit GHG emissions. The agency has not only failed to take informed action to address climate change, as required by Order 3226 and Order 3289, but has signaled a deep misunderstanding of basic climate science as well as the "tools and methodologies for quantifying GHG emissions and comparing GHG quantities across alternative scenarios." *See* Climate Guidance at 11.[11] As stated in Order 3289, BLM must "appl[y] scientific tools to increase understanding of climate change and to coordinate an effective response to its impacts," and "management decisions made in response to climate change impacts must be informed by [this] science."

---

[10] *See generally* section III.A. NEPA regulations direct federal agencies, "to discuss any inconsistency of a proposed action with any approved State or local plan and laws (whether or not federally sanctioned)," 40 C.F.R. § 1506.2(d), and require agencies to address "possible conflicts between the proposed action and the objectives of Federal, regional, State, and local (and in the case of a reservation, Indian tribe) land use plans, policies and controls for the area concerned." 40 C.F.R. § 1502.16(c). CEQ's NEPA Climate Guidance interprets these regulations to encompass the requirement to address "approved federal, regional, state, tribal, or local plans, policies, or laws for GHG emission reductions or climate adaptation to make clear whether a proposed project's GHG emissions are consistent with such plans or laws." Climate Guidance at 28-29.

[11] *See also*, Climate Guidance at 12 n. 28 (linking to quantification tools that "are widely available, and are already in broad use in the Federal and private sectors").

Through statements that have been offered to avoid any actual analysis, BLM has historically failed to take a hard look at the climate impacts of fossil fuel leasing and development on public lands in the planning area, as required by NEPA and underscored by the CEQ. These mistakes must not be repeated here. The FFO must also consider alternatives that would meaningfully address greenhouse gas emissions and climate change impacts in the planning area—including a no-leasing alternative—and that are reflective of current science and national policy. The FFO planning area is already over 90% leased for oil and gas. Over 40,000 oil and gas wells have historically been drilled, with at least 21,725 wells currently in production. This legacy of exploitation has resulted in vast impacts to the regions land, air, and water—including a methane hotspot that drapes over the basin—which people and our communities have been forced to endure. To correct past failures, BLM must, at a minimum, ensure it uses the best and most up-to-date climate science available, much of which is summarized below.

Since the dawn of the industrial revolution a century ago, the average global temperature has risen some 1.6 degrees Fahrenheit. Most climatologists agree that, while the warming to date is already causing environmental problems, another 0.4 degree Fahrenheit rise in temperature, representing a global average atmospheric concentration of carbon dioxide ("CO_2") of 450 parts per million ("ppm"), could set in motion unprecedented changes in global climate and a significant increase in the severity of natural disasters—and could represent the point of no return.[12] In August 2016, the atmospheric concentration of CO_2 was approximately 402.25 ppm, up from 398.93 ppm the same month a year earlier.[13]

Climate change has been intensively studied and acknowledged at the global, national, and regional scales. Climate change is being fueled by the human-caused release of greenhouse gas emissions, in particular carbon dioxide and methane. The Intergovernmental Panel on Climate Change ("IPCC") is a Nobel Prize-winning scientific body within the United Nations that reviews and assesses the most recent scientific, technical, and socio-economic information relevant to our understanding of climate change. In its most recent report to policymakers in 2014, the IPCC provided a summary of our understanding of human-caused climate change. Among other things, the IPCC summarized:[14]

- Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems.

[12] *See* David Johnston, *Have We Passed the Point of No Return on Climate Change?*, Scientific American (April 2015), available at: http://www.scientificamerican.com/article/have-we-passed-the-point-of-no-return-on-climate-change/.
[13] NOAA, Earth System Research Laboratory, *Trends in Atmospheric Carbon Dioxide*, available at: http://www.esrl.noaa.gov/gmd/ccgg/trends/.
[14] IPCC AR5*, Summary for Policymakers* (March 2014) available at: http://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf (attached as Exhibit 5).

- Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen.

- Anthropogenic greenhouse gas emissions have increased since the pre-industrial era, driven largely by economic and population growth, and are now higher than ever. This has led to atmospheric concentrations of carbon dioxide, methane, and nitrous oxide that are unprecedented in at least the last 800,000 years. Their effects, together with those of other anthropogenic drivers, have been detected throughout the climate system and are extremely likely to have been the dominant cause of the observed warming since the mid-20th century.

- In recent decades, changes in climate have caused impacts on natural and human systems on all continents and across the oceans. Impacts are due to observed climate change, irrespective of its cause, indicating the sensitivity of natural and human systems to changing climate.

- Continued emission of greenhouse gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive, and irreversible impacts for people and ecosystems. Limiting climate change would require substantial and sustained reductions in greenhouse gas emissions which, together with adaptation, can limit climate change risks.

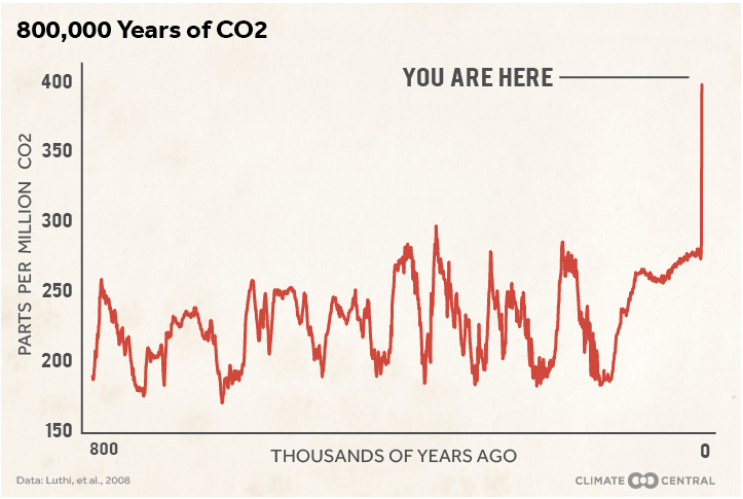
- Surface temperature is projected to rise over the 21st century under all assessed emission scenarios. It is very likely that heat waves will occur more often and last longer, and that extreme precipitation events will become more intense and frequent in many regions. The ocean will continue to warm and acidify, and global mean sea level to rise.

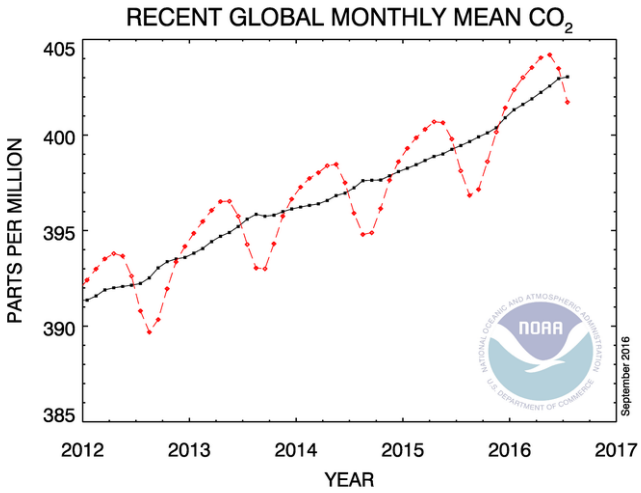
Carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are recognized as the key greenhouse gases contributing to climate change. In 2009, the EPA found that these "six greenhouse gases taken in combination endanger both the public health and the public welfare of current and future generations."[15] The D.C. Circuit has upheld this decision as supported by the vast body of scientific evidence on the subject. *See Coal. for Responsible Regulation, Inc. v. EPA.*, 684 F.3d 102, 120-22 (D.C. Cir. 2012).

According to the National Oceanic and Atmospheric Administration ("NOAA"), "[t]he combined average temperature over global land and ocean surfaces for August 2016 was the highest for August in the 137-year period of record, marking the 16th consecutive month of

[15] Environmental Protection Agency, *Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act* 74 Fed. Reg. 66,496 (Dec. 15, 2009).

record warmth for the globe." [16] The global climate crisis is happening and it may well be accelerating quickly.





The graphs show globally averaged historic and monthly mean carbon dioxide.

The IPCC in 2013 affirmed: "Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased" causing "widespread impacts on human and natural systems."[17] This is consistent with the findings of the United States' 2014 Third National Climate Assessment, stating: "That the planet has warmed is 'unequivocal,' and is corroborated through multiple lines of evidence, as is the conclusion that the causes are very likely human in origin."[18] With particular regard to the Southwest Region—which includes Colorado, New Mexico, Utah, Arizona, Nevada, and California—the National Climate Assessment included in the following overview:[19]

- Snowpack and streamflow amounts are projected to decline in parts of the Southwest, decreasing surface water supply reliability for cities, agriculture, and ecosystems.
- The Southwest produces more than half of the nation's high-value specialty crops, which are irrigation-dependent and particularly vulnerable to extremes of moisture, cold, and heat. Reduced yields from increasing temperatures and increasing competition for scarce water supplies will displace jobs in some rural communities.

---

[16] NOAA, Global Analysis – August 2016, available at: https://www.ncdc.noaa.gov/sotc/global/201608.
[17] IPCC AR5 Synthesis Report at 2 (attached as Exhibit 5).
[18] Jerry M. Melillo, *et al.*, Climate Change Impacts in the United States: The Third National Climate Assessment (2014) at 61, available at: http://nca2014.globalchange.gov (attached as Exhibit 6).
[19] *See id.* at 463-86.

- Increased warming, drought, and insect outbreaks, all caused by or linked to climate change, have increased wildfires and impacts to people and ecosystems in the Southwest. Fire models project more wildfire and increased risks to communities across extensive areas.
- Flooding and erosion in coastal areas are already occurring even at existing sea levels and damaging some California coastal areas during storms and extreme high tides. Sea level rise is projected to increase as Earth continues to warm, resulting in major damage as wind-driven waves ride upon higher seas and reach farther inland.
- Projected regional temperature increases, combined with the way cities amplify heat, will pose increased threats and costs to public health in southwestern cities, which are home to more than 90% of the region's population. Disruptions to urban electricity and water supplies will exacerbate these health problems.

Immediate and substantial greenhouse gas reductions are required to avoid catastrophic impacts to people and communities. "Following the warmest year on record in 2014 according to most estimates, 2015 reached record warmth yet again, surpassing the previous record by more than 0.1°C."[20] This record warming was again surpassed in 2016. "Globally-averaged temperatures in 2016 were 1.78 degrees Fahrenheit (0.99 degrees Celsius) warmer than the mid-20th century mean. This makes 2016 the third year in a row to set a new record for global average surface temperatures."[21]

> Most of the warming occurred in the past 35 years, with 16 of the 17 warmest years on record occurring since 2001. Not only was 2016 the warmest year on record, but eight of the 12 months that make up the year – from January through September, with the exception of June – were the warmest on record for those respective months. October, November, and December of 2016 were the second warmest of those months on record – in all three cases, behind records set in 2015.[22]

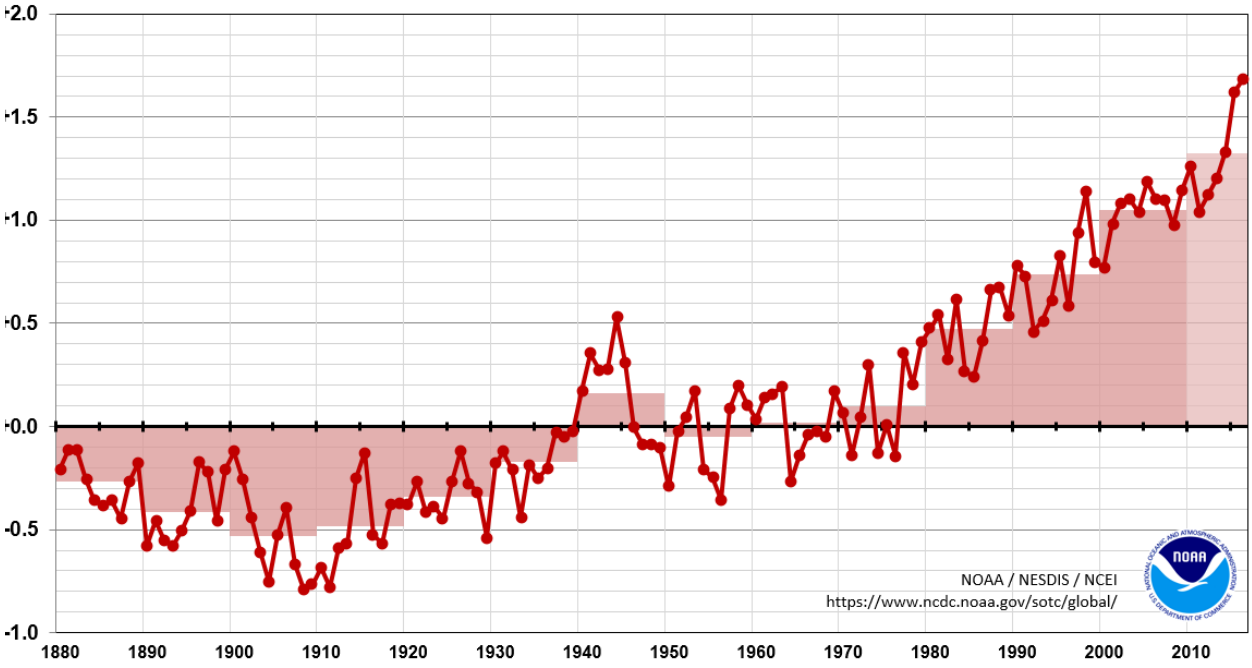
Earlier this year, researchers developed a mathematical equation to describe the impacts of human activity on the Earth.[23] The equation shows that astronomical and geophysical forces on the Earth system, while complex, tend to zero over time because of their slow nature and rarity. Whereas GHG emissions caused by humans over the past 45 years have increased the rate of temperature rise to 1.7 degrees Celsius per century,

---

[20] American Meteorological Society, *State of the Climate in 2015*, Vol.97, No.8 (Aug. 2016), at S7 (attached as Exhibit 7).
[21] NASA, *NASA NOAA Data Show 2016 Warmest Year on Record Globally* (Jan. 18, 2017), available at: https://www.nasa.gov/press-release/nasa-noaa-data-show-2016-warmest-year-on-record-globally.
[22] *Id.*; *see also* NOAA/NASA, *Annual Global Analysis for 2016* (Jan 2017) (attached as Exhibit 27).
[23] Owen Gaffney and Will Steffen, *The Anthropocene Equation*, The Anthropocene Review (2017) (attached as Exhibit 28).

representing a change to the climate that is 170 times faster than the natural background rate.[24] The researchers conclude that failing to reduce anthropological climate change "could trigger societal collapse."[25]

Annual Global Temperature: Difference from 20th Century Average, in °F



As noted above, the Paris Agreement commits all signatories—including the United States—to a target holding long-term global average temperature "to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels."[26] As articulated by a team of international climate scientists, including Dr. James Hansen, in a 2013 report: "The widely accepted target of limiting human-made global warming to 2 degrees Celsius (3.6 degrees Fahrenheit) above preindustrial level is too high and would subject young people, future generations and nature to irreparable harm…. Observational data reveal that some climate extremes are already increasing in response to warming of several tenths of a degree in recent decades; these extremes would likely be much enhanced with warming of 2°C or more."[27] "Runaway climate change—in which feedback loops drive ever-worsening climate change, regardless of human activities—are now seen as a risk even at 2°C of warming."[28] "[T]here is an unacceptable risk that before 2°C of warming, significant 'long-term'

[24] Gaffney at 3.
[25] Gaffney at 7.
[26] Paris Agreement at Art. 2 (attached as Exhibit 2).
[27] James Hansen, *et al., Assessing "Dangerous Climate Change": Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature,* 8 PLoS ONE 8 e81648 (2013) (attached as Exhibit 8).
[28] Greg Muttitt, *et al.*, *The Sky's Limit: Why the Paris Climate Goals Require a Managed Decline of Fossil Fuel Production*, Oil Change International (Sept. 2016) at 6 (attached as Exhibit 9).

feedbacks will be triggered, in which warming produces conditions that generate more warming, so that carbon sinks such as the oceans and forests become less efficient in storing carbon, and polar warming triggers the release of significant permafrost and clathrate carbon stores. Such an outcome could render ineffective human efforts to control the level of future warming to manageable proportions."[29] Indeed, the impacts of 2°C temperature rise have been "revised upwards, sufficiently so that 2°C now more appropriately represents the threshold between 'dangerous' and 'extremely dangerous' climate change."[30] "[T]he risks previously believed to be associated with an increase of around 4°C in global temperatures are now associated with the rise of a little over 2°C, while the risks previously associated with 2°C are now thought to occur with only 1°C rise."[31]

Although the Paris Agreement has underscored that immediate action is needed to avoid 'extremely dangerous' warming, meeting the voluntary commitments adopted in Paris alone will be insufficient to meet goal of limiting temperature change to between 1.5°C and 2.0°C above pre-industrial levels. As noted by a 2015 UNEP technical report:

> The emissions gap between what the full implementation of the unconditional [intended nationally determined contributions (INDCs)] contribute and the least-cost emission level for a pathway to stay below 2°C, is estimated to be 14 $GtCO_2e$ (range: 12-17) in 2030 and 7 $GtCO_2e$ (range: 5-10) in 2025. When conditional INDCs are included as fully implemented, the emissions gap in 2030 is estimated to be 12 GtCO2e (range: 10-15) and 5 $GtCO_2e$ (range: 4-8) in 2025.[32]

In other words, far greater emissions reductions are necessary to stay below and 2.0°C, let alone aspire to 1.5°C of warming. If no further progress were made beyond the Paris Agreement, expected warming by 2100 would be 3.5°C.[33] In the alternative, if no action is taken and the status quo is maintained—a position long reflected in BLM's management of public lands in the San Juan Basin—estimated warming by 2100 is upwards of 4.5°C.[34] To achieve an outcome consistent with a 50% chance of keeping warming to 2.0°C, the growth in global-energy related CO_2 emissions needs to halt and start to reverse within the current decade.[35] Delaying stronger climate action to 2020 would come at a cost: $1.5 trillion in low-carbon investments are avoided

---

[29] David Spratt, *Climate Reality Check: After Paris, Counting the Cost* (March 2016) at 8 (attached as Exhibit 10).
[30] Kevin Anderson and Alice Bows, *Beyond 'Dangerous' Climate Change: Emission Scenarios for a New World*, Phil. Trans. R. Soc. (2011) (attached as Exhibit 11).
[31] International Energy Agency, *Redrawing the Energy-Climate Map* (June 2013) at 14, (attached as Exhibit 29).
[32] United Nations Environment Programme (UNEP), *The Emissions Gap Report 2015: A UNEP Synthesis Report* (Nov. 2015) at xviii (attached as Exhibit 12).
[33] Spratt, *Climate Reality Check* at 2 (attached as Exhibit 10).
[34] *See* Climate Interactive, Climate Scorecard, available at: https://www.climateinteractive.org/programs/scoreboard/*; see also,* Andrew P. Schurer, *et al., Separating Forced from Chaotic Climate Variability over the Past Millennium*, Journal of Climate, Vol. 26 (March 2013) (attached as Exhibit 13).
[35] IEA (2013) at 13.

before 2020, but $5 trillion in additional investments would be required between 2020-2035 to get back on track.[36]

With specific regard to United States commitments under the Paris Agreement, the U.S. INDC set specific greenhouse gas emissions reduction target for 2025 of a 26% to 28% reduction below the 2005 emission levels, producing a range in 2005 net GHG emissions from 6,323 to 7,403 $MTCO_2e$.[37] The difference between this target and the estimated 2025 emissions without INDC policies results in an 'emissions gap' ranging from 896 to 2,121 $MTCO_2e$.[38]

Both the IPCC and National Climate Assessment recognize the dominant role of fossil fuels in driving climate change:

> While scientists continue to refine projections of the future, observations unequivocally show that climate is changing and that the warming of the past 50 years is primarily due to human-induced emissions of heat-trapping gases. These emissions come mainly from burning coal, oil, and gas, with additional contributions from forest clearing and some agricultural practices.[39]
>
> ***
>
> CO_2 emissions from fossil fuel combustion and industrial processes contributed about 78% to the total GHG emission increase between 1970 and 2010, with a contribution of similar percentage over the 2000–2010 period (*high confidence*).[40]

The energy sector accounts for around two-thirds of GHG emissions, and more than 80% of global energy consumption is based on fossil fuels.[41] To keep open a realistic chance of meeting the 2°C target, intensive action is required before 2020. As summarized in a recent report:

> The Paris Agreement aims to help the world avoid the worst effects of climate change and respond to its already substantial impacts. The basic climate science involved is simple: cumulative carbon dioxide (CO_2) emissions over time are the key determinant of how much global warming occurs. This gives us a finite *carbon budget* of how much may be emitted in total without surpassing dangerous temperature limits.[42]

---

[36] IEA (2013) at 114.
[37] Jeffery Greenblatt & Max Wei, *Assessment of the climate commitments and additional mitigation policies of the Unites States*, Nature Climate Change (Sept. 2016), available at: http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate3125.html (attached as Exhibit 14).
[38] *Id.* at 2; *see also* UNEP, Emissions Gap Report (attached as Exhibit 12).
[39] Third National Climate Assessment at 2 (attached as Exhibit 6).
[40] IPCC AR5 Synthesis Report at 46 (attached as Exhibit 5).
[41] IEA (2013) at 9.
[42] *The Sky's Limit* at 6 (attached as Exhibit 9).

According to the IPCC, as of 2011, the remaining carbon budget of cumulative CO_2 emissions from all anthropogenic sources must remain below 1,000 $GtCO_2$ to provide a 66% probability of limiting warming to 2°C above pre-industrial levels.[43] For years 2012-2014, approximately 107 $GtCO_2$ was emitted, averaging approximately 36 $GtCO_2$ per year, which left us at the start of 2016 with a carbon budget of only 850 $GtCO_2$.[44] These emissions were the highest in human history and 60% higher than in 1990 (the Kyoto Protocol reference year). Of course, the Paris Agreement aim of limiting global warming to 1.5°C requires adherence to a more stringent carbon budget of only 400 $GtCO_2$ from 2011 onward, of which about 250 $GtCO_2$ remained at the start of 2016.[45] "With global annual emissions amounting to 36 $GtCO_2$ in 2015, scientists predict that at current rates global emissions will exceed the carbon budgets necessary to stay under the 1.5°C target by 2021 and the 2°C target by 2036.[46]

The potential carbon emissions from *existing* fossil fuel reserves—the known belowground stock of extractable fossil fuels—considerably exceed both 2°C and 1.5°C of warming. "Estimated total fossil carbon reserves exceed this remaining [carbon budget] by a factor of 4 to 7."[47] "For the 2°C or 1.5°C limits, respectively 68% or 85% of reserves must remain in the ground."[48] The reserves in currently operating oil and gas field alone, even with no coal, would take the world beyond 1.5°C.[49]

---

[43] IPCC AR5 Synthesis Report at 63-64 & Table 2.2 (attached as Exhibit 5). For an 80% probability of staying below 2°C, the budget from 2000 is 890 $GtCO_2$, with less than 430 $GtCO_2$ remaining. Malte Meinshausen *et al., Greenhouse-gas emission targets for limiting global warming to 2°C*, Nature (2009) at 1159 (attached as Exhibit 15). Other sources offer slightly different calculations in order to have a 50% probability of keeping warming below 2°C, with total emissions to 2050 below 1,440 $GtCO_2$ from 2000 onward, of which 420 $GtCO_2$ has already been emitted (as of 2011). It is estimated that another 136 $GtCO_2$ will be emitted from non-energy sources up to 2050, meaning the energy sector can emit a maximum of 884 $GtCO_2$ by 2050. IEA (2013) at 16-17.

[44] *See* Annual Global Carbon Emissions, available at: https://www.co2.earth/global-co2-emissions; *see also* C. Le Quéré, *et al., Global Carbon Budget 2015*, Earth Syst. Sci. Data (Dec. 2015) (attached as Exhibit 16).

[45] Dustin Mulvaney, *et al.*, *Over-Leased: How Production Horizons of Already Leased Federal Fossil Fuels Outlast Global Carbon Budgets,* EcoShift Consulting (July 2016) (attached as Exhibit 17) at 2 (citing Joeri Rogelj, *et al., Difference between carbon budget estimates unraveled*, Nature Climate Change (2016) (attached as Exhibit 18).

[46] Mulvaney at 2 (citing Oak Ridge National Laboratories, Carbon Dioxide Information Analysis Center (2015), available at: http://cdiac.ornl.gov/GCP/).

[47] IPCC AR5 Synthesis Report at 63 (attached as Exhibit 5).

[48] The Sky's Limit at 6 (attached as Exhibit 9); *see also* Kevin Anderson and Alice Bows, *Reframing the climate change challenge in light of post-2000 emission trends*, Phil. Trans. R. Soc. (2008) (attached as Exhibit 19) ("to provide a 93% mid-value probability of not exceeding 2°C, the concentration (of atmospheric greenhouse gases) would need to be stabilized at or below 350 parts per million carbon dioxide equivalent (ppm CO_2e)" compared to the current level of ~485 ppm CO_2e.).

[49] The Sky's Limit at 5, 17 (attached as Exhibit 9).

In order for the world to stay within a carbon budget consistent with Paris Agreement goals—"holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C"[50]—significant fossil fuel resources must remain in the ground. More specifically, to meet the target of 2°C, globally "a third of oil reserves, half of gas reserves and over 80 percent of current coal reserves should remain unused from 2010-2050."[51] These fossil fuel reserves represent "unburnable carbon" and as such would be are stranded assets in which countries, industries, and companies are heavily invested but on which they would be unable to recoup returns. Citigroup warned investors that "the total value of stranded assets could be over $100 trillion based on current market prices."[52] Studies estimate that global coal, oil and gas resources considered currently economically recoverable contain potential greenhouse gas emissions of 4,196 $GtCO_2$,[53] with other estimates as high as 7,120 $GtCO_2$.[54]

Critically, the United States carbon quota—equivalent to 11% of the global carbon budget needed for a 50% chance of limiting warming to 2°C—allocates approximately 158 $GtCO_2$ to the United States as of 2011.[55] By way of comparison, federal and non-federal fossil fuel emissions together would produce between 697 and 1,070 $GtCO_2$.[56] Regarding just federal fossil fuel resources, the United States contains enough recoverable coal, oil and gas that, if extracted and burned, would result in as much as 492 $GtCO_2$, far surpassing the entire global carbon budget for a 1.5°C target and nearly eclipsing the 2°C target—to say nothing of the United States 'share' of global emissions.[57] Unleased federal fossil fuels comprise 91% of these potential emissions, with already leased federal fossil fuels accounting for as much as 43 $GtCO_2$.[58]

In 2012, "the GHG emissions resulting from the extraction of fossil fuels from federal lands by private leaseholders totaled approximately 1,344 $MMTCO_2e$."[59] Between 2003 and 2014, approximately 25% of all United States and 3-4% of global fossil fuel greenhouse gas emissions are attributable to federal minerals leased and developed by the Department of the

---

[50] Paris Agreement at Art. 2 (attached as Exhibit 2).
[51] Christophe McGlade & Paul Ekins, *The geographical distribution of fossil fuels unused when limiting global warming to 2°C*, Nature (Jan 2015) (attached as Exhibit 20).
[52] Jason Channell, *et al.*, *Energy Darwinism II*, Citi GPS: Global Perspectives & Solutions (August 2015) at 118 (attached as Exhibit 30).
[53] Michael Raupach, *et al., Sharing a quota on cumulative carbon emissions*, Nature Climate Change (Sept. 2014) (attached as Exhibit 21).
[54] IPCC AR5, Mitigation of Climate Change, Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (2014) at Table 7.2 (attached as Exhibit 22).
[55] Raupach at 875 (attached as Exhibit 21).
[56] Dustin Mulvaney, *et al.*, *The Potential Greenhouse Gas Emissions from U.S. Federal Fossil Fuels*, EcoShift Consulting (Aug. 2015) at 16 (attached as Exhibit 23).
[57] *Id.*
[58] *Id.*
[59] Stratus Consulting, *Greenhouse Gas Emissions from Fossil Energy Extracted from Federal Lands and Waters: An Update* (Dec. 2014) at 9 (attached as Exhibit 24).

Interior.[60] Continued leasing and development of federal fossil fuel resources commits the world to 'extremely dangerous' warming well beyond the 2°C threshold. As one study put it, "the disparity between what resources and reserves exist and what can be emitted while avoiding a temperature rise greater than the agreed 2°C limit is therefore stark."[61] In short, *any* new leasing of federal fossil fuel resources is inconsistent with a carbon budget that would seek to avoid catastrophic climate change.

The production horizons for already leased federal fossil fuel resources underscore how unwarranted any additional leasing is, and in turn the reasonableness of the FFO's consideration of a no-leasing alternative. Comparing these production horizons to dates at which carbon budgets would be exceeded if current emission levels continue:

- Federal crude oil already leased will continue producing for 34 years beyond the 1.5°C threshold and 19 years beyond the 2°C threshold;
- Federal natural gas already leased will continue producing 23 years beyond the 1.5°C threshold and 8 years beyond the 2°C threshold;
- Federal coal already leased will continue producing 20 years beyond the 1.5°C threshold and 5 years beyond the 2°C threshold.[62]

Not only can the federal government not afford to lease *any* additional public lands for fossil fuel development—underscoring the need to consider a no leasing alternative—but substantial efforts must also be made to limit the production horizon of fossil fuel resources already leased. Accordingly, the FFO must also consider taking an aggressive position on the non-renewal and expiration of non-producing leases, as well as review of agency policy on lease suspensions and unitization.

If new leasing and renewal of existing non-producing leases continues, by 2040 it will contribute about two-thirds of expected federal fossil fuel production (forecast based on EIA and other sources).[63] On the other hand, if new leasing ceases and existing non-producing leases are not renewed, 40% of forecast coal production could be avoided in 2025 and 74% of coal production could be avoided in 2040. As for oil and gas, 12% of oil production could be avoided in 2025 and 65% could be avoided by 2040 while 6% of natural gas production could be avoided in 2025 and 59% could be avoided by 2040.[64]

This avoided production would significantly reduce future U.S. emissions. Cessation of new and renewed leases for federal fossil fuel extraction could reduce CO_2 emissions by about

---

[60] *See* Energy Information Administration, *Sales of Fossil Fuels Produced from Federal and Indian Lands, FY 2003 through FY 2014* (July 2015) (attached as Exhibit 25); *see also* Stratus Consulting (attached as Exhibit 24).
[61] McGlade at 188.
[62] Mulvaney (2016) at 5.
[63] Peter Erickson and Michael Lazarus, *How Would Phasing Out U.S. Federal Leases for Fossil Fuel Extraction Affect CO2 Emissions and 2°C Goals?,* Stockholm Environmental Institute (2016) at 12 (attached as Exhibit 323).
[64] Erickson and Lazarus at 16.

100 Mt per year by 2030. Annual emission reductions could become greater than that over time as production declines on existing leases and maintaining or increasing production becomes dependent on yet-to-be issued leases.[65]

A comparison with other measures shows that "no leasing" could be a very significant part of U.S. efforts to address climate change. The 100 Mt CO_2 emissions savings that could result from no leasing in 2030 compares favorably with EPA standards for light- and medium-vehicles that are expected to yield 200 Mt in CO_2 savings in 2030, and with standards for heavy-duty vehicles that are expected to yield 70 Mt in CO_2 savings in the same year. The 100 Mt CO_2 emissions reduction from leasing restrictions would be greater than either the emission reductions that the EPA expects to achieve through its existing regulation of oil and gas industry emissions or reductions the BLM expects to achieve from its proposed methane waste standards on oil and gas operations on federal land. Clearly, cessation of new and renewed leases could make an important contribution to U.S. climate change mitigation efforts.[66]

Also, importantly, avoided production through no new leasing and the non-renewal of existing non-producing leases could help avoid further carbon lock-in in terms of investment in both fossil fuel-producing and fossil fuel-using infrastructure.[67] Simply put, the timeframe to avoid catastrophic climate change is short, and the management of our federal minerals is dangerously out of step with this reality.

B. Projected Energy Demands, International Finance, and Stranded Assets

The world's energy needs continue to grow, with projections of a 30% rise in global energy demand to 2040. The International Energy Agency ("IEA") has estimated that for this increasing demand to be met, a cumulative $48 trillion in investment is needed in global energy supply,[68] of which 60% is comprised of fossil fuels and nearly 20% to renewables, with an additional $23 trillion invested in improvements in energy efficiency.[69] "Countries are generally on track to achieve, and even exceed in some instances, many of the targets set in their Paris Agreement pledges; this is sufficient to slow the projected rise in global energy-related CO_2 emissions, but not nearly enough to limit warming to less than 2°C."[70] By contrast, it would be exceedingly difficult to chart a course toward a 2°C pathway. A major reallocation of investment capital going to the energy sector would be needed, requiring an estimated $40 trillion in cumulative energy supply investment moving away from fossil fuels and toward renewables.[71] The more ambitious target of limiting warming to less than 1.5°C would be even more difficult to achieve, demanding net-zero emissions between 2040 and 2060, a goal that would require

[65] Erickson and Lazarus at 26.
[66] Erickson and Lazarus at 27.
[67] Erickson and Lazarus at 30.
[68] International Energy Agency, *World Energy Investment Outlook* (2014), at 3 (attached as Exhibit 31).
[69] International Energy Agency, *World Energy Outlook 2016: Executive Summary* (2016), at 2 (attached as Exhibit 32).
[70] IEA (2016) at 2.
[71] IEA (2016) at 5.

radical near-term reductions in energy sector CO_2 emissions.[72] IEA estimates that "$53 trillion in cumulative investment in energy supply and efficiency is required over the period to 2035 in order to get the world onto a 2°C emissions path."[73]

The liability exposure from not acting is enormous, with cumulative 'lost' GDP from the impacts of climate change equating to $44 trillion.[74] Yet, investment decisions being taken today are not consistent with a 2°C climate goal and are not aimed at creating infrastructure that is sufficiently resilient to withstand the increased physical risks that are expected to result from future climate change.[75] "[O]ur current energy infrastructure has already 'locked-in' future carbon-dioxide emissions."[76] Even as this energy infrastructure is quickly sealing our climate fate in the near term, it will become obsolete in the slightly longer term. Indeed, many new energy sector assets are destined to become stranded when carbon reduction policies that limit the utilization of those assets are inevitably adopted in response to climate change impacts. As of 2013, emissions from existing global fossil fuel energy infrastructure already represented four-fifths, or 550 $GtCO_2$, of the total volume of CO_2 emissions that the earth can accommodate under a 2°C trajectory.[77] With delayed climate action to date, in 2017 we now find ourselves at an investment watershed, where energy infrastructure now locks in the entire remaining carbon budget to 2035.[78] From this point forward, far more costly actions are going to be required to subsequently undo the lock-in effect, and every additional investment in the energy sector committed to fossil fuels would become stranded assets under policies to achieve a 2°C pathway.

At the same time, the capital expenditures required to maintain current energy sector demand for fossil fuels have more than doubled since 2000, to $950 billion annually.[79] In other words, more capital investment is being required to maintain our current reliance on fossil fuels at a time, paradoxically, when from a climate perspective all of the new investment must be redirected towards renewable energy sources to effect a radical transformation of the energy sector, as necessary to avoid catastrophic warming. The market value of oil and gas produced globally was around $4.2 trillion in 2012, which was almost double what it was in 2005.[80] Yet, this has not resulted in a financial windfall to the oil and gas industry, as costs and royalties have more than kept pace with increased revenues.[81] In short, oil and gas companies are merely maintaining a fossil fuel treadmill where increasingly costly investments are needed to meet demand but lead to rising costs for the oil and gas industry as well as significant costs to society as reliance on oil and gas fuels climate change, an irrational system. In the face of these increasing capital requirements, there is growing awareness of significant financial exposure for individual companies from the possible future stranding of new fossil fuel investments. For

[72] IEA (2016) at 5.
[73] IEA (2014) at 14.
[74] Citi at 8.
[75] IEA (2013) at 84.
[76] IEA (2013) at 98.
[77] IEA (2013) at 99.
[78] IEA (2013) at 113.
[79] IEA (2014) at 51, 52.
[80] IEA (2014) at 54.
[81] IEA (2014) at 54.

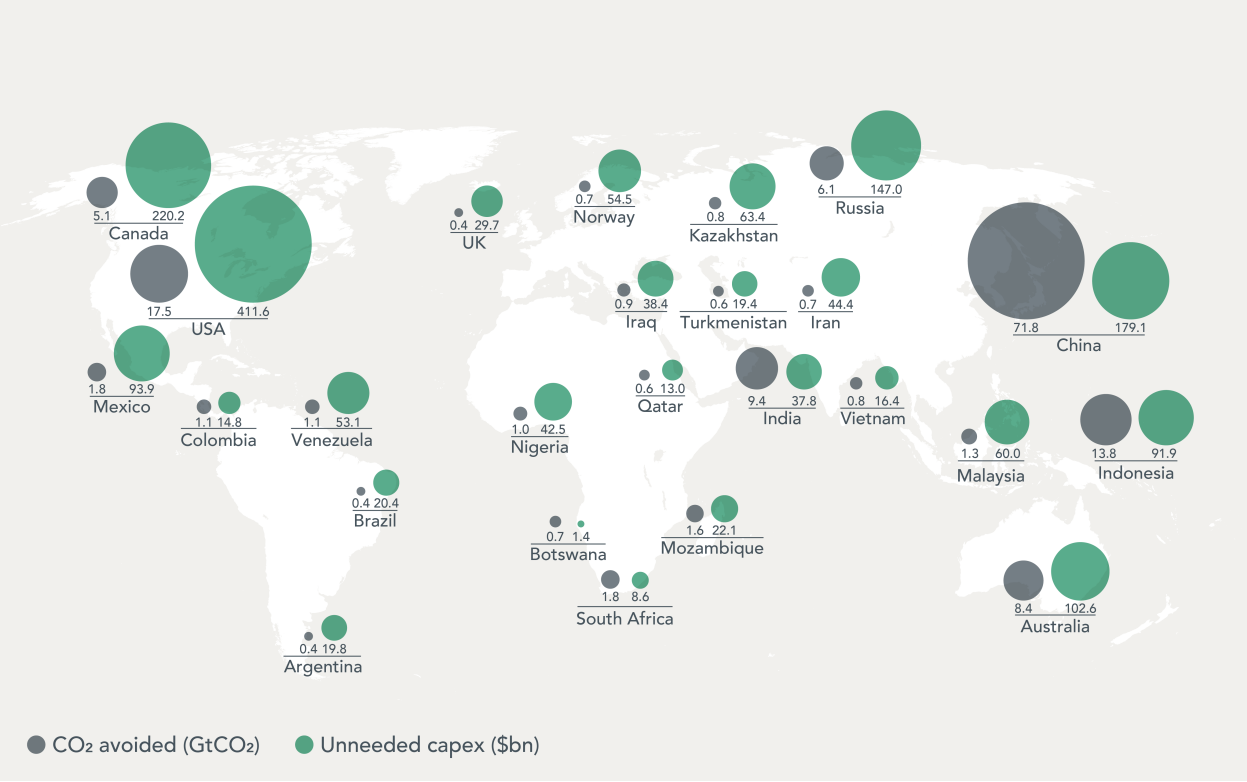
example, among major oil and gas companies, the estimated cost of stranded assets over the next decade ranges from $21.5 billion for ConocoPhillips to $76.9 billion for Shell.[82] Nevertheless, the global capital markets have yet to internalize these risks and charge premiums that would steer investment towards renewable energy.

"Analysis of the entire energy system shows that delaying action on climate change is a false economy. Investments of around $1.5 trillion are avoided in the period to 2020, but an additional $5 trillion of investments are required between 2020 and 2035."[83]

According to the 2°C pathway modeled by IEA, from 2015-2035 the carbon budget for energy-based emissions from all fossil fuels is 593 $GtCO_2$.[84] If global energy investment continues on its current course, there will be over $2 trillion in investment in energy sources that will emit around 156 $GtCO_2$ of emissions over the 2°C target of 593 $GtCO_2$.[85] This can also be viewed through the lens of specific fossil fuel demand to 2035 under a 2°C pathway. For coal, zero additional capital investment is needed, as production from existing coalmines would exceed demand.[86] For gas, approximately $460 billion—or over 40% of anticipated capital expenditures—is unneeded, resulting in 9.3 $GtCO_2$ of avoided emissions.[87] For oil, it is projected that demand peaks around 2020, meaning that the oil sector does not need to continue to grow. Based on current Paris Agreement commitments, oil production required in the period to 2035 amounts to around 760 billion barrels, but falls to 690 billion barrels to maintain a course for 2°C.[88] Yet the estimated level of proven oil reserves are close to 1.7 trillion barrels.[89] This results to between a 940 and 1,010 billion barrel surplus of proven reserves that cannot be burned. Avoided capital expenditures for oil are nearly $1.5 trillion, avoiding 27.6 $GtCO_2$ of emissions.[90]

[82] Carbon Tracker Initiative, *The $2 trillion stranded assets danger zone: How fossil fuel firms risk destroying investor returns* (Nov. 2015) at 23, (attached as Exhibit 33).
[83] IEA (2013) at 114.
[84] Carbon Tracker (2015) at 7.
[85] Carbon Tracker (2015) at 2.
[86] Carbon Tracker (2015) at 10.
[87] Carbon Tracker (2015) at 14.
[88] IEA (2014) at 87.
[89] IEA (2014) at 87.
[90] Carbon Tracker (2015) at 18.

Unneeded capital expenditures to 2025 and related CO_2 to 2035 under a 2°C pathway



It is cheaper for the world to address climate change than bear its economic consequences. As detailed above, there are enough coal, oil and gas reserves that are technically recoverable to equal up to 7,120 $GtCO_2$ of emissions.[91] Only a portion of this carbon is already locked-in—i.e., total reserves held by fossil fuel companies and state owned assets—but this 'embedded' carbon still amounts to 2,860 $GtCO_2$—already enough to take us beyond 3°C of warming.[92] Only 20% of these fossil fuel reserves can be burned to 2050 if the world is to have a chance of not exceeding global warming of 2°C.[93]

The total coal, oil and gas reserves listed on the world's stock exchanges equaled 762 $GtCO_2$ in 2013—an amount that continues to grow.[94] "If listed fossil fuel companies have a pro-rata allocation of the global carbon budget, this would amount to around 125–275 $GtCO_2$, or 20 - 40% of the 762 $GtCO_2$ currently booked as reserves. The scale of this carbon budget deficit poses a major risk for investors. They need to understand that 60 - 80% of coal, oil and gas reserves of listed firms are unburnable."[95] The systemic risks threatening the stability of financial markets related to unburnable carbon are growing more entrenched, with 200 fossil fuel

[91] IPCC AR5 at Table 7.2.
[92] Carbon Tracker Initiative, *Unburnable Carbon 2013: Wasted capital and stranded assets* (2013), at 14 (attached as Exhibit 34).
[93] Carbon Tracker (2013) at 4.
[94] Carbon Tracker (2013) at 4.
[95] Carbon Tracker (2013) at 4.

companies having a market value of $4 trillion and debt of $1.5 trillion.[96]

As provided by Citigroup in a warning to investors:

> Emissions contained in current 'reserves' figures are around three times higher than the so called 'carbon budget'. Some studies suggest that globally a third of oil reserves, half of gas reserves and over 80% of current coal reserves would have to remain unused from 2010 to 2050 in order to have a chance of meeting the 2°C target. In financial terms, we estimate that the value of unburnable reserves could amount to over $100 trillion out to 2050.[97]

The longer climate action is delayed the more expensive it becomes to avoid each additional ton of GHG emissions, and the more capital expenditures will become stranded. [98] In other words, climate action is directly tied to economic resilience, and the longer action is delayed the larger the lead balloon becomes. This is not only a problem for the fossil fuel industry, but for our economy and the wellbeing of our communities. These financial implications also bear directly on BLM's decisionmaking relative to the leasing and development of our public lands for fossil fuel resources. Not only do each additional acre leased and well authorized contribute to societies collective carbon burden, but inherent financial risk and market instability has far reaching implications for public lands remediation. When fossil fuel resources become stranded it is the public, not financially struggling fossil fuel companies, who are left holding the bag.

II. BLM Must Consider All Reasonable Alternatives.

A. BLM Has a Legal Obligation to Consider All Reasonable Alternatives.

The centerpiece of environmental regulation in the United States, the National Environmental Policy Act ("NEPA") requires federal agencies to pause before committing resources to a project and consider the likely environmental impacts of the preferred course of action as well as reasonable alternatives. *See* 42 U.S.C. § 4331(b) (congressional declaration of national environmental policy); *U.S. Dep't of Transp. v. Public Citizen,* 541 U.S. 752, 756–57 (2004). BLM must "rigorously explore and objectively evaluate all reasonable alternatives" to the proposed action in comparative form, so as to provide a "clear basis for choice among the options" open to the agency. 40 C.F.R. § 1502.14. At a minimum, the agency must identify and analyze its preferred alternative, as well as a null or "no action" alternative that would occur if the agency elected to maintain the current state of affairs unchanged. *Id.* In addition, the agency should address all other reasonable alternatives to the proposed action. *See Colorado Envtl. Coal. v. Salazar*, 875 F. Supp. 2d 1233, 1245 (D. Colo. 2012).

Through the RMP planning process, the FFO is required to "estimate and display the physical, biological, economic, and social effects of implementing each alternative considered in detail. The estimation of effects shall be guided by the planning criteria and procedures

[96] Carbon Tracker (2013) at 5, 30.
[97] Citi at 82.
[98] IEA (2014) at 43.

implementing [NEPA]." 43 C.F.R. § 1610.4-6. Essential to any NEPA process is a robust analysis of alternatives to the proposed action. Consideration of reasonable alternatives is necessary to ensure that the agency has before it and takes into account all possible approaches to, and potential environmental impacts of, a particular project. NEPA's alternatives requirement, therefore, ensures that the "most intelligent, optimally beneficial decision will ultimately be made." *Calvert Cliffs' Coordinating Comm., Inc. v. U.S. Atomic Energy Comm'n,* 449 F.2d 1109, 1114 (D.C. Cir. 1971).

"[T]he heart" of an environmental analysis under NEPA is the analysis of alternatives to the proposed project, and agencies must evaluate all reasonable alternatives to a proposed action." *Colorado Environmental Coalition*, 185 F.3d at 1174 (quoting 40 C.F.R. § 1502.14). An agency must gather "information sufficient to permit a reasoned choice of alternatives as far as environmental aspects are concerned." *Greater Yellowstone*, 359 F.3d at 1277 (citing *Colorado Environmental Coalition*, 185 F.3d at 1174); *see also Holy Cross Wilderness Fund v. Madigan*, 960 F.2d 1515, 1528 (10th Cir. 1992). Thus, agencies must "ensure that the statement contains sufficient discussion of the relevant issues and opposing viewpoints to enable the decisionmaker to take a 'hard look' at environmental factors, and to make a reasoned decision." *Izaak Walton League of America v. Marsh,* 655 F.2d 346, 371 (D.C. Cir. 1981) (citing *Kleppe v. Sierra Club,* 427 U.S. 390, 410 n. 21 (1976)).

When determining whether an EIS analyzed sufficient alternatives to allow BLM to take a hard look at the available options, courts apply the "rule of reason." *New Mexico ex rel. Richardson v. Bureau of Land Mgmt.*, 565 F.3d 683, 709 (10th Cir. 2009) (citing *Westlands Water Dist. v. U.S. Dep't of the Interior*, 376 F.3d 853, 868 (9th Cir. 2004)). The reasonableness of the alternatives considered is measured against two guideposts. First, when considering agency actions taken pursuant to a statute, an alternative is reasonable only if it falls within the agency's statutory mandate. *Westlands,* 376 F.3d at 866. Second, reasonableness is judged with reference to an agency's objectives for a particular project.[99] *See Dombeck,* 185 F.3d at 1174–75; *Simmons v. U.S. Army Corps of Eng'rs,* 120 F.3d 664, 668–69 (7th Cir. 1997); *Idaho Conservation League v. Mumma,* 956 F.2d 1508, 1520 (9th Cir. 1992).

On the first point, FLPMA is BLM's organic act and delegates authority to the agency to create and amend land use plans. FLPMA's congressional declaration states:

> It is the policy of the United States that … the public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use;

[99] While an agency may restrict its analysis to alternatives that suit the "basic policy objectives" of a planning action, *Seattle Audubon Soc'y v. Moseley,* 80 F.3d 1401, 1404 (9th Cir. 1996), it may do so only as long as "the statements of purpose and need drafted to guide the environmental review process ... are not unreasonably narrow," *Dombeck*, 185 F.3d at 1175.

43 U.S.C. § 1701(a)(8) (emphasis added). Indeed, BLM is duty bound to develop and revise land use plans according to this congressional mandate, so as to "observe the principles of multiple use." 43 U.S.C. § 1712(c)(1). "Multiple use" means "a combination of balanced and diverse resource uses that takes into account the long-term needs of future generations for renewable and nonrenewable resources, including, but not limited to, recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific and historical values." 43 U.S.C. § 1702(c).

The RMP revision process, undertaken pursuant to FLPMA, requires BLM to engage in the type of foundational land use planning that is intended to give context to the agency's multiple use mandate. Accordingly, FLPMA provides specific criteria for land use plan revisions, requiring consideration of things such as: observation of the principles of multiple use and sustained yield; integrated consideration of physical, biological, economic, and other sciences; reliance on public lands resources and other values; consideration of present and future uses of the public lands; consideration of the relative scarcity of resource values; and weighing the long-term benefits to the public against the short-term benefits. *See* 43 U.S.C. § 1712(c)(1)-(9). Consideration of these criteria must drive the RMP revision.

Critically, FLPMA does not mandate that every use be accommodated on every piece of land; rather, delicate balancing is required. *See Norton v. S. Utah Wilderness Alliance*, 542 U.S. 55, 58 (2004). "'Multiple use' requires management of the public lands and their numerous natural resources so that they can be used for economic, recreational, and scientific purposes without the infliction of permanent damage." *Public Lands Council v. Babbitt*, 167 F.3d 1287, 1290 (10th Cir. 1999) (citing 43 U.S.C. § 1702 (c)). As held by the Tenth Circuit, "[i]f all the competing demands reflected in FLPMA were focused on one particular piece of public land, in many instances only one set of demands could be satisfied. A parcel of land cannot both be preserved in its natural character and mined." *Rocky Mtn. Oil & Gas Ass'n v. Watt,* 696 F.2d 734, 738 n. 4 (10th Cir.1982) (quoting *Utah v. Andrus,* 486 F.Supp. 995, 1003 (D.Utah 1979)); *see also* 43 U.S.C. § 1701(a)(8) (stating, as a goal of FLPMA, the necessity to "preserve and protect certain public lands in their natural condition"); *Pub. Lands Council,* 167 F.3d at 1299 (citing § 1701(a)(8)). As further provided by the Tenth Circuit:

> It is past doubt that the principle of multiple use does not require BLM to prioritize development over other uses… BLM's obligation to manage for multiple use does not mean that development *must* be allowed on [a particular piece of public lands]. Development is a *possible* use, which BLM must weigh against other possible uses—including conservation to protect environmental values, which are best assessed through the NEPA process. Thus, an alternative that closes the [proposed public lands] to development does not necessarily violate the principle of multiple use, and the multiple use provision of FLPMA is not a sufficient reason to exclude more protective alternatives from consideration.

New Mexico ex rel. Richardson, 565 F.3d at 710. Accordingly, the RMP amendment must consider, on equal footing, the value of permanent protection and preservation of public lands in the planning area, along with industry pressure to lease and develop public lands for fossil fuel resources. It is incumbent on the FFO to re-evaluate these competing resources and give suitable

weight to FLPMA's mandate to preserve and protect public lands in their natural condition. *See* 43 U.S.C. § 1701(a)(8). This is, after all, the agency's statutory mandate. *See New Mexico ex rel. Richardson,* 565 F.3d at 709.

By the measures detailed above, BLM must develop a range of alternatives to satisfy its statutory obligation under FLPMA, which necessarily includes alternatives that would close remaining lands to fossil fuel leasing and development. Over 91% of the FFO planning area is already leased. We are past the point where any reasonable balance can be made between oil and gas development and other resources, including land, water, air, and cultural values they community relies on.

BLM's alternatives must account for current resource conditions, changes in circumstances, and new or revised national-level policy, in particular with regard to climate change. BLM must consider all reasonable alternatives, including alternatives that would significantly reduce planning area greenhouse gas emissions, and in particular an alternative that considers not leasing public lands for fossil fuel development. 40 C.F.R. § 1502.14.

Courts have interpreted BLM's authority under the MLA as discretionary and not as an absolute mandate to lease. In fact, the Ninth Circuit held that the MLA "allows the Secretary to lease such lands, but does not require him to do so.... [T]he Secretary has discretion to refuse to issue any lease at all on a given tract . . . we affirm the district court's holding that the agencies failed to give the no action alternative meaningful consideration and thereby violated NEPA." *Bob Marshall All. v. Hodel*, 852 F.2d 1223, 1229-30 (9th Cir. 1988) (internal citations omitted). In an analogous case, the district court in *Wilderness Soc., Ctr. For Native Ecosystems v. Wisely* found:

> [T]he BLM's rejection of the 'no surface occupancy' alternative violated NEPA in both a technical and substantive sense. The Court finds that final September 2005 EA does not adequately explain why the 'no surface occupancy' alternative was dropped. 40 C.F.R. § 1502.14(a) requires that the EA 'briefly discuss the reasons' why an alternative was eliminated. Moreover, even if the BLM had fully articulated the reasons for excluding the 'no surface occupancy' alternative, the Court would nevertheless find that, on the present record, the decision to eliminate that alternative was arbitrary and capricious.

524 F. Supp. 2d 1285, 1311–12 (D. Colo. 2007). Moreover, because BLM is conducting an EIS review for this RMP, the requirement for analyzing or dismissing no action or no-leasing alternatives is heightened. *See W. Watersheds Project v. Bureau of Land Mgmt.*, 721 F.3d 1264, 1274-75 (10th Cir. 2013) ("Regulations require both documents to incorporate a range of reasonable alternatives, but the depth of discussion and analysis required is different depending on whether the document is an EIS or an EA. For example, section 40 C.F.R. §1502.14 provides that an EIS should '[r]igorously explore . . . all reasonable alternatives,' and '[d]evote substantial treatment to each alternative' with 'detail.' *Id*. at (a)-(b).")

Thus, BLM's consideration of a no-leasing alternative reasonable in light of new information, science, and national policy related to climate change, and therefore must be

included in the FFO's RMPA. BLM should resist any inclination toward maintaining a status quo approach to federal lands management in the San Juan Basin, which would be unhinged from current reality and the demands of the time.

B. BLM Must Consider a No Leasing Alternative in Response to Threats Posed by Climate Change.

Climate change has fundamentally altered the paradigm of public lands management—a reality reflected in new national policy as well as international commitments—but long ignored by the FFO in its management of the planning area. The business-as-usual approach fails to meet the needs of present and future generations—the agency's core mandate in managing public lands and minerals. 43 C.F.R. § 1702(c). Both science and common sense dictate that perpetuating a management approach which has substantially contributed to climate change is no longer sufficient. The agency must consider alternatives that are responsive to this reality, including not leasing fossil fuel minerals.

Every ton of carbon dioxide added to the atmosphere worsens climate change. So any additional oil and gas production permitted on BLM land managed by the FFO and the combustion of those fossil fuels will worsen climate change. Due to the urgent need to protect mankind and federal public lands from the potentially devastating impacts of catastrophic global warming, BLM must consider and analyze an alternative that reduces or eliminates the number of new fossil fuel leases in the Farmington planning area.

The BLM has explicit legal authority under FLPMA, the MLA and NEPA to adopt a no-leasing alternative as necessary to respond to the threats posed by climate change. BLM has broad discretion in determining when, how, and if fossil fuel resources are made available for leasing.

With regard to oil and gas, the MLA states: "All lands subject to disposition under this Act which are known or believed to contain oil or gas deposits *may* be leased by the Secretary." 30 US.C. § 226(a) (emphasis added); *see also Udall v. Tallman,* 30 U.S. 1, 4 (1965) (MLA "left the Secretary discretion to refuse to issue any lease at all on a given tract"); *Burglin v. Morton*, 527 F.2d 486, 488 (9th Cir. 1975) ("The permissive word 'may' in Section 226(a) allows the Secretary to lease such lands, but does not require him to do so."); *Pease v. Udall*, 332 F.2d 62, 63 (9th Cir. 1964) ("[T]he Mineral Leasing Act has consistently been construed as leaving to the Secretary, within his discretion, a determination as to what lands are to be leased thereunder.").

Although the MLA states that, for oil and gas, "[l]ease sales shall be held for each State where eligible lands are available at least quarterly and more frequently *if* the Secretary of the Interior determines such sales are necessary," quarterly leasing is *not required* if no lands are "eligible" and "available" due to factors including withdrawal from the operation of the MLA under FLPMA, allocation decisions under an applicable land management plan, need for additional environmental review, or exercise of Secretarial discretion. 30 U.S.C. § 226(b)(1)(A); *see also* 43 C.F.R. § 3120.1-1; U.S. Bureau of Land Management, Oil and Gas Leasing Reform, Instruction Memorandum No. 2010-117 ("Eligible lands include those identified in 43 C.F.R. § 3120.1-1 as being available for leasing (BLM Manual 3120, Competitive Leases). They are

considered available for leasing when all statutory requirements have been met, including compliance with the NEPA, appropriate reviews have been conducted, and *lands have been allocated for leasing in the RMP* (BLM Handbook H-3101-1, Issuance of Leases).") (emphasis added). Thus, a decision to allocate an area as ineligible for leasing through the planning process is contemplated by BLM's regulations, contradicting any perceived requirement that BLM must lease the area.

The Federal Onshore Oil and Gas Leasing Reform Act ("FOOGLRA")—while not altering the fundamental leasing structure of the MLA—imposed a competitive bidding requirement on all offered leases. 30 U.S.C. §§ 188, 195, 226. Critically, FOOGLRA did not repeal or alter Secretarial discretion of *whether* to offer any particular lands for lease. *See Western Energy Alliance v. Salazar*, 709 F.3d 1040, 1044 (10th Cir. 2013) ("Before the MLA was amended by the [FOOGLRA]…it was well established that the Secretary had extremely broad discretion and was not obligated to issue any lease on public lands…. The MLA, as amended by the Reform Act of 1987, continues to vest the Secretary with considerable discretion to determine which lands are 'to be leased' under § 226(b)(1)(A)."). As held by the Court of Appeals in *Bob Marshall Alliance v. Hodel*:

> the Mineral Leasing Act gives the Interior Secretary discretion to determine which lands are to be leased under the statute. 30 U.S.C. §226(a) (1982); *see Mountain States,* 499 F.Supp. at 391-92. We have held that the Mineral Leasing Act "allows the Secretary to lease such lands, but does not require him to do so.... [T]he Secretary has discretion to refuse to issue any lease at all on a given tract." *Burglin v. Morton*, 527 F.2d 486, 488 (9th Cir. 1975) (citing *Udall v. Tallman*, 380 U.S. 1, 4 (1965), *cert denied,* 425 U.S. 973 (1976)).

852 F.2d 1223, 1230 (9th Cir. 1988).

The Secretary of the Interior also has authority under FLPMA to "withdraw" an area of federal land from oil and gas leasing to "maintain . . . public values" or for a "particular public purpose." FLPMA defines a withdrawal as:

> withholding an area of Federal land from settlement, sale, location, or entry, under some or all of the general land laws, for the purpose of limiting activities under those laws in order to maintain other public values in the area or reserving the area for a particular public purpose or program . . .

43 U.S.C. § 1702(j). FLPMA further provides that Congress declares that it is the policy of the United States that "the public lands [shall] be managed in a manner that will protect the quality of … air and atmospheric … values." 43 U.S.C. § 1701(a)(8).

Under FLPMA's "multiple use and sustained yield" management directive, *id.* § 1701(a)(7), the federal government must manage public lands and resources in a manner that "takes into account the long-term needs of future generations for renewable and nonrenewable resources, including, but not limited to, recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific and historical values; and harmonious and coordinated

management of the various resources without permanent impairment of the productivity of the land[,]" *id.* § 1702(3). Further, "[i]n managing the public lands the Secretary shall … take any action necessary to prevent unnecessary or undue degradation of the lands." *Id.* § 1732(b).

Under these authorities, BLM is required not only to evaluate the impacts of federal leasing to public lands, water, and wildlife resources, but to avoid harm to those resources whenever possible. Accordingly, the MLA and FLPMA provide BLM the legal authority to either decide not to lease particular lands, or to withdraw large tracts from leasing.[100]

Further, the Tenth Circuit Court of Appeals has explicitly rejected arguments that FLPMA's multiple use mandate requires that public lands be made available for fossil fuel extraction.

> BLM's obligation to manage for multiple use does not mean that development *must* be allowed on [a particular piece of public lands]. Development is a *possible* use, which BLM must weigh against other possible uses – including conservation to protect environmental values, which are best assessed through the NEPA process. Thus, an alternative that closes the [proposed public lands] to development does not necessarily violate the principle of multiple use, and the multiple use provision of FLPMA is not a sufficient reason to exclude more protective alternatives from consideration.

New Mexico ex rel. Richardson, 565 F.3d at 710 (emphasis in original).

C. BLM Must Explicitly Consider a Renewable Energy Alternative or Include Renewable Energy as a Priority Element in Each Alternative.

A transition to clean energy is critical to achieving the national climate goals discussed in Section I of these comments. Several statements of national policy in regulations and executive orders create an obligation for BLM to look more closely at renewable energy as a resource in the Farmington Field Office planning area. As of 2010, these include:

---

[100] Even if BLM concludes that the agency lacks authority to bar new oil and gas leasing throughout the planning area, it should still consider such an alternative because it is otherwise reasonable. Federal courts hold that agencies have the duty to consider reasonable alternatives that are outside the jurisdiction of the agency or that require a change of law to implement. *See* 40 C.F.R. § 1502.14(c) (an EIS "shall" "[i]nclude reasonable alternatives not within the jurisdiction of the lead agency"); Council on Environmental Quality, Executive Office of the President, Publication of Memorandum to Agencies Containing Answers to 40 Most Asked Questions on NEPA Regulations, 46 Fed. Reg. 18,026–01 at 18,027 (1981) ("An alternative that is outside the legal jurisdiction of the lead agency must still be analyzed in the EIS if it is reasonable. A potential conflict with local or federal law does not necessarily render an alternative unreasonable"); *Muckleshoot Indian Tribe v. U.S. Forest Serv.*, 177 F.3d 800, 814 (9th Cir. 1999) (setting aside EIS for failure to address alternative requiring Congressional action).

- The Energy Policy Act of 2005 (Title II, Sec. 211), which requires the DOI to approve at least 10,000 megawatts of non-hydropower renewable energy on public lands by 2015. The President has requested that BLM produce an additional 10,000 megawatts beyond that mandated in the Energy Policy Act of 2005.

- Secretarial Order 3285, which requires the DOI to identify and prioritize specific locations best suited for large-scale renewable energy production.

- Instruction Memorandum 2007-097, Solar Energy Development Policy (BLM 2007), establishes policy for the processing of right-of-way (ROW) applications for solar energy development projects on BLM-administered lands and evaluating the feasibility of installing solar energy systems on BLM administrative facilities and projects.

- Instruction Memorandum 2006-216, Wind Energy Development Policy (BLM 2006), provides guidance on implementing the Record of Decision for the Programmatic Environmental Impact Statement (EIS) on Wind Energy Development (BLM 2005) and processing ROW applications for wind energy projects on BLM-administered lands. Instruction Memorandum 2009-043, Wind Energy Development Policy (BLM 2009b), provides updated guidance on processing ROW applications for wind energy projects on BLM-administered lands.

- Instruction Memorandum 2004-227, Biomass Utilization Strategy (BLM 2004), updated in July 2005, provides sets of goals to help focus and increase utilization of biomass from BLM lands. In June 2005, the final rule in the *Federal Register* revised the authority of 48 Code of Federal Regulations (CFR) Part 1452 by adding 1452.237-71, which is a new contract clause for removal and utilization of woody biomass generated as a result of land management service contracts whenever ecologically and lawfully appropriate. The BLM issued Instruction Memorandum 2009-120 in May 2009, which updated the contract clause for utilization for woody biomass.

The Farmington planning area has long been a sacrifice zone for extractive industry, and in particular for oil and gas—with over 40,000 historic wells drilled and at least 21,725 wells currently in production. Not only have local communities been forced to endure the effects of this development on their land, air, water, but they have also long suffered from the industry's boom and bust cycles. The federal government must consider alternatives that would allow for a just transition of local and state economies, and which support community independence from fossil fuels.

III. The FFO Must to Take a Hard Look at Greenhouse Gas Emissions and Impacts to Climate Change.

Conservation Groups provided detailed technical information on the agency's need to take a hard look at GHG emissions and impacts to climate change in previously submitted scoping comments, which are again incorporated by reference. This additional and supplemental information must also be considered. NEPA mandates that EISs contain "high quality" information and "[a]ccurate scientific analysis" sufficient to "help public officials make

decisions that are based on understanding environmental consequences." 40 C.F.R. § 1500.1(b), (c). Moreover, agencies have a duty to "insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements." 40 C.F.R. § 1502.24. NEPA therefore prohibits BLM from relying on outdated data.

Federal courts have long held that agency reliance on data that is stale or inaccurate invalidates environmental review. *See, e.g.*, *Northern Plains Resource Council, Inc. v. Surface Transp. Bd.*, 668 F.3d 1067, 1085-86 (9th Cir. 2011) (ten-year old survey data for wildlife "too stale" thus reliance on it in EIS was arbitrary and capricious); *Lands Council v. Powell*, 395 F.3d 1019, 1031 (9th Cir. 2005) (six year-old survey data for cutthroat trout was "too outdated to carry the weight assigned to it" and reliance on that data violated NEPA); *Seattle Audubon Soc. v. Espy*, 998 F.2d 699, 704-05 (9th Cir. 1993) (reliance on "stale scientific evidence" regarding owl population data without adequate discussion of scientific uncertainty violated NEPA).

As introduced above, the CEQ's Climate Guidance provides a framework for BLM to employ in its review of GHG emissions and climate change in the RMPA. First and foremost, the agency must resist the temptation of dismissing planning area emissions by comparing them on a scale with national and global emissions—which the FFO has frequently done in the past. The CEQ explained that these comparisons do not reveal anything beyond "the nature of the climate change challenge itself"; i.e., the fact that many individual sources together make a big impact on the climate:

> Climate change results from the incremental addition of GHG emissions from millions of individual sources, which collectively have a large impact on a global scale. CEQ recognizes that the totality of climate change impacts is not attributable to any single action, but are exacerbated by a series of actions including actions taken pursuant to decisions of the Federal Government. Therefore, a statement that emissions from a proposed Federal action represent only a small fraction of global emissions is essentially a statement about the nature of the climate change challenge, and is not an appropriate basis for deciding whether or to what extent to consider climate change impacts under NEPA. Moreover, these comparisons are also not an appropriate method for characterizing the potential impacts associated with a proposed action and its alternatives and mitigations because this approach does not reveal anything beyond the nature of the climate change challenge itself: the fact that diverse individual sources of emissions each make a relatively small addition to global atmospheric GHG concentrations that collectively have a large impact. When considering GHG emissions and their significance, agencies should use appropriate tools and methodologies for quantifying GHG emissions and comparing GHG quantities across alternative scenarios. Agencies should not limit themselves to calculating a proposed action's emissions as a percentage of sector, nationwide, or global emissions in deciding whether or to what extent to consider climate change impacts under NEPA.[101]

[101] Climate Guidance at 9 (attached as Exhibit 4).

Meaningful consideration of GHG emissions is clearly within the scope of required NEPA review. *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin*., 538 F.3d 1172, 1217 (9th Cir. 2008). As the Ninth Circuit has held, in the context of fuel economy standard rules:

> The impact of greenhouse gas emissions on climate change is precisely the kind of cumulative impacts analysis that NEPA requires agencies to conduct. Any given rule setting a CAFE standard might have an "individually minor" effect on the environment, but these rules are "collectively significant actions taking place over a period of time" *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin*., 538 F.3d 1172, 1216 (9th Cir. 2008)(quoting 40 C.F.R. § 1508.7).

The courts have ruled that federal agencies should consider indirect GHG emissions resulting from agency policy, regulatory, planning and leasing decisions. For example, agencies cannot ignore the indirect air quality and climate change impact of decisions that would open up access to coal reserves. *See Mid States Coal. For Progress v. Surface Transp. Bd*., 345 F.3d 520, 532, 550 (8th Cir. 2003); *High Country Conservation Advocates v. U.S. Forest Serv*., 52 F.Supp. 3d 1174, 1197-98 (D.Colo. 2014).

The CEQ Climate Guidance is dispositive on the issue of federal agency review of GHG emissions as foreseeable direct and indirect effects of the proposed action. 81 Fed. Reg. 51,866 (Aug. 5, 2016). The CEQ guidance provides clear direction for BLM to conduct a lifecycle greenhouse gas analysis because the modeling and tools to conduct this type of analysis are readily available to the agency:

> If the direct and indirect GHG emissions can be quantified based on available information, including reasonable projections and assumptions, agencies should consider and disclose the reasonably foreseeable direct and indirect emissions when analyzing the direct and indirect effects of the proposed action. Agencies should disclose the information and any assumptions used in the analysis and explain any uncertainties. To compare a project's estimated direct and indirect emissions with GHG emissions from the no-action alternative, agencies should draw on existing, timely, objective, and authoritative analyses, such as those by the Energy Information Administration, the Federal Energy Management Program, or Office of Fossil Energy of the Department of Energy. In the absence of such analyses, agencies should use other available information.

81 Fed. Reg. 51,866 at 16 (Aug. 5, 2016)(citations omitted).

CEQ's guidance even provides an example of where a lifecycle analysis is appropriate in a leasing context:

> The indirect effects of such an action that are reasonably foreseeable at the time would vary with the circumstances of the proposed action. For actions such as a Federal lease sale of coal for energy production, the impacts associated with the

> end-use of the fossil fuel being extracted would be the reasonably foreseeable combustion of that coal.[102]

The volume of potential oil and gas from the new parcels available for lease in the FFO projected by the RFD, and the lifecycle GHG emissions impact from these new lease parcels is also quantifiable.

The agency can easily generate an accurate, site-specific impact analysis for each alternative by utilizing BLM's own Energy Policy and Conservation Act phase III Oil and Gas Inventory Model geodatabase and the RMPA alternatives GIS shapefiles to establish future extractible oil and gas volume from the planning area. This information can then be used to generate potential lifecycle GHG emissions for resultant oil and gas volumes using a peer-reviewed carbon calculator and lifecycle GHG emissions model developed by EcoShift consulting.[103] This model is not novel in its development or methodology. Numerous greenhouse gas calculation tools exist to develop lifecycle analyses, particularly for fossil fuel extraction, operations, transport and end-user emissions.[104]

State and federal agencies frequently recognize the obligation to employ upstream, downstream and lifecycle GHG emissions analyses for NEPA review of energy-related projects.[105] For example, the Department of Energy has historically utilized these types of

---

[102] *Id.* at 16, n. 42 (attached as Exhibit 4).
[103] *See* Mulvaney (attached as Exhibit 23).
[104] *See* Council on Environmental Quality, Revised draft guidance for greenhouse gas emissions and climate change impacts (2014).
[105] In addition to those cited below, a recent but by no means exhaustive list of life-cycle analyses that incorporate energy market modeling and comparison of greenhouse gas emissions across alternatives include the U.S. Forest Service's Supplemental EIS on the Colorado Roadless Rule (2016); the Surface Transportation Board's DEIS for the Tongue River Railroad (2015); EPA's regulatory impact analysis of the Clean Power Plan; and the Washington State Department of Ecology's DEIS for the proposed Millenium Export Bulk Terminal (2016); *see also* U.S. Forest Service, Record of Decision and Final Environmental Impact Statement, Oil and Gas Leasing Analysis, Fishlake National Forest, 169 (Aug 2013) (attached as Exhibit 90) (Table 3.12-7: shows GHG emissions from transportation, offsite refining and end use; and total direct and indirect emissions); *see also id*. at Appendix E/SIR-2 (more detailed calculations of direct and indirect emissions); U.S. Army Corps of Engineers, Final Environmental Impact Statement: Alaska Stand Alone Gas Pipeline, Volume 2 Sec. 5.20-70–71 (Oct. 2012) (attached as Exhibit 91) (The Corps, in a 2012 EIS for an intrastate natural gas pipeline in Alaska, estimated downstream emissions from combustion of the natural gas that would be transported, and also discussed the potential for natural gas to displace other, dirtier fuel sources such as coal and oil.); U.S. Department of State, Final Supplemental Environmental Impact Statement for the Keystone XL Project, § 4.14.3, Appendix U (Jan. 2014) (attached as Exhibit 92) (The Department of State, as lead agency on the Keystone XL Pipeline Review conducted a relatively comprehensive life-cycle greenhouse gas analysis for the proposed pipeline, alternatives, and baseline scenarios that could occur if the pipeline was not constructed.); U.S. Environmental Protection Agency Region X, Letter from Dennis McLerran, Regional Administrator, to Randel Perry, U.S. Army Corps of

lifecycle emissions analyses in NEPA review of oil and gas infrastructure projects.[106] Courts have upheld the viability and usefulness of lifecycle analyses, and adoption of this trend is clearly reflected in the CEQ Guidance on Climate Change. 81 Fed. Reg. 51, 866 at 11 (Aug. 5, 2016) ("This guidance recommends that agencies quantify a proposed agency action's projected direct and indirect GHG emissions. Agencies should be guided by the principle that the extent of the analysis should be commensurate with the quantity of projected GHG emissions and take into account available data and GHG quantification tools that are suitable for and commensurate with the proposed agency action").[107]

Engineers Seattle District, re Gateway Pacific Projects (Jan 22, 2013) *available* at: http://www.eisgatewaypacificwa.gov/sites/default/files/content/files/EPA_Reg10_McLerran.pdf#overlay-context=resources/project-library (attached as Exhibit 93) (EPA submitted comments on the scope of impacts that should be evaluated in the coal terminal EIS that the Corps is preparing, in which it urged the Corps to conduct a lifecycle emissions analysis of GHG emissions from the coal that would be transported via the terminal.)

[106] U.S. Department of Energy National Renewable Energy Laboratory, Life Cycle Greenhouse Gas Emissions from Electricity Generation Fact Sheet, Pub No. NREL/FS-6A20-57817 (2013) *available at* http://www.nrel.gov/docs/fy13osti/57187.pdf (attached as Exhibit 95); U.S. Department of Energy National Energy Technology Laboratory Role of Alternative Energy Sources: Natural Gas Technology Assessment, Pub No. DOE/NETL- 2012/1539 (NETL, 2012) *available at* https://www.netl.doe.gov/File%20Library/Research/Energy%20Analysis/Life%20Cycle%20Analysis/LCA-2012-1539.pdf (attached as Exhibit 96); U.S. Department of Energy National Energy Technology Laboratory, Life Cycle Greenhouse Gas Inventory of Natural Gas Extraction, Delivery and Electricity Production, Pub No. DOE/NETL-2011/1522 (NETL, 2011) *available at* http://www.fossil.energy.gov/programs/gasregulation/authorizations/2013_applications/sierra_club_13-69_venture/exhibits_44_45.pdf (attached as Exhibit 97); U.S. Department of Energy National Energy Technology Laboratory, Life Cycle Analysis: Natural Gas Combined Cycle (NGCC) Power Plant, Pub No DOE/NETL-403-110509 (Sep 10, 2012) (NETL, 2010) *available at* https://www.netl.doe.gov/energy-analyses/temp/FY13_LifeCycleAnalysisNaturalGasCombinedCycle(NGCC)PowerPlantFinal_060113.pdf (attached as Exhibit 98).

[107] *High Country Conservation Advocates v. United States Forest Serv*., 52 F. Supp. 3d 1174 (D. Colo. 2014) (Court held that the agencies' failure to quantify the effect of greenhouse gas (GHG) emissions from the mining lease modifications was arbitrary in violation of NEPA because the social cost of carbon protocol tool existed for such analysis under 40 C.F.R. § 1502.23 but the agencies did not provide reasons in the final EIS for not using the tool; and that the agencies' decision to forgo calculating the foreseeable GHG emissions was arbitrary in light of their ability to perform such calculations and their decision to include a detailed economic analysis of the benefits.); *see also Dine Citizens Against Ruining Our Env't v. United States Office of Surface Mining Reclamation & Enf't*, 82 F. Supp. 3d 1201, 1213-1218 (D. Colo. 2015) (Court held that the agency failed to adequately consider the reasonably foreseeable combustion-related downstream effects of the proposed action. Also held that that combustion emissions associated with a mine that fed a single power plant were reasonably foreseeable because the agency knew where the coal would be consumed).

The extreme urgency of the climate crisis requires BLM to pursue all means available to limit the climate change effects of its actions, beginning with a robust and accurate quantitative analysis of potential GHG emissions from fossil fuel development proposed in the planning area. Any emissions source, no matter how small, is potentially significant, such that BLM should fully explore mitigation and avoidance options for all sources.

A. BLM Must Address Whether Alternatives Are Consistent with National Climate Goals.

NEPA regulations require agencies to account for conflicts with existing laws and requirements imposed for the protection of the environment when engaging in environmental analysis.[108] In addition, Executive Order 12,866 also requires that "[e]ach agency shall avoid regulations that are inconsistent [or] incompatible" with the regulations of any other agency.[109]

Any subsequently prepared NEPA document must disclose whether each of the proposed plan alternatives would interfere with efforts to meet federal and international greenhouse gas emission reduction targets.[110] As explained by the CEQ in its Climate Guidance, federal agencies evaluating the climate impacts of their decisions should "discuss relevant approved federal, regional, state, tribal, or local plans, policies, or laws for GHG emission reductions or climate adaptation to make clear whether a proposed project's GHG emissions are consistent with such plans or laws."[111]

In November 2014 the President announced a joint U.S.-China agreement aimed at reducing climate pollution that calls for even more aggressively cutting net greenhouse gas emissions to 26-28 percent below 2005 levels by 2025.[112] Further, the BLM must address whether the plan alternatives accord with the Paris Agreement, which represents an international agreement to limit global temperatures to 1.5-2°C below pre-industrial levels, in which the U.S. has pledged to reduce GHG emissions by 26-28% from 2005 levels by 2025, on a path to reduce those emissions by 80% by 2050.

As part of its analysis, BLM should disclose to the public the clearly competing interests at stake: one the one hand, meeting these national and international climate emission reduction targets set by EPA, the President, or agreed upon by 195 nations; and on the other, any plan alternatives that serve to perpetuate dependence on fossil fuel resources largely for the benefit of private companies and oil and gas operators. Any failure to acknowledge this potential conflicts would be arbitrary and capricious, in violation of NEPA and Executive Order 12,866.

---

[108] *See* 40 C.F.R. § 1506.2(d) (EISs must discuss inconsistencies with state law); 40 C.F.R. § 1508.27(b)(10) (when examining whether actions are "significant" within the meaning of NEPA, agencies must consider whether the action "threatens a violation of Federal, State, or local law or *requirements imposed for the protection of the environment*.").

[109] Executive Order 12,866 (Sep. 30, 1993), Sec. 1(b)(10).

[110] *See* 40 C.F.R. § 1506.2(d); 40 C.F.R. § 1508.27(b)(10).

[111] Climate Guidance at 28 (attached as Exhibit 4).

[112] White House Fact Sheet, U.S.-China Joint Announcement on Climate Change and Clean Energy Cooperation (November 11, 2014), available at: https://www.whitehouse.gov/the-press-office/2014/11/11/us-china-joint-announcement-climate-change (attached as Exhibit 46).

B. BLM Must Quantify the Severity of Harm from Greenhouse Gas Emissions

1. Social Cost of Carbon Protocol

Research conducted by the National Research Council has confirmed that the negative impacts of energy generation from fossil fuels are not represented in the market price for such generation.[113] In other words, failing to internalize the externalities of energy generation from fossil fuels—such as the impacts to climate change and human health—has resulted in a market failure that requires government intervention. As aptly summarized by the White House Council of Economic Advisors in 2016:

> Climate change reflects a classic environmental externality. When consumers or producers emit greenhouse gases, they enjoy the benefits from the services provided by the use of the fuels, while not paying the costs of the damages from climate change. Since the price of goods and services whose production emits greenhouse gases does not reflect the economic damages associated with those gases, market forces result in a level of emissions that is too high from a social perspective. Such a market failure can be addressed by policy.[114]

Executive Order 12866 directs federal agencies to assess and quantify such costs and benefits of regulatory action, including the effects on factors such as the economy, environment, and public health and safety, among others. *See* Exec. Order No. 12866, 58 Fed. Reg. 51,735 (Sept. 30, 1993).[115] The Ninth Circuit has ruled that agencies must include the climate benefits of a significant regulatory action in federal cost-benefit analyses to comply with EO 12866.

> [T]he fact that climate change is largely a global phenomenon that includes actions that are outside of [the agency's] control ... does not release the agency from the duty of assessing the effects of its actions on global warming within the context of other actions that also affect global warming.

Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin., 538 F.3d 1172, 1217 (9th Cir. 2008) (quotations and citations omitted); *see also Border Power Plant Working Grp. v. U.S. Dep't of Energy*, 260 F. Supp. 2d 997, 1028-29 (S.D. Cal. 2003) (finding agency failure to disclose project's indirect carbon dioxide emissions violates NEPA).

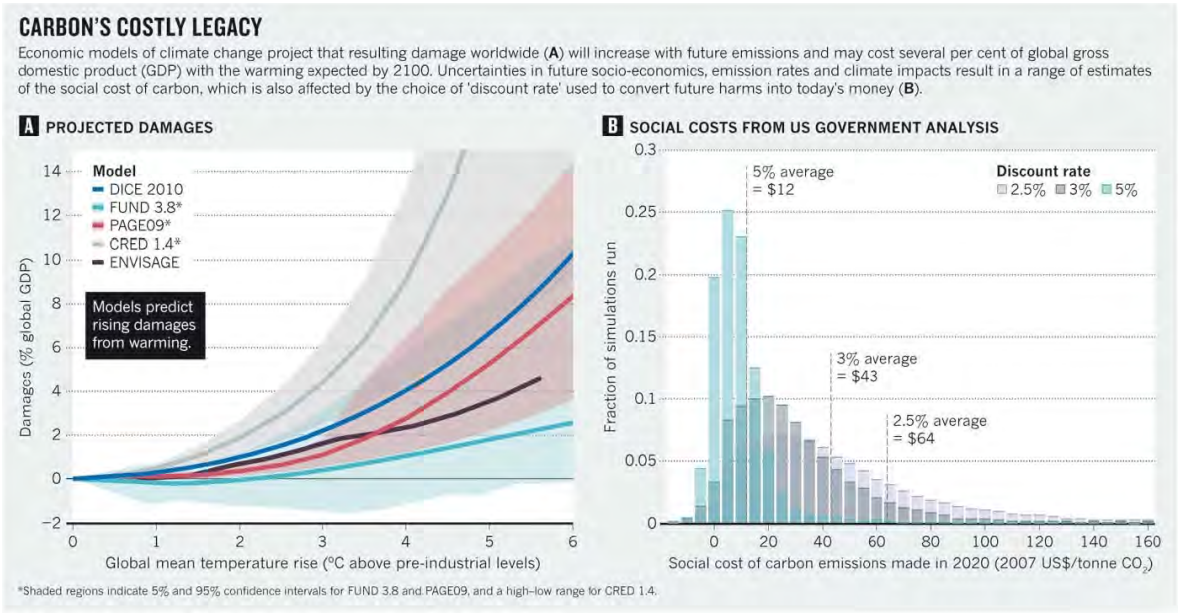
---

[113] *See, e.g.,* National Research Council, *Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use* (2010) (attached as Exhibit 106); Nicholas Muller, et. al., *Environmental Accounting for Pollution in the United States Economy*, AMERICAN ECONOMIC REVIEW (Aug. 2011) (attached as Exhibit 107); *see also* Generation Investment Management, *Sustainable Capitalism,* (Jan. 2012) (attached as Exhibit 108) (advocating a paradigm shift to "a framework that seeks to maximize long-term economic value creation by reforming markets to address real needs while considering *all* costs and stakeholders.").

[114] White House Council of Economic Advisors, The Economic Record of the Obama Administration: Addressing Climate Change at 11 (Sept. 2016) (attached as Exhibit 37).

[115] *See also* Executive Order 13563, 76 Fed. Reg. 3821 (Jan. 18, 2011) (reaffirming the framework of EO 12866 and directing federal agencies to conduct regulatory actions based on the best available science).

In response, an Interagency Working Group ("IWG") was formed to develop a consistent and defensible estimate of the social cost of carbon—allowing agencies to "incorporate the social benefits of reducing carbon dioxide (CO_2) emissions into cost-benefit analyses of regulatory actions that impact cumulative global emissions."[116] In other words, SCC is a measure of the benefit of reducing greenhouse gas emissions now and thereby avoiding costs in the future.[117] The charts below depict, (A) dramatically increasing damages from global warming over time, as well as (B) the social cost of these carbon emissions based on 2013 TDS values.[118]



Leading economic models all point in the same direction: that climate change causes substantial economic harm, justifying immediate action to reduce emissions.[119] The interagency process to develop SCC estimates—originally described in the 2010 interagency technical support document ("TSD"), and updated in 2013 and 2015—developed four values based on the average SCC from three integrated assessment models (DICE, PAGE, and FUND), at discount rates of 2.5, 3, and 5 percent,[120] as well as a fourth value, which represents the 95th percentile

---

[116] *See* Interagency Working Group on the Social Cost of Carbon, United States Government, *Technical Support Document: Technical Update on the Social Cost of Carbon for Regulatory Impact Analysis – Under Executive Order 12866* (May 2013) at 2 (hereinafter 2013 TSD) (attached as Exhibit 109).

[117] *See* Ruth Greenspan and Dianne Callan, *More than Meets the Eye: The Social Cost of Carbon in U.S Climate Policy, in Plain English,* WORLD RESOURCES INSTITUTE (July 2011) (attached as Exhibit 110).

[118] *See* Richard Revesz, *et al., Global warming: Improve economic models of climate change,* NATURE 508, 173-175 (April 10, 2014) (attached as Exhibit 111).

[119] *See id.* at 174.

[120] The choice of which discount rate to apply—translating future costs into current dollars—is critical in calculating the social cost of carbon. The higher the discount rate, the less significant future costs become, which shifts a greater burden to future generations based on the notion that the world will be better able to make climate investments in the future. The underlying

SCC estimate across all three models at a 3 percent discount rate, and demonstrates the cost of worst-case impacts.[121] These models are intended to quantify damages, including health impacts, economic dislocation, agricultural changes, and other effects that climate change can impose on humanity. While these values are inherently speculative, a recent GAO report has confirmed the soundness of the methodology in which the IWG's SCC estimates were developed, therefore further underscoring the importance of integrating SCC analysis into the agency's decisionmaking process.[122] In fact, certain types of damages remain either unaccounted for or poorly quantified in IWG's estimates, suggesting that the SCC values are conservative and should be viewed as a lower bound.[123]

The updated interagency SCC estimates for 2020 are $12, $42, $62 and $123 per ton of CO_2 (in 2007$).[124] The IWG does not instruct federal agencies which discount rate to use, suggesting that the 3 percent discount rate ($42 per ton of CO_2) as the "central value," but further emphasizing "the importance and value of including all four SCC values[;]" i.e., that the agency should use the range of values in developing NEPA alternatives.[125]

In 2014, the district court for the District of Colorado faulted the Forest Service for failing to calculate the social cost of carbon, refusing to accept the agency's explanation that such a calculation was not feasible. *High Country Conservation Advocates v. U.S. Forest Service*, 52 F.Supp.3d 1174 (D.Colo. 2014) (a decision the agency decided not to appeal, thus implicitly recognizing the importance of incorporating a social cost of carbon analysis into NEPA decisionmaking). Notably, the *High Country Conservation Advocates* decision applies to the same geographic area (the North Fork Valley), and to the same coal field (the Somerset),

---

assumption of applying a higher discount rate is that the economy is continually growing. The IWG's "central value" of three percent is consistent with this school of thought—that successive generations will be increasingly wealthy and more able to carry the financial burden of climate impacts. "The difficultly with this argument is that, as climate change science becomes increasingly concerning, it becomes a weaker bet that future generations will be better off. If they are not, lower or negative discount rates are justified." WRI Report, at 9 (attached as Exhibit 110). "Three percent values an environmental cost or benefit occurring 25 years in the future at about half as much as the same benefit today." *Id.*

[121] *See* 2013 TSD at 2 (attached as Exhibit 109).

[122] GAO-14-663, *Social Cost of Carbon* (July 24, 2014).

[123] *See* Peter Howard, et al., *Omitted Damages: What's Missing From the Social Cost of Carbon*, ENVIRONMENTAL DEFENSE FUND, INSTITUTE FOR POLICY INTEGRITY, NATURAL RESOURCES DEFENSE COUNCIL (March 13, 2014) (attached as Exhibit 112) (providing, for example, that damages such as "increases in forced migration, social and political conflict, and violence; weather variability and extreme weather events; and declining growth rates" are either missing or poorly quantified in SCC models).

[124] *See* 2013 TSD (July 2015 Revision) at 3 (attached as Exhibit 109) (including a table of revised SCC estimates from 2010-2050). To put these figures in perspective, in 2009 the British government used a range of $41-$124 per ton of CO_2, with a central value of $85 (during the same period, the 2010 TSD used a central value of $21). WRI Report at 4 (attached as Exhibit 110). The UK analysis used very different assumptions on damages, including a much lower discount rate of 1.4%. The central value supports regulation four times a stringent as the U.S. central value. *Id.*

[125] *See* 2013 TSD at 12 (attached as Exhibit 109).

that is at issue here. In his decision, Judge Jackson identified the IWG's SCC protocol as a tool to "quantify a project's contribution to costs associated with global climate change." *Id.* at 1190.[126] To fulfill this mandate, they agency must disclose the "ecological[,] … economic, [and] social" impacts of the proposed action. 40 C.F.R. § 1508.8(b). Simple calculations applying the SCC to GHG emissions from this project offer a straightforward comparative basis for analyzing impacts, and identifying very significant costs.[127]

Notably, according to the IPCC, the 20-year GWP for methane—which is not only the planning lifespan of the RMP, but the relevant timeframe for consideration if we are to stem the worst of climate change—is 87.[128] BLM has historically used an outdated GWP when calculating methane's warming impact. The agency should avoid that temptation here, as it not only underestimates to relevant emissions and their impacts, but also near term benefits of avoiding this pollution.

CEQ provides that "[i]t is essential … that Federal agencies not rely on boilerplate text to avoid meaningful analysis, including consideration of alternatives or mitigation." *Id.* at 5-6 (citing 40 C.F.R. §§ 1500.2, 1502.2). Indeed, the EPA has also cautioned "against comparing GHG emissions associated with a single project to global GHG emission levels" because it erroneously leads to a conclusion that "on a global scale, emissions are not likely to change" as a result of the project.[129] Applying the SCC, as provided above, takes these abstract emissions and places them in concrete, economic terms. As noted by Judge Jackson, the SCC protocol provides a tool to quantify the costs of these emissions. *See High Country Conservation Advocates,* 52 F.Supp.3d at 1190. By failing to consider the costs of GHG emissions from the Proposed Action, the agency's analysis effectively assumes a price of carbon that is $0. *See id.* at 21 (holding that although there is a "wide range of estimates about the social cost of GHG emissions[,] neither the BLM's economist nor anyone else in the record appears to suggest the cost is as low as $0 per unit. Yet by deciding not to quantify the costs as all, the agencies effectively zeroed out the cost in its quantitative analysis."). The agency's failure to consider the SCC is arbitrary and capricious, and ignores the explicit directive of EO 12866.

An agency must "consider every significant aspect of the environmental impact of a proposed action." *Baltimore Gas & Elec. Co. v. Natural Resources Defense Council*, 462 U.S. 87, 107 (1983) (quotations and citation omitted). This includes the disclosure of direct, indirect, and cumulative impacts of its actions, including climate change impacts and emissions. 40 C.F.R.

---

[126] *See also id.* at 18 (noting the EPA recommendation to "explore other means to characterize the impact of GHG emissions, including an estimate of the 'social cost of carbon' associated with potential increases in GHG emissions.") (citing Sarah E. Light, *NEPA's Footprint: Information Disclosure as a Quasi-Carbon Tax on Agencies*, 87 Tul. L. Rev. 511, 546 (Feb. 2013)).

[127] It is important to note that, although the 2010 IWG SCC protocol did not address methane impacts, the 2013 IWG Technical Update explicitly addresses methane impacts. Thus, it is appropriate to calculate a SCC outcome that takes into account the full CO_2e emissions associated with the proposed leasing.

[128] *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *Working Group I Contribution to the IPCC Fifth Assessment Report Climate Change 2013: The Physical Science Basis,* at 8-58 (Table 8.7) (Sept. 2013) (attached as Exhibit 113).

[129] *See* Light, 87 Tul. L. Rev. 511, 546.

§ 1508.25(c). The need to evaluate such impacts is bolstered by the fact that "[t]he harms associated with climate change are serious and well recognized," and environmental changes caused by climate change "have already inflicted significant harms" to many resources around the globe. *Massachusetts v. EPA*, 549 U.S. 497, 521 (2007); *see also id.* at 525 (recognizing "the enormity of the potential consequences associated with manmade climate change."). Among other things, the agency's analysis must disclose "the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity[,]" including the "energy requirements and conservation potential of various alternatives and mitigation measures." 42 U.S.C. § 4332(c); 40 C.F.R. § 1502.16(e). As explained by CEQ, this requires agencies to "analyze total energy costs, including possible hidden or indirect costs, and total energy benefits of proposed actions." 43 Fed. Red. 55,978, 55,984 (Nov. 29, 2978); *see also* Executive Order 13514, 74 Fed. Reg. 52,117 (Oct. 5, 2009) (requiring government agencies to disclose emissions information annually from direct and indirect activities). Failing to perform such analysis undermines the agency's decisionmaking process and the assumptions made.

Nor can the agency tout the benefits of coal, oil and gas development without similarly disclosing the costs. *See* 40 C.F.R. § 1502.23. For example, BLM identifies "tax impact from coal extraction in the planning area" as a benefit, with revenues "associated with the sales and income earned from extraction and transportation of coal." DEIS at 4-465. Although not quantified in the same way, BLM also assumes that "increased production of oil and gas on BLM-administered lands would result in a comparable increase in contributions to local counties and communities." *Id.* Accordingly, BLM relies on figures in Table 4-90 (Baseline Regional Economic Impacts for Coal), to suggest a substantial net economic benefit, including $556 million in annual output and $175 million in labor income. DEIS at 4-469. Setting aside that this economic data is based on wildly optimistic assumptions on future coal production and employment for 2,518 people—with a current reality of coal mines being shut down and present employment of around 250 people—this type of misleading and one-sided analysis is expressly forbidden under NEPA. *See Hughes River Watershed Conservancy v. Glickman*, 81 F.3d 437, 446-47 (4th Cir. 1996) ("it is essential that the EIS not be based on misleading economic assumptions); *Sierra Club v. Sigler,* 695 F.2d 957, 979 (5th Cir. 1983) (agency choosing to "trumpet" an action's benefits has a duty to disclose its costs).

2. Social Cost of Methane Protocol

In August 2016, the Interagency Working Group ("IWG") provided an update to the social cost of carbon technical support document,[130] and, for the first time, adopted a similar methodology for evaluating the climate impact of each additional ton of methane and nitrogen oxide emissions.[131] Given its recent endorsement by the IWG, BLM should use the social cost of

[130] Interagency Working Group, Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 (August 2016), (attached as Exhibit 324). The August 2016 update added some clarifying information around uncertainties in the modeling that supports the social cost of carbon, but did not adjust the damages values (the costs) published in the 2015 update.

[131] Interagency Working Group, Addendum to Technical Support Document on Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866: Application of the

methane to quantify the expected climate damage caused by the extraction and combustion of oil and gas extracted under BLM's Mancos RMPA.

Similar to the social cost of carbon, the social cost of methane provides a standard methodology that allows state and federal agencies to quantify the social benefits of reducing methane emissions through actions that have comparatively small impacts on cumulative global emission levels. The social cost of methane is intended to "offer a method for improving the analyses of regulatory actions that are projected to influence [methane or nitrogen oxide] emissions in a manner consistent with how [carbon dioxide] emission changes are valued."[132] Like the social cost of carbon, the social cost of methane is presented as a range of figures across four discount rates; it is based on results from three integrated assessment models; displayed in dollars per metric ton of emissions; and increases over time because emissions become more damaging as their atmospheric concentrations increase.[133] Like the social cost of carbon, the social cost of methane has been subject to peer review and will be updated by the IWG to ensure it reflects the best available scientific information.[134] The IWG estimates that each additional ton of methane emitted in 2020 will cause between $540 and $3,200 dollars (measured in $2007).[135]

BLM should use the best tools available to it in order to fully analyze and disclose the climate impacts of its proposal. Given that both the social cost of carbon and social cost of methane have been adopted by the IWG, which includes a dozen federal offices and agencies including the Department of Interior, BLM should use these tools to evaluate the climate impacts of its draft plan for the Uncompahgre planning area, which, as noted, anticipates generating more than half a billion tons of CO2-e over the next two decades.

****

C. *Expert Comments: Economic Scoping for the Mancos RMPA*

CONSERVATION ECONOMICS INSTITUTE, Dr. Evan E. Hjerpe, Executive Director, and Dr. Pete Morton, Advising Economist, prepared the following for Conservation Groups specifically for the Mancos RMPA and EIS:

CLIMATE CHANGE ECONOMICS AND FOSSIL FUEL DEVELOPMENT

The development of oil and gas fields on BLM lands provides both costs and benefits to society. The benefits to society include the fiscal benefits to national taxpayers via lease revenues and royalties paid to the U.S. treasury. The costs to society of fossil fuel development on public lands includes the cost of managing and administering oil and gas leases and a slew of social

---

Methodology to Estimate the Social Cost of Methane and the Social Cost of Nitrous Oxide (August 2016) (attached as Exhibit 325).

[132] *Id*. at 3.

[133] *Id.* at 7.

[134] *Id.* at 3.

[135] *Id.* at 7. For comparison purposes, the current social cost of carbon values for CO2 emissions in 2020 range from $120 to $123 per ton.

costs in terms of environmental and community damages. These economic damages (costs) include social costs associated with boom and bust natural resource extraction, but are heavily comprised of costs related to the pollution and community disruption generated by oil and gas development.

The pollution includes the release of greenhouse gases (GHGs), other volatile organic compounds (VOCs), particulates, degradation of plant and wildlife habitats, and potential acute pollution of water and surrounding environs associated with production and transportation failures. Communities are disrupted by increased traffic, noise, light pollution, and disruption of traditional religious practices. Pollution from oil and gas development is not contained on site. Rather, the pollution adversely affects the surrounding environments, regional environments, and in the case of greenhouse gases, extends globally. In economics jargon, pollution and community disruption are externalities. That is, most of the impacts are external to the production and consumer costs of oil and gas; it is not accounted for in the economic ledgers because it is passed on to other places and people over a period of time.

Externalities create market failures, where the private costs of oil and gas production on public lands (lease and production costs) do not cover the public, or social costs, of fossil fuel development (such as pollution). A.C. Pigou was one of the first economists to isolate and propose accounting for the social costs of externalities such as pollution in the 1920s and 1930s. Since Pigou, and entire field of environmental economics has been developed to account for externalities and to appropriately account for natural amenities. In environmental economics, pollution is characterized as a public "bad" resulting from "waste discharges" associated with the production of private goods.[136]

In cases of pollution and community disruption, as would happen under the proposed expansion of the Mancos Shale/Gallup Formation, the BLM should account for these externalities by estimating the social costs generated from the pollution and comparing them to the benefits of further oil and gas development. Social costs must be considered to whom all they apply. In regards to climate change and GHG emissions, these social costs must be considered locally, domestically, globally, and inter-temporally (future generations).

ACCOUNTING FOR CLIMATE CHANGE DAMAGES WITH THE SOCIAL COST OF CARBON

Emissions of GHGs are the primary cause of anthropogenic climate change. Released GHGs, and the resulting climate change, represents a special case of pollution both temporally and spatially. A number of pollutants, such as heavy metals and fine particulates, have a limited geographic scope of damage typically regional in nature. GHGs, on the other hand, mix with other GHGs in the atmosphere triggering global damages. Temporally, GHGs accumulate and cause climate change long into the future. That is, GHGs emitted today have both a marginal effect in the present and contribute to an increased total pollution effect for many years to come. The dispersed spatial and temporal effects of GHGs have led to specific accounting of their societal damages across the globe and for future generations. The concept of the Social Cost of

[136] Cropper, M. L., & Oates, W. E. (1992). Environmental economics: a survey. *Journal of economic literature*, *30*(2), 675-740.

Carbon (SCC) has been developed by inter-disciplinary biophysical and social scientists to properly account for the negative externalities generated by human activities that lead to climate change. The SCC was developed primarily for regulatory policy to help understand the monetary benefits of avoiding damages caused by releasing additional carbon dioxide into the atmosphere. These values are typically expressed as dollars per metric ton of carbon dioxide. The SCC utilizes integrated assessment models (IAMs) that combine climate science projections for the effect of increasing GHGs on temperatures, sea levels, and climate systems with projections of economic growth and emission controls. The models estimate climate damage functions, or the relationship between CO_2 emissions and the damage caused.[137] Damages include agricultural productivity losses, property damages, and human health effects. There are three primary IAMs (DICE, PAGE, and FUND) that allow for varying sensitivity analysis. The models are generally considered conservative as they have not included numerous other potential damages.

With the welfare of not only current generations, but future generations to come, at stake under escalating climate change scenarios, a contentious component of estimating the SCC (or SCM) is the concept of a discount rate. The discount rate devalues future costs and benefits as compared to current costs and benefits, often close to the long-term average rate of annual inflation (2-6%). As there is a societal preference, or time value, for $100 dollars today as opposed to next year, a discount rate attempts to account for this time preference when bringing future successive years of costs to a present value (PV). That is, the current society must place a value on economic damages caused by climate change to future generations in present dollars. The current generation must also choose whether or not they should pay for damages from current emissions. How far damages are projected into the future, and at what discount rate, have significant influence on the current (PV) value assigned to climate damages. The dramatic differences caused by varying discount rates can completely change the resulting SCC. A quick illustration:

- $1,000,000 of climate change damages in 50 years from now has a present value of $372,000 at a 2% discount rate, but only a present value of $34,000 at a 7% discount rate.

In the case of pollution and long term damages to the earth, some have called for very low discount rates. More equitable intergenerational valuation has been proposed by many, calling for discount rates of zero or approaching zero. Furthermore, a case can be made that costs and benefits related to the earth's natural capital (e.g., natural resources, ecosystems, and climatic/disturbance process) and the pollution/degradation of that natural capital should be assessed with very low discount rates. Critical planetary infrastructure should be devalued less than traditional financial investments. Turns out, they are not substitutes.

Most researchers recommend utilizing the global SCC for BCA in order to account for the externalities of our domestic emissions (e.g., Pizer et al. 2014, Greenstone et al. 2013, and Johnson and Hope 2012). However, a recent pub from Gayer and Viscusi (2016) make a compelling case for inclusion of a domestic SCC for US regulatory analysis in addition to the global SCC.

[137] Bell, R. G., & Callan, D. (2011). More than meets the eye: the social cost of carbon in US climate policy. *Environmental Law*.

RECOMMENDED ECONOMIC ACCOUNTING FRAMEWORK FOR THE MANCOS RMPA

For federal regulatory policy, benefit/cost analysis (BCA) is required for Regulatory Impact Analyses (RIA) and is often performed at the regional land management planning level for various alternatives under NEPA analysis. The SCC has been included in a number of federal rulemakings, including some BLM planning documents. However, given the role of fossil fuel development in climate change, it is critical that all planning associated with oil and gas development weigh the social costs of GHGs explicitly in land management planning. Only by fully accounting for reduced societal welfare due to climate change, can the Mancos RMPA examine the most economically efficient development strategy. For example, the most economically efficient alternative may very well be the "no-leasing" alternative, once market failures associated with pollution are fully internalized.

We recommend that the FFO conduct a full benefit/cost analysis that includes the SCC projected into the future. We suggest that the SCC be examined at both a global and domestic level, and that discount rates for the BCA include two levels, one at 3%, and one at the lower recommended discount rate for benefits and costs of critical natural capital changes (1%). We recommend using the 2020 estimates recommended for federal agency use by the IWG.
At the regional planning level, such as the Mancos RMPA, we recommend a further accounting of environmental and social damages resulting from oil and gas development pollution (in addition to the BCA proposed above). From the public's perspective, the benefits of a No-Leasing alternative can be viewed as damage avoided from pollution associated with oil and gas development alternatives. Natural resource damage assessments (NRDA) are an additional framework that can highlight potential damages resulting from pollution. NRDAs are measures of liability, or damage estimates to be paid to replace, offset, or mitigate lost economic values. The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), or Superfund, provided for liability of polluters of hazardous waste. The first legislation to identify injuries to natural resources as compensable damages was the Clean Water Act.[138] After these provisions were enacted, the federal government, states, and others filed legal claims to recoup damages from environmental contaminators and utilized natural resource damage assessments to estimate the value of the damages. The most publicized NRDA was conducted to determine compensation from damages from the Exxon Valdez oil spill to the Prince William Sound ecosystem in Alaska. These compensatory damages included lost use and passive use values to local and Native peoples.

While the FFO may not be able to fully quantify all regional aspects of environmental and social damages resulting from pollution, they can begin to provide a monitoring baseline for key pollutants and degradation that can be developed into overall damage functions. Similar to the damage functions estimated in the IAMs to determine the social costs of carbon, the FFO needs to catalog and quantify key pollutants and degradation stemming from action alternatives. Key categories needing monitoring and presentation to the public include all pollutants stemming from both the development of oil and gas and the eventual combustion of products extracted

[138] Kopp, R. J., & Smith, V. K. (2013). Valuing natural assets: the economics of natural resource damage assessment. Routledge.

from BLM lands, water use, air quality measures, seismic activity, and wildlife habitat fragmentation (more detail in section below).

The proposed baseline monitoring of pollutants and degradation can be initially qualitatively connected to regional economic damage functions, and eventually may be quantitatively estimated as damage functions. As previously noted, climate change is leading to greater drought conditions, wildfire risk, and decreased agricultural productivity in the Southwest. Regional BLM planning efforts cannot ignore the linkage between their leasing of oil and gas extraction to the immediate and surrounding climate change damages and other environmental and social costs.

As compared to further development alternatives from the FFO, a No Lease alternative would yield tremendous benefits in terms of the avoided impacts and resulting avoided social costs. Without a proper economic accounting of these damages, the BLM is unable to assess the economic efficiency of their land management alternatives. For Pareto efficiency gains, it is essential that firms pay not only the costs of their marginal damages, but also the total cost arising from their impacts.[139] If the free market cannot induce these payments, it is up to the BLM to ensure that these environmental damages are covered when leasing out public lands for fossil fuel extraction.

EXAMPLE BCA PARAMETERS FOR THE MANCOS RMPA

For our recommended BCA for the Mancos RMPA, we have reviewed some parameters related to SCC/SCM that will be helpful in conducting the BCA. The following parameters clearly indicate that incorporation of SCC in a BCA of the Mancos RMPA would have a significant effect on determining overall economic efficiency for different alternatives.
Based on GHG equivalencies,[140] the eventual combustion of one barrel of crude oil will produce .43 metric tons of CO_2. For one thousand cubic feet (mcf) of produced natural gas, .055 metric tons of CO_2 will be emitted.
Using the recommended "central value" of $42/metric ton of CO_2 stemming from the latest technical supporting document for the IWG's social cost of carbon (discussed above), we illustrate the economic efficiency effect of properly accounting for the climate change damages resulting from further approval of developing the Mancos Shale/Gallup Formation.
A SCC of $42 in current dollars, roughly translates into $18 of SCC per barrel of crude oil approved in the new Mancos RMPA, or:

- .43 metric tons of CO_2/barrel X $42 SCC = $18 of SCC/barrel of crude

A BCA for the FFO should compare public costs to public benefits. The benefits to the public and the U.S. Treasury include returned royalties of 12.5% per produced barrel of crude and

[139] Cropper, M. L., & Oates, W. E. (1992). Environmental economics: a survey. *Journal of economic literature*, *30*(2), 675-740.
[140] Available at: https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator.

smaller amounts of bonus bids and rental rates.[141] Based on current prices of crude oil ($54/barrel),[142] the public royalty return on investment is:

- $54/barrel X .125 = $6.75 of royalty benefit to the public/barrel of crude

Under these price assumptions, the SCC of new oil production in the Mancos RMPA by itself is 267% greater than the royalty benefits. When including all the other social costs previously described, it is clear that the SCC + additional social costs far outweigh the benefits of further oil and gas expansion in the region.

For natural gas production it is even more dramatic. A SCC of $42 in current dollars, roughly translates into $2.30 per mcf of natural gas approved in the new Mancos RMPA, or:

- .055 metric tons of CO_2/mcf X $42 SCC = $2.30 of SCC/mcf of natural gas

The benefits of returned royalties at 12.5% of natural gas produced, at current gas prices around $3/mcf are:

- $3/mcf X .125 = $.38 of royalty benefit to the public/mcf of natural gas

Under current conditions, the SCC of new natural gas production considered in the Mancos RMPA by itself is 613%, or more than 6 times as great, as the natural gas royalty benefits. The parameters and simple illustrations reviewed above illustrate the importance of the BLM, and specifically the FFO, in accounting for the social costs of further oil and gas development on public lands. On the face of it, the social benefits of further oil and gas production in the Mancos Shale/Gallup Formation do not even come close to exceeding the social costs that will be incurred. Extrapolating these benefit/cost ratios to the potential production of some 1.5 billion barrels of crude oil and 2,000 new gas wells,[143] indicates that the social costs are billions of dollars greater in present value than the benefits of this production.

While there are range of SCC prices to be used, it should be noted that other industrialized nations, such as England, are using a SCC two times greater than the $42 used in this example.[144] Furthermore, the SCC only incorporates a portion of all social costs, and even only a portion of all climate change social costs. We further recommend an accounting of the social cost of methane, a GHG with 25 times the amount of warming power. In this region, a percentage of all natural gas developed is directly leaked into the atmosphere, estimated at 6% of gas production

[141] For example, royalties provided for more than 90% of federal onshore related oil and gas revenues in 2014. See, "Reported Revenues: Federal Onshore in All States for FY 2014 by Accounting Year." Office of Natural Resources Revenue.
[142] Current market prices for oil and gas are greater than the wellhead prices received and thus are an inflated measure of overall royalties returned to the public. We recommend the BLM utilize wellhead pricing and prices that reflect the true rate of royalty return.
[143] See the Reasonable Foreseeable Development (RFD) for Northern New Mexico final report, October 2014.
[144] *See* previous discussion of the Stern Review, etc.

in the San Juan Basin. This leakage, and the subsequent climate change damages, also needs to be included in the BCA.

Sensitivity analysis is recommend to model costs and benefits (and market prices) into the future. Additional estimates of fossil fuel combustion (and additional emitted metric tons of CO_2) that occur during extraction processes and during transportation of products should also be included.[145] Even the inclusion of a reduced domestic SCC would still indicate that the social costs are extremely high, and much greater than the zero price currently projected in the Mancos RMPA. Without proper accounting of social and environmental damages, the FFO planning process is skewed towards the promotion of oil and gas development.

IMPLEMENT FISCALLY RESPONSIBLE OIL AND NATURAL GAS DEVELOPMENT

The Trump Administration should be committed to implementing fiscally responsible oil and gas development on public land. Taxpayers expect economic efficiency and to receive fair market value for oil and gas resource developed on public land. Three significant issues related to fiscal responsibility include: 1) appraising fair market value and minimum bids for oil and gas lease sales based on quantities of oil and gas that is economically recoverable; 2) not offering leases for sale in places where the revenue and does not cover the costs to taxpayers or where natural gas waste is likely to occur; and 3) correctly estimating jobs and royalty revenue from proposed drilling based on economically recoverable resources. These issues should be addressed in the Mancos RMPA.

Implementing a fiscally responsible oil and natural gas development requires a quantitative understanding of the volume of oil and natural gas that can be extracted economically over a wide range of prices. Scientists use the concept of CO2 equivalent (CO2 –eq) to sum their climate change impacts. Estimates of economically recoverable resource can be converted CO2 equivalents (CO2 –eq) for use developing damage functions that provide an approximation of the social costs of carbon from extracting these resources. The revenues, benefits and jobs in local communities from planned oil and natural gas development in the planning area must also be based on quantities of oil and natural gas that are estimated to be economically recoverable based on a range of prices (Rose 2001, Morton and Kerkvliet 2014).[146]

Technically recoverable estimates of oil and gas are much larger than economically recoverable estimates because they ignore the economic and environmental costs from producing commercial quantities of oil and gas. Regardless of the technology chosen, technically recoverable oil and natural gas will not become an economically recoverable resource unless the market prices cover

[145] For example, GHG equivalencies for tanker trucks used to haul oil and gas are available.
[146] Rose, P. 2001. Risk Analysis and Management of Petroleum Exploration Ventures. AAPG Methods in Exploration Series, No 12. American Association of Petroleum Geologists. Morton, P. and J Kerkvliet, 2014. Redefining responsible oil and gas development. Presentation at University of Colorado, Center of the American West, FrackingSENSE Lecture Series, Boulder, CO. https://www.youtube.com/watch?v=KbSy_8KNjcY

the costs of extraction. The cost of extracting the oil or natural gas must be less than the market price in order to be economically recoverable (Morton et al. 2004).[147]

Economists may not agree on much but they do agree that you have to do the math. Continuing to rely on estimates of technically recoverable energy resources biases and distorts the RMP planning process in favor of oil and gas development -- because the economic costs of bringing the energy to market are not being considered. Relying on technically recoverable estimates will bias the RMP by exaggerating the local and regional jobs created and the royalty revenues estimated for oil and natural gas drilling proposals. We recommend that the BLM develop estimates of production from future leasing that may occur based on quantities of oil and gas that are economically recoverable.

A 2011 highly touted report from MIT included estimates of economically recoverable natural gas and indicates that at current wellhead prices less than half of our domestic technically recoverable natural gas is economically recoverable.[148] According to the MIT research, natural gas prices will have to increase dramatically – well past $30/MMBTU to recover all of the technically recoverable gas. Quite simply price matters. If current prices have to increase 8 to 10-fold in order to economically extract our nation's technically recoverable natural gas – taxpayers expect BLM planning to address this significant economic issue in planning documents.

We further recommend the BLM invest in a GIS mapping tools for estimating the volume of oil and gas that is economically recoverable projected to be produced in the future from additional leasing in the planning area. GIS methods using data from the USGS have been used to estimate undiscovered oil and gas by industry groups, government agencies, and environmental organizations (National Petroleum Council 1999, DOI-DOE-USGS 2003, 2006, 2008, Morton et al. 2002, LaTourrette, et al. 2002).[149]
Investing in a GIS based tool will help the BLM develop estimates of economically recoverable oil and natural gas -- which fully account for the market costs as well as the non-market

---

[147] Morton, P., C. Weller, J. Thomson, M. Haefele, and N. Culver. 2004. Drilling in the Rockies: How much and what cost? Special Energy Session of the 69th North American Wildlife and Natural Resources Conference, Spokane, WA. Wildlife Management Institute, Washington, DC.

[148] Massachusetts Institute of Technology, 2011. The Future of Natural Gas. An Interdisciplinary MIT Study.

[149] National Petroleum Council 1999. Natural Gas: Meeting the Challenges of the Nation's Growing Natural Gas Demand. U.S. Department of Interior and U.S. Department of Energy 2003, 2006, 2008. Scientific Inventory of Onshore Federal Lands' Oil and Gas Resources and Reserves and the Extent and Nature of Restrictions or Impediments to their Development. Phase 1, 2 and 3. Morton, P., C. Weller, and J. Thomson. 2002. Energy and Western Wildlands: A GIS analysis of Economically Recoverable Oil and Gas. The Wilderness Society, Washington, DC. LaTourrette, T., M. Bernstein, P. Holtberg, C. Pernin, B. Vollaard, M. Hanson, K. Anderson, and D. Knopman. 2002. Assessing Gas and Oil Resources in the Intermountain West: Review of Methods and Framework for a New Approach. RAND Science and Technology. Santa Monica, CA.

environmental costs (e.g. air and water pollution, loss of wildlife and bird habitat) from extracting and burning fossil fuels – for the basis of NEPA planning at the RMP level. LaTourrette, et al. 2002 in their economic analysis of oil and gas include GIS spatial data as proxies for non-market costs. Such an approach is worth building on.

Fiscally Responsible Leasing

The public expects to receive fair market value for oil and gas resources produced from public land. At the leasing level, implementing responsible oil and natural gas should take advantage of estimates of the volume of oil and natural gas that can be extracted economically to establish fair market value for taxpayers. Such information is critical for among other things, establishing the minimum bid for a lease sale. Estimating the economic value of oil and natural gas from a proposed lease area would make the BLM more consistent with how the U.S. Forest Service established fair market value and minimum bids for commercial timber sales. Taxpayers deserve no less.

The BLM continues to sell leasing rights for oil and gas based on per acre bids. In stark contrast, the USFS sells commercial timber based on an appraisal of the value of the millions of board feet being offered for sale – not the total acres within the sale boundary. We recommend the BLM follow the lead of the USFS and develop a more efficient appraisal process for estimating fair market value and setting minimum lease bids based on the estimated value of economically recoverable oil and gas covered by the lease.

We seriously question whether the current appraisal method of establishing minimum bids based on dollars per acre basis is fiscally responsible as it ignores the economic value of the good to be sold – which is the volume of oil and gas in the ground. Economics and fiscal prudence suggests that selling leasing rights based on estimates of the economically recoverable quantities of oil and gas underground is a more efficient appraisal method for setting minimum bids. We recommend the BLM begin appraising leases and establishing minimum bids based on estimates of the undiscovered economically recoverable oil and gas for a lease sale.

As part of this effort, we also recommend the BLM examine the benefits of a no-leasing alternative. A no new leasing alternative may lower BLM planning, leasing mitigation and enforcement cost in the short run as well as reclamation and monitoring costs in the long. A no new leasing alternative may be a more economically efficient alternative -- especially when non-market costs and budget constraints are considered (discussed below).

Eliminate Below Cost Lease Sales

Below cost timber sales – timber sales where the revenue was less than the cost to taxpayers -- were a huge issue for the Forest Service in the 1990s. The same fiscal arguments apply to the BLM setting minimum bids for oil and gas leasing sales below the cost to taxpayers of offering the lease for sale. When the BLM leases land for just $2 per acre – we question whether the revenue generated from that lease sale covers the BLM administrative costs of setting up the lease sale. Does $2 per acre even cover the social cost of carbon associated with the oil and gas covered by the lease? We doubt that $2 per acres covers the market and non-market costs

associated with extracting and burning the oil and gas covered by the lease. A no more leasing alternative will by design directly eliminate future below cost lease sales and help mitigate climate change damages.

We question the fiscal responsibility of the BLM continuing to offer "below cost lease sales". Relevant questions that we recommend the BLM address is to estimate the administrative and oversight costs associated with offering oil and gas leases for sale. For the planning area, how much does BLM spend when it offers oil and gas leases for sale? Does the revenue from each oil and gas lease sale cover the cost to taxpayers of setting up and administering each lease sale? To the extent does below cost leasing occurs in the planning area, it represents an implicit subsidy that costs taxpayers and undercuts investors in oil and gas on private land. The BLM by offering "below cost leasing" – is distorting the energy markets and not providing taxpayers with a fair return on their resources.

We recommend that the BLM examine the potential for below cost leasing in the planning area by developing a predictive model for estimating where leases with low bids tend to occur. Do lease parcels that the receive $2 per acre bids tend to occur in wild areas far from roads? A well-designed regression model is one approach for examining where and how often below cost leasing occurs. The regression model would be analogous to the "transaction evidence approach" developed by the U.S. Forest Service for appraising the fair market value of timber. In addition to a goal of identifying and eliminating below cost leases, the predictive model could also be used to establish the fair market value of the oil and gas to be leased and for setting minimum bids of those leases.

We also recommend that the BLM eliminate lease sales where the public costs are greater than the public benefits. Again, one possibility is to develop a predictive model that includes spatial consideration of non-markets benefits and costs similar to the one developed by LaTourrette, et al. 2002.[150] The model could be linked to a benefit cost analysis which fully accounts for the social cost of carbon and methane as well as other non-market costs and benefits is needed to address this issue. As discussed above, estimates of economically recoverable oil and gas for a proposed leases sale can be converted to CO2 equivalents (CO2 –eq) for use in provide an approximation of the social costs of offering the proposed lease for sale. Leases should not be sold at a price less than the social costs of carbon associated with the oil and gas estimated to be under the lease.

ACCOUNT FOR COMMUNITY CONCERNS AND POTENTIAL FOR DISRUPTION

Since 2001, when the domestic drilling boom began, more than 400,000 oil and gas wells have been drilled on U.S. public and private land. In retrospect, the current drilling boom, like past drilling booms, was not done in a thoughtful way and caused more damage to communities and the environment than necessary. As has happened in earlier busts, rural towns that overbuilt

[150] LaTourrette, T., M. Bernstein, P. Holtberg, C. Pernin, B. Vollaard, M. Hanson, K. Anderson, and D. Knopman. 2002. Assessing Gas and Oil Resources in the Intermountain West: Review of Methods and Framework for a New Approach. RAND Science and Technology. Santa Monica, CA.

their infrastructure during the boom are now in fiscal trouble. Williston, North Dakota for example, took on $215 million in debt to build infrastructure, including a sewer plant and recreation center for the growing population (Healy 2016).[151] As quoted in Healy (2016), Nancy Hodur a research assistant professor at North Dakota State University stated the following - "Those communities out there were drinking out of a fire hose…A lot of those communities would come right out and say that pace of growth isn't good, isn't sustainable."

Quantifying and understanding the direct, indirect and cumulative effects from the recent drilling boom is key information for successfully implementing responsible oil and gas program in the future. We recommend the BLM quantitatively review economic and environmental data for local communities associated with the recent drilling boom and bust. We recommend the BLM use the planning process to look back and gain an understanding of lessons learned by communities from the extended domestic oil and gas drilling boom.

Economic Development is Different than Economic Impacts

Short term job creation from an oil and gas drilling boom must be balanced with the longer-term perspective represented in economic development plans. Economic development is concerned with an improved standard of living and a diverse economy that can weather downturns in any particular industrial sector. Economic development is concerned with the long-term health of communities and regions. A healthy community includes a diverse economy, public facilities and services, a higher and equitable standard of living, and a clean environment. In contrast, the economic impact is a short-term measure of the jobs created from plans for developing oil and gas resources.

Economic development and healthy communities involve other economic criteria that are not included when estimating economic impact in terms of job creation. Unfortunately, decision-makers and the general public remain unaware of the limitations of economic impact studies and as a result the results are often misunderstood and misused by decision-makers.
The IMPLAN model is a commonly tool used by economists to estimate the jobs associated with oil and gas development as part of an economic impact analysis. The IMPLAN model is typically used to estimate the direct, indirect and induced jobs generated from marginal changes in investments and public policies. Direct jobs are created by direct hiring to perform the activity (i.e. drilling); indirect are jobs created by spending to support the work of direct jobs (e.g. pipe used by drillers to drill wells); and induced are jobs created when direct and indirect job holders spend their wages. So, jobs in the drilling pipe industry are indirect jobs, while bar and restaurant workers are induced jobs.

When reviewing the results of economic impact analysis, it is important to examine the short terms job creation from oil and gas drilling within the context of longer term community plans for sustainable economic development.

[151] J. Healy, 2016. Built Up by Oil Boom, North Dakota Now Has an Emptier Feeling http://www.nytimes.com/2016/02/08/us/built-up-by-oil-boom-north-dakota-now-has-an-emptier-feeling.html?_r=0

Short Term Economic Disruption

In the short term, drilling booms produce the "crowding out effect". Crowding out" can negatively affect agriculture, recreation and tourism, and hunting and fishing business. Higher housing costs, labor competition, air and water pollution can make the resource dependent regions less attractive to other industries than alternative locations. The potential for crowding out and economic displacement has implications for the choices faced by community leaders in distinguishing between short term economic impacts and longer term plans for sustainable development. If the pace and scale of development exceeds the assimilative socio-economic capacity of a county or community, businesses and residents can suffer economically. As pace and scale increase, there will be tradeoffs and non-compatibility issues which can lead to slower net job growth due to economic displacement.

In addition to job creation, the fiscal health of communities is also an issue with oil and gas development. As the scale of the drilling boom for oil and natural gas increases communities experienced an increase in traffic and crime that overwhelmed the assimilative capacity (e.g. roads, wastewater treatment facilities, enforcement staff) and budgets of communities and counties for handling these problems.

Local governments – counties and communities – are subjected to a wide range of demands for new services, staff, equipment, and expertise that impacts budgets. The additional the fiscal costs to local taxpayers from oil and natural gas development include land use planning, hiring additional expertise (i.e. legal counsel, oil and natural gas coordinator, community outreach, inspectors) purchasing monitoring equipment (i.e. infrared camera for emission detection), administration, oversight and inspection, the equipment for and training of emergency services so they are prepared for the kind of fire, accident, or spill incidents associated with drilling operations can produce. Public Health departments must be prepared to receive and respond to incident reports and citizen concerns about environmental health issues

Boxall et al (2005) also found that property values are negatively correlated with the number of gas wells.[152] The study's mean estimates indicate that when residential properties are within 4 km (about 2.5 miles) of oil and gas facilities, property values decline 4-8 percent. The impact can easily be twice that depending upon the level and composition of the nearby industry activities. Any decline in property values may result in a long term drop in tax revenue.

Long Term Economic Disruption

IMPLAN is a tool for estimating jobs in the short run but does not consider fiscal costs from these jobs nor the crowding out effect or business displacement or community disruption. The IMPLAN model also does not consider the long term economic costs associated boom and bust cycles and the resource curse.

[152] Boxall, P.C., W.H. Chan, M.L. McMillan. 2005.The impact of oil and natural gas facilities on rural residential property values: a spatial hedonic analysis. Resource and Energy Economics. 27: 248-269.

Natural resource extraction, including energy development – oil and gas drilling and mining – when properly managed can provide economic opportunities for resource producing regions. But an established and growing body of research indicates that countries, states and communities that are dependent on natural resource extraction suffer socio-economically.

Boom and bust cycles are a longstanding historic challenge for communities impacted by oil and natural gas drilling and production. While energy development can benefit communities, historically drilling booms bring an influx of non-local workers, a rise in crime and emergency service calls, increased demand for public services, more wear and tear on local infrastructure, and upward pressure on local wages and housing costs. Local governments need to provide basic services for a rapidly growing population, along with increased per capita service demand, resulting in fiscal burdens for taxpayers.

Economic theory suggests that an abundance of natural resources should promote economic growth by providing economies with ‘‘natural capital.’’ However, many academic studies have found that economies relying heavily on natural resource extraction are poor performers in terms of growing income, decreasing poverty, and improving lives. This poor performance has become known as the "resource curse". Avoiding the resource curse is a worthy goal for responsible oil and natural gas development.

Recent studies comparing U.S. states and counties find convincing evidence of a resource curse. Papyrakis and Gerlagh (2007) found that all twelve states with more than 5% of state earnings derived from the resource sector experienced negative economic growth during the 1980–1995 period.[153] James and Aadland (2011) found that a typical resource rich county whose economy was 20 percent dependent on resource extraction experienced slower per capital income growth compared to a county with 5 percent dependency.[154] James and Audland (2011) conclude "Although the resource curse appears to be waning over the sample period 1980–2005, it is always negative and statistically significant. The coefficient estimates imply sizable differences in standards of living if one extrapolates the annual growth differences to future generations." The strong evidence of boom and bust cycles and the resources curse shows that energy development is not a panacea. Instead it is a risky business that must be done wisely. If done irresponsibly, energy development threatens the economic health of local communities.

IMPLEMENT PHASED ENERGY DEVELOPMENT TO REDUCE COMMUNITY DISRUPTION

Phased energy development – which involves regulating the pace and scale of leasing and development – provides a cost-effective approach for managing fiscal and environmental risk

[153] Papyrakis, E. and R. Gerlagh. 2007. Resource abundance and economic growth in the United States. European Economic Review. 51: 1011-1039.

[154] James, A. and D. Aadland. 2011. The curse of natural resources: an empirical investigation of U.S. counties. Resources and Energy Economics. 33: 440-453.

(Haefele and Morton 2009).[155] Pace and scale are regulated because they are key variables for reducing and internalizing the externalized damages; managing risk; mitigating boom and bust cycles; and avoiding the resource curse.

A reduced pace will moderate the deluge of energy wealth and the hyperactivity that disrupts normal patterns of business and government. Regulating the pace of drilling is a fiscally and economically sound approach to oil and natural gas development. Slowing the pace and spreading drilling over years or even decades means there will be producing wells in the area for a longer time period, while reducing the dramatic spike in drilling peak in the earlier years. Many of the problems associated with the recent drilling boom in the Rockies are either caused by or exacerbated by the large scale and rapid pace of development (Haefele and Morton 2009). Slowing the pace and scale or oil and natural gas development can help reduce these problems by staying within the assimilative capacity of a community.

A reduced pace will promote carefully considered regulations that allow energy extraction to proceed with less environmental damage. In this regard, a no new leasing alternative can help slow the pace and scale of disruption and displacement in the short run and promote more sustainable economic development and healthier communities in the long run.

ESTIMATE NET FISCAL IMPACTS

Conventional wisdom assumes the net fiscal impacts are positive because of the millions in tax revenue reported. But the revenue reports based on royalties represent only gross revenues. Businesses survive or go broke based on the net revenues from the sale of goods and services. Estimated of gross revenue do not measure profit or the success of a business because they exclude the costs of doing business. Unfortunately, government estimates of oil and natural gas revenue leave out the fiscal and environmental costs of doing business – and therefore only report gross revenues.

Generating oil and natural gas revenues is not a cost-free endeavor – especially for impacted communities. Unfortunately, economic impact analysis does not consider the cumulative fiscal costs associated with oil and gas development. What has been missing from the economic conversation and fiscal calculus are the cumulative costs to taxpayers associated with collecting the gross revenue (i.e. proper oversight, frequent inspections, increased road maintenance costs, declining property value change, etc.). We recommend a new fiscal focus on estimating the net revenues that accrue from oil and natural gas development.

NONMARKET VALUE CONSIDERATIONS

The BLM must evaluate its oil and gas program within the context of the agency's larger legislative mission as steward of America's public land. One of the most important purposes of

[155] Haefele, M. and P. Morton. 2010. The Influence of the Pace and Scale of Energy Development on Communities: Lessons from the Natural Gas Drilling Boom in the Rocky Mountains, Western Economics Forum Vol. VIII, No. 2.

public lands, including BLM lands, is the provision of non-market public goods such as opportunities for solitude, outdoor recreation, clean air, clean water, biodiversity, and the preservation of wilderness and other undeveloped areas that would be underprovided if left entirely to market forces (Loomis 1993).[156] It is incumbent upon the BLM, as the administering body for oil and gas leasing of public lands, to provide for greater accounting of non-market social and environmental costs as well as greater transparency of the processes used to make these calculations.

The Federal Land Policy and Management Act (FLPMA) specifically incorporates such non-market resources as "the long-term needs of future generations" for recreation and "natural scenic, scientific and historical values" into the BLM's multiple use mandate.[157] FLPMA further defines multiple use to require the agency to encompass non-market values into management, directing the BLM to achieve:

> **harmonious** and coordinated management of the various resources without permanent impairment of the productivity of the land and the **quality of the environment** with consideration being given to the relative values of the resources and **not necessarily to the combination of uses that will give the greatest economic return** or the greatest unit output.[158] (emphasis added).

The Trump Administration should be committed to an oil and gas program grounded in stewardship of public land and one that holds oil and gas companies to the highest standard of fiscal and environmental responsibility. To accomplish this goal, the BLM should consider fully and carefully balancing the benefits of oil and gas production with the environmental costs of oil and gas exploration, production, and remediation. While increasing returns to the Treasury and increasing efficiency of oil and gas management are laudable goals, we also know that extracting and burning oil and natural gas has significant social and environmental costs.

Strategically in 2013, the BLM issued guidance for considering nonmarket environmental costs when preparing NEPA analyses for BLM resource management planning and other decision-making. From the document (BLM 2013):

> All BLM managers and staff are directed to utilize estimates of nonmarket environmental values in NEPA analysis supporting planning and other decision-making where relevant and feasible, in accordance with the attached guidance…The use of quantitative valuation methods should contribute to the analysis of one or more issues to be addressed in the environmental analysis supporting planning or other decision-making. A quantitative analysis of

[156] Loomis, J. B. 1993. Integrated Public Lands Management: Principles and Applications to National Forests, Parks, Wildlife Refuges, and BLM Lands. First Edition. Columbia University Press: New York, NY.
[157] 43 U.S.C. § 1702(c).
[158] Id.

> nonmarket values in EIS-level NEPA analyses is strongly encouraged where one or more of the criteria described in the attached guidance apply.[159]

As discussed above, we recommend that the BLM use this guidance to internalize the negative externalities by developing multiple damage functions associated with the social cost of carbon and other non-market costs associated with oil and gas production from public land. The table below provides a comprehensive framework that combines distributional impacts (i.e. jobs) with a total economic valuation of the local and regional damages associated with oil and natural gas extraction.[160] Estimating the local and regional damage functions included in this framework would provide valuable local information to inform and supplement the macro-level damage functions currently used in integrated climate assessment models.

Comprehensive Economic Framework: Jobs and Total Economic Damages from Oil and Natural Gas Development that Spillover into our Communities and Environment		
Cost Category	**Description of Cost**	**Methods for Estimating Cost**
Direct Use Costs	Displacement or loss of land for habitat, recreation opportunities, hunting, farmland, grazing, reclamation costs, water quantity and drought.	Travel cost method, contingent valuation surveys.
Community Concerns	NOx, VOCs, ozone and kids' health, noise pollution, truck traffic and infrastructure costs, property values, loss of local control, displaced jobs and revenues due to "crowding out", natural amenities and quality of life issues, loss of retirement income, displaced farming due to competition for water, boom-bust cycles, revenue lag and fiscal risks, water treatment plants and recycled fracking water, draining of reservoirs for fracking water and the loss of fishing and recreation revenue.	Surveys of residents and businesses. Averting expenditure methods for estimating the costs of mitigating health and noise impacts. Change in recreation visitation, expenditures and business income. Documented migration patterns.
Science Benefits Foregone	Loss of natural areas for scientific study as an experimental control for adaptive ecosystem management.	Change in management costs, loss of information from natural studies foregone.

[159] U.S. Department of the Interior, Bureau of Land Management, 2013. Guidance on Estimating Nonmarket Environmental Values. Instruction Memorandum No. 2013-131, Change 1. http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/2013/IM_2013-131__Ch1.print.html

[160] Morton, P., C. Weller, J. Thomson, M. Haefele, and N. Culver. 2004. Drilling in the Rockies: How much and what cost? Special Energy Session of the 69th North American Wildlife and Natural Resources Conference, Spokane, WA. Wildlife Management Institute, Washington, DC. 33 pages.

Comprehensive Economic Framework: Jobs and Total Economic Damages from Oil and Natural Gas Development that Spillover into our Communities and Environment		
Cost Category	**Description of Cost**	**Methods for Estimating Cost**
Off-site Damages	Fugitive methane emissions, water pollution from spills, noise pollution from compressor stations, visual impacts, erosion from well pads and roads, pipeline explosion risks, road dust on petroglyphs and snowpack, seismic activity from injection wells, decline in property values.	Contingent valuation surveys, hedonic pricing analysis of property values, preventative expenditures, well replacement costs, restoration and environmental mitigation costs.
Biodiversity Impacts	Loss and fragmentation of wildlife habitat by roads and well pads, pipelines are conduits for invasive weeds, endocrine disrupter's impact amphibians and fish, produced water holding ponds and bird deaths, noise impacts on wildlife species.	Replacement costs, restoration and environmental mitigation costs.
Ecosystem Services Lost or Compromised	Water lost from fracking, impacts to aquifer re-charge and wetland function, carbon lost via land use change, fossil fuels and climate change, decline in net primary productivity.	Change in productivity, replacement costs, increased water treatment costs for cities, preventative expenditures.
Passive Use Benefits Foregone	Loss of option, bequest and existence benefits generated by open spaces, parks, and wildlands.	Contingent valuation surveys, opportunity costs of not utilizing future information about the health, safety, and environmental impacts of oil and natural gas drilling.

Source: Adapted from Morton, P., et al. (2004). Drilling in the Rockies: How Much and at What Cost? Proceedings of a Special Energy Session of the 69th North American Wildlife and Natural Resources Conference, Spokane, WA. Wildlife Management Institute

ESTIMATE LOCAL AND REGIONAL DAMAGE FUNCTIONS

Integrated assessment models estimate global climate change damage functions based on increasing CO2 emissions. A goal of integrated assessment models (IAMs) is to estimate the economic efficiency of climate change policies in the context of a cost-benefit analysis. IAMs use mathematical relationships between economic activity and GHG emissions. Climate damage functions subsequently estimate the relationship between CO2 emissions and the global damage caused, in order to approximate how future damages might be reduced if CO2 emissions were also reduced.

In addition to global damage functions, local and regional damage functions should be developed to account for the damages that occur in oil and gas producing regions. We recommend the BLM identify relevant variables and methods appropriate for developing damage functions for

use in regional BLM planning of oil and gas fuel development. Local and regional damage functions can be developed per unit of production (per barrel of oil and per mcf of gas) and for oil and gas development itself. Damage functions can also be estimated on per well basis, for each compressor station, waste pit and storage tank – and linked to an economic model for use in the benefit-cost analysis.

An example of a regional damage function from oil and gas development is the potential damage from earthquakes associated with the underground injection and disposal of waste water from oil and gas development. IAMs include monetary damages functions for floods and droughts – but not for earthquakes. Damage functions for increase regional seismic activity from underground injection could be developed using methods similar to those used in the IAMs. We recommend the BLM develop a predictive model on the relationship between underground injections and increased seismic activity. The results could be linked to an economic model that estimates appropriate damage functions around earthquakes and disposal of waste from oil and gas development based, for example, on the increased costs recorded by the insurance industry. Air pollution damage functions can be used, for example, to examine the health impacts to regional citizens from oil and gas development. IAMs include human health damage functions at the global level, but human health damage functions at the local and regional level are needed. Ozone pollution from oil and gas development exacerbates a range of health problems for local residents including respiratory illnesses and asthma. There are many health studies that can be referenced and used to develop local and regional human health damage functions that will supplement and inform global human health damage functions currently used in IAMs.

We recommend the RMP alternatives include implementation of the BLM's methane capture rule. As part of this analysis the BLM should include the many human health co-benefits generated by implementing the agency's methane capture rule. These human health co-benefits occur because the methane capture requirements also reduce air pollution from volatile organic chemicals (VOC), fine particulate matter (PM) and other hazardous air pollutants (HAP). We recommend that the BLM include these human health co-benefits in the BCA completed for the planning area.

CAPTURING METHANE POLLUTION INCREASES ECONOMIC EFFICIENCY

The BLM's own research on its methane capture rule indicates that implementing climate mitigation measure like capturing methane emissions improves economic efficiency. Morton and Hjerpe (2016)[161] conducted a case study of two counties in the San Juan Basin of northwest New Mexico to better understand regional impacts of the BLM's proposed methane capture rule and focus on natural gas wells as it is the dominant fossil fuel produced in the region. The analysis included: 1) a Net Present Valuation of the costs of complying with proposed LDAR requirements and the new revenues from the methane captured; and 2) estimated change in overall gas production and associated royalty payments to the state. The study examined 13,493

[161] Morton, P. and E. Hjerpe 2016., A Review of the Economic Factors Surrounding the Capture of Methane from Oil and Natural Gas Development on Federal Public Land, Conservation Economics Institute.

active federal gas wells in these two counties and determined that 8,718 (65%) of these wells produced less than 90Mcf per day.

The results indicate that the majority of marginal gas wells will not only reduce methane emissions and natural gas waste, but by capturing the methane for sale, production, revenues, royalties and profits will also increase as a result of the proposed rule. These findings are consistent with the economic literature and with the BLM's findings in the Regulatory Impact Analysis.[162] We therefore recommend the BLM include a plan alternatives that includes implementation of methane emissions mitigation measures in the planning area.

BUDGET CONSTRAINTS MUST BE CONSIDERED IN THE RMPA

The level of damages (non-market costs) associated with each plan alternative are directly influenced by budgets available to fully implement the alternative. If funding is less than planned, and the promised environmental protection measures are not implemented due to budget shortages, the non-market damages and costs will increase. If on the other hand, budgets are flush and environmental protection measures are implemented as planned, the non-market costs will in general be less. The negative externalities (i.e. damages) generated from each plan alternative must be estimated with due consideration of the effect budget constraints – for example, annual funding levels and bonding amounts available for reclamation, inspection mitigation and well closure – have on damage functions.

We recommend that the BLM take steps to reduce methane emissions from oil and gas operations by examining budgets to make sure climate change mitigation measures are enforceable. Without adequate funding, climate mitigation measures included in the RMP are not enforceable and are more likely to fail.

A fiscally and environmentally responsible oil and gas program requires sufficient funding for implementing management plans. Based on numerous investigations we know that the BLM does not have the information, staffing or budget to actually implement responsible oil and gas development (GAO 2010, 2011, 2013a,2013b, and 2014).[163] In addition, efforts to mitigate the

---

[162] U.S. Bureau of Land Management, Regulatory Impact Analysis for Revisions to 43 CFR 3100 (Onshore Oil and Gas Leasing) and 43 CFR 3600 (Onshore Oil and Gas Operations), Additions of 43 CFR 3178 (Royalty-Free Use of Lease Production) and 43 CFR 3179 (Waste Prevention and Resource Conservation) at 39 , (November 10, 2016).

[163] U.S. Government Accountability Office. 2005. Oil and Gas Development: Increased Permitting Has Lessened BLM's Ability to Meet Its Environmental Protection Responsibilities. Report to the Ranking Minority Member, Committee on Homeland Security and Governmental Affairs, U.S. Senate. U.S. Government Accountability Office. 2010. Oil and Gas Bonds: Bonding Requirements and BLM Expenditures to Reclaim Orphaned Wells. GAO-10-245. U.S. Government Accountability Office. 2011. Oil and Gas Bonds: BLM Needs a Comprehensive Strategy to Better Manage Potential Oil and Gas Well Liability. GAO-11-292. U.S. Government Accountability Office. 2013a. Oil and Gas Development: BLM Needs Better Data to Track Permit Processing Times and Prioritize Inspections. GAO-13-572. U.S.

damages from climate change require adequate funding to insure the measures are enforceable. The BLM can include very effective climate change mitigation strategies in the RMP, but if the costs of climate mitigation is not considered in the context of agency budgets, and funding for climate mitigation turns out to be lacking, the mitigation measures will not be enforceable. Unfortunately, history has shown that funding levels clearly affect the timing and implementation of management actions and proposals, often resulting in protective measures such as mitigation and reclamation not being implemented. Because these budgetary shortfalls result in the damage or destruction of sensitive resources, it is imperative to recognize that funding levels *do* affect the findings and decisions made in an RMP.

A decision to lease more land for drilling involves a budget commitment for planning, inspection and mitigation. In contrast, no new leasing may lower BLM planning, leasing mitigation and enforcement cost in the short run as well as reclamation and monitoring costs in the long run. The decision to lease public land is also a commitment to increase surface disturbance and fragment wildlife habitat. Increasing surface disturbance directly increases the risk of damage to cultural resources and wildlife. In contrast a no new leasing alternative will result in less surface disturbing activities and fragmentation of wildlife habitat. As such, the costs of implementing each alternative will vary as the pace and scale of proposed leasing and drilling increases. When the BLM provides a range of alternative in a RMP, the public needs to understand the cost of implementing each alternative will also range. In other words, a range of implementation costs is associated with the range of alternatives. For example, a no new leasing alternative may cost less and be a more efficient alternative when budget constraints are considered.

It is imperative for taxpayers to understand whether the expected budget will be sufficient to cost of implementing each alternative. The total costs of implementation and mitigation must then be compared to the expected budgets to assess the probability of mitigation measures being fully implemented. Management risks can be fully evaluated based on a range of budget expectations, which should be clearly stated and consistent across alternatives.

We recommend the BLM complete a cost-budget analysis to show the feasibility of implementing each alternative. Taxpayers are entitled to know if decision makers are selecting a more damaging and more costly alternative, when a less damaging, less costly alternative is available. For example, what effect might the current federal hiring freeze have on implementation of the plan? And longer term, what are the consequence of a reduction in the federal workforce on the BLM's ability to comply with the law and implement fiscally and environmentally responsible oil and gas development? These are significant questions that must be addressed in the plan.

Historical evidence indicates significant budget shortfalls have prevented the BLM from fully implementing and keeping the promises and environmental commitments made in past

---

Government Accountability Office. 2013b. Oil And Gas Resources: Actions Needed for Interior to Better Ensure a Fair Return. GAO-14-50: U.S. Government Accountability Office. 2014. Oil and Gas: Interior Has Begun to Address Hiring and Retention Challenges but Needs to Do More. GAO-14-205.

management plans. We recommend the BLM fully examine the uncertainty in budgets and the subsequent risks and damages from budget shortfalls. An analysis of costs and budgets is needed to help reduce budget uncertainty associated with each alternative.

There is federal precedence for completing a cost-budget analysis, as the U.S. Forest Service completed one in 2002 for the White River National forest plan in Colorado.[164] The Forest Service used two budget levels in the cost budget analysis used to develop the White River National Forest (WRNF) plan.

> Two budget levels were analyzed for each management alternative. The first is based on the Forest's "experienced budget" level, which represents the average annual budget between 1997 and 2000. The second is the "full budget" level, which represents the funding of all programs at a level one and one-half times as much as the experienced budget level. The purpose of the two budget levels was to describe to the public and the decision maker how production levels and effects change under varying budgets. (Page A3-236).

While an open checkbook would be a nice, public land management plans need to be grounded in fiscal reality. Consider the following statements from the USDA Forest Service in the 2002 FEIS for the WRNF plan:

> ...the purpose of this budget analysis is to show that outputs and achievements are restricted by the amount of funding allocated to the White River National Forest…It is not realistic, however, to have an unconstrained budget level…output levels based on unconstrained budget level would not ever be realized. (Page A1 -35).
>
> ****
>
> Achievement of any strategy or objective is partially based on the staffing and budget resources available…achievement levels in the draft and final documents were estimated using realistic budget estimates. Using budget constraints in achievement estimates help predict a realistic outcome. (Page A1 -31)

We recommend that the BLM present the public with a realistic plan by completing a cost-budget analysis for each alternative. If the U.S. Forest Service can develop a fiscally responsible forest plan in 2002 – a plan the correctly considers implementation costs and budgets – we believe the BLM is also capable of producing a fiscally responsible RMP in 2017. The Forest Service has long used linear programming models for planning, perhaps it's time for the BLM to try such an approach. We recommend the BLM explore the potential to develop a linear programming planning model with an objective function of maximizing net public benefits subject to agency budget constraints. Developing such a planning model would help the BLM

[164] USDA Forest Service, 2002. Final Environmental Impact Statement, Volume 1, White River National Forest, Colorado.

develop fiscally responsible RMPs for oil and gas development that can be implemented with expected budgets.

Since budgets should vary with the pace and scale of development, we recommend budget comparisons based on various levels of the pace and scale of development. If more leasing and drilling is allowed the oversight budgets must correspondingly increase. We recommend developing fully funded budgets at three levels: 1) budgets necessary for implementing responsible oil and gas development for the existing wells and associated road and pipeline infrastructure within the planning area; 2) additional budgets required from responsibly implementing new oil and gas development on public land already under lease but not currently developed; and 3) the additional budgetary commitments associated with continuing to offer additional more acres of public land in the planning area for lease.

Background

In a 1992 report to Congress, the U.S Office of Technology Assessment reviewed federal land management budgets and found that the funding received by public land management agencies had been significantly less than the budgets required to fully implement plans.[165] The lower-than-planned budgets prevented public agencies from producing many of the outputs and resource protections that were promised in land management plans.

The BLM's budget challenge persists today as current funding is insufficient for accomplishing the agency's twin goals of environmentally and fiscally responsible oil and gas development. The environmental risks from oil and gas development increase when mitigation and monitoring measures are not adequately funded (Morton et al. 2004).[166]

The impacts from budget shortfalls with respect to implementing responsible oil and gas development were documented in a June 2005 report issued by the General Accounting Office (GAO).[167] The GAO found that the increased volume of permits has resulted in more BLM staff resources devoted to issuing permits with less attention being paid to monitoring and enforcing compliance with environmental standards that apply to the activities conducted under the permits.

---

[165] U.S. Congress, Office of Technology Assessment (1992). Forest Service Planning: Accommodating uses, producing outputs, and sustaining ecosystems. OTA-F-505, Washington, DC

[166] Morton, P., C. Weller, J. Thomson, M. Haefele, and N. Culver. 2004. Drilling in the Rockies: How much and what cost? Special Energy Session of the 69th North American Wildlife and Natural Resources Conference, Spokane, WA. Wildlife Management Institute, Washington, DC.

[167] U.S. Government Accountability Office. 2005. Oil and Gas Development: Increased Permitting Has Lessened BLM's Ability to Meet Its Environmental Protection Responsibilities. Report to the Ranking Minority Member, Committee on Homeland Security and Governmental Affairs, U.S. Senate.

More evidence of unfunded mandates and broken promises comes from a May 2006 BLM document from the Pinedale Field Office in Wyoming titled "Commitments made in Decision Documents not yet achieved" (Bureau of Land Management, Pinedale Field Office. 2006). The authors found that 580 requirements and commitments had been cumulatively made in recent decision documents – many of which had not been achieved. One of the more prominent commitments BLM made repeatedly in several decision documents was to track NOx emissions from oil and gas development in southwest Wyoming. The authors of the 2006 document concluded that NOx monitoring had not been completed since 2000. The report details dozens of examples where funding was not allocated to successfully implement the plan and achieve the cumulative commitments made by the BLM in decision documents.

We recommend that the BLM fully examine past Mancos planning documents and examine the past commitments promised that were never achieved. Such information is critical for understanding the ability of the BLM to fulfill promises made in future management plans. Such information is needed as the BLM continues to be challenged to find the resources, staffing or budget to implement responsible oil and gas development. A 2013 GAO report stated the following:[168]

> In fiscal year 2012, companies received over $66 billion from the sale of oil and gas produced from federal lands and waters, and they paid $10 billion to the federal government for developing these resources according to the Department of the Interior. The federal government seeks a fair return on its share of revenue from leasing and production activities on federal lands and waters through the federal oil and gas fiscal system….In May 2007, GAO found, based on several studies, that the government received one of the lowest percentages of value of oil and gas produced in the world. In September 2008, GAO found that Interior had not evaluated the federal oil and gas fiscal system for over 25 years and recommended that a periodic assessment was needed.

These challenges were confirmed in a 2014 GAO report which stated:[169]

> Interior employs a wide range of highly-trained specialists and scientists with key skills to oversee oil and gas operations on leased federal lands and waters. GAO and others have reported that Interior has faced challenges hiring and retaining sufficient staff to carry out these responsibilities. In February 2011, GAO added Interior's management of federal oil and gas resources to its list of programs at high risk of fraud, waste, abuse, and mismanagement in part because of Interior's long-standing and continued human capital challenges.

---

[168] U.S. Government Accountability Office. 2013. Oil and Gas Resources: Actions Needed for Interior to Better Ensure a Fair Return. GAO-14-50: U.S. Government Accountability Office. 2014.

[169] U.S. Government Accountability Office. 2014. Oil and Gas: Interior Has Begun to Address Hiring and Retention Challenges but Needs to Do More. GAO-14-205

A 2015 GAO report titled Oil and Gas Resources: Interior's Production Verification Efforts and Royalty Data Have Improved, but Further Actions Needed stated the following:[170]

> The Department of the Interior has made considerable progress in improving both the verification of oil and gas produced from federal leases and the reasonableness and completeness of royalty data. Since fiscal year 2009, Interior has implemented 28 of 36 GAO recommendations made in these areas; however, key challenges remain, including the following:
>
> Interior has not updated its regulations for onshore oil and gas measurement in over 25 years and, as a result, they do not reflect newer measurement technologies and standards adopted by industry, hampering Interior's ability to have reasonable assurance that oil and gas are being measured accurately.

All of which begs the question of how much money BLM needs for its oil and gas program to have fiscally and environmentally sound management? In order to address this question, we recommend the BLM estimate the fully funded budgets necessary for successfully implementing responsible oil and gas development and comparing them with historic budgets. Comparing fully funded budgets with historic budgets provides an estimate of the additional revenue that must be captured in order to implement a fiscally and environmentally responsible oil and gas program.

Legal Mandate

The BLM must consider the impact of budget constraints on its ability to fulfill the promises made in a RMP with respect to protecting ecological and multiple use values. According to a Council of Environmental Quality memorandum on NEPA requirements [cited in NEPA Compliance Manual, 2nd Edition (1994)]:[171]

> [T]o ensure that environmental effects of a proposed action are fairly assessed, the probability of the mitigation measure being implemented must also be discussed. Thus the EIS and the Record of Decision should indicate the likelihood that such measures will be adopted or enforced by the responsible agencies. (Section 1502.16(h), and 1505.2).

The probability that a mitigation measure will be implemented (and that risks will decrease) is largely a function of budgets and funding levels. In order to discuss the probability of mitigation, the agency must examine data and compare the cost of proposed commitments with historic and projected budgets.

---

[170] U.S. Government Accountability Office. 2011. Oil and Gas Bonds: BLM Needs a Comprehensive Strategy to Better Manage Potential Oil and Gas Well Liability. GAO-11-292

[171] Freeman, L.R.; March, F,; Spensley, J.W. 1994. NEPA Compliance Manual, 2nd Edition. Government Institutes, Inc., Rockville MD

In order to fulfill NEPA's mandate and truly take a "hard look" at its actions, the government must do a full assessment of the environmental risks from proposed management. Examining the probability of mitigation measures being funded and implemented is a necessary part of analyzing environmental risks. Environmental risks tend to increase when mitigation measures are not funded and implemented. The relative risk associated with implementing each alternative is essential information for decision makers selecting a preferred alternative.

Assess and Address Bonding Shortfalls

Climate mitigation requires not only adequate implementation funding to insure mitigation requirements are enforceable, but importantly, performance bond dollar amounts that provide the BLM with essential revenue to cover long term mitigation, closure and reclamation costs of oil and gas well pads and infrastructure – including capping wells, decommissioning roads and compressor station sites, and cleanup of containment ponds. These bonds may be surety bonds, a third-party guarantee that an operator purchases from a private insurance company; or personal bonds accompanied by a financial instrument, such as a cashier's check or negotiable Treasury security. Unfortunately, federal bonding amounts are outdated and inadequate. The federal government, for example, only requires $25,000 for a statewide bond or $150,000 for a nationwide bond – no matter how many federal oil and gas wells a company has permitted and drilled.

Anderson et al. (2009) estimated that Wyoming has a current shortfall in bonding of around $814 million – a shortfall that will require taxpayers to clean up the messes. [172] U.S. GAO (2011) found that federal bonding amounts may not be sufficient to encourage operators to comply with reclamation requirements. In order to better internalize the externalities and improve fiscal responsibility, we recommend the BLM assess current reclamation and closure costs in the planning area and contrast those costs with the bonding amounts currently available. Is there a current shortfall in bonding for existing wells and infrastructure? If a bonding shortfall is present, a no new leasing option will help limit the current shortfall. The current shortfall in bonding for existing oil and gas wells should be examined as well as any additional shortfall from new wells proposed in each plan alternative.

If current bonding is less than climate mitigation needs, as well as reclamation and closure costs for current wells and infrastructure, any new additional wells will only serve to increase the fiscal liability for taxpayers. Under such fiscal conditions, a no new leasing option is warranted and should be evaluated in the RMP. for each alternative.

We recommend the BLM complete an analysis of closure and reclamation costs in the planning area and compare those costs with current bonding amounts. As part of this effort we recommend the BLM collect, analyze and make available to researchers site specific data on the closure and reclamation costs -- as well as the success of past reclamation efforts -- for well pads, roads, and pipelines on public land in the planning area.

[172] Andersen, M., R. Coupal, and B. White. 2009. Reclamation Costs and Regulation of Oil and Gas Development with Application to Wyoming. Western Economics Forum, Spring 2009

****

D. The FFO Must Take a Hard Look at Natural Gas Waste and Consider Alternatives to Prevent Waste including Phasing Development to Keep Pace with Gas Capture Infrastructure.

On November 18, 2016, BLM published its final methane waste rule in the Federal Register (Waste Prevention, Production Subject to Royalties, and Resource Conservation) 43 CFR Parts 3100, 3160 and 3170. According to the Preamble to the rule:

> This final regulation aims to reduce the waste of natural gas from mineral leases administered by the BLM. This gas is lost during oil and gas production activities through venting or flaring of the gas, and through equipment leaks. While oil and gas production technology has advanced dramatically in recent years, the BLM's rules to minimize waste of gas have not been updated in over 30 years. The Mineral Leasing Act of 1920 (MLA) requires the BLM to ensure that lessees ''use all reasonable precautions to prevent waste of oil or gas developed in the land,'' 30 U.S.C. 225, and that leases include ''a provision that such rules . . . for the prevention of undue waste as may be prescribed by [the] Secretary shall be observed,'' *id.* at § 187. The BLM believes there are economical, cost effective, and reasonable measures that operators can take to minimize gas waste. These measures will enhance our nation's natural gas supplies, boost royalty receipts for American taxpayers, tribes, and States, reduce environmental damage from venting, flaring, and leaks of gas, and ensure the safe and responsible development of oil and gas resources. 81 CFR 83009

The effective date of the rule is January 17, 2017 and it is now in full force and effect. Compliance dates for many of the requirements of the rule are deferred for one year until January 17, 2018, well within the planning horizon of the RMPA.

In the Preamble, BLM found that there is a significant amount of waste of natural gas on federal lands.

> In 2014, operators vented about 30 Bcf and flared at least 81 Bcf of natural gas from BLM-administered leases, totaling 4.1 percent of the total production from those leases in that year, and sufficient gas to supply nearly 1.5 million households with gas for a year. 81 CFR 83082

The rule was adopted to prevent as much of this waste as possible. The provisions of the rule will cover new leasing and drilling approvals under the RMPA. The rule also applies to existing leases and existing wells within the planning area.

As an initial matter, in the Preamble to the rule, BLM clearly states the critical role that land use planning and NEPA analysis must play in preventing methane waste on public lands. As applied to the RMPA, this language obligates the FFO to identify areas where gas capture

infrastructure is not available to get produced gas to market and where leasing and permitting should be restricted. The Preamble states:

> [T]he land use planning and NEPA processes are critical to achieving our simultaneous goals of responsible oil and gas development, land stewardship and resource conservation, and protection of air quality on (and reduction of air emissions from) Federal lands.
>
> The BLM already has land use planning and NEPA tools and processes in place that can be used to help achieve the specific goals of this rulemaking—to reduce the wasteful and environmentally harmful loss of gas through venting, flaring, and leaks … In particular, the land use planning and NEPA processes for new RMPs and MLPs provide important opportunities to consider the effects of oil and gas development over a larger area and to optimize planned development to minimize impacts from venting and flaring, among other activities. *The planning process gives the BLM the opportunity to consider how a specific land management plan could address the timing and location of development of oil and gas and related infrastructure, such as pipelines, and the projected consequences of such decisions in terms of the quantities of vented and flared gas and the impacts associated with those emissions.*
>
> *Thus, the BLM already has the NEPA processes and tools in place to evaluate the effects of the gas that would be flared, vented, and leaked from proposed oil and gas production, including impacts to wildlife and air quality, as well as GHG emissions, which contribute to climate change. The NEPA analyses can also identify ways to minimize such effects, such as evaluating alternative options for siting and timing of development that would maximize the opportunities for gas capture in lieu of flaring.* [emphasis added]

In addition to BLM's planning and NEPA obligations, the rule establishes ten requirements for operators to prevent natural gas waste on federal lands. These standards are all designed to prevent methane waste from a particular activity that operators conduct or equipment they utilize in the production of oil and gas. These provisions are:

1. Waste Minimization Plan. §3162.3-1 requires that an operator submitting an APD for a new well or multiple wells on a well pad must simultaneously submit a waste minimization plan. This plan must "set forth a strategy for how the operator will comply with the requirements of 43 CFR subpart 3179 regarding control of waste from venting and flaring, and must explain how the operator plans to capture associated gas upon the start of oil production." While the plan is not enforceable, it must be "complete and adequate" or the APD will denied or disapproved.

2. Ban on venting. §3179.6 prohibits operators from venting natural gas, requiring vented gas to be flared while establishing a narrow set of exceptions.

3. Gas capture percentage requirement. §3179.7 establishes gas capture percentage requirement to reduce the amount of flared gas. Capture percentages decline over time, from 85% in 2018-2019 to 98% after 2026. Operators who fail to meet these percentages must pay royalty on the amount of methane exceeding these percentages and are also subject to production curtailments or other enforcement actions.

4. Ban on venting during drilling and completions. §3179.101 and §3179.102 require operators to capture and sell, flare, use on site, or inject all gas that reaches the surface during these activities.

5. Requirement for replacement of pneumatic devices. §3179.201 and §3179.202 require the replacement of pneumatic controllers and pneumatic pumps that release gas over certain thresholds (i.e., high-bleed and intermediate-bleed devices). Replacement devices must release amounts of gas that are below these limits. Devices with releases that are routed to a flare or processing equipment are exempted from the requirements.

6. Requirement to route storage tank vapor gas to a sales line. §3179.203 requires that storage tanks that release gas over a certain threshold must route the gas to a sales line or, in certain circumstances, to a flare.

7. Requirement to minimize venting during liquids unloading. §3179.204 requires operators to minimize venting during downhole maintenance and liquids unloading by optimizing automated systems or, for wells without automated systems, by considering alternatives to manual purging.

8. Requirements for leak detection and repair. §3179.203 requires that operators inspect sites for leaks at least semi-annually and make repairs to eliminate leaks within thirty days of discovering a leak.

9. Requirements to measure vented and flared gas. §3179.9 requires operators to measure all gas that is vented and flared over 50 Mcf/day, and estimate gas volumes vented and flared below this threshold.

The BLM rule places an obligation on the FFO RMPA to take a hard look at natural gas waste both from existing leases and wells and from new leasing, drilling, and production. The RMPA must consider alternatives to prevent waste, including restricting the timing and location of new leasing and drilling to areas where gas capture infrastructure will be available to enable produced gas to be marketed.

The FFO is also obligated to address implementation of the mandatory waste prevention requirements contained in the rule through, among other mechanisms, lease stipulations and conditions of approval on drilling permits.

In 2014 NASA released a report identifying a methane “hot spot” over the San Juan

Basin.[173] The research found emissions through satellite imaging of 590,000 MT of methane annually between 2003-2009 (14,500,000 $MTCO_2e$). This is almost *twice as high* as the 330,000 MT (8,250,000 $MTCO_2e$) reported to the EPA GHG Reporting Program for 2012. In 2016 NASA released a subsequent study on the source of the concentrated methane emissions in the San Juan Basin, identifying 250 large methane plumes emitted from well pads, storage tanks, pipelines, gas processing plants, and venting from the San Juan coal mine.[174] Together these sources make up roughly half of all basin-wide methane emissions, and all but one of these sources is from the oil and gas industry.

Even absent BLM's methane waste rule, existing regulations through NTL-4A direct BLM policy with respect to waste. NTL-4A states unequivocally that "Except as provided in II.C and III above, *gas well gas may not be flared or vented*. The exceptions include emergencies, well purging, initial production testing, and routine well testing." §IV.A With respect to oil well gas, NTL-4A also states that:

> Oil well gas may not be vented or flared unless approved in writing by the Supervisor. The Supervisor may approve an application for the venting or flaring of oil well gas if justified either by the submittal of (1) *an evaluation report* supported by engineering, geologic, and economic data which demonstrates to the satisfaction of theSupervisor that the expenditures necessary to market or beneficially use such gas are not economically justified and that conservation of the gas, if required, would lead to the premature abandonment of recoverable oil reserves and ultimately to a greater loss of equivalent energy than would be recovered if the venting or flaring were permitted to continue or (2) *an action plan* that will eliminate venting or flaring of the gas within 1 year from the date of application. §IV.B [emphasis added]

BLM's implementing regulations—which underlie NTL4a and should inform BLM's revised waste rule—reflect these provisions, providing that "[t]he objective" of its MLA regulations in 43 C.F.R. Subpart 3160 "is to promote the orderly and efficient exploration, development and production of oil and gas." 43 C.F.R. § 3160.0-4. Subpart 3160 specifically requires BLM officials to ensure "that all [oil and gas] operations be conducted in a manner which *protects other natural resources and environmental quality*, protects life and property and results in the *maximum ultimate recovery of oil and gas with minimum waste and with minimum adverse effect on the ultimate recovery of other mineral resources*." 43 C.F.R. § 3161.2. The lease owner and or operator is similarly charged with "conducting all operations in a manner which ensures the proper handling, measurement, disposition, and site security of leasehold

---

[173] *See* NASA Science News, *U.S. Methane 'Hot Spot' Bigger than Expected*, Oct. 9, 2014, available at: http://science.nasa.gov/science-news/science-at-nasa/2014/09oct_methanehotspot/. *See also,* Eric A. Kort, *et al.*, *Four Corners: The largest US methane anomaly viewed from space*, GEOPHYSICAL RESEARCH LETTERS, Vol. 41, Issue 19, Oct 16, 2014 (attached as Exhibit 38).

[174] Christian Frankenberg, et al., *Airborne methane remote measurements reveal heavy-tail flux distribution in Four Corners region*, PNAS, vol. 113 no. 25 (Aug. 30, 2016) (attached as Exhibit 39).

production; which protects other natural resources and environmental quality; which protects life and property; and *which results in maximum ultimate economic recovery of oil and gas with minimum waste and with minimum adverse effect on ultimate recovery of other mineral resources*." 43 C.F.R. § 3162.1(a).

If not replaced by the waste rule, NTL-4A would obligate the FFO to take a hard look at measures to ensure that no gas well gas other than that excepted will be vented or flared from new gas wells. It would also obligate the FFO to take a hard look at procedures to ensure that no oil well gas will be vented or flared without prior approval. The FFO must also take a hard look at procedures that will ensure that evaluation reports or action plans are required to justify those approvals.

E. Managing for Community and Ecosystem Resiliency.

CEQ Guidance requires that agencies address the impacts of climate change on the environmental consequences of a proposed action. As the CEQ Guidance recognizes, "[c]limate change can make a resource, ecosystem, human community, or structure more susceptible to many types of impacts and lessen its resilience to other environmental impacts apart from climate change." Climate Guidance at 21. These effects are already occurring and are expected to increase, resulting in shrinking water resources, extreme flooding events, invasion of more combustible non-native plant species, soil erosion, loss of wildlife habitat, and larger, hotter wildfires. These impacts have been catalogued in recent scientific studies by federal agencies, including the National Climate Assessment,[175] and highlighted by President Obama. *See* Exec. Order No. 13,653, § 1. As the CEQ Guidance recognizes, "GHGs already in the atmosphere will continue altering the climate system into the future, even with current or future emissions control efforts." Climate Guidance at 20. In other words, climate change impacts are and will continue to be part of the new normal, and "managing th[o]se risks requires deliberate preparation, close cooperation, and coordinated planning … to improve climate preparedness and resilience; help safeguard our economy, infrastructure, environment, and natural resources; and provide for the continuity of … agency operations, services, and programs." Exec. Order No. 13,653, § 1.

NEPA analyses must account for this reality. While the CEQ Guidance suggests that existing and reasonably foreseeable climate change impacts be considered as part of an agency's hard look at impacts, the guidance must also account for the fact that climate change effects are and will continue to be a key component of the environmental baseline. Agencies are required under NEPA to "describe the environment of the areas to be affected or created by the alternatives under consideration." 40 C.F.R. § 1502.15. The affected environment discussion sets the "baseline" for the impacts analysis and comparison of alternatives. As the Ninth Circuit has recognized, "without establishing…baseline conditions…there is simply no way to determine what effect [an action] will have on the environment, and consequently, no way to comply with NEPA." *Half Moon Bay Fisherman's Marketing Ass'n v. Carlucci*, 857 F.2d 505, 510 (9th Cir. 1988) (explaining further that "[t]he concept of a baseline against which to compare predictions of the effects of the proposed action and reasonable alternatives is critical to the NEPA process").

[175] Available at http://nca2014.globalchange.gov/ (attached as Exhibit 6).

Excluding climate change effects from the environmental baseline ignores the reality that the impacts of proposed actions must be evaluated based on the already deteriorating, climate-impacted state of the resources, ecosystems, human communities, and structures that will be affected. Accordingly, BLM must clarify that existing and reasonably foreseeable climate change impacts as part of the affected environment in the planning area, which then must be assessed as part of the agency's hard look at impacts, and integrated into *each* of the alternatives, including the no action alternative. Put differently, simply acknowledging climate impacts as part of the affected environment is insufficient. BLM must incorporate that information into their hard look at impacts (e.g., the cumulative impact of climate change, the proposed action, and other past, present, and reasonably foreseeable impacts), in particular to help inform the design and consideration of alternatives and mitigation measures.

Critically, the RMPA should emphasize that agencies may not shirk their responsibility to assess climate change merely because of uncertainties. "Reasonable forecasting and speculation is…implicit in NEPA, and we must reject any attempt by agencies to shirk their responsibilities under NEPA by labelling any and all discussion of future environmental effects as 'crystal ball inquiry.'" *Save Our Ecosystems v. Clark*, 747 F.2d 1240, 1246 n.9 (9th Cir. 1984 (quoting *Scientists' Inst. for Pub. Info., Inc. v. Atomic Energy Comm*., 481 F.2d 1079, 1092 (D.C. Cir. 1973)). NEPA's hard look merely requires "a reasonably thorough discussion of the significant aspects of the probable environmental consequences" to "foster both informed decision-making and informed public participation." *Ctr. for Biological Diversity v. NHTSA*, 538 F.3d 1172, 1194 (9th Cir. 2008) (quotations and citations omitted). As here, BLM has refused to address the implications of their actions in the context of climate change on the basis of uncertainties, such as the lack of fine-scale modeling, which has led BLM to take short-sighted, arbitrary, and capricious action that does not, in fact, account for climate change.

In this context, and to accurately account for and integrate climate change impacts into the affected environment, hard look, alternatives, and mitigation analysis, BLM should evaluate the relevant resources, ecosystems, or communities for key vulnerabilities as part of the baseline assessment. The vulnerability of ecosystems and communities, as well as the species and physical elements they comprise, depends on their inherent qualities and their ability to change or adapt to address new climatic conditions. For example, the vulnerability of certain species can be affected by the tolerance of individual organisms to the direct effects of climate change, the ability of populations to adapt to those conditions through the expression of genetic variability, and the ability to adjust behaviorally to changes in the ecosystem, such as prey shifts. A vulnerability assessment would examine the species and physical elements of existing ecosystems and determine which elements are sensitive, which are resilient, which have the ability to adapt, and what the likely consequences would be of anticipated changes in climate. Human infrastructure—bridges, roads, buildings, etc.—should be assessed similarly.

Because ecosystems (including the human communities that rest within such ecosystems) are so complex, it is impossible to evaluate the vulnerabilities of every population, species, community, or other element of the system in question. Instead, risk assessment must focus on particular, high-priority elements or "key vulnerabilities." In its 5th Assessment Report, the IPCC suggested the following criteria for identifying key vulnerabilities:

- Exposure of society, community or social-ecological system to climate stressors.
- Importance of vulnerable system(s).
- Limited ability of society, community, or social-ecological systems to cope with and build adaptive capacities or limit the adverse consequences of climate related hazard.
- Persistence of vulnerable conditions and degree of irreversibility of consequences.
- Presence of conditions that make societies highly susceptible to cumulative stressors in complex and multiple-interacting systems.

In other words, key vulnerabilities are likely to occur where the effects of climate change are large and intense, imminent, long lasting, highly probable, irreversible, and likely to limit the distribution of highly valued systems or system elements. BLM should clarify that understanding and assessing these vulnerabilities, based on existing information and tools,[176] is a key component of the affected environment, hard look at impacts, and the design and consideration of alternatives and mitigation measures.

F. BLM Must Ensure NEPA Documentation Addresses Mitigation for Climate Impacts Consistent with All Relevant Laws and Policies, Including Current Mitigation Guidance.

NEPA's statutory language implicitly charges agencies with mitigating the adverse environmental impacts of their actions. *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 351-52 (1989); *Holy Cross Wilderness Fund v. Madigan*, 960 F.2d 1515, 1522 (10th Cir. 1992). Mitigation measures are required by NEPA's implementing regulations. 40 C.F.R. §§ 1502.14(f), 1502.16(h).

The CEQ has stated: "All relevant, reasonable mitigation measures that could improve the project are to be identified, even if they are outside the jurisdiction of the lead agency or the cooperation agencies ...." Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations, 46 Fed. Reg. 18026, 18031 (March 23, 1981). According to the CEQ, "[a]ny such measures that are adopted must be explained and committed in the ROD." Forty Questions, 46 Fed. Reg. at 18036.

The Tenth Circuit has held that an agency's analysis of mitigation measures "must be 'reasonably complete' in order to 'properly evaluate the severity of the adverse effects' of a proposed project prior to making a final decision." *Colo. Envt'l Coalition v. Dombeck*, 185 F.3d 1162, 1173 (10th Cir. 1999) (quoting Robertson, 490 U.S. at 352). Mitigation "must be discussed in sufficient detail to ensure that environmental consequences have been fairly evaluated." *City of Carmel-by-the-Sea v. U.S. Dep't of Transp.*, 123 F.3d 1142, 1154 (9th Cir. 1997) (quoting *Robertson*, 490 U.S. at 353).

[176] Where there is scientific uncertainty, agencies must satisfy the requirements of 40 C.F.R. § 1502.22.

"[O]mission of a reasonably complete discussion of possible mitigation measures would undermine the 'action-forcing' function of NEPA. Without such a discussion, neither the agency nor other interested groups and individuals can properly evaluate the severity of the adverse effects." *Robertson*, 490 U.S. at 353. A "perfunctory description," of mitigation, without "supporting analytical data" analyzing their efficacy, is inadequate to satisfy NEPA's requirements that an agency take a "hard look" at possible mitigating measures. *Neighbors of Cuddy Mountain v. U.S. Forest Serv.*, 137 F.3d 1372, 1380 (9th Cir. 1998). An agency's "broad generalizations and vague references to mitigation measures ... do not constitute the detail as to mitigation measures that would be undertaken, and their effectiveness, that the Forest Service is required to provide." *Id.* at 1380-81. *See also Northwest Indian Cemetery Protective Association v. Peterson*, 795 F.2d 688, 697 (9th Cir. 1986), rev'd on other grounds, 485 U.S. 439 (1988) ("A mere listing of mitigation measures is insufficient to qualify as the reasoned discussion required by NEPA."); *Idaho Sporting Congress v. Thomas*, 137 F.3d 1146, 1151 (9th Cir. 1988) ("Without analytical data to support the proposed mitigation measures, we are not persuaded that they amount to anything more than a 'mere listing' of good management practices."). Moreover, in its final decision documents, an agency must "[s]tate whether all practicable means to avoid or minimize environmental harm from the alternative selected have been adopted, and if not, why they were not." 40 C.F.R. § 1505.2(c).

CEQ also recognizes that the consideration of mitigation measures and reasonable alternatives is closely related. For example, CEQ's guidance on mitigation and monitoring states that "agencies may commit to mitigation measures considered as alternatives in an EA or EIS so as to achieve an environmentally preferable outcome." Council on Environmental Quality, Appropriate Use of Mitigation and Monitoring and Clarifying the Appropriate Use of Mitigated Findings of No Significant Impact (Jan. 14, 2011) at 1 (hereafter "CEQ Mitigation Guidance"); *see also id.* at 6-7 ("When a Federal agency identifies a mitigation alternative in an EA or an EIS, it may commit to implement that mitigation to achieve an environmentally-preferable outcome.").

Guidance from CEQ specifically directs agencies to consider where appropriate a variety of mitigation measures for actions that will cause climate pollution, including measures that will capture or use methane emissions:

> As Federal agencies evaluate potential mitigation of GHG emissions and the interaction of a proposed action with climate change, the agencies should also carefully evaluate the quality of that mitigation to ensure it is additional, verifiable, durable, enforceable, and will be implemented. Agencies should consider the potential for mitigation measures to reduce or mitigate GHG emissions and climate change effects when those measures are reasonable and consistent with achieving the purpose and need for the proposed action. Such mitigation measures could include enhanced energy efficiency, lower GHG-emitting technology, carbon capture, carbon sequestration (e.g., forest, agricultural soils, and coastal habitat restoration), sustainable land management practices, and capturing or beneficially using GHG emissions such as methane.[177]

[177] Climate Guidance at 19 (attached as Exhibit 4) (citation omitted).

1. Consistent with the Mitigation Hierarchy, BLM Must Avoid, Minimize and Offset Impacts from Fossil Fuels Made Available by the RMPA, Including Climate Change-Related Impacts.

BLM has significant obligations and authority related to mitigation for all unavoidable impacts. Secretarial Order 3330 requires the development of a landscape-scale mitigation policy for the Department of the Interior, which is appropriately done at the field office plan level. Section 4(c) of Secretarial Order 3330 directs the Department of the Interior's Energy and Climate Change Task Force to:

> [I]dentify any new policies or practices, revisions to existing policies or practices, or regulatory or other changes that could be implemented to incorporate landscape-scale planning into mitigation-related decisions… The Task Force will also determine what steps can and should be taken to ensure that mitigation opportunities are identified as early in the permitting process as possible, such as at the scoping or pre-application stage, to maximize predictability and transparency in the review and permitting process.

In a report to the Secretary of the Interior, the Energy and Climate Change Task Force laid out a landscape approach to mitigation.[178] This approach contained the following steps:

> 1. Identifying key landscape attributes, and the conditions, trends and baselines that characterize these attributes;
>
> 2. Developing landscape-scale goals and strategies;
>
> 3. Developing efficient and effective compensatory mitigation programs for impacts that cannot be avoided or minimized; and
>
> 4. Monitoring and evaluating progress and making adjustments, as necessary, to ensure that mitigation is effective despite changing conditions.

BLM's current guidance (IM No. 2013-142 and Draft Manual Section 1794) states that as part of approving specific land uses, mitigation implementation may be "within (onsite) or outside of the area of impact." The manual emphasizes that onsite mitigation is always the first choice, including a "mitigation priority order," then discusses options to provide offsite mitigation by replacing or providing similar or substitute resources or values through "restoration, enhancement, creation, or preservation."

BLM's policy emphasizes that it is designed to "shift the BLM's mitigation focus from a permit-by-permit perspective to a proactive regional-scale mitigation planning perspective" and

---

[178] Clement, J.P. *et al.*, A strategy for improving the mitigation policies and practices of the Department of the Interior. A report to the Secretary of the Interior from the Energy and Climate Change Task Force (April 2014), available at: https://www.doi.gov/sites/doi.gov/files/migrated/news/upload/Mitigation-Report-to-the-Secretary_FINAL_04_08_14.pdf (attached as Exhibit 145).

to cut across jurisdictions and land ownership to "attain the highest mitigation benefit, regardless of land ownership."[179] These key tools from the agency's guidance should also be emphasized as important aspects of incorporating mitigation into land use planning.

BLM is also considering new tools and approaches the agency could use to increase the effectiveness of mitigation on public lands, including layering protective management and designations and exploring creative ways existing authorities could be used for conservation benefits. Effective new mitigation tools and approaches should be integrated into planning as well.

Mitigating climate-related impacts includes avoiding and minimizing generation of GHG emissions through management prescriptions and preventing harm to carbon sinks. The CEQ guidance on considering climate change in NEPA analyses provides that agencies should analyze reasonable alternatives that would mitigate both direct and indirect GHG emissions impacts and the cumulative effects of climate change (e.g., enhanced energy efficiency, carbon sequestration, lower GHG-emitting technology).[180] BLM must address the quality of mitigation measures as well as ensure they are additional, verifiable, durable, enforceable, and will be implemented.

In addition to the legal and policy directions which require mitigation for climate impacts from the Mancos RMPA and provide the agency with ample discretion to require mitigation, it is important to underscore that, as a land manager, the federal government in general and BLM in particular are facing huge and rapidly escalating costs to address the impacts caused by fossil-fuel driven climate change. Forest fires, widespread drought, unusual flooding, rising sea levels, spread of invasive species and spread of disease already result in significant costs to the federal government, and each new fossil fuel production project that BLM authorizes through the Uncompahgre plan will worsen these problems and increase the associated costs. Research from the University of Vermont's Gund Institute for Ecological Economics and The Wilderness Society suggests that total costs in degraded ecosystem services on federal public lands could exceed $14.5 billion annually under a 2-degree Celsius warming scenario.[181] These costs are ultimately borne by all American taxpayers, and BLM has a responsibility to recoup these costs when it makes decisions authorizing activities that cause these impacts and associated costs.

---

[179] BLM, *Draft – Regional Mitigation*, Manual Section 1794 at 1-3 (attached as Exhibit 146).

[180] Climate Guidance at 13, 16 (attached as Exhibit 4).

[181] *See* Esposito, Valerie; Phillips, Spencer; Boumans, Roelof; Moulaert, Azur; Boggs, Jennifer. 2011. "Climate change and ecosystem services: The contribution of and impacts on federal public lands in the United States." In: Watson, Alan; Murrieta-Saldivar, Joaquin; McBride, Brooke, comps. *Science and stewardship to protect and sustain wilderness values: Ninth World Wilderness Congress symposium*; November 6-13, 2009; Merida, Yucatan, Mexico. Proceedings RMRS-P-64. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. p. 155-164, available at: http://www.fs.fed.us/rm/pubs/rmrs_p064.pdf (last viewed Oct. 27, 2016) (attached as Exhibit 147).

2. BLM Should Adopt a Mitigation Strategy as Part of the Mancos RMPA to Address Unavoidable Climate Change Impacts.

To comply with NEPA's mandates, and BLM policy, concerning mitigation, BLM should require compensatory mitigation to offset the unavoidable direct and indirect climate change impacts of the Mancos RMPA. Such mitigation would contain several key features:

- *BLM should quantify and offset emissions through specific compensatory mitigation actions*

Quantifying climate change impacts is becoming increasingly more practical, and the science connecting impacts to temperature changes increasingly more precise. Compensatory mitigation actions can be directed at enhancing the adaptive capacity of human and natural communities in the affected landscape to improve their health and resilience in the face of expected change. Offsetting actions should include investments in land protection to ensure that the FFO's ecological systems have the space and conditions to adapt.

Significant opportunity exists to offset GHG emissions. EPA has repeatedly urged land management agencies to assess carbon offsets in Environmental Assessments and EISs as a way to reduce the climate change impacts of agency actions. For example, EPA specifically recommended that the Forest Service's Lease Modifications EIS for the West Elk Mine "acknowledge that revenues for carbon credits are available via several existing markets."[182] Similarly, EPA has recommended that a Forest Service NEPA analysis of a forest health project "discuss reasonable alternatives and/or potential means to mitigate *or offset* the GHG emissions from the action."[183] Numerous state agencies already use offsets to control GHG emissions.[184] Offsets can include participation in third-party offset markets or renewable energy credits.

In any subsequently prepared NEPA document, the BLM should consider mitigation measures that offset the direct and indirect carbon emissions attributable to the draft plan alternatives – 27 million tons. Specifically, BLM should consider requiring that purchasers of fossil fuel leases be required to purchase offsets from reputable carbon markets that offset the direct and indirect greenhouse gas emissions from the mining and combustion of fossil fuels from their leases.

---

[182] EPA July 2012 Comment Letter at 5 (attached as Exhibit 148) (identifying four U.S. carbon exchanges creating a market for carbon credits).

[183] Letter of L. Svoboda, EPA, to T. Malecek, USFS, at 8 (Oct. 27, 2010) (attached as Exhibit 149).

[184] *See, e.g.*, Settlement Agreement, ConocoPhillips and California (Sept. 10, 2007) (California agency requiring offsets as a condition of approving a project) (attached as Exhibit 150); Minn. Stat. § 216H.03 subd. 4(b) (Minnesota law requiring offsets for certain new coal-fired power plants); Me. Rev. Stat. Ann. tit. 38, § 580-B(4)(c) (Maine law establishing greenhouse gas initiative that includes the use of carbon offsets).

- *BLM should address the full scope of lifecycle emissions through avoidance, minimization, and compensatory mitigation for fossil fuel production, transport and combustion.*

The premise of compensatory mitigation is to address unavoidable harm. In the case of fossil fuel production, the harm from GHG emissions is primarily attributable to end-use combustion. Nevertheless, BLM should at least address the direct emissions that could be avoided or minimized by, for example, requiring the capture or combustion of methane, adopting enforceable mitigation requirements to minimize methane emissions and waste from oil and gas production, etc.

- *BLM should specify whether compensatory mitigation should be paid on an annual basis or paid up front.*

Fees collected for compensatory mitigation are often paid in a lump sum at the beginning of a project's operational life. In the case of climate impacts, however, it may make more sense to consider an annual payment on the basis of production, or an annualized payment schedule based on expected production with corrections on a semi-annual basis. By spreading payments over the life of the project (and tying them to when the impacts actually occur), the system should be both fairer to producers and more true to the spirit of mitigation.

- *BLM must ensure that compensatory mitigation actions are additional and durable, and last for the duration of impacts.*

This is an established principle for the Department's approach to mitigation, but it is particularly important with regard to climate impacts. For example, the Australian Government's Climate Change Authority found that, "Assessing additionality is a key feature of all baseline and credit schemes. An additionality test assesses whether a project or activity creates 'additional' emissions reduction that would not have occurred in the absence of the incentive. The baseline for the project assesses how much emissions have been reduced. Additionality is important to ensure that a baseline and credit scheme does not pay for emissions reductions that would have occurred anyway."[185]

IV. BLM Must Take a Hard Look at the Direct, Indirect and Cumulative Impacts of Oil and Gas Leasing and Development on Resource Values in the Planning Area.

A. The FFO Must Take a Hard Look at Certain Impacts to Air Quality.

1. Air Resource Mitigation Measures

BLM should commit to implementation of specific and enforceable management actions that ensure no significant impacts to air quality and air quality related values—as determined by

[185] *See* Australian Government Climate Change Authority, *Additionality*, http://www.climatechangeauthority.gov.au/reviews/carbon-farming-initiative-study/additionality.

air quality modeling—in the RMPA/EIS. Specifically, BLM must consider Best Management Practices (BMPs) to ensure that human health and the environment are protected from oil and gas drilling over the life of the new RMPA.

2. Ozone Impacts

Background concentrations of ozone in the Farmington planning area are already at or exceed the National Ambient Air Quality Standards ("NAAQS"), leaving virtually no room for growth in emissions. The RMPA must also include wintertime ozone monitoring information within the planning area. Spikes in ozone levels have been documented to occur in oil and gas producing basins in the Western United States during cold, snowy periods when wintertime "inversions" concentrate air pollutants from oil and gas activities.[186] Adding hundreds of additional oil and wells to the area will add hundreds of tons of additional ozone precursors to the region, threatening considerable exceedances of the ozone NAAQS—especially in wintertime in the region's valleys. *See id.*

BLM may not avoid including winter ozone modeling, even if information about winter ozone levels is incomplete. According to NEPA regulation, if an estimation of reasonably foreseeable significant adverse impacts cannot be obtained because, among other things, the means to obtain it are "not known," BLM has an obligation to include an evaluation "based upon theoretical approaches or research methods generally accepted in the scientific community," provided that "the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason." 40 C.F.R. § 1502.22. These methods of dealing with incomplete information are required under NEPA and must be thoroughly exercised before drawing the conclusion that a wintertime ozone analysis cannot be included in the RMPA/EIS. *See id*.

BLM has, in fact, modeled winter ozone concentrations for other recent NEPA actions. Even though BLM did not perform a winter ozone modeling analysis of the proposed development, modeling results for wintertime ozone concentrations were included as part of the base case modeling performance evaluation for the Continental Divide-Creston (CD-C) DEIS in Wyoming.[187] The DEIS included model performance evaluations for the 2005 and 2006 base case scenarios based on CD-C project modeling and on previously-conducted modeling for the Hiawatha Regional Energy Development Project EIS (Hiawatha). The results of the base case modeling evaluations suggest it is not unreasonable or inappropriate to include wintertime modeling results in BLM's analysis. Specifically, model results are presented in the CD-C DEIS and compared with year-round monitoring data at several sites.[188] In general, the modeling results appear to underestimate winter ozone concentrations, but not in all cases.[189] Generally,

---

[186] Peter M. Edwards et al., *High Winter Ozone Pollution from Carbonyl Photolysis in an Oil and Gas Basin*, 514 Nature 351 (October 16, 2014).
[187] *See* BLM Continental Divide-Creston (CD-C) AQTSD Appendix A.
[188] BLM CD-C AQTSD Appendix A at 68.
[189] *See*, *e.g.*, BLM CD-C AQTSD Appendix A at 68 (Close to the project area, the performance of the CD-C and Hiawatha modeling appears to be reasonably good "with the exception of a few

the results of the CD-C DEIS performance evaluation indicate that there is a tendency towards underestimation, especially at observed maximum concentrations in winter. Even so, if modeled wintertime ozone concentrations are shown to be a problem and the performance evaluation for the modeling indicates that modeled results likely underestimate impacts in winter then, at a minimum, the BLM would have an obligation under NEPA to reduce emissions from the proposed development in order to ensure there will be no significant impacts to wintertime ozone levels based on the modeling, as evaluated (with an underestimation bias). BLM should consider a similar approach for the RMPA/EIS. As shown by the high wintertime ozone levels nearby in Rangely, in the Uinta Basin in Utah, as well as in Wyoming's Sublette County, wintertime ozone near concentrated oil and gas development has simply become far too big of an issue, of tremendous public interest and concern, to be ignored in this long-term planning action.

Ozone has long been recognized to cause adverse health effects. Exposure to ozone can cause or exacerbate respiratory health problems—including shortness of breath, asthma, chest pain and coughing—can decrease lung function, and can even lead to long-term lung damage. *See also* EPA's National Ambient Air Quality Standards for Particulates and Ozone, 62 FR 38,856 (July 18, 1997). Short term exposure to ozone causes multiple negative respiratory effects, from inflammation of airways to more serious respiratory effects that can lead to use of medication, absences from school and work, hospital admissions, emergency room visits, and chronic obstructive pulmonary disease ("COPD"). According to a recent report by the National Research Council ("NRC"), short-term exposure to current levels of ozone in many areas is likely to contribute to premature deaths.[190] As described in more detail below, even ozone concentrations as low as 60 ppb can be harmful to human health. Long-term exposure to elevated levels of ozone results in numerous negative harmful effects, such as permanent lung damage and abnormal lung development in children. Long-term exposure may also increase risk of death from respiratory problems. Short- and long-term exposure to elevated levels of ozone can also harm people's hearts and cardiovascular systems. *See* 79 Fed. Reg. 75234-311.

On October 26, 2015, EPA published a final rule to revise the NAAQS for ozone to 70 parts per billion (ppb) from the current 75 ppb. National Ambient Air Quality Standards for Ozone, 80 Fed. Reg. 65292 (Oct. 26, 2015). This decision was driven by significant recent scientific evidence that the standard of 75 ppb was not adequately protecting public health. *Id.* at 136. In fact, recent studies have documented decreased lung functioning and airway inflammation in young, healthy adults at ozone concentrations as low as 60 ppb. *Id.* at 146.

Additionally, climate change is likely to worsen ozone pollution, offsetting the improvements in air quality and public health that would be expected from reductions in emissions of ozone precursors. As described by the EPA in its recent ozone rulemaking:

> In addition to being affected by changing emissions, future O_3 concentrations may also be affected by climate change. Modeling studies in the EPA's Interim

---

days, the two base case simulations reproduce the observed ozone at [the OCI monitor] reasonably well.").

[190] National Research Council, *Link Between Ozone Air Pollution and Premature Death Confirmed,* (April 2008), available at: http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=12198.

> Assessment (U.S. EPA, 2009a) that are cited in support of the 2009 Endangerment Finding under CAA section 202(a) (74 FR 66496, Dec. 15, 2009) as well as a recent assessment of potential climate change impacts (Fann et al., 2015) project that climate change may lead to future increases in summer O_3 concentrations across the contiguous U.S. While the projected impact is not uniform, climate change has the potential to increase average summertime O_3 concentrations by as much as 1-5 ppb by 2030, if greenhouse gas emissions are not mitigated. Increases in temperature are expected to be the principal factor in driving any O_3 increases, although increases in stagnation frequency may also contribute (Jacob and Winner, 2009). If unchecked, climate change has the potential to offset some of the improvements in O_3 air quality, and therefore some of the improvements in public health, that are expected from reductions in emissions of O_3 precursors.

80 Fed. Reg. 65292, 65300 (October 26, 2015). For example, climate change impacts include an increase in the area burned by wildfires, which, in turn are sources of O_3 precursors. *Id.* at 65371.

3. Hazardous Air Pollutant Impacts

The FFO should look at additional hazardous air pollutant impacts from projected development, including the impacts from 1,3-butadiene and secondary formaldehyde that will result from the proposed development. The BLM has completed a more comprehensive analysis of HAPs in other recent NEPA actions which resulted in significant impacts from HAPs. Specifically, the Gasco EIS in Utah evaluated short-term and long-term impacts from numerous HAPs, including methanol, chlorinated solvents and acrolein.[191] The Gasco EIS analysis found elevated cancer risks for acetaldehyde, 1,3-butadiene, and ethylene dibromide.[192] The Gasco EIS also reported acrolein emissions that exceeded the acute Reference Exposure Level (REL) and the Reference Concentration for Chronic Inhalation (RfC).[193] BLM must include a more comprehensive analysis of HAP impacts and, in addition to the HAPs identified above, the BLM should also assess any HAP impacts associated with volatile emissions from hydraulic fracturing fluids. It is important to continue to improve upon the HAP analyses conducted under NEPA in order to ensure there are no significant health impacts from near-field exposure to HAPs from the proposed development in the planning area. *See* 40 C.F.R. §1508.27(b)(2).

4. Visibility and Ecosystem Impacts

Much of air pollution from oil and gas development and operations also degrades visibility. Section 169A of the Clean Air Act ("CAA"), 42, U.S.C. § 7401 *et seq.* (1970) sets forth a national goal for visibility, which is the "prevention of any future, and the remedying of any existing, impairment of visibility in Class I areas which impairment results from manmade air pollution." Congress adopted the visibility provisions in the CAA to protect visibility in "areas of great scenic importance." H.R. Rep. No. 294, 95th Cong. 1st Sess. at 205 (1977). In

[191] *See* BLM Gasco Energy Project FEIS, Table 4-12, Table 4-19 and Appendix H. April 2010.
[192] BLM Gasco FEIS Table 4-19.
[193] BLM Gasco FEIS Appendix H, at H-45.

promulgating its Regional Haze Regulations, 64 Fed. Reg. 35,714 (July 1, 1999), the U.S. Environmental Protection Agency ("EPA") provided:

> Regional haze is visibility impairment that is produced by a multitude of sources and activities which emit fine particles and their precursors and which are located across a broad geographic area. Twenty years ago, when initially adopting the visibility protection provisions of the CAA, Congress specifically recognized that the "visibility problem is caused primarily by emission into the atmosphere of SO2, oxides of nitrogen, and particulate matter, especially fine particulate matter, from inadequate[ly] controlled sources." H.R. Rep. No. 95-294 at 204 (1977). The fine particulate matter (PM) (e.g., sulfates, nitrates, organic carbon, elemental carbon, and soil dust) that impairs visibility by scattering and absorbing light can cause serious health effects and mortality in humans, and contribute to environmental effects such as acid deposition and eutrophication.

The visibility protection program under sections 169A, 169B, and 110(a)(2)(J) of the CAA is designed to protect Class I areas from impairment due to man-made air pollution. The current regulatory program addresses visibility impairment in these areas that is "reasonably attributable" to a specific source or small group of sources, such as, here, air pollution resulting from oil and gas development and operations authorized by the RMP. *See* 64 Fed. Reg. 35,714.

Moreover, EPA finds the visibility protection provisions of the CAA to be quite broad. Although EPA is addressing visibility protection in phases, the national visibility goal in section 169A calls for addressing visibility impairment generally, including regional haze. *See e.g., State of Maine v. Thomas*, 874 F.2d 883, 885 (1st Cir. 1989) ("EPA's mandate to control the vexing problem of regional haze emanates directly from the CAA, which 'declares as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in Class I areas which impairment results from manmade air pollution.' ") (citation omitted).

5. Air Quality Impacts on Human Health

Although adherence to air quality mitigation and NAAQS standards will have a positive relationship to human health, poor baseline air quality conditions due to direct, indirect and cumulative impacts in the planning area warrants an independent hard look analysis at human health; and, moreover, such analysis is required by NEPA and CEQ implementing regulations.

Ozone is just one air-related byproduct of oil and gas development that may pose serious impacts to human health. Recent studies in Garfield County confirm that air toxics are generated during every stage of oil and gas development and can have potentially significant health impacts even at concentrations below regulatory thresholds.[194] Another recent study undertaken in rural Colorado locations found that women who lived close to gas wells were more likely to have

[194] Theo Colborn et al., *An exploratory study of air quality near natural gas operations*, HUM. ECOL. RISK ASSESS (Nov. 9, 2012) (attached as Exhibit 156).

children born with a variety of defects, from oral clefts to heart issues.[195] And, yet another recent study found that people who lived less than half a mile from a gas well had a higher risk of health issues. The research found a small increase in cancer risk and alleged that exposure to benzene was a major contributor to the risk.[196]

Oil and gas development is one of the largest sources of VOCs, ozone, and sulfur dioxide emissions in the United States. The relationship between air quality and human health must be analyzed in the RMPA/EIS. The failure of the FFO to do so would represent a fundamental shortcoming in the agency's analysis. "The agency must examine the relevant data and articulate a satisfactory explanation for its action including a 'rational connection between the facts found and the choice made.'" *Motor Vehicle Mfrs.,* 463 U.S. at 43 (1983).

B. The BLM Must to Take a Hard Look at Impacts to Human Health.

As introduced above, emissions from oil and gas development are not limited only to the combustion stage but, rather, occur throughout the chain of production. These emissions not only impact the critical resource values of the FFO – as detailed throughout these Comments – but also can result in serious harm to human health. BLM must fully consider the potential human health impacts that may be caused by oil and gas operations approved under the RMPA, as required by NEPA.[197] Congress stated that "…it is the continuing responsibility of the Federal Government to use all practicable means…to attain the widest range of beneficial uses of the environment **without degradation, risk to health or safety**, or other undesirable and unintended consequences…" 42 U.S.C. § 4331 (emphasis added). NEPA implementing regulations direct agencies to consider "the degree to which the proposed action affects public health or safety." 40 C.F.R. § 1508.27(b). These regulations also state: "Federal agencies shall to the fullest extent possible…. Use all practicable means, consistent with the requirements of the Act and other essential considerations of national policy, to restore and enhance the quality of the human environment and avoid or minimize any possible adverse effects of their actions upon the quality of the human environment." 40 C.F.R. § 1500.2(f).

1. The FFO Must Conduct a Health Impact Assessment.

BLM must conduct a health impact assessment, or equivalent analysis, as required by NEPA and its implementing regulations. NEPA requires that the BLM employ at least the same level of effort to analyze human health impacts as it does to promote industry's interest in development when preparing the RFD and associated analyses regarding projected drilling levels.

---

[195] Lisa M. McKenzie et al., *Birth Outcomes and Maternal Residential Proximity to Natural Gas Development in Rural Colorado,* ENVIRONMENTAL HEALTH PERSPECTIVES (April 2014) (attached as Exhibit 157).
[196] McKenzie *et al*.
[197] *See* Second Community Health Impact Report (HIR-2) Oil Well Exposure, Counselor Chapter Residents (attached as Exhibit 35); Testimonial from Daniel Tso, Community Member, Counselor Chapter (attached as Exhibit 36); Testimonial from Kendra Pinto, Community Member (attached as Exhibit 44).

A health impact assessment ("HIA") or equivalent analysis would fulfill the regulations governing NEPA, to examine human health impacts "to the fullest extent possible." A HIA would be forward-looking and attempt to identify all of the potential direct, indirect, and cumulative links between a proposed activity and the health and well-being of affected communities, and to develop mitigation measures to minimize harms and maximize benefits. The RMPA must include this type of analysis of human health impacts.

The U.S. EPA has posted on its website an excellent document on the utility of an HIA as part of the NEPA analysis of federal agencies where public health impacts are at issue.[198] HIA "provides a systematic process and methodology to anticipate and proactively address the potential health consequences of a program or policy in order to maximize the potential benefits and minimize adverse outcomes."[199] Steps in the HIA process include:

1. Screening: Determines whether an HIA is necessary, and whether it is likely to be useful.
2. Scoping: Establish the population to which the HIA applies, the scope of health problems to be analyzed, the HIA team, methods to be used in the assessment, and data sources.
3. Assessment: describe the baseline health status and determinants of health in the population and assess likely impacts through a literature review and qualitative or quantitative analysis.
4. Decision and recommendations to minimize adverse impacts and maximize benefits.
5. Monitoring and reassessment plan: select a set of outcomes likely to be sensitive/accurate indicators of the changes predicted, such as health outcomes and develop a plan to monitor and then reassess if needed.

The BLM did not conduct these steps, and did not analyze the impacts to the population within the planning area, considering how many people might be exposed to health impacts, analyze where development would take place relative to water sources or residences, or assess the likely impacts to the actual population in the area, including particularly vulnerable populations. It also omitted significant potential impacts. For example, the agency did not include any potential impacts from vehicle accidents or other safety issues, or the illness caused by the stress and mental anguish associated with living near intensive oil and gas development.

According to the U.S. Centers for Disease Control, "HIA can be used to evaluate objectively the potential health effects of a project or policy before it is built or implemented. It can provide recommendations to increase positive health outcomes and minimize adverse health outcomes. A major benefit of the HIA process is that it brings public health issues to the

---

[198] *See* EPA, Human Impact Partners, *Frequently Asked Questions About Integrating Health Impact Assessment into Environmental Impact Statement,* available at: http://www.epa.gov/region9/nepa/PortsHIA/pdfs/FAQIntegratingHIA-EIA.pdf (attached as Exhibit 281).

[199] *See* Aaron Wernham, *Inupiat Health and Proposed Alaskan Oil Development: Results of the First Integrated Health Impact Assessment/Environmental Impact Statement for Proposed Oil Development on Alaska's North Slope*, ECOHEALTH, 2007 (attached as Exhibit 282).

attention of persons who make decisions about areas that fall outside of traditional public health arenas, such as transportation or land use."[200]

BLM must also include impacts to water resources from fracking in its examination of health effects. Any later, site-specific analysis and application of mitigation measures is no substitute for analysis of impacts and development of alternatives and mitigation measures at the RMPA/EIS level. Waiting for the approval of site-specific projects forecloses not only analysis of the true impacts of the agency action that is actually being proposed, but in so doing, forecloses the ability of BLM, other agencies, and the public to identify at an early stage the significant environmental issues that are deserving of study in this EIS. This RMPA is a major point in the leasing decisionmaking process, requiring analysis of all of the impacts at this stage.

2. Health data

In Colorado, symptoms reported in the state's inspection/incident database by residents living within a half mile of well development included headaches, nausea, upper respiratory irritation, and nosebleeds.[201] In Pennsylvania, the following symptoms were reported by over half the people living near gas development who responded to a health survey. They included fatigue (62%), nasal irritation (61%), throat irritation (60%), sinus problems (58%), burning eyes (53%), shortness of breath (52%), joint pain (52%), feeling weak and tired (52%), severe headaches (51%), and sleep disturbance (51%). The survey was completed by 108 individuals (in 55 households) in 14 counties across Pennsylvania.[202]

These and additional recent studies that were not considered by BLM include:

1. Lisa M. McKenzie et al., *Birth Outcomes and Maternal Residential Proximity to Natural Gas Development in Rural Colorado,* Environmental Health Perspectives (April 2014) (attached above as Exhibit 157).

2. Jessica Gilman, *et al., Source signature of volatile organic compounds (VOCs) from oil and natural gas operations in northeastern Colorado*, ENVIRONMENTAL SCIENCE & TECHNOLOGY (2013) (attached as Exhibit 286).

3. John L. Adgate, *et al., Potential Public Health Hazards, Exposures and Health Effects from Unconventional Natural Gas Development*, ENVIRONMENTAL SCIENCE & TECHNOLOGY (2014) (attached as Exhibit 295).

---

[200] Centers for Disease Control, *Health Impact Assessment*, available at: http://www.cdc.gov/healthyplaces/hia.htm (attached as Exhibit 283).
[201] Roxana Z. Witter, *et al., The Use of Health Impact Assessment for a Community Undergoing Natural Gas Development,* FRAMING HEALTH MATTERS (2013) (attached as Exhibit 284).
[202] Nadia Steinzor, *et al*., *Investigating links between shale gas development and health impacts through a community survey project in Pennsylvania*, NEW SOLUTIONS, vol. 23 iss. 1. (2013) (attached as Exhibit 285).

4. Seth Shonkoff, *et al., Environmental Public Health Dimensions of Shale and Tight Gas Development*, ENVIRONMENTAL HEALTH PERSPECTIVES (2014) (attached as Exhibit 287).

5. Christopher W. Moore, *et al., Air Impacts of Increased Natural Gas Acquisition, Processing, and Use: A Critical Review*, ENVIRONMENTAL SCIENCE & TECHNOLOGY (2014) (attached as Exhibit 288).

6. Avner Vengosh, *et al., The effects of shale gas exploration and hydraulic fracturing on the quality of water resources in the United States*, PROCEDIA EARTH AND PLANETARY SCIENCE (2014) (attached as Exhibit 289).

7. Christopher D. Kassotis, *et al., Estrogen and Androgen Receptor Activities of Hydraulic Fracturing Chemicals and Surface and Ground Water in a Drilling-Dense Region*, Endocrinolgy (2014) (attached as Exhibit 176). (attached above as Exhibit 176).

8. Brian E. Fontenot, *et al., An Evaluation of Water Quality in Private Drinking Water Wells Near Natural Gas Extraction Sites in the Barnett Shale Formation*, ENVIRONMENTAL SCIENCE & TECHNOLOGY (2013) (attached as Exhibit 290).

9. Sherilyn A. Gross, *et al., Analysis of BTEX Groundwater Concentrations from Surface Spills Associated with Hydraulic Fracturing Operations*, JOURNAL OF THE AIR & WASTE MANAGEMENT ASSOCIATION (2013) (attached as Exhibit 291).

10. K.D. Retzer, *et al., Motor vehicle fatalities among oil and gas extraction workers,* ACCIDENT ANALYSIS & PREVENTION (2013) (attached as Exhibit 292).

11. Eric J. Esswein, *et al, Occupational exposures to respirable crystalline silica during hydraulic fracturing*, JOURNAL OF OCCUPATIONAL AND ENVIRONMENTAL HYGIENE (2013) (attached as Exhibit 293).

12. R.Z. Witter, *et al., Occupational exposures in the oil and gas extraction industry: state of the science and research recommendations*, AMERICAN JOURNAL OF INDUSTRIAL MEDICINE (2014) (attached as Exhibit 294).

13. Physicians for Social Responsibility, *Compendium of Scientific, Medical, and Media Findings Demonstrating Risks and Harms of Fracking (Unconventional Oil and Gas Extraction)*, Third Edition (October 14, 2015), available at: http://www.psr.org/assets/pdfs/fracking-compendium.pdf (attached as Exhibit 326).

14. Gayathri Vaidyanathan, *Fracking Can Contaminate Drinking Water*, Climate Wire (April 4, 2016), available at: https://www.scientificamerican.com/article/fracking-can-contaminate-drinking-water/ (last visited November 1, 2016).

15. A. Austin, et al., *Associations Between Unconventional Natural Gas Development and Nasal and Sinus, Migraine Headache, and Fatigue Symptoms in Pennsylvania*, Environmental Health Perspectives (July 31, 2016), available at:

http://ehp.niehs.nih.gov/wp-content/uploads/advpub/2016/8/EHP281.acco.pdf (attached as Exhibit 327).

EPA is also currently investigating the potential impacts of hydraulic fracturing on drinking water resources due to concerns about its potential environmental and human health impacts. Until such research is completed, there is insufficient information to fully understand the potential impacts on human health, an uncertainty that the BLM must take into consideration. The EPA is still in the process of completing this study. Nevertheless, the BLM ignored the uncertainty of the impacts of hydraulic fracturing on drinking water. BLM must consider these studies in any subsequently prepared NEPA document to ensure that it took the required hard look at health impacts.

3. Cumulative impacts on human health

BLM must also fully consider cumulative health impacts of different alternatives. Because the BLM will be leasing minerals located directly beneath and adjacent to private property, and because thousands of people live in close proximity to the industrial activity that will be permitted by the agency, BLM has the responsibility to consider potential impacts on human health from all development, and look at them cumulatively. For example, an individual exposed to both air and water pollution will have different health impacts than an individual exposed only to air pollution.

The assessment of cumulative impacts in NEPA documents is required by CEQ regulations. *See* 40 C.F.R. §1508.25 (Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act). Oil and gas development involves multiple sources of pollutants and disturbance caused by connected actions, including the operations of wellpads, trucks, wells, compressors, pipelines, tanks, pits, separators, dehydrators, rigs and more. Oil and gas development also includes hundreds of potential pollutants, both man-made and naturally occurring. When considered together, pollutants emitted with common timing and/or common geography may create additional health impacts that should be assessed. Also, oil and gas development may create health impacts from air pollution, water contamination, soil contamination, or a combination of all three. Due to the multiple variables and factors involved in oil and gas development, it is essential that the BLM ensure a health impact assessment that fully considers all cumulative impacts to comply with federal regulations and to appropriately assess health impacts and inform the public.

If the full cumulative health impacts are not considered by BLM at this stage it is unlikely that BLM would consider them adequately in connection with individual lease sales, or in project-level and site-specific EAs. This type of shell game, whereby the agency avoids an analysis of the cumulative impacts of the entire project (in this case, 15,000 plus wells) is in contravention of NEPA. *See e.g. Blue Mountains Biodiversity Project v. U.S. Forest Service*, 161 F.3d 1208, 1215 (9th Cir. 2008).

4. Ozone

Background concentrations of ozone in the RMPA planning area are already at or exceed the National Ambient Air Quality Standards ("NAAQS"), leaving virtually no room for growth in emissions. Several studies that measured and/or modeled natural gas related air emissions in various states have identified significant increases in ground level ozone as a result of natural gas development.[203] Ozone was once a summertime urban phenomenon but is now being seen increasingly in western rural areas during the winter due to the natural gas boom, so much so that some relatively small cities are no longer in compliance with the federal regulations that set allowable ozone levels.[204]

Ozone can cause difficulty breathing, coughing and sore throat. It can also inflame and damage the airways. It aggravates lung diseases like asthma, emphysema, and chronic bronchitis. It can make the lungs more susceptible to infection and it can continue to damage the lungs even when the symptoms have disappeared.[205]

Children are particularly vulnerable because their lungs are still developing until about age 18. As their lungs grow in the presence of ozone, their alveoli production is reduced, and they can end up with smaller, more brittle lungs. Women exposed during pregnancy deliver preterm, low birth weight babies with a high probability of developing asthma. In a letter to former EPA Administrator Lisa Jackson, a group of five national medical and public health groups wrote that the most vulnerable individuals, including children, teens, senior citizens, people who exercise or work outdoors, and people with chronic lung diseases like asthma, COPD, and emphysema, are most in danger of being sickened by ozone and that children who grow up in areas of high ozone pollution may never develop their full lung capacity as adults, which can put them at greater risk of lung disease throughout their lives.[206]

5. Naturally Occurring Radioactive Materials

Processes used to produce oil and gas often generate radioactive waste containing concentrations of naturally occurring radioactive materials (NORM). Radioactive wastes from oil and gas production can be found in produced water, flowback water from hydraulic fracturing, drilling waste including cuttings and mud, and/or sludge. This material can concentrate in pipes, storage tanks and facilities, and on other extraction equipment, and may be left on site or be emitted into the environment. Some of these materials can penetrate the skin and raise the risk of cancer. The RMP includes no discussion on potential health impacts associated with NORM that may be released into the environment due to oil and gas extraction activities.

---

[203] *See, e.g.,* Seth Lyman and Howard Shorthill, *Final Report: 2012 Uintah Basin Winter Ozone & Air Quality Study*, UTAH STATE UNIVERSITY, February 1, 2013.
[204] Gabrielle Pétron, *et al*., *Estimation of emissions from oil and natural gas operations in northeastern Colorado*, Power Point available at: http://www.epa.gov/ttnchie1/conference/ei20/session6/gpetron_pres.pdf (attached as Exhibit 296).
[205] *See* EPA, *Ozone – Good Up High Bad Nearby*, available at: http://www.epa.gov/oar/oaqps/gooduphigh/bad.html#7.
[206] *See* American Lung Association (attached above as Exhibit 276).

C. National Historic Preservation Act, San Juan County Road 7950 Improvements and BLM Authorities

The National Historic Preservation Act ("NHPA") imposes the requirement on federal agencies to "take into account the effect[s] of [their] undertaking[s] on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register." 16 U.S.C. § 470f ("Section 106"). *The RMPA is a federal undertaking subject to NHPA compliance*. The regulations implementing Section 106 of the NHPA prescribe the steps agencies must follow to adequately evaluate the effects of undertakings on historic properties. These steps include identifying historic properties in the area of potential effect, assessing whether the undertaking will adversely affect eligible historic properties, and resolving any adverse effects to historic properties from the undertaking. 36 C.F.R. §§ 800.4, 800.5, 800.6.

In addition to the detailed information provided in Conservation Groups' original scoping comments, BLM must also consider, analyze, and respond to information specifically concerning San Juan County Road 7950—the primary entrance into Chaco Culture National Historical Park ("CCNHP" or "Park"), a World Heritage Site.

First, any road improvements beyond basic maintenance may result in harm to CCNHP by increasing visitation, and must be considered. These concerns were first raised with the Federal Highway Administration ("FHWA") through the NEPA process in 2006, when they intended to authorize improvements trough a categorical exclusion. By this time, FHWA had already chip-sealed the first three miles without consideration of the NHPA or conducting required consultation. Although BLM was not a party in the original 2006 improvement, it was nevertheless a required party. Moreover, the New Mexico State Historic Preservation Office ("SHPO") wanted Section 106 requirements met, but San Jan County performed the work without consultation. The FHWA's attempt to chip seal the second section of road was analyzed under NEPA, but this attempt was abandoned in 2012 after years of conflict. San Juan County offered a compromise in early 2012 to use stabilized aggregate as the preferred alternative, but the NEPA process was ultimately abandoned entirely in November of 2012. The stabilized aggregate alternative would have adversely affected six eligible sites under the NHPA according to the final Cultural Resources Survey in 2012. To re-iterate, stabilized aggregate was in fact the final chosen alternative of the NEPA process, and BLM was included as part of that NEPA process. San Juan County initiated the second phase of improvements in 2014, remarkably, despite the NEPA and NHPA processes being abandoned. Although no federal funding was used for these improvements, BLM and BIA remained indispensible parties given the nexus to federal lands and CCNHP. To date, funding for the 2014 remain a mystery, and we have been unable to track it through the NM system. These past improvements likely destroyed NHPA eligible sites, in violation of the law. Any future authorizations for road improvements in the Greater Chaco region—given the dispersed nature of historical properties and sacred sites—and in particular improvements to facilitate the development of oil and gas resources, must fully comply with NEPA and the NHPA.

Second, none of the work on CR7950 since 2006 was ever permitted under NHPA. No consultation with the Hopi (or SHPO) occurred under NHPA Section 106 for the 2006 improvement (chip sealing) or for the 2014 improvement (stabilized aggregate). The later

improvement was done after the NEPA project was abandoned. This failure to consult is documented in a Hopi letter, which clearly states they had no consultation since 2012.[207] Although it was assumed that San Juan County had claimed RS2477 ROW for both improvements, subsequent correspondence confirms that no applications were ever submitted by San Juan County, and thus none of the work was permitted.[208] There are four archeological sites in the first three-mile improvement, six sites in the stretch of road covered in the 2014 improvement. BLM contends that because they were never asked for a permit, and therefore had no responsibility.[209] This self-serving claim offers no defense. San Juan County and BLM worked hand in hand to promote an easy path for development in and around Chaco and may be continuing this pattern on countless other roads in San Juan County. BIA also should have been involved from the beginning. It remains unclear whether the Navajo THPO was ever consulted in the 2006 project or the 2014 improvement.

The Mancos RMPA/EIS must address the fact that BLM has, for many years, been ignoring their obligations under federal law with regard to road improvements in the Greater Chaco region. BLM has instead worked with San Juan County to facilitate improvements and expedite development. The agency has allowed archeological sites be damaged or destroyed. Road improvement is a large part of the energy development scenario. The EIS must take a hard look at how BLM has approached its responsibilities and attempt to outline proper procedure in the future.

V. Conclusion

The Conservation Groups appreciate your consideration of the information and concerns addressed herein, as well as the information included in the attached exhibits. This information is critical and must be reflected in the agency's formulation of alternatives and in its draft RMPA and EIS. For the reasons described above, we urge BLM to: (1) fully consider a range of alternatives, including a "no-leasing" alternative; (2) fully consider the problem of methane waste, and takes steps to control methane waste; (3) fully consider current scientific and economic information, especially regarding climate change; and (4) provide a true "hard look" at impacts to air, water, and human health, including by conducting a Health Impact Assessment.

Should you have any questions, please do not hesitate to contact me.

Sincerely,

[207] Letter from Leigh Kuwanwisiwma, Hopi Cultural Preservation Office to Jeff Pappas, NM SHPO (Aug. 25, 2014) (attached as Exhibit 40).
[208] Letter from Anon Wright, Chaco Alliance to Jeff Pappas, NM SHPO (July 21, 2014) (attached as Exhibit 41); Email from Jillian Aragon, San Juan County to Rick Wessel, NMDOT (May 10, 2016) (attached as Exhibit 42).
[209] Letter from Victoria Bar, BLM to Anson Wright, Chaco Alliance (Jun. 23, 2016) (attached as Exhibit 43).

Kyle Tisdel
WESTERN ENVIRONMENTAL LAW CENTER
208 Paseo del Pueblo Sur, Unit 602
Taos, New Mexico 87571
575.751.0351
tisdel@westernlaw.org

Along with:

Rachel Conn
AMIGOS BRAVOS
PO Box 238
Taos, NM 87571
575.758.3874
rconn@amigosbravos.org

Michael Saul
CENTER FOR BIOLOGICAL DIVERSITY
1536 Wynkoop St., Ste. 421
Denver, CO 80202
msaul@biologicaldiversity.org

Anson Wight
CHACO ALLIANCE
4990 SW Hewett Blvd.
Portland, OR97221
503.709.0038
ansonw@comcast.net

Carol Davis
DINÉ CARE
Dilkon, on Navajo Nation
HRC 63 Box 272
Winslow, AZ 86047
caroljdavis.2004@gmail.com

Allyson Siwik
GILA RESOURCES INFORMATION PROJECT
305A North Cooper St.
Silver City, NM 88061
575.538.8078
allysonsiwik@gmail.com

Mike Eisenfeld
SAN JUAN CITIZENS ALLIANCE
PO Box 6655

Farmington, NM 87499
970.259.3583
meisenfeld@frontier.net

Nathaniel Shoaff
SIERRA CLUB ENVIRONMENTAL LAW PROGRAM
2100 Webster Street, Suite 1300
Oakland, CA 94612
415.997.5610
nathaniel.shaoff@sierraclub.org

Jeremy Nichols
WILDEARTH GUARDIANS
1536 Wynkoop St., Ste. 301
Denver, CO 80202
303.437.7663
jnichols@wildearthguardians.org

From:	Kyle Tisdel
To:	blm_nm_ffo_rmp@blm.gov; anisula@blm.gov
Subject:	Re: Delivery delayed:Mancos RMPA_Scoping Comments 2.0
Date:	Tuesday, February 21, 2017 11:39:31 AM
Attachments:	Mancos RMPA_Scoping 2.0 (final).pdf

Dear Ms. Nisula,

Please note the email below that "delivery is delayed" for the scoping comments submitted by Conservation Groups yesterday. I am attempting to re-submit them with this email.

Below is the note from yesterdays email:

Please find the attached Scoping Comments 2.0 submitted by Western Environmental Law Center on behalf of Conservation Groups, Amigos Bravos, Center for Biological Diversity, Chaco Alliance, Diné CARE, Gila Resources Information Project, San Juan Citizens Alliance, Sierra Club, and WildEarth Guardians. Given the federal holiday, a hard copy of comments and a disc containing the attached exhibits will be sent by certified mail tomorrow. Should you have any questions, please do not hesitate to contact me.

Regards.

Kyle J. Tisdel
Attorney, Climate & Energy Program Director
Western Environmental Law Center
208 Paseo del Pueblo Sur, #602
Taos, New Mexico 87571
Ph: 575.613.8050

tisdel@westernlaw.org

www.westernlaw.org

Defending the West

From: <postmaster@doi.gov>
Date: Monday, February 20, 2017 at 11:21 PM
To: Kyle Tisdel <tisdel@westernlaw.org>
Subject: Delivery delayed:Mancos RMPA_Scoping Comments 2.0

Delivery is delayed to these recipients or groups:

anisula@blm.gov

Subject: Mancos RMPA_Scoping Comments 2.0

This message hasn't been delivered yet. Delivery will continue to be attempted.

The server will keep trying to deliver this message for the next 1 days, 18 hours and 35 minutes. You'll be notified if the message can't be delivered by that time.

Received: from mail-pg0-f72.google.com (74.125.83.72) by smtp5.doi.gov (137.227.28.11) with Microsoft SMTP Server (TLS) id 14.3.319.2; Mon, 20 Feb 2017 19:57:12 -0500 Received: by mail-pg0-f72.google.com with SMTP id 1so112014159pgz.5 for ; Mon, 20 Feb 2017 16:57:10 -0800 (PST) X-Gm-Message-State: AMke39nYlgVXDln7ajGWKK9gZc1w9lyEticvRiUuNPj1lF0hq8+upn1+Y+Okq3+UVKYCIb00iApPViWmGKnkHLN MfD9DlNLAFRmIxyPzb7rVMczbnup0knI3FgHyNq+iBWFiePNjcN6toNMVydSJEWHlLk237W0Sv+uQ7MxUHhx/ 61jvHxHKQI70VeQrL8jcjmX5/ql2gdY= X-Received: by 10.99.173.6 with SMTP id g6mr18872495pgf.75.1487638625199; Mon, 20 Feb 2017 16:57:05 -0800 (PST) X-Received: by 10.99.173.6 with SMTP id g6mr18871904pgf.75.1487638616384; Mon, 20 Feb 2017 16:56:56 -0800 (PST) Return-Path: Received: from npomail1.electricembers.net (mail.electricembers.net. [208.90.215.73]) by mx.google.com with ESMTPS id q21si20144918pgi.412.2017.02.20.16.56.54 (version=TLS1_2 cipher=ECDHE-RSA-AES128-GCM-SHA256 bits=128/128); Mon, 20 Feb 2017 16:56:55 -0800 (PST) Received-SPF: neutral (google.com: 208.90.215.73 is neither permitted nor denied by best guess record for domain of tisdel@westernlaw.org) client-ip=208.90.215.73; Authentication-Results: mx.google.com; spf=neutral (google.com: 208.90.215.73 is neither permitted nor denied by best guess record for domain of tisdel@westernlaw.org) smtp.mailfrom=tisdel@westernlaw.org Received: from private by npomail1.electricembers.net; User-Agent: Microsoft-MacOutlook/14.5.7.151005 Date: Mon, 20 Feb 2017 17:55:53 -0700 Subject: Mancos RMPA_Scoping Comments 2.0 From: Kyle Tisdel To: , Message-ID: Thread-Topic: Mancos RMPA_Scoping Comments 2.0 MIME-Version: 1.0 Content-Type: multipart/mixed; boundary="B_3570458157_20354111" X-Gm-Spam: 0 X-Gm-Phishy: 0 X-MS-Exchange-Organization-OriginalArrivalTime: 21 Feb 2017 00:57:12.3084 (UTC) X-MS-Exchange-Organization-OriginalClientIPAddress: 74.125.83.72 X-MS-Exchange-Organization-OriginalServerIPAddress: 137.227.28.11 X-MS-Exchange-Organization-AuthSource: smtp5.doi.gov X-MS-Exchange-Organization-AuthAs: Anonymous X-MS-Exchange-Organization-MessageDirectionality: Incoming X-MS-Exchange-Organization-Cross-Premises-Headers-Processed: smtp5.doi.gov X-MS-Exchange-Organization-OriginalSize: 5311174 X-MS-Exchange-Forest-MessageScope: 00000000-0000-0000-0000-000000000000 X-MS-Exchange-Organization-MessageScope: 00000000-0000-0000-0000-000000000000 X-MS-Exchange-Organization-HygienePolicy: Standard X-MS-Exchange-Organization-MessageLatencyInProgress: LSRV=smtp5.doi.gov:TOTAL=6|SMR=6;2017-02-21T00:57:18.548Z

Northwest
1216 Lincoln Street
Eugene, Oregon 97401
(541) 485-2471

Rocky Mountains
103 Reeder's Alley
Helena, Montana 59601
(406) 443-3501

Southwest
208 Paseo del Pueblo Sur #602
Taos, New Mexico 87571
(575) 751-0351

Defending the West www.westernlaw.org

Western Environmental Law Center

February 20, 2017

Sent via Electronic Mail (scoping comments only) and Certified Mail (comments and exhibits)

U.S. Bureau of Land Management
Farmington Field Office
Attn: Amanda Nisula
6251 College Blvd., Suite A
Farmington, New Mexico 87402
Email: anisula@blm.gov
Email: blm_nm_ffo_rmp@blm.gov

Re: Scoping Comments 2.0 – Farmington Resource Management Plan Amendment

Dear RMP Amendment Project Manager:

The Western Environmental Law Center, along with Amigos Bravos, Center for Biological Diversity, Chaco Alliance, Diné Citizens Against Ruining our Environment, Gila Resources Information Project, San Juan Citizens Alliance, Sierra Club, and WildEarth Guardians (together "Conservation Groups"), submit the following Scoping Comments 2.0 regarding the Bureau of Land Management ("BLM") Farmington Field Office ("FFO") Resource Management Plan Amendment ("RMPA") and associated Environmental Impact Statement ("EIS") encompassing approximately 4 million acres, and an analysis area of approximately 6 million acres, in northwest New Mexico. The RMPA is intended to analyze impacts of additional oil and gas development in the Mancos Shale/Gallup Formation that were not anticipated in the 2002 Reasonable Foreseeable Development ("RFD") Scenario or considered in the 2003 Farmington RMP/EIS.

Given the critical and fundamental role that the RMPA plays in determining land use values for the area, and specifically the FFO's management of oil and gas resources, we appreciate the opportunity to participate in Scoping, as well as the FFO's commitment to integrate of the following concerns into the forthcoming Draft RMPA/EIS. *See* 43 C.F.R. § 1610.2; 42 U.S.C. § 4332. In announcing the RMPA process, BLM has recognized that "[a]s full-field development occurs, especially in the shale oil play, additional impacts may occur that previously were not anticipated in the RFD or analyzed in the current 2003 RMP/EIS which will require an EIS-level plan amendment and revision of the RFD for complete analysis of the Mancos Shale/Gallup Formation." 79 Fed. Reg. 10,548 (Feb. 25, 2014). Conservation Groups submitted extensive technical and legal comments and exhibits on May 28, 2014 in response to

BLM's request for scoping. Those Scoping Comments remain relevant to the agency's decisionmaking and are hereby incorporated by this reference. BLM subsequently reinitiated the scoping process for the Mancos RMPA "specific to the extension of analysis in that EIS to BIA decision-making where BIA manages mineral leasing and associated activities in the RMPA Planning Area." 81 Fed. Reg. 72,819 (Oct. 21, 2016). Conservation Groups accordingly provide the following Scoping Comments responsive to that request, as well as to provide "significant new circumstances [and] information relevant to environmental concerns and bearing on the proposed action and its impacts" which have occurred during the pendency of BLM's first scoping period, and which must be considered and included within BLM's range of alternatives for the RMPA. 40 C.F.R. §§ 1502.9 (c)(1)(ii), 1502.14.

This letter focuses on the BLM's failure to adequately analyze and disclose the direct, indirect, and landscape scale impacts of fossil fuel leasing and development authorized and made available by BLM throughout the Farmington Field Office—a planning area that is already over 90% leased for oil and gas—and in particular those impacts to the Greater Chaco region. On behalf of members and supporters that live, work, recreate, worship, and otherwise rely on the land, air, and water in Greater Chaco for their wellbeing, the Conservation Groups call on the BLM to reconsider the wisdom of the fossil fuel leasing and development considered by the Mancos RMPA. Specifically, Conservation Groups request that:

- BLM must consider and analyze a "no-leasing" alternative that would bar new fossil fuel leases in the Farmington planning area.
- BLM must take steps to reduce methane emissions from oil and gas operations, including (1) by undertaking a true hard-look analysis of methane waste and global warming potential; and (2) by adopting enforceable mitigation requirements to minimize methane emissions and waste. Such analysis is both critical and necessary to address to "methane hotspot" that plagues the region and our communities.
- BLM must address new scientific and economic information, including regarding (1) the impacts of climate change on the Farmington planning area; (2) the social burden, or cost, of carbon and methane waste that would be authorized by the RMPA; and (3) fossil fuel production and employment, including a just transition away from the regions long dependence on fossil fuel development.
- BLM must take a hard look at impacts to air, water, and human health, which must include a detailed Health Impact Assessment.

The **Western Environmental Law Center** ("WELC") uses the power of the law to defend and protect the American West's treasured landscapes, iconic wildlife and rural communities. WELC combines legal skills with sound conservation biology and environmental science to address major environmental issues in the West in the most strategic and effective manner. WELC works at the national, regional, state, and local levels; and in all three branches of government. WELC integrates national policies and regional perspective with the local knowledge of our 100+ partner groups to implement smart and appropriate place-based actions.

Amigos Bravos is a statewide river conservation organization guided by social justice principles. Amigos Bravos' mission is to protect and restore the waters of New Mexico, and ensure that those waters provide a reliable source of clean water to the communities and farmers

that depend on them, as well as a safe place to swim, fish, and go boating. Amigos Bravos works locally, statewide, and nationally to ensure that the waters of New Mexico are protected by the best policy and regulations possible.

Center for Biological Diversity ("Center") is a non-profit environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center also works to reduce greenhouse gas emissions to protect biological diversity, our environment, and public health. The Center has over one million members and activists, including those living in New Mexico who have visited these public lands in the FFO for recreational, scientific, educational, and other pursuits and intend to continue to do so in the future, and are particularly interested in protecting the many native, imperiled, and sensitive species and their habitats that may be affected by the proposed oil and gas leasing.

Chaco Alliance is a grassroots citizens group dedicated to protecting and preserving Chaco Culture National Historical Park. We are interested in all threats to the park and its surrounding landscape, especially the threat created by energy development in the area.

Diné Citizens Against Ruining our Environment ("Diné C.A.R.E.") is an all-Navajo organization comprised of a federation of grassroots community activists in Arizona, New Mexico and Utah who strive to educate and advocate for our traditional teachings derived from our Diné Fundamental Laws. Our goal is to protect all life in our ancestral homeland by empowering local and traditional people to organize, speak out, and determine the outlook of the environment through civic involvement and engagement in decision-making process relating to tribal development.

Gila Resources Information Project ("GRIP") has the mission to promote community health by protecting our environment and natural resources. GRIP achieves its mission by facilitating informed public participation in natural resource use decisions, engaging our diverse communities in education and stewardship of our natural resources, and advocating at the local, state and federal level for protection of our land, air, ecosystems and water resources. GRIP is very concerned about the environmental, community health, and cultural impacts of oil and gas development in the Greater Chaco area.

Founded in 1986, **San Juan Citizens Alliance** ("SJCA") organizes people to protect our water and air, our lands, and the character of our rural communities in the San Juan Basin. SJCA focuses on four program areas, including the *San Juan Basin Energy Reform Campaign*, which ensures proper regulation and enforcement of the oil, gas, and coal industry and transitioning to a renewable energy economy. SJCA has been active in BLM and National Forest oil and gas issues in the San Juan Basin since the early 1990s, and has commented on virtually every multi-well drilling program, lease sale, and programmatic environmental review conducted in the region by the federal land management agencies since the early 1990s. SJCA's members live, work, and recreate throughout the San Juan Basin and San Juan Mountains. SJCA's members' health, use and enjoyment of this region is directly impacted by the decisions identified in this protest.

Sierra Club was founded in 1892 and is the nation's oldest grassroots environmental organization. The Sierra Club is incorporated in California, and has approximately 600,000 members nationwide and is dedicated to the protection and preservation of the environment. The Sierra Club's mission is to explore, enjoy and protect the wild places of the earth; to practice and promote the responsible use of the earth's ecosystems and resources; and to educate and enlist humanity to protect and restore the quality of the natural and human environments. The Sierra Club has a New Mexico chapter, known as the Rio Grande chapter, with members that live in and use this area for recreation such as hiking, climbing, backpacking, camping, fishing and wildlife viewing, as well as for business, scientific, spiritual, aesthetic and environmental purposes.

WildEarth Guardians protects and restores wildlife, wild places, and wild rivers in the American West. As part of its Climate and Energy Program, Guardians works to advance clean energy and expose the true cost of fossil fuels. Guardians works to protect and restore the San Juan Basin in northwestern New Mexico in order to safeguard its cultural heritage, natural values, communities, and open spaces.

TABLE OF CONTENTS

I. BLM Must Consider Existing, New, and Revised National Policy on Climate Change Into RMP Decisionmaking. 1

A. BLM Must Consider National Policy on Climate Change in Agency Decisionmaking on the RMPA, as well as Consider Recent Climate Science and Carbon Budgeting. 4

B. Projected Enegy Demands, International Finance, and Stranded Assets 15

II. BLM Must Consider All Reasonable Alternatives. 19

A. BLM Has a Legal Obligation to Consider All Reasonable Alternatives. 19

B. BLM Must Consider a No Leasing Alternative in Response to Threats Posed by Climate Change. 23

C. BLM Must Explicitly Consider a Renewable Energy Alternative or Include Renewable Energy as a Priority Element in Each Alternative. 25

III. The FFO Must to Take a Hard Look at Greenhouse Gas Emissions and Impacts to Climate Change. 26

A. BLM Must Address Whether Alternatives Are Consistent with National Climate Goals. 31

B. BLM Must Quantify the Severity of Harm from Greenhouse Gas Emissions 32

1. Social Cost of Carbon Protocol 32

2. Social Cost of Methane Protocol 36

C. Expert Comments: Economic Scoping for the Mancos RMPA 37

D. The FFO Must Take a Hard Look at Natural Gas Waste and Consider Alternatives to Prevent Waste including Phasing Development to Keep Pace with Gas Capture Infrastructure. 62

E. Managing for Community and Ecosystem Resiliency. 66

F. BLM Must Ensure NEPA Documentation Addresses Mitigation for Climate Impacts Consistent with All Relevant Laws and Policies, Including Current Mitigation Guidance. 68

1. Consistent with the Mitigation Hierarchy, BLM Must Avoid, Minimize and Offset Impacts from Fossil Fuels Made Available by the RMPA, Including Climate Change-Related Impacts. 70

2. BLM Should Adopt a Mitigation Strategy as Part of the Mancos RMPA to Address Unavoidable Climate Change Impacts. 72

IV. BLM Must Take a Hard Look at the Direct, Indirect and Cumulative Impacts of Oil and Gas Leasing and Development on Resource Values in the Planning Area. 73

A. The FFO Must Take a Hard Look at Certain Impacts to Air Quality. 73

1. Air Resource Mitigation Measures 73

2. Ozone Impacts 74

3. Hazardous Air Pollutant Impacts 76
4. Visibility and Ecosystem Impacts 76
5. Air Quality Impacts on Human Health 77
B. The BLM Failed to Take a Hard Look at Impacts to Human Health 78
1. The FFO Must Conduct a Health Impact Assessment. 78
2. Health data 80
3. Cumulative impacts on human health 82
4. Ozone 82
5. Naturally Occurring Radioactive Materials 83
C. National Historic Preservation Act, San Juan County Road 7950 Improvements and BLM Authorities 84
V. Conclusion 85

I. BLM Must Consider Existing, New, and Revised National Policy on Climate Change Into RMP Decisionmaking.

The National Environmental Policy Act ("NEPA") is our "basic national charter for the protection of the environment," achieving its purpose through "action forcing procedures. . . requir[ing] that agencies take a *hard look* at environmental consequences." 40 C.F.R. § 1500.1; *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989) (citations omitted) (emphasis added). This includes the consideration of best available information and data, as well as disclosure of any inconsistencies with federal policies and plans.

In 2014, President Obama described climate change as an "urgent and growing threat . . . that will define the contours of this century more dramatically than any other."[1] In that same year, the U.S. pledged to reduce its greenhouse gas ("GHG") emissions 26-28 percent below 2005 levels by 2020.[2] Since then, the President has also announced a new goal to cut methane emissions from the oil and gas sector by 40-45 percent below 2012 levels by 2025,[3] and set standards to reduce carbon dioxide emissions from the electricity sector by 32 percent from 2005 levels by 2030.[4] In 2015, President Obama recognized, "ultimately, if we're going to prevent large parts of this Earth from becoming not only inhospitable but uninhabitable in our lifetimes, we're going to have to keep some fossil fuels in the ground rather than burn them and release more dangerous pollution into the sky."[5] In his final State of the Union address, President Obama again noted the federal government's commitment to fighting climate change, vowing "to accelerate the transition away from old, dirtier energy sources," and making a powerful promise "to change the way we manage our oil and coal resources so that they better reflect the costs they impose on taxpayers and our planet."[6] These statements culminated in December, 2015 when the President joined with 194 other nations in recognizing "that climate change represents an urgent and potentially irreversible threat to human societies and the planet" and setting the goal of "holding the increase in the global average temperature to well below 2°C above pre-industrial

---

[1] The White House, Remarks by the President at U.N. Climate Change Summit (Sept. 23, 2014), available at: https://www.whitehouse.gov/the-press-office/2014/09/23/remarks-president-un-climate-change-summit.

[2] U.S.-China Joint Announcement on Climate Change (Nov. 11, 2014), available at: https://www.whitehouse.gov/the-press-office/2014/11/11/us-china-joint-announcement-climate-change (attached as Exhibit 46).

[3] The White House, Climate Action Plan: Strategy to Reduce Methane Emissions (March 2014), available at: https://www.whitehouse.gov/blog/2014/03/28/strategy-cut-methane-emissions (attached as Exhibit 1).

[4] Environmental Protection Agency, Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64662 (Oct. 23, 2015).

[5] The White House, Statement by the President on the Keystone XL Pipeline (Nov. 6, 2015), available at: https://www.whitehouse.gov/the-press-office/2015/11/06/statement-president-keystone-xl-pipeline.

[6] President Barack Obama, State of the Union (Jan. 12, 2016), available at: https://www.whitehouse.gov/sotu.

levels and pursuing efforts to limit the temperature increase to 1.5°C."[7] The President ratified the Paris Agreement, along with China, on September 3, 2016.[8] The President has also recognized that "the Paris Agreement alone will not solve the climate crisis. Even if we meet every target embodied in the agreement, we'll only get to part of where we need to go."[9]

Although the Trump administration, in public comments and rhetoric, has suggested a different set of priorities with respect to action on climate change, this does not alter the fundamental math and science of the challenges we face. Indeed, even if the Trump administration were to back out of the United States' many commitments to reduce greenhouse gas emissions and to create a pathway that limits warming—which, to date, has not occurred—that does not absolve the agency from considering the best available information and taking a hard look at impacts, as well as to have its decisionmaking be reflective of this analysis.

It should further be recognized that while national policy and statements addressing climate change accelerated during the Obama presidency—as they should given the narrowing window of time to take meaningful action—the federal government's recognition of climate change is not new. The Secretary of the United States Department of the Interior stated, in Secretarial Order 3226, *Evaluating Climate Change Impacts in Management Planning* (January 19, 2001), that "[t]here is a consensus in the international community that global climate change is occurring and that it should be addressed in governmental decision making." Order 3226 established the responsibility of agencies to "consider and analyze potential climate change impacts when undertaking long-range planning exercises, when setting priorities for scientific research and investigations, when developing multi-year management plans, and/or when making major decisions regarding potential utilization of resources under the Department's purview."

In a 2007 report entitled *Climate Change: Agencies Should Develop Guidance for Addressing the Effects on Federal Land and Water Resources,* the GAO concluded that the Department of the Interior had not provided specific guidance to implement Secretarial Order 3226, that officials were not even aware of Secretarial Order 3226, and that Secretarial Order 3226 had effectively been ignored. This report led to Secretarial Order 3289, *Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources* (September 14, 2009), which reinstated the provisions of Order 3226, and recognized that "the realities of climate change require us to change how we manage land, water, fish and

---

[7] United Nations Framework Convention on Climate Change, Conference of the Parties (Nov 30-Dec. 11, 2015), Adoption of the Paris Agreement, Art. 2, U.N. Doc. FCCC/CP/2015/L.9 (Dec. 12, 2015), available at: http://unfccc.int/resource/docs/2015/cop21/eng/l09.pdf ("Paris Agreement") (attached as Exhibit 2).

[8] The White House, President Obama: The United States Formally Enters the Paris Agreement (Sept. 3, 2016), available at: https://www.whitehouse.gov/blog/2016/09/03/president-obama-united-states-formally-enters-paris-agreement.

[9] The White House, Office of the Press Secretary, Remarks by the President on the Paris Agreement (Oct. 5, 2016), attached as Exhibit 3, and available at https://www.whitehouse.gov/the-press-office/2016/10/05/remarks-president-paris-agreement (last viewed Oct. 26, 2016).

wildlife, and cultural heritage and tribal lands and resources we oversee," and acknowledged that the Department of the Interior is "responsible for helping protect the nation from the impacts of climate change." A month later, in Executive Order No. 13514, *Federal Leadership in Environmental, Energy, and Economic Performance* (Oct. 5, 2009), the President called on all federal agencies to "measure, report, and reduce their greenhouse gas emissions from direct and indirect activities." 74 Fed. Reg. 52,117 (Oct. 8, 2009). This directive was followed by Executive Order No. 13693, *Planning for Federal Sustainability in the Next Decade* (March 25, 2015), which reaffirmed the federal government's commitment to reducing GHG emissions. 80 Fed. Reg. 15,871 (March 25, 2015).

In 2009, the Environmental Protection Agency ("EPA") issued a finding that the changes in our climate caused by elevated concentrations of greenhouse gases in the atmosphere are reasonably anticipated to endanger the public health and welfare of current and future generations. 74 Fed. Reg. 66496 (Dec. 15, 2009). In 2015, EPA acknowledged more recent scientific assessments that "highlight the urgency of addressing the rising concentrations of CO_2 in the atmosphere." 80 Fed. Reg. 64661 (Oct. 23, 2015).

Recently, the White House Council on Environmental Quality ("CEQ")—the federal agency tasked with managing the federal government's implementation of NEPA—recognized the unique nature of climate change and the challenges it imposed on NEPA compliance. On August 1, 2016, CEQ released *Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* (hereafter, "Climate Guidance") (attached as Exhibit 4). The guidance applies to all proposed federal agency actions, "including land and resource management actions." *Id*. at 9. Notably, CEQ's guidance is intended to "facilitate compliance with existing NEPA requirements." *Id.* at 1. In other words, the Climate Guidance is meant to underscore BLM's existing legal obligations to disclose and consider the foreseeable effects that, for example, oil and gas leasing and development has on climate change. On January 12, 2017, BLM issued a Permanent Instruction Memorandum to all Washington Office and Field Officials requiring that "[a]ll relevant NEPA documents must be consistent with the CEQ guidance." IM No. 2017-003 (attached as Exhibit 26). BLM is accordingly required to incorporate Climate Guidance into its RMPA. In its Climate Guidance, the CEQ recognized that:

> Climate change results from the incremental addition of GHG emissions from millions of individual sources, which collectively have a large impact on a global scale. CEQ recognizes that the totality of climate change impacts is not attributable to any single action, but are exacerbated by a series of actions including actions taken pursuant to decisions of the Federal Government. Therefore, a statement that emissions from a proposed Federal action represent only a small fraction of global emissions is essentially a statement about the nature of the climate change challenge, and is not an appropriate basis for deciding whether or to what extent to consider climate change impacts under NEPA. Moreover, these comparisons are also not an appropriate method for characterizing the potential impacts associated with a proposed action and its alternatives and mitigations because this approach does not reveal anything beyond the nature of the climate change challenge itself: the fact that diverse

> individual sources of emissions each make a relatively small addition to global atmospheric GHG concentrations that collectively have a large impact.

Id. at 10-11. CEQ's Climate Guidance also explains the application of NEPA principles and practices to the analysis of GHG emissions and climate change, including: (1) that agencies quantify a proposed action's projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools; (2) that agencies use projected GHG emissions as a proxy for assessing potential climate change effects when preparing a NEPA analysis; (3) where GHG emission tools, methodologies, or data inputs are not reasonably available, that agencies include a qualitative analysis in the NEPA document and explain the basis for determining that quantification is not reasonably available; (4) that agencies analyze foreseeable direct, indirect, and cumulative GHG emissions and climate effects; (5) that agencies consider reasonable alternatives and the short- and long-term effect and benefits in the alternatives and mitigation analysis; (6) that agencies consider alternatives that would make the actions and affected communities more resilient to the effects of a changing climate; and (7) that agencies assess the broad-scale effects of GHG emissions and climate change, either to inform programmatic decisions, or at both the programmatic and project-level. *See id.* at 4-6.

A. BLM Must Consider National Policy on Climate Change in Agency Decisionmaking on the RMPA, as well as Consider Recent Climate Science and Carbon Budgeting.

NEPA requires BLM to consider national policy in its decisionmaking process.[10] The FFO has historically adopted a position in its decisionmaking that reflects a fundamental disconnect with regard to how our public lands are managed for energy production and national policies to limit GHG emissions. The agency has not only failed to take informed action to address climate change, as required by Order 3226 and Order 3289, but has signaled a deep misunderstanding of basic climate science as well as the "tools and methodologies for quantifying GHG emissions and comparing GHG quantities across alternative scenarios." *See* Climate Guidance at 11.[11] As stated in Order 3289, BLM must "appl[y] scientific tools to increase understanding of climate change and to coordinate an effective response to its impacts," and "management decisions made in response to climate change impacts must be informed by [this] science."

---

[10] *See generally* section III.A. NEPA regulations direct federal agencies, "to discuss any inconsistency of a proposed action with any approved State or local plan and laws (whether or not federally sanctioned)," 40 C.F.R. § 1506.2(d), and require agencies to address "possible conflicts between the proposed action and the objectives of Federal, regional, State, and local (and in the case of a reservation, Indian tribe) land use plans, policies and controls for the area concerned." 40 C.F.R. § 1502.16(c). CEQ's NEPA Climate Guidance interprets these regulations to encompass the requirement to address "approved federal, regional, state, tribal, or local plans, policies, or laws for GHG emission reductions or climate adaptation to make clear whether a proposed project's GHG emissions are consistent with such plans or laws." Climate Guidance at 28-29.

[11] *See also*, Climate Guidance at 12 n. 28 (linking to quantification tools that "are widely available, and are already in broad use in the Federal and private sectors").

Through statements that have been offered to avoid any actual analysis, BLM has historically failed to take a hard look at the climate impacts of fossil fuel leasing and development on public lands in the planning area, as required by NEPA and underscored by the CEQ. These mistakes must not be repeated here. The FFO must also consider alternatives that would meaningfully address greenhouse gas emissions and climate change impacts in the planning area—including a no-leasing alternative—and that are reflective of current science and national policy. The FFO planning area is already over 90% leased for oil and gas. Over 40,000 oil and gas wells have historically been drilled, with at least 21,725 wells currently in production. This legacy of exploitation has resulted in vast impacts to the regions land, air, and water—including a methane hotspot that drapes over the basin—which people and our communities have been forced to endure. To correct past failures, BLM must, at a minimum, ensure it uses the best and most up-to-date climate science available, much of which is summarized below.

Since the dawn of the industrial revolution a century ago, the average global temperature has risen some 1.6 degrees Fahrenheit. Most climatologists agree that, while the warming to date is already causing environmental problems, another 0.4 degree Fahrenheit rise in temperature, representing a global average atmospheric concentration of carbon dioxide ("CO_2") of 450 parts per million ("ppm"), could set in motion unprecedented changes in global climate and a significant increase in the severity of natural disasters—and could represent the point of no return.[12] In August 2016, the atmospheric concentration of CO_2 was approximately 402.25 ppm, up from 398.93 ppm the same month a year earlier.[13]

Climate change has been intensively studied and acknowledged at the global, national, and regional scales. Climate change is being fueled by the human-caused release of greenhouse gas emissions, in particular carbon dioxide and methane. The Intergovernmental Panel on Climate Change ("IPCC") is a Nobel Prize-winning scientific body within the United Nations that reviews and assesses the most recent scientific, technical, and socio-economic information relevant to our understanding of climate change. In its most recent report to policymakers in 2014, the IPCC provided a summary of our understanding of human-caused climate change. Among other things, the IPCC summarized:[14]

- Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems.

[12] *See* David Johnston, *Have We Passed the Point of No Return on Climate Change?*, Scientific American (April 2015), available at: http://www.scientificamerican.com/article/have-we-passed-the-point-of-no-return-on-climate-change/.
[13] NOAA, Earth System Research Laboratory, *Trends in Atmospheric Carbon Dioxide*, available at: http://www.esrl.noaa.gov/gmd/ccgg/trends/.
[14] IPCC AR5*, Summary for Policymakers* (March 2014) available at: http://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf (attached as Exhibit 5).

- Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen.

- Anthropogenic greenhouse gas emissions have increased since the pre-industrial era, driven largely by economic and population growth, and are now higher than ever. This has led to atmospheric concentrations of carbon dioxide, methane, and nitrous oxide that are unprecedented in at least the last 800,000 years. Their effects, together with those of other anthropogenic drivers, have been detected throughout the climate system and are extremely likely to have been the dominant cause of the observed warming since the mid-20th century.

- In recent decades, changes in climate have caused impacts on natural and human systems on all continents and across the oceans. Impacts are due to observed climate change, irrespective of its cause, indicating the sensitivity of natural and human systems to changing climate.

- Continued emission of greenhouse gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive, and irreversible impacts for people and ecosystems. Limiting climate change would require substantial and sustained reductions in greenhouse gas emissions which, together with adaptation, can limit climate change risks.

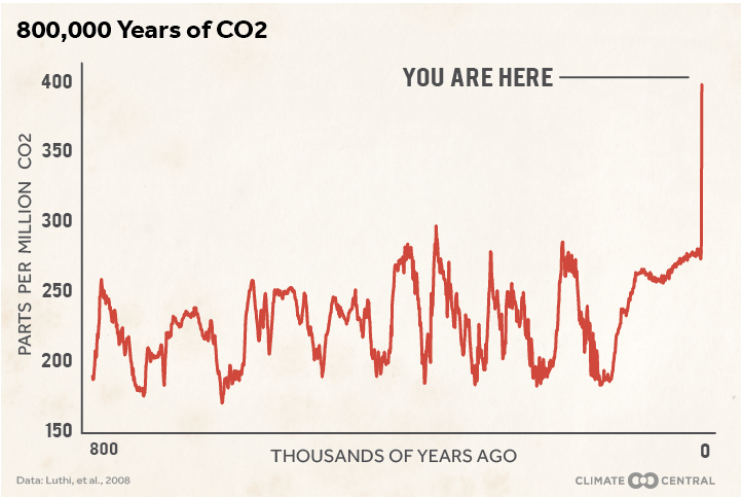
- Surface temperature is projected to rise over the 21st century under all assessed emission scenarios. It is very likely that heat waves will occur more often and last longer, and that extreme precipitation events will become more intense and frequent in many regions. The ocean will continue to warm and acidify, and global mean sea level to rise.

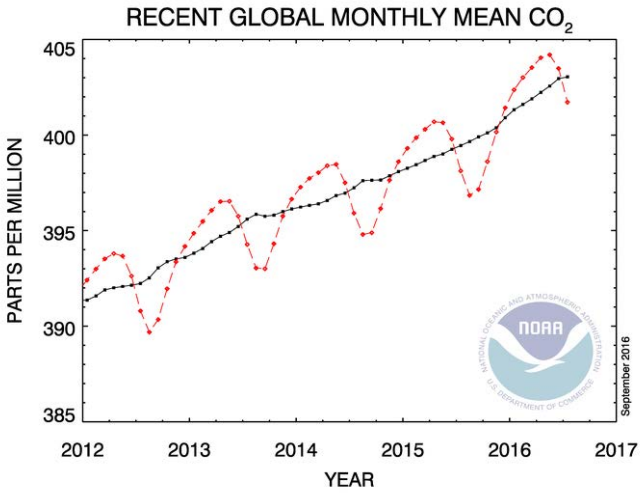
Carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are recognized as the key greenhouse gases contributing to climate change. In 2009, the EPA found that these "six greenhouse gases taken in combination endanger both the public health and the public welfare of current and future generations."[15] The D.C. Circuit has upheld this decision as supported by the vast body of scientific evidence on the subject. *See Coal. for Responsible Regulation, Inc. v. EPA.*, 684 F.3d 102, 120-22 (D.C. Cir. 2012).

According to the National Oceanic and Atmospheric Administration ("NOAA"), "[t]he combined average temperature over global land and ocean surfaces for August 2016 was the highest for August in the 137-year period of record, marking the 16th consecutive month of

[15] Environmental Protection Agency, *Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act* 74 Fed. Reg. 66,496 (Dec. 15, 2009).

record warmth for the globe." [16] The global climate crisis is happening and it may well be accelerating quickly.





The graphs show globally averaged historic and monthly mean carbon dioxide.

The IPCC in 2013 affirmed: "Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased" causing "widespread impacts on human and natural systems."[17] This is consistent with the findings of the United States' 2014 Third National Climate Assessment, stating: "That the planet has warmed is 'unequivocal,' and is corroborated through multiple lines of evidence, as is the conclusion that the causes are very likely human in origin."[18] With particular regard to the Southwest Region—which includes Colorado, New Mexico, Utah, Arizona, Nevada, and California—the National Climate Assessment included in the following overview:[19]

- Snowpack and streamflow amounts are projected to decline in parts of the Southwest, decreasing surface water supply reliability for cities, agriculture, and ecosystems.
- The Southwest produces more than half of the nation's high-value specialty crops, which are irrigation-dependent and particularly vulnerable to extremes of moisture, cold, and heat. Reduced yields from increasing temperatures and increasing competition for scarce water supplies will displace jobs in some rural communities.

---

[16] NOAA, Global Analysis – August 2016, available at: https://www.ncdc.noaa.gov/sotc/global/201608.
[17] IPCC AR5 Synthesis Report at 2 (attached as Exhibit 5).
[18] Jerry M. Melillo, *et al.*, Climate Change Impacts in the United States: The Third National Climate Assessment (2014) at 61, available at: http://nca2014.globalchange.gov (attached as Exhibit 6).
[19] *See id.* at 463-86.

- Increased warming, drought, and insect outbreaks, all caused by or linked to climate change, have increased wildfires and impacts to people and ecosystems in the Southwest. Fire models project more wildfire and increased risks to communities across extensive areas.
- Flooding and erosion in coastal areas are already occurring even at existing sea levels and damaging some California coastal areas during storms and extreme high tides. Sea level rise is projected to increase as Earth continues to warm, resulting in major damage as wind-driven waves ride upon higher seas and reach farther inland.
- Projected regional temperature increases, combined with the way cities amplify heat, will pose increased threats and costs to public health in southwestern cities, which are home to more than 90% of the region's population. Disruptions to urban electricity and water supplies will exacerbate these health problems.

Immediate and substantial greenhouse gas reductions are required to avoid catastrophic impacts to people and communities. "Following the warmest year on record in 2014 according to most estimates, 2015 reached record warmth yet again, surpassing the previous record by more than 0.1°C."[20] This record warming was again surpassed in 2016. "Globally-averaged temperatures in 2016 were 1.78 degrees Fahrenheit (0.99 degrees Celsius) warmer than the mid-20th century mean. This makes 2016 the third year in a row to set a new record for global average surface temperatures."[21]

> Most of the warming occurred in the past 35 years, with 16 of the 17 warmest years on record occurring since 2001. Not only was 2016 the warmest year on record, but eight of the 12 months that make up the year – from January through September, with the exception of June – were the warmest on record for those respective months. October, November, and December of 2016 were the second warmest of those months on record – in all three cases, behind records set in 2015.[22]

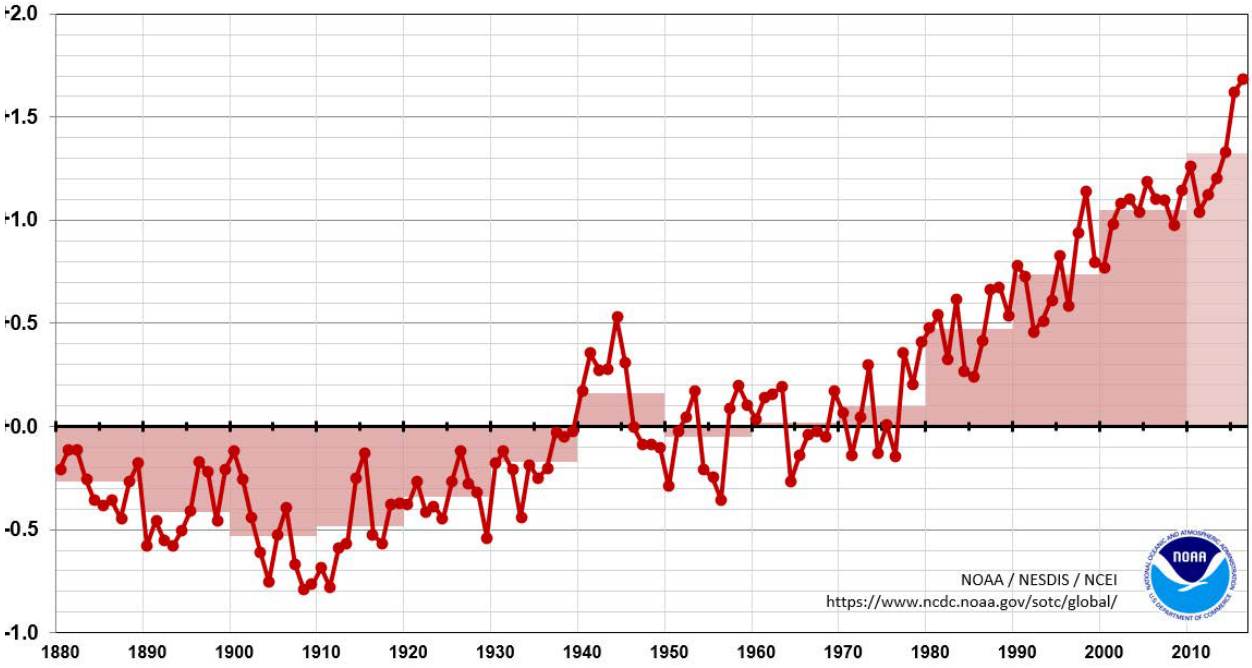
Earlier this year, researchers developed a mathematical equation to describe the impacts of human activity on the Earth.[23] The equation shows that astronomical and geophysical forces on the Earth system, while complex, tend to zero over time because of their slow nature and rarity. Whereas GHG emissions caused by humans over the past 45 years have increased the rate of temperature rise to 1.7 degrees Celsius per century,

---

[20] American Meteorological Society, *State of the Climate in 2015*, Vol.97, No.8 (Aug. 2016), at S7 (attached as Exhibit 7).
[21] NASA, *NASA NOAA Data Show 2016 Warmest Year on Record Globally* (Jan. 18, 2017), available at: https://www.nasa.gov/press-release/nasa-noaa-data-show-2016-warmest-year-on-record-globally.
[22] *Id.*; *see also* NOAA/NASA, *Annual Global Analysis for 2016* (Jan 2017) (attached as Exhibit 27).
[23] Owen Gaffney and Will Steffen, *The Anthropocene Equation*, The Anthropocene Review (2017) (attached as Exhibit 28).

representing a change to the climate that is 170 times faster than the natural background rate.[24] The researchers conclude that failing to reduce anthropological climate change "could trigger societal collapse."[25]

Annual Global Temperature: Difference from 20th Century Average, in °F



As noted above, the Paris Agreement commits all signatories—including the United States—to a target holding long-term global average temperature "to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels."[26] As articulated by a team of international climate scientists, including Dr. James Hansen, in a 2013 report: "The widely accepted target of limiting human-made global warming to 2 degrees Celsius (3.6 degrees Fahrenheit) above preindustrial level is too high and would subject young people, future generations and nature to irreparable harm…. Observational data reveal that some climate extremes are already increasing in response to warming of several tenths of a degree in recent decades; these extremes would likely be much enhanced with warming of 2°C or more."[27] "Runaway climate change—in which feedback loops drive ever-worsening climate change, regardless of human activities—are now seen as a risk even at 2°C of warming."[28] "[T]here is an unacceptable risk that before 2°C of warming, significant 'long-term'

[24] Gaffney at 3.
[25] Gaffney at 7.
[26] Paris Agreement at Art. 2 (attached as Exhibit 2).
[27] James Hansen, *et al., Assessing "Dangerous Climate Change": Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature,* 8 PLoS ONE 8 e81648 (2013) (attached as Exhibit 8).
[28] Greg Muttitt, *et al.*, *The Sky's Limit: Why the Paris Climate Goals Require a Managed Decline of Fossil Fuel Production*, Oil Change International (Sept. 2016) at 6 (attached as Exhibit 9).

feedbacks will be triggered, in which warming produces conditions that generate more warming, so that carbon sinks such as the oceans and forests become less efficient in storing carbon, and polar warming triggers the release of significant permafrost and clathrate carbon stores. Such an outcome could render ineffective human efforts to control the level of future warming to manageable proportions."[29] Indeed, the impacts of 2°C temperature rise have been "revised upwards, sufficiently so that 2°C now more appropriately represents the threshold between 'dangerous' and 'extremely dangerous' climate change."[30] "[T]he risks previously believed to be associated with an increase of around 4°C in global temperatures are now associated with the rise of a little over 2°C, while the risks previously associated with 2°C are now thought to occur with only 1°C rise."[31]

Although the Paris Agreement has underscored that immediate action is needed to avoid 'extremely dangerous' warming, meeting the voluntary commitments adopted in Paris alone will be insufficient to meet goal of limiting temperature change to between 1.5°C and 2.0°C above pre-industrial levels. As noted by a 2015 UNEP technical report:

> The emissions gap between what the full implementation of the unconditional [intended nationally determined contributions (INDCs)] contribute and the least-cost emission level for a pathway to stay below 2°C, is estimated to be 14 $GtCO_2e$ (range: 12-17) in 2030 and 7 $GtCO_2e$ (range: 5-10) in 2025. When conditional INDCs are included as fully implemented, the emissions gap in 2030 is estimated to be 12 GtCO2e (range: 10-15) and 5 $GtCO_2e$ (range: 4-8) in 2025.[32]

In other words, far greater emissions reductions are necessary to stay below and 2.0°C, let alone aspire to 1.5°C of warming. If no further progress were made beyond the Paris Agreement, expected warming by 2100 would be 3.5°C.[33] In the alternative, if no action is taken and the status quo is maintained—a position long reflected in BLM's management of public lands in the San Juan Basin—estimated warming by 2100 is upwards of 4.5°C.[34] To achieve an outcome consistent with a 50% chance of keeping warming to 2.0°C, the growth in global-energy related CO_2 emissions needs to halt and start to reverse within the current decade.[35] Delaying stronger climate action to 2020 would come at a cost: $1.5 trillion in low-carbon investments are avoided

---

[29] David Spratt, *Climate Reality Check: After Paris, Counting the Cost* (March 2016) at 8 (attached as Exhibit 10).
[30] Kevin Anderson and Alice Bows, *Beyond 'Dangerous' Climate Change: Emission Scenarios for a New World*, Phil. Trans. R. Soc. (2011) (attached as Exhibit 11).
[31] International Energy Agency, *Redrawing the Energy-Climate Map* (June 2013) at 14, (attached as Exhibit 29).
[32] United Nations Environment Programme (UNEP), *The Emissions Gap Report 2015: A UNEP Synthesis Report* (Nov. 2015) at xviii (attached as Exhibit 12).
[33] Spratt, *Climate Reality Check* at 2 (attached as Exhibit 10).
[34] *See* Climate Interactive, Climate Scorecard, available at: https://www.climateinteractive.org/programs/scoreboard/*; see also,* Andrew P. Schurer, *et al., Separating Forced from Chaotic Climate Variability over the Past Millennium*, Journal of Climate, Vol. 26 (March 2013) (attached as Exhibit 13).
[35] IEA (2013) at 13.

before 2020, but $5 trillion in additional investments would be required between 2020-2035 to get back on track.[36]

With specific regard to United States commitments under the Paris Agreement, the U.S. INDC set specific greenhouse gas emissions reduction target for 2025 of a 26% to 28% reduction below the 2005 emission levels, producing a range in 2005 net GHG emissions from 6,323 to 7,403 $MTCO_2e$.[37] The difference between this target and the estimated 2025 emissions without INDC policies results in an 'emissions gap' ranging from 896 to 2,121 $MTCO_2e$.[38]

Both the IPCC and National Climate Assessment recognize the dominant role of fossil fuels in driving climate change:

> While scientists continue to refine projections of the future, observations unequivocally show that climate is changing and that the warming of the past 50 years is primarily due to human-induced emissions of heat-trapping gases. These emissions come mainly from burning coal, oil, and gas, with additional contributions from forest clearing and some agricultural practices.[39]
>
> ***
>
> CO_2 emissions from fossil fuel combustion and industrial processes contributed about 78% to the total GHG emission increase between 1970 and 2010, with a contribution of similar percentage over the 2000–2010 period (*high confidence*).[40]

The energy sector accounts for around two-thirds of GHG emissions, and more than 80% of global energy consumption is based on fossil fuels.[41] To keep open a realistic chance of meeting the 2°C target, intensive action is required before 2020. As summarized in a recent report:

> The Paris Agreement aims to help the world avoid the worst effects of climate change and respond to its already substantial impacts. The basic climate science involved is simple: cumulative carbon dioxide (CO_2) emissions over time are the key determinant of how much global warming occurs. This gives us a finite *carbon budget* of how much may be emitted in total without surpassing dangerous temperature limits.[42]

---

[36] IEA (2013) at 114.
[37] Jeffery Greenblatt & Max Wei, *Assessment of the climate commitments and additional mitigation policies of the Unites States*, Nature Climate Change (Sept. 2016), available at: http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate3125.html (attached as Exhibit 14).
[38] *Id.* at 2; *see also* UNEP, Emissions Gap Report (attached as Exhibit 12).
[39] Third National Climate Assessment at 2 (attached as Exhibit 6).
[40] IPCC AR5 Synthesis Report at 46 (attached as Exhibit 5).
[41] IEA (2013) at 9.
[42] *The Sky's Limit* at 6 (attached as Exhibit 9).

According to the IPCC, as of 2011, the remaining carbon budget of cumulative CO_2 emissions from all anthropogenic sources must remain below 1,000 $GtCO_2$ to provide a 66% probability of limiting warming to 2°C above pre-industrial levels.[43] For years 2012-2014, approximately 107 $GtCO_2$ was emitted, averaging approximately 36 $GtCO_2$ per year, which left us at the start of 2016 with a carbon budget of only 850 $GtCO_2$.[44] These emissions were the highest in human history and 60% higher than in 1990 (the Kyoto Protocol reference year). Of course, the Paris Agreement aim of limiting global warming to 1.5°C requires adherence to a more stringent carbon budget of only 400 $GtCO_2$ from 2011 onward, of which about 250 $GtCO_2$ remained at the start of 2016.[45] "With global annual emissions amounting to 36 $GtCO_2$ in 2015, scientists predict that at current rates global emissions will exceed the carbon budgets necessary to stay under the 1.5°C target by 2021 and the 2°C target by 2036.[46]

The potential carbon emissions from *existing* fossil fuel reserves—the known belowground stock of extractable fossil fuels—considerably exceed both 2°C and 1.5°C of warming. "Estimated total fossil carbon reserves exceed this remaining [carbon budget] by a factor of 4 to 7."[47] "For the 2°C or 1.5°C limits, respectively 68% or 85% of reserves must remain in the ground."[48] The reserves in currently operating oil and gas field alone, even with no coal, would take the world beyond 1.5°C.[49]

---

[43] IPCC AR5 Synthesis Report at 63-64 & Table 2.2 (attached as Exhibit 5). For an 80% probability of staying below 2°C, the budget from 2000 is 890 $GtCO_2$, with less than 430 $GtCO_2$ remaining. Malte Meinshausen *et al., Greenhouse-gas emission targets for limiting global warming to 2°C*, Nature (2009) at 1159 (attached as Exhibit 15). Other sources offer slightly different calculations in order to have a 50% probability of keeping warming below 2°C, with total emissions to 2050 below 1,440 $GtCO_2$ from 2000 onward, of which 420 $GtCO_2$ has already been emitted (as of 2011). It is estimated that another 136 $GtCO_2$ will be emitted from non-energy sources up to 2050, meaning the energy sector can emit a maximum of 884 $GtCO_2$ by 2050. IEA (2013) at 16-17.

[44] *See* Annual Global Carbon Emissions, available at: https://www.co2.earth/global-co2-emissions; *see also* C. Le Quéré, *et al., Global Carbon Budget 2015*, Earth Syst. Sci. Data (Dec. 2015) (attached as Exhibit 16).

[45] Dustin Mulvaney, *et al.*, *Over-Leased: How Production Horizons of Already Leased Federal Fossil Fuels Outlast Global Carbon Budgets,* EcoShift Consulting (July 2016) (attached as Exhibit 17) at 2 (citing Joeri Rogelj, *et al., Difference between carbon budget estimates unraveled*, Nature Climate Change (2016) (attached as Exhibit 18).

[46] Mulvaney at 2 (citing Oak Ridge National Laboratories, Carbon Dioxide Information Analysis Center (2015), available at: http://cdiac.ornl.gov/GCP/).

[47] IPCC AR5 Synthesis Report at 63 (attached as Exhibit 5).

[48] The Sky's Limit at 6 (attached as Exhibit 9); *see also* Kevin Anderson and Alice Bows, *Reframing the climate change challenge in light of post-2000 emission trends*, Phil. Trans. R. Soc. (2008) (attached as Exhibit 19) ("to provide a 93% mid-value probability of not exceeding 2°C, the concentration (of atmospheric greenhouse gases) would need to be stabilized at or below 350 parts per million carbon dioxide equivalent (ppm CO_2e)" compared to the current level of ~485 ppm CO_2e.).

[49] The Sky's Limit at 5, 17 (attached as Exhibit 9).

In order for the world to stay within a carbon budget consistent with Paris Agreement goals—"holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C"[50]—significant fossil fuel resources must remain in the ground. More specifically, to meet the target of 2°C, globally "a third of oil reserves, half of gas reserves and over 80 percent of current coal reserves should remain unused from 2010-2050."[51] These fossil fuel reserves represent "unburnable carbon" and as such would be are stranded assets in which countries, industries, and companies are heavily invested but on which they would be unable to recoup returns. Citigroup warned investors that "the total value of stranded assets could be over $100 trillion based on current market prices."[52] Studies estimate that global coal, oil and gas resources considered currently economically recoverable contain potential greenhouse gas emissions of 4,196 $GtCO_2$,[53] with other estimates as high as 7,120 $GtCO_2$.[54]

Critically, the United States carbon quota—equivalent to 11% of the global carbon budget needed for a 50% chance of limiting warming to 2°C—allocates approximately 158 $GtCO_2$ to the United States as of 2011.[55] By way of comparison, federal and non-federal fossil fuel emissions together would produce between 697 and 1,070 $GtCO_2$.[56] Regarding just federal fossil fuel resources, the United States contains enough recoverable coal, oil and gas that, if extracted and burned, would result in as much as 492 $GtCO_2$, far surpassing the entire global carbon budget for a 1.5°C target and nearly eclipsing the 2°C target—to say nothing of the United States 'share' of global emissions.[57] Unleased federal fossil fuels comprise 91% of these potential emissions, with already leased federal fossil fuels accounting for as much as 43 $GtCO_2$.[58]

In 2012, "the GHG emissions resulting from the extraction of fossil fuels from federal lands by private leaseholders totaled approximately 1,344 $MMTCO_2e$."[59] Between 2003 and 2014, approximately 25% of all United States and 3-4% of global fossil fuel greenhouse gas emissions are attributable to federal minerals leased and developed by the Department of the

---

[50] Paris Agreement at Art. 2 (attached as Exhibit 2).
[51] Christophe McGlade & Paul Ekins, *The geographical distribution of fossil fuels unused when limiting global warming to 2°C*, Nature (Jan 2015) (attached as Exhibit 20).
[52] Jason Channell, *et al.*, *Energy Darwinism II*, Citi GPS: Global Perspectives & Solutions (August 2015) at 118 (attached as Exhibit 30).
[53] Michael Raupach, *et al., Sharing a quota on cumulative carbon emissions*, Nature Climate Change (Sept. 2014) (attached as Exhibit 21).
[54] IPCC AR5, Mitigation of Climate Change, Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (2014) at Table 7.2 (attached as Exhibit 22).
[55] Raupach at 875 (attached as Exhibit 21).
[56] Dustin Mulvaney, *et al.*, *The Potential Greenhouse Gas Emissions from U.S. Federal Fossil Fuels*, EcoShift Consulting (Aug. 2015) at 16 (attached as Exhibit 23).
[57] *Id.*
[58] *Id.*
[59] Stratus Consulting, *Greenhouse Gas Emissions from Fossil Energy Extracted from Federal Lands and Waters: An Update* (Dec. 2014) at 9 (attached as Exhibit 24).

Interior.[60] Continued leasing and development of federal fossil fuel resources commits the world to 'extremely dangerous' warming well beyond the 2°C threshold. As one study put it, "the disparity between what resources and reserves exist and what can be emitted while avoiding a temperature rise greater than the agreed 2°C limit is therefore stark."[61] In short, *any* new leasing of federal fossil fuel resources is inconsistent with a carbon budget that would seek to avoid catastrophic climate change.

The production horizons for already leased federal fossil fuel resources underscore how unwarranted any additional leasing is, and in turn the reasonableness of the FFO's consideration of a no-leasing alternative. Comparing these production horizons to dates at which carbon budgets would be exceeded if current emission levels continue:

- Federal crude oil already leased will continue producing for 34 years beyond the 1.5°C threshold and 19 years beyond the 2°C threshold;
- Federal natural gas already leased will continue producing 23 years beyond the 1.5°C threshold and 8 years beyond the 2°C threshold;
- Federal coal already leased will continue producing 20 years beyond the 1.5°C threshold and 5 years beyond the 2°C threshold.[62]

Not only can the federal government not afford to lease *any* additional public lands for fossil fuel development—underscoring the need to consider a no leasing alternative—but substantial efforts must also be made to limit the production horizon of fossil fuel resources already leased. Accordingly, the FFO must also consider taking an aggressive position on the non-renewal and expiration of non-producing leases, as well as review of agency policy on lease suspensions and unitization.

If new leasing and renewal of existing non-producing leases continues, by 2040 it will contribute about two-thirds of expected federal fossil fuel production (forecast based on EIA and other sources).[63] On the other hand, if new leasing ceases and existing non-producing leases are not renewed, 40% of forecast coal production could be avoided in 2025 and 74% of coal production could be avoided in 2040. As for oil and gas, 12% of oil production could be avoided in 2025 and 65% could be avoided by 2040 while 6% of natural gas production could be avoided in 2025 and 59% could be avoided by 2040.[64]

This avoided production would significantly reduce future U.S. emissions. Cessation of new and renewed leases for federal fossil fuel extraction could reduce CO_2 emissions by about

---

[60] *See* Energy Information Administration, *Sales of Fossil Fuels Produced from Federal and Indian Lands, FY 2003 through FY 2014* (July 2015) (attached as Exhibit 25); *see also* Stratus Consulting (attached as Exhibit 24).
[61] McGlade at 188.
[62] Mulvaney (2016) at 5.
[63] Peter Erickson and Michael Lazarus, *How Would Phasing Out U.S. Federal Leases for Fossil Fuel Extraction Affect CO2 Emissions and 2°C Goals?,* Stockholm Environmental Institute (2016) at 12 (attached as Exhibit 323).
[64] Erickson and Lazarus at 16.

100 Mt per year by 2030. Annual emission reductions could become greater than that over time as production declines on existing leases and maintaining or increasing production becomes dependent on yet-to-be issued leases.[65]

A comparison with other measures shows that "no leasing" could be a very significant part of U.S. efforts to address climate change. The 100 Mt CO_2 emissions savings that could result from no leasing in 2030 compares favorably with EPA standards for light- and medium-vehicles that are expected to yield 200 Mt in CO_2 savings in 2030, and with standards for heavy-duty vehicles that are expected to yield 70 Mt in CO_2 savings in the same year. The 100 Mt CO_2 emissions reduction from leasing restrictions would be greater than either the emission reductions that the EPA expects to achieve through its existing regulation of oil and gas industry emissions or reductions the BLM expects to achieve from its proposed methane waste standards on oil and gas operations on federal land. Clearly, cessation of new and renewed leases could make an important contribution to U.S. climate change mitigation efforts.[66]

Also, importantly, avoided production through no new leasing and the non-renewal of existing non-producing leases could help avoid further carbon lock-in in terms of investment in both fossil fuel-producing and fossil fuel-using infrastructure.[67] Simply put, the timeframe to avoid catastrophic climate change is short, and the management of our federal minerals is dangerously out of step with this reality.

B. Projected Energy Demands, International Finance, and Stranded Assets

The world's energy needs continue to grow, with projections of a 30% rise in global energy demand to 2040. The International Energy Agency ("IEA") has estimated that for this increasing demand to be met, a cumulative $48 trillion in investment is needed in global energy supply,[68] of which 60% is comprised of fossil fuels and nearly 20% to renewables, with an additional $23 trillion invested in improvements in energy efficiency.[69] "Countries are generally on track to achieve, and even exceed in some instances, many of the targets set in their Paris Agreement pledges; this is sufficient to slow the projected rise in global energy-related CO_2 emissions, but not nearly enough to limit warming to less than 2°C."[70] By contrast, it would be exceedingly difficult to chart a course toward a 2°C pathway. A major reallocation of investment capital going to the energy sector would be needed, requiring an estimated $40 trillion in cumulative energy supply investment moving away from fossil fuels and toward renewables.[71] The more ambitious target of limiting warming to less than 1.5°C would be even more difficult to achieve, demanding net-zero emissions between 2040 and 2060, a goal that would require

[65] Erickson and Lazarus at 26.
[66] Erickson and Lazarus at 27.
[67] Erickson and Lazarus at 30.
[68] International Energy Agency, *World Energy Investment Outlook* (2014), at 3 (attached as Exhibit 31).
[69] International Energy Agency, *World Energy Outlook 2016: Executive Summary* (2016), at 2 (attached as Exhibit 32).
[70] IEA (2016) at 2.
[71] IEA (2016) at 5.

radical near-term reductions in energy sector CO_2 emissions.[72] IEA estimates that "$53 trillion in cumulative investment in energy supply and efficiency is required over the period to 2035 in order to get the world onto a 2°C emissions path."[73]

The liability exposure from not acting is enormous, with cumulative 'lost' GDP from the impacts of climate change equating to $44 trillion.[74] Yet, investment decisions being taken today are not consistent with a 2°C climate goal and are not aimed at creating infrastructure that is sufficiently resilient to withstand the increased physical risks that are expected to result from future climate change.[75] "[O]ur current energy infrastructure has already 'locked-in' future carbon-dioxide emissions."[76] Even as this energy infrastructure is quickly sealing our climate fate in the near term, it will become obsolete in the slightly longer term. Indeed, many new energy sector assets are destined to become stranded when carbon reduction policies that limit the utilization of those assets are inevitably adopted in response to climate change impacts. As of 2013, emissions from existing global fossil fuel energy infrastructure already represented four-fifths, or 550 $GtCO_2$, of the total volume of CO_2 emissions that the earth can accommodate under a 2°C trajectory.[77] With delayed climate action to date, in 2017 we now find ourselves at an investment watershed, where energy infrastructure now locks in the entire remaining carbon budget to 2035.[78] From this point forward, far more costly actions are going to be required to subsequently undo the lock-in effect, and every additional investment in the energy sector committed to fossil fuels would become stranded assets under policies to achieve a 2°C pathway.

At the same time, the capital expenditures required to maintain current energy sector demand for fossil fuels have more than doubled since 2000, to $950 billion annually.[79] In other words, more capital investment is being required to maintain our current reliance on fossil fuels at a time, paradoxically, when from a climate perspective all of the new investment must be redirected towards renewable energy sources to effect a radical transformation of the energy sector, as necessary to avoid catastrophic warming. The market value of oil and gas produced globally was around $4.2 trillion in 2012, which was almost double what it was in 2005.[80] Yet, this has not resulted in a financial windfall to the oil and gas industry, as costs and royalties have more than kept pace with increased revenues.[81] In short, oil and gas companies are merely maintaining a fossil fuel treadmill where increasingly costly investments are needed to meet demand but lead to rising costs for the oil and gas industry as well as significant costs to society as reliance on oil and gas fuels climate change, an irrational system. In the face of these increasing capital requirements, there is growing awareness of significant financial exposure for individual companies from the possible future stranding of new fossil fuel investments. For

[72] IEA (2016) at 5.
[73] IEA (2014) at 14.
[74] Citi at 8.
[75] IEA (2013) at 84.
[76] IEA (2013) at 98.
[77] IEA (2013) at 99.
[78] IEA (2013) at 113.
[79] IEA (2014) at 51, 52.
[80] IEA (2014) at 54.
[81] IEA (2014) at 54.

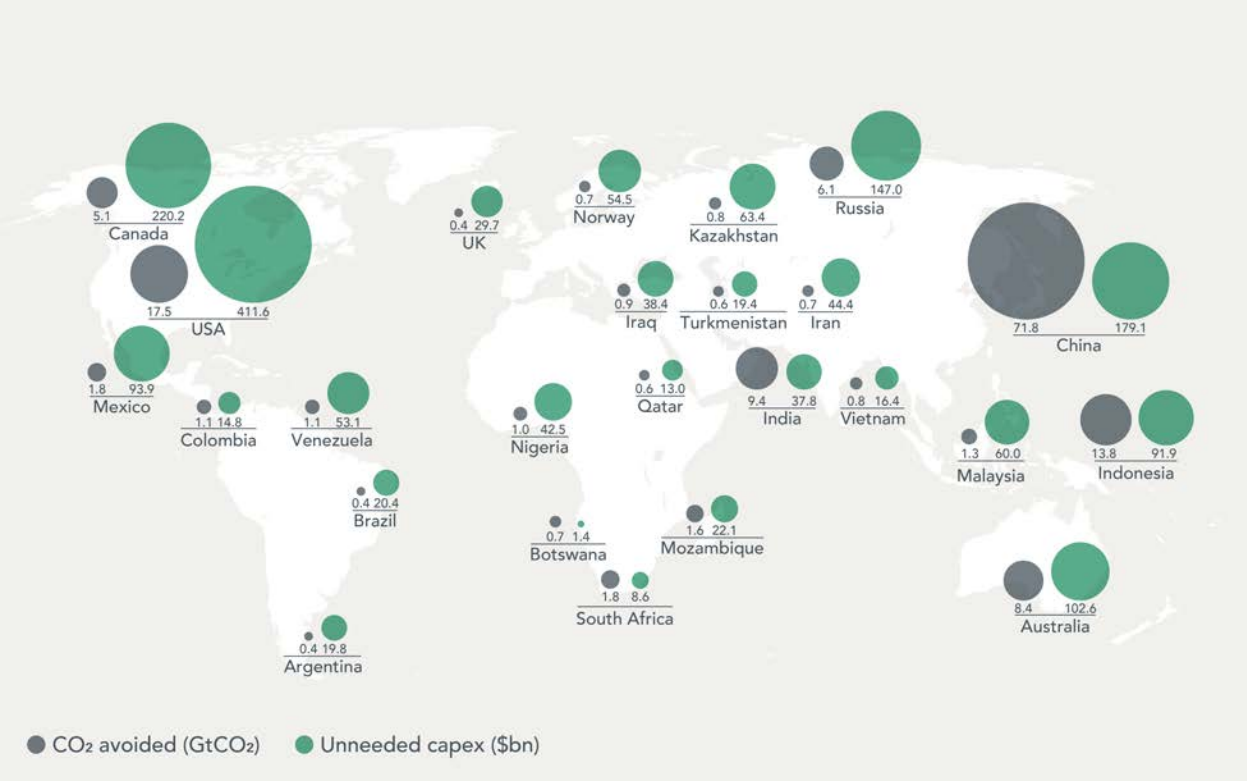
example, among major oil and gas companies, the estimated cost of stranded assets over the next decade ranges from $21.5 billion for ConocoPhillips to $76.9 billion for Shell.[82] Nevertheless, the global capital markets have yet to internalize these risks and charge premiums that would steer investment towards renewable energy.

"Analysis of the entire energy system shows that delaying action on climate change is a false economy. Investments of around $1.5 trillion are avoided in the period to 2020, but an additional $5 trillion of investments are required between 2020 and 2035."[83]

According to the 2°C pathway modeled by IEA, from 2015-2035 the carbon budget for energy-based emissions from all fossil fuels is 593 $GtCO_2$.[84] If global energy investment continues on its current course, there will be over $2 trillion in investment in energy sources that will emit around 156 $GtCO_2$ of emissions over the 2°C target of 593 $GtCO_2$.[85] This can also be viewed through the lens of specific fossil fuel demand to 2035 under a 2°C pathway. For coal, zero additional capital investment is needed, as production from existing coalmines would exceed demand.[86] For gas, approximately $460 billion—or over 40% of anticipated capital expenditures—is unneeded, resulting in 9.3 $GtCO_2$ of avoided emissions.[87] For oil, it is projected that demand peaks around 2020, meaning that the oil sector does not need to continue to grow. Based on current Paris Agreement commitments, oil production required in the period to 2035 amounts to around 760 billion barrels, but falls to 690 billion barrels to maintain a course for 2°C.[88] Yet the estimated level of proven oil reserves are close to 1.7 trillion barrels.[89] This results to between a 940 and 1,010 billion barrel surplus of proven reserves that cannot be burned. Avoided capital expenditures for oil are nearly $1.5 trillion, avoiding 27.6 $GtCO_2$ of emissions.[90]

[82] Carbon Tracker Initiative, *The $2 trillion stranded assets danger zone: How fossil fuel firms risk destroying investor returns* (Nov. 2015) at 23, (attached as Exhibit 33).
[83] IEA (2013) at 114.
[84] Carbon Tracker (2015) at 7.
[85] Carbon Tracker (2015) at 2.
[86] Carbon Tracker (2015) at 10.
[87] Carbon Tracker (2015) at 14.
[88] IEA (2014) at 87.
[89] IEA (2014) at 87.
[90] Carbon Tracker (2015) at 18.

Unneeded capital expenditures to 2025 and related CO_2 to 2035 under a 2°C pathway



It is cheaper for the world to address climate change than bear its economic consequences. As detailed above, there are enough coal, oil and gas reserves that are technically recoverable to equal up to 7,120 $GtCO_2$ of emissions.[91] Only a portion of this carbon is already locked-in—i.e., total reserves held by fossil fuel companies and state owned assets—but this 'embedded' carbon still amounts to 2,860 $GtCO_2$—already enough to take us beyond 3°C of warming.[92] Only 20% of these fossil fuel reserves can be burned to 2050 if the world is to have a chance of not exceeding global warming of 2°C.[93]

The total coal, oil and gas reserves listed on the world's stock exchanges equaled 762 $GtCO_2$ in 2013—an amount that continues to grow.[94] "If listed fossil fuel companies have a pro-rata allocation of the global carbon budget, this would amount to around 125–275 $GtCO_2$, or 20 - 40% of the 762 $GtCO_2$ currently booked as reserves. The scale of this carbon budget deficit poses a major risk for investors. They need to understand that 60 - 80% of coal, oil and gas reserves of listed firms are unburnable."[95] The systemic risks threatening the stability of financial markets related to unburnable carbon are growing more entrenched, with 200 fossil fuel

[91] IPCC AR5 at Table 7.2.
[92] Carbon Tracker Initiative, *Unburnable Carbon 2013: Wasted capital and stranded assets* (2013), at 14 (attached as Exhibit 34).
[93] Carbon Tracker (2013) at 4.
[94] Carbon Tracker (2013) at 4.
[95] Carbon Tracker (2013) at 4.

companies having a market value of $4 trillion and debt of $1.5 trillion.[96]

> As provided by Citigroup in a warning to investors:
>
> > Emissions contained in current 'reserves' figures are around three times higher than the so called 'carbon budget'. Some studies suggest that globally a third of oil reserves, half of gas reserves and over 80% of current coal reserves would have to remain unused from 2010 to 2050 in order to have a chance of meeting the 2°C target. In financial terms, we estimate that the value of unburnable reserves could amount to over $100 trillion out to 2050.[97]

The longer climate action is delayed the more expensive it becomes to avoid each additional ton of GHG emissions, and the more capital expenditures will become stranded. [98] In other words, climate action is directly tied to economic resilience, and the longer action is delayed the larger the lead balloon becomes. This is not only a problem for the fossil fuel industry, but for our economy and the wellbeing of our communities. These financial implications also bear directly on BLM's decisionmaking relative to the leasing and development of our public lands for fossil fuel resources. Not only do each additional acre leased and well authorized contribute to societies collective carbon burden, but inherent financial risk and market instability has far reaching implications for public lands remediation. When fossil fuel resources become stranded it is the public, not financially struggling fossil fuel companies, who are left holding the bag.

II. BLM Must Consider All Reasonable Alternatives.

A. BLM Has a Legal Obligation to Consider All Reasonable Alternatives.

The centerpiece of environmental regulation in the United States, the National Environmental Policy Act ("NEPA") requires federal agencies to pause before committing resources to a project and consider the likely environmental impacts of the preferred course of action as well as reasonable alternatives. *See* 42 U.S.C. § 4331(b) (congressional declaration of national environmental policy); *U.S. Dep't of Transp. v. Public Citizen,* 541 U.S. 752, 756–57 (2004). BLM must "rigorously explore and objectively evaluate all reasonable alternatives" to the proposed action in comparative form, so as to provide a "clear basis for choice among the options" open to the agency. 40 C.F.R. § 1502.14. At a minimum, the agency must identify and analyze its preferred alternative, as well as a null or "no action" alternative that would occur if the agency elected to maintain the current state of affairs unchanged. *Id.* In addition, the agency should address all other reasonable alternatives to the proposed action. *See Colorado Envtl. Coal. v. Salazar*, 875 F. Supp. 2d 1233, 1245 (D. Colo. 2012).

Through the RMP planning process, the FFO is required to "estimate and display the physical, biological, economic, and social effects of implementing each alternative considered in detail. The estimation of effects shall be guided by the planning criteria and procedures

[96] Carbon Tracker (2013) at 5, 30.
[97] Citi at 82.
[98] IEA (2014) at 43.

implementing [NEPA]." 43 C.F.R. § 1610.4-6. Essential to any NEPA process is a robust analysis of alternatives to the proposed action. Consideration of reasonable alternatives is necessary to ensure that the agency has before it and takes into account all possible approaches to, and potential environmental impacts of, a particular project. NEPA's alternatives requirement, therefore, ensures that the "most intelligent, optimally beneficial decision will ultimately be made." *Calvert Cliffs' Coordinating Comm., Inc. v. U.S. Atomic Energy Comm'n,* 449 F.2d 1109, 1114 (D.C. Cir. 1971).

"[T]he heart" of an environmental analysis under NEPA is the analysis of alternatives to the proposed project, and agencies must evaluate all reasonable alternatives to a proposed action." *Colorado Environmental Coalition*, 185 F.3d at 1174 (quoting 40 C.F.R. § 1502.14). An agency must gather "information sufficient to permit a reasoned choice of alternatives as far as environmental aspects are concerned." *Greater Yellowstone*, 359 F.3d at 1277 (citing *Colorado Environmental Coalition*, 185 F.3d at 1174); *see also Holy Cross Wilderness Fund v. Madigan*, 960 F.2d 1515, 1528 (10th Cir. 1992). Thus, agencies must "ensure that the statement contains sufficient discussion of the relevant issues and opposing viewpoints to enable the decisionmaker to take a 'hard look' at environmental factors, and to make a reasoned decision." *Izaak Walton League of America v. Marsh,* 655 F.2d 346, 371 (D.C. Cir. 1981) (citing *Kleppe v. Sierra Club,* 427 U.S. 390, 410 n. 21 (1976)).

When determining whether an EIS analyzed sufficient alternatives to allow BLM to take a hard look at the available options, courts apply the "rule of reason." *New Mexico ex rel. Richardson v. Bureau of Land Mgmt.*, 565 F.3d 683, 709 (10th Cir. 2009) (citing *Westlands Water Dist. v. U.S. Dep't of the Interior*, 376 F.3d 853, 868 (9th Cir. 2004)). The reasonableness of the alternatives considered is measured against two guideposts. First, when considering agency actions taken pursuant to a statute, an alternative is reasonable only if it falls within the agency's statutory mandate. *Westlands,* 376 F.3d at 866. Second, reasonableness is judged with reference to an agency's objectives for a particular project.[99] *See Dombeck,* 185 F.3d at 1174–75; *Simmons v. U.S. Army Corps of Eng'rs,* 120 F.3d 664, 668–69 (7th Cir. 1997); *Idaho Conservation League v. Mumma,* 956 F.2d 1508, 1520 (9th Cir. 1992).

On the first point, FLPMA is BLM's organic act and delegates authority to the agency to create and amend land use plans. FLPMA's congressional declaration states:

> It is the policy of the United States that … the public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use;

[99] While an agency may restrict its analysis to alternatives that suit the "basic policy objectives" of a planning action, *Seattle Audubon Soc'y v. Moseley,* 80 F.3d 1401, 1404 (9th Cir. 1996), it may do so only as long as "the statements of purpose and need drafted to guide the environmental review process ... are not unreasonably narrow," *Dombeck*, 185 F.3d at 1175.

43 U.S.C. § 1701(a)(8) (emphasis added). Indeed, BLM is duty bound to develop and revise land use plans according to this congressional mandate, so as to "observe the principles of multiple use." 43 U.S.C. § 1712(c)(1). "Multiple use" means "a combination of balanced and diverse resource uses that takes into account the long-term needs of future generations for renewable and nonrenewable resources, including, but not limited to, recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific and historical values." 43 U.S.C. § 1702(c).

The RMP revision process, undertaken pursuant to FLPMA, requires BLM to engage in the type of foundational land use planning that is intended to give context to the agency's multiple use mandate. Accordingly, FLPMA provides specific criteria for land use plan revisions, requiring consideration of things such as: observation of the principles of multiple use and sustained yield; integrated consideration of physical, biological, economic, and other sciences; reliance on public lands resources and other values; consideration of present and future uses of the public lands; consideration of the relative scarcity of resource values; and weighing the long-term benefits to the public against the short-term benefits. *See* 43 U.S.C. § 1712(c)(1)-(9). Consideration of these criteria must drive the RMP revision.

Critically, FLPMA does not mandate that every use be accommodated on every piece of land; rather, delicate balancing is required. *See Norton v. S. Utah Wilderness Alliance*, 542 U.S. 55, 58 (2004). "'Multiple use' requires management of the public lands and their numerous natural resources so that they can be used for economic, recreational, and scientific purposes without the infliction of permanent damage." *Public Lands Council v. Babbitt*, 167 F.3d 1287, 1290 (10th Cir. 1999) (citing 43 U.S.C. § 1702 (c)). As held by the Tenth Circuit, "[i]f all the competing demands reflected in FLPMA were focused on one particular piece of public land, in many instances only one set of demands could be satisfied. A parcel of land cannot both be preserved in its natural character and mined." *Rocky Mtn. Oil & Gas Ass'n v. Watt,* 696 F.2d 734, 738 n. 4 (10th Cir.1982) (quoting *Utah v. Andrus,* 486 F.Supp. 995, 1003 (D.Utah 1979)); *see also* 43 U.S.C. § 1701(a)(8) (stating, as a goal of FLPMA, the necessity to "preserve and protect certain public lands in their natural condition"); *Pub. Lands Council,* 167 F.3d at 1299 (citing § 1701(a)(8)). As further provided by the Tenth Circuit:

> It is past doubt that the principle of multiple use does not require BLM to prioritize development over other uses… BLM's obligation to manage for multiple use does not mean that development *must* be allowed on [a particular piece of public lands]. Development is a *possible* use, which BLM must weigh against other possible uses—including conservation to protect environmental values, which are best assessed through the NEPA process. Thus, an alternative that closes the [proposed public lands] to development does not necessarily violate the principle of multiple use, and the multiple use provision of FLPMA is not a sufficient reason to exclude more protective alternatives from consideration.

New Mexico ex rel. Richardson, 565 F.3d at 710. Accordingly, the RMP amendment must consider, on equal footing, the value of permanent protection and preservation of public lands in the planning area, along with industry pressure to lease and develop public lands for fossil fuel resources. It is incumbent on the FFO to re-evaluate these competing resources and give suitable

weight to FLPMA's mandate to preserve and protect public lands in their natural condition. *See* 43 U.S.C. § 1701(a)(8). This is, after all, the agency's statutory mandate. *See New Mexico ex rel. Richardson,* 565 F.3d at 709.

By the measures detailed above, BLM must develop a range of alternatives to satisfy its statutory obligation under FLPMA, which necessarily includes alternatives that would close remaining lands to fossil fuel leasing and development. Over 91% of the FFO planning area is already leased. We are past the point where any reasonable balance can be made between oil and gas development and other resources, including land, water, air, and cultural values they community relies on.

BLM's alternatives must account for current resource conditions, changes in circumstances, and new or revised national-level policy, in particular with regard to climate change. BLM must consider all reasonable alternatives, including alternatives that would significantly reduce planning area greenhouse gas emissions, and in particular an alternative that considers not leasing public lands for fossil fuel development. 40 C.F.R. § 1502.14.

Courts have interpreted BLM's authority under the MLA as discretionary and not as an absolute mandate to lease. In fact, the Ninth Circuit held that the MLA "allows the Secretary to lease such lands, but does not require him to do so.... [T]he Secretary has discretion to refuse to issue any lease at all on a given tract . . . we affirm the district court's holding that the agencies failed to give the no action alternative meaningful consideration and thereby violated NEPA." *Bob Marshall All. v. Hodel*, 852 F.2d 1223, 1229-30 (9th Cir. 1988) (internal citations omitted). In an analogous case, the district court in *Wilderness Soc., Ctr. For Native Ecosystems v. Wisely* found:

> [T]he BLM's rejection of the 'no surface occupancy' alternative violated NEPA in both a technical and substantive sense. The Court finds that final September 2005 EA does not adequately explain why the 'no surface occupancy' alternative was dropped. 40 C.F.R. § 1502.14(a) requires that the EA 'briefly discuss the reasons' why an alternative was eliminated. Moreover, even if the BLM had fully articulated the reasons for excluding the 'no surface occupancy' alternative, the Court would nevertheless find that, on the present record, the decision to eliminate that alternative was arbitrary and capricious.

524 F. Supp. 2d 1285, 1311–12 (D. Colo. 2007). Moreover, because BLM is conducting an EIS review for this RMP, the requirement for analyzing or dismissing no action or no-leasing alternatives is heightened. *See W. Watersheds Project v. Bureau of Land Mgmt.*, 721 F.3d 1264, 1274-75 (10th Cir. 2013) ("Regulations require both documents to incorporate a range of reasonable alternatives, but the depth of discussion and analysis required is different depending on whether the document is an EIS or an EA. For example, section 40 C.F.R. §1502.14 provides that an EIS should '[r]igorously explore . . . all reasonable alternatives,' and '[d]evote substantial treatment to each alternative' with 'detail.' *Id*. at (a)-(b).")

Thus, BLM's consideration of a no-leasing alternative reasonable in light of new information, science, and national policy related to climate change, and therefore must be

included in the FFO's RMPA. BLM should resist any inclination toward maintaining a status quo approach to federal lands management in the San Juan Basin, which would be unhinged from current reality and the demands of the time.

B. BLM Must Consider a No Leasing Alternative in Response to Threats Posed by Climate Change.

Climate change has fundamentally altered the paradigm of public lands management—a reality reflected in new national policy as well as international commitments—but long ignored by the FFO in its management of the planning area. The business-as-usual approach fails to meet the needs of present and future generations—the agency's core mandate in managing public lands and minerals. 43 C.F.R. § 1702(c). Both science and common sense dictate that perpetuating a management approach which has substantially contributed to climate change is no longer sufficient. The agency must consider alternatives that are responsive to this reality, including not leasing fossil fuel minerals.

Every ton of carbon dioxide added to the atmosphere worsens climate change. So any additional oil and gas production permitted on BLM land managed by the FFO and the combustion of those fossil fuels will worsen climate change. Due to the urgent need to protect mankind and federal public lands from the potentially devastating impacts of catastrophic global warming, BLM must consider and analyze an alternative that reduces or eliminates the number of new fossil fuel leases in the Farmington planning area.

The BLM has explicit legal authority under FLPMA, the MLA and NEPA to adopt a no-leasing alternative as necessary to respond to the threats posed by climate change. BLM has broad discretion in determining when, how, and if fossil fuel resources are made available for leasing.

With regard to oil and gas, the MLA states: "All lands subject to disposition under this Act which are known or believed to contain oil or gas deposits *may* be leased by the Secretary." 30 US.C. § 226(a) (emphasis added); *see also Udall v. Tallman,* 30 U.S. 1, 4 (1965) (MLA "left the Secretary discretion to refuse to issue any lease at all on a given tract"); *Burglin v. Morton*, 527 F.2d 486, 488 (9th Cir. 1975) ("The permissive word 'may' in Section 226(a) allows the Secretary to lease such lands, but does not require him to do so."); *Pease v. Udall*, 332 F.2d 62, 63 (9th Cir. 1964) ("[T]he Mineral Leasing Act has consistently been construed as leaving to the Secretary, within his discretion, a determination as to what lands are to be leased thereunder.").

Although the MLA states that, for oil and gas, "[l]ease sales shall be held for each State where eligible lands are available at least quarterly and more frequently *if* the Secretary of the Interior determines such sales are necessary," quarterly leasing is *not required* if no lands are "eligible" and "available" due to factors including withdrawal from the operation of the MLA under FLPMA, allocation decisions under an applicable land management plan, need for additional environmental review, or exercise of Secretarial discretion. 30 U.S.C. § 226(b)(1)(A); *see also* 43 C.F.R. § 3120.1-1; U.S. Bureau of Land Management, Oil and Gas Leasing Reform, Instruction Memorandum No. 2010-117 ("Eligible lands include those identified in 43 C.F.R. § 3120.1-1 as being available for leasing (BLM Manual 3120, Competitive Leases). They are

considered available for leasing when all statutory requirements have been met, including compliance with the NEPA, appropriate reviews have been conducted, and *lands have been allocated for leasing in the RMP* (BLM Handbook H-3101-1, Issuance of Leases).") (emphasis added). Thus, a decision to allocate an area as ineligible for leasing through the planning process is contemplated by BLM's regulations, contradicting any perceived requirement that BLM must lease the area.

The Federal Onshore Oil and Gas Leasing Reform Act ("FOOGLRA")—while not altering the fundamental leasing structure of the MLA—imposed a competitive bidding requirement on all offered leases. 30 U.S.C. §§ 188, 195, 226. Critically, FOOGLRA did not repeal or alter Secretarial discretion of *whether* to offer any particular lands for lease. *See Western Energy Alliance v. Salazar*, 709 F.3d 1040, 1044 (10th Cir. 2013) ("Before the MLA was amended by the [FOOGLRA]…it was well established that the Secretary had extremely broad discretion and was not obligated to issue any lease on public lands…. The MLA, as amended by the Reform Act of 1987, continues to vest the Secretary with considerable discretion to determine which lands are 'to be leased' under § 226(b)(1)(A)."). As held by the Court of Appeals in *Bob Marshall Alliance v. Hodel*:

> the Mineral Leasing Act gives the Interior Secretary discretion to determine which lands are to be leased under the statute. 30 U.S.C. §226(a) (1982); *see Mountain States,* 499 F.Supp. at 391-92. We have held that the Mineral Leasing Act "allows the Secretary to lease such lands, but does not require him to do so.... [T]he Secretary has discretion to refuse to issue any lease at all on a given tract." *Burglin v. Morton*, 527 F.2d 486, 488 (9th Cir. 1975) (citing *Udall v. Tallman*, 380 U.S. 1, 4 (1965), *cert denied,* 425 U.S. 973 (1976)).

852 F.2d 1223, 1230 (9th Cir. 1988).

The Secretary of the Interior also has authority under FLPMA to "withdraw" an area of federal land from oil and gas leasing to "maintain . . . public values" or for a "particular public purpose." FLPMA defines a withdrawal as:

> withholding an area of Federal land from settlement, sale, location, or entry, under some or all of the general land laws, for the purpose of limiting activities under those laws in order to maintain other public values in the area or reserving the area for a particular public purpose or program . . .

43 U.S.C. § 1702(j). FLPMA further provides that Congress declares that it is the policy of the United States that "the public lands [shall] be managed in a manner that will protect the quality of … air and atmospheric … values." 43 U.S.C. § 1701(a)(8).

Under FLPMA's "multiple use and sustained yield" management directive, *id.* § 1701(a)(7), the federal government must manage public lands and resources in a manner that "takes into account the long-term needs of future generations for renewable and nonrenewable resources, including, but not limited to, recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific and historical values; and harmonious and coordinated

management of the various resources without permanent impairment of the productivity of the land[,]" *id.* § 1702(3). Further, "[i]n managing the public lands the Secretary shall … take any action necessary to prevent unnecessary or undue degradation of the lands." *Id.* § 1732(b).

Under these authorities, BLM is required not only to evaluate the impacts of federal leasing to public lands, water, and wildlife resources, but to avoid harm to those resources whenever possible. Accordingly, the MLA and FLPMA provide BLM the legal authority to either decide not to lease particular lands, or to withdraw large tracts from leasing.[100]

Further, the Tenth Circuit Court of Appeals has explicitly rejected arguments that FLPMA's multiple use mandate requires that public lands be made available for fossil fuel extraction.

> BLM's obligation to manage for multiple use does not mean that development *must* be allowed on [a particular piece of public lands]. Development is a *possible* use, which BLM must weigh against other possible uses – including conservation to protect environmental values, which are best assessed through the NEPA process. Thus, an alternative that closes the [proposed public lands] to development does not necessarily violate the principle of multiple use, and the multiple use provision of FLPMA is not a sufficient reason to exclude more protective alternatives from consideration.

New Mexico ex rel. Richardson, 565 F.3d at 710 (emphasis in original).

C. BLM Must Explicitly Consider a Renewable Energy Alternative or Include Renewable Energy as a Priority Element in Each Alternative.

A transition to clean energy is critical to achieving the national climate goals discussed in Section I of these comments. Several statements of national policy in regulations and executive orders create an obligation for BLM to look more closely at renewable energy as a resource in the Farmington Field Office planning area. As of 2010, these include:

---

[100] Even if BLM concludes that the agency lacks authority to bar new oil and gas leasing throughout the planning area, it should still consider such an alternative because it is otherwise reasonable. Federal courts hold that agencies have the duty to consider reasonable alternatives that are outside the jurisdiction of the agency or that require a change of law to implement. *See* 40 C.F.R. § 1502.14(c) (an EIS "shall" "[i]nclude reasonable alternatives not within the jurisdiction of the lead agency"); Council on Environmental Quality, Executive Office of the President, Publication of Memorandum to Agencies Containing Answers to 40 Most Asked Questions on NEPA Regulations, 46 Fed. Reg. 18,026–01 at 18,027 (1981) ("An alternative that is outside the legal jurisdiction of the lead agency must still be analyzed in the EIS if it is reasonable. A potential conflict with local or federal law does not necessarily render an alternative unreasonable"); *Muckleshoot Indian Tribe v. U.S. Forest Serv.*, 177 F.3d 800, 814 (9th Cir. 1999) (setting aside EIS for failure to address alternative requiring Congressional action).

- The Energy Policy Act of 2005 (Title II, Sec. 211), which requires the DOI to approve at least 10,000 megawatts of non-hydropower renewable energy on public lands by 2015. The President has requested that BLM produce an additional 10,000 megawatts beyond that mandated in the Energy Policy Act of 2005.

- Secretarial Order 3285, which requires the DOI to identify and prioritize specific locations best suited for large-scale renewable energy production.

- Instruction Memorandum 2007-097, Solar Energy Development Policy (BLM 2007), establishes policy for the processing of right-of-way (ROW) applications for solar energy development projects on BLM-administered lands and evaluating the feasibility of installing solar energy systems on BLM administrative facilities and projects.

- Instruction Memorandum 2006-216, Wind Energy Development Policy (BLM 2006), provides guidance on implementing the Record of Decision for the Programmatic Environmental Impact Statement (EIS) on Wind Energy Development (BLM 2005) and processing ROW applications for wind energy projects on BLM-administered lands. Instruction Memorandum 2009-043, Wind Energy Development Policy (BLM 2009b), provides updated guidance on processing ROW applications for wind energy projects on BLM-administered lands.

- Instruction Memorandum 2004-227, Biomass Utilization Strategy (BLM 2004), updated in July 2005, provides sets of goals to help focus and increase utilization of biomass from BLM lands. In June 2005, the final rule in the *Federal Register* revised the authority of 48 Code of Federal Regulations (CFR) Part 1452 by adding 1452.237-71, which is a new contract clause for removal and utilization of woody biomass generated as a result of land management service contracts whenever ecologically and lawfully appropriate. The BLM issued Instruction Memorandum 2009-120 in May 2009, which updated the contract clause for utilization for woody biomass.

The Farmington planning area has long been a sacrifice zone for extractive industry, and in particular for oil and gas—with over 40,000 historic wells drilled and at least 21,725 wells currently in production. Not only have local communities been forced to endure the effects of this development on their land, air, water, but they have also long suffered from the industry's boom and bust cycles. The federal government must consider alternatives that would allow for a just transition of local and state economies, and which support community independence from fossil fuels.

III. The FFO Must to Take a Hard Look at Greenhouse Gas Emissions and Impacts to Climate Change.

Conservation Groups provided detailed technical information on the agency's need to take a hard look at GHG emissions and impacts to climate change in previously submitted scoping comments, which are again incorporated by reference. This additional and supplemental information must also be considered. NEPA mandates that EISs contain "high quality" information and "[a]ccurate scientific analysis" sufficient to "help public officials make

decisions that are based on understanding environmental consequences." 40 C.F.R. § 1500.1(b), (c). Moreover, agencies have a duty to "insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements." 40 C.F.R. § 1502.24. NEPA therefore prohibits BLM from relying on outdated data.

Federal courts have long held that agency reliance on data that is stale or inaccurate invalidates environmental review. *See, e.g.*, *Northern Plains Resource Council, Inc. v. Surface Transp. Bd.*, 668 F.3d 1067, 1085-86 (9th Cir. 2011) (ten-year old survey data for wildlife "too stale" thus reliance on it in EIS was arbitrary and capricious); *Lands Council v. Powell*, 395 F.3d 1019, 1031 (9th Cir. 2005) (six year-old survey data for cutthroat trout was "too outdated to carry the weight assigned to it" and reliance on that data violated NEPA); *Seattle Audubon Soc. v. Espy*, 998 F.2d 699, 704-05 (9th Cir. 1993) (reliance on "stale scientific evidence" regarding owl population data without adequate discussion of scientific uncertainty violated NEPA).

As introduced above, the CEQ's Climate Guidance provides a framework for BLM to employ in its review of GHG emissions and climate change in the RMPA. First and foremost, the agency must resist the temptation of dismissing planning area emissions by comparing them on a scale with national and global emissions—which the FFO has frequently done in the past. The CEQ explained that these comparisons do not reveal anything beyond "the nature of the climate change challenge itself"; i.e., the fact that many individual sources together make a big impact on the climate:

> Climate change results from the incremental addition of GHG emissions from millions of individual sources, which collectively have a large impact on a global scale. CEQ recognizes that the totality of climate change impacts is not attributable to any single action, but are exacerbated by a series of actions including actions taken pursuant to decisions of the Federal Government. Therefore, a statement that emissions from a proposed Federal action represent only a small fraction of global emissions is essentially a statement about the nature of the climate change challenge, and is not an appropriate basis for deciding whether or to what extent to consider climate change impacts under NEPA. Moreover, these comparisons are also not an appropriate method for characterizing the potential impacts associated with a proposed action and its alternatives and mitigations because this approach does not reveal anything beyond the nature of the climate change challenge itself: the fact that diverse individual sources of emissions each make a relatively small addition to global atmospheric GHG concentrations that collectively have a large impact. When considering GHG emissions and their significance, agencies should use appropriate tools and methodologies for quantifying GHG emissions and comparing GHG quantities across alternative scenarios. Agencies should not limit themselves to calculating a proposed action's emissions as a percentage of sector, nationwide, or global emissions in deciding whether or to what extent to consider climate change impacts under NEPA.[101]

[101] Climate Guidance at 9 (attached as Exhibit 4).

Meaningful consideration of GHG emissions is clearly within the scope of required NEPA review. *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin*., 538 F.3d 1172, 1217 (9th Cir. 2008). As the Ninth Circuit has held, in the context of fuel economy standard rules:

> The impact of greenhouse gas emissions on climate change is precisely the kind of cumulative impacts analysis that NEPA requires agencies to conduct. Any given rule setting a CAFE standard might have an "individually minor" effect on the environment, but these rules are "collectively significant actions taking place over a period of time" *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin*., 538 F.3d 1172, 1216 (9th Cir. 2008)(quoting 40 C.F.R. § 1508.7).

The courts have ruled that federal agencies should consider indirect GHG emissions resulting from agency policy, regulatory, planning and leasing decisions. For example, agencies cannot ignore the indirect air quality and climate change impact of decisions that would open up access to coal reserves. *See Mid States Coal. For Progress v. Surface Transp. Bd*., 345 F.3d 520, 532, 550 (8th Cir. 2003); *High Country Conservation Advocates v. U.S. Forest Serv*., 52 F.Supp. 3d 1174, 1197-98 (D.Colo. 2014).

The CEQ Climate Guidance is dispositive on the issue of federal agency review of GHG emissions as foreseeable direct and indirect effects of the proposed action. 81 Fed. Reg. 51,866 (Aug. 5, 2016). The CEQ guidance provides clear direction for BLM to conduct a lifecycle greenhouse gas analysis because the modeling and tools to conduct this type of analysis are readily available to the agency:

> If the direct and indirect GHG emissions can be quantified based on available information, including reasonable projections and assumptions, agencies should consider and disclose the reasonably foreseeable direct and indirect emissions when analyzing the direct and indirect effects of the proposed action. Agencies should disclose the information and any assumptions used in the analysis and explain any uncertainties. To compare a project's estimated direct and indirect emissions with GHG emissions from the no-action alternative, agencies should draw on existing, timely, objective, and authoritative analyses, such as those by the Energy Information Administration, the Federal Energy Management Program, or Office of Fossil Energy of the Department of Energy. In the absence of such analyses, agencies should use other available information.

81 Fed. Reg. 51,866 at 16 (Aug. 5, 2016)(citations omitted).

CEQ's guidance even provides an example of where a lifecycle analysis is appropriate in a leasing context:

> The indirect effects of such an action that are reasonably foreseeable at the time would vary with the circumstances of the proposed action. For actions such as a Federal lease sale of coal for energy production, the impacts associated with the

> end-use of the fossil fuel being extracted would be the reasonably foreseeable combustion of that coal.[102]

The volume of potential oil and gas from the new parcels available for lease in the FFO projected by the RFD, and the lifecycle GHG emissions impact from these new lease parcels is also quantifiable.

The agency can easily generate an accurate, site-specific impact analysis for each alternative by utilizing BLM's own Energy Policy and Conservation Act phase III Oil and Gas Inventory Model geodatabase and the RMPA alternatives GIS shapefiles to establish future extractible oil and gas volume from the planning area. This information can then be used to generate potential lifecycle GHG emissions for resultant oil and gas volumes using a peer-reviewed carbon calculator and lifecycle GHG emissions model developed by EcoShift consulting.[103] This model is not novel in its development or methodology. Numerous greenhouse gas calculation tools exist to develop lifecycle analyses, particularly for fossil fuel extraction, operations, transport and end-user emissions.[104]

State and federal agencies frequently recognize the obligation to employ upstream, downstream and lifecycle GHG emissions analyses for NEPA review of energy-related projects.[105] For example, the Department of Energy has historically utilized these types of

---

[102] *Id.* at 16, n. 42 (attached as Exhibit 4).
[103] *See* Mulvaney (attached as Exhibit 23).
[104] *See* Council on Environmental Quality, Revised draft guidance for greenhouse gas emissions and climate change impacts (2014).
[105] In addition to those cited below, a recent but by no means exhaustive list of life-cycle analyses that incorporate energy market modeling and comparison of greenhouse gas emissions across alternatives include the U.S. Forest Service's Supplemental EIS on the Colorado Roadless Rule (2016); the Surface Transportation Board's DEIS for the Tongue River Railroad (2015); EPA's regulatory impact analysis of the Clean Power Plan; and the Washington State Department of Ecology's DEIS for the proposed Millenium Export Bulk Terminal (2016); *see also* U.S. Forest Service, Record of Decision and Final Environmental Impact Statement, Oil and Gas Leasing Analysis, Fishlake National Forest, 169 (Aug 2013) (attached as Exhibit 90) (Table 3.12-7: shows GHG emissions from transportation, offsite refining and end use; and total direct and indirect emissions); *see also id*. at Appendix E/SIR-2 (more detailed calculations of direct and indirect emissions); U.S. Army Corps of Engineers, Final Environmental Impact Statement: Alaska Stand Alone Gas Pipeline, Volume 2 Sec. 5.20-70–71 (Oct. 2012) (attached as Exhibit 91) (The Corps, in a 2012 EIS for an intrastate natural gas pipeline in Alaska, estimated downstream emissions from combustion of the natural gas that would be transported, and also discussed the potential for natural gas to displace other, dirtier fuel sources such as coal and oil.); U.S. Department of State, Final Supplemental Environmental Impact Statement for the Keystone XL Project, § 4.14.3, Appendix U (Jan. 2014) (attached as Exhibit 92) (The Department of State, as lead agency on the Keystone XL Pipeline Review conducted a relatively comprehensive life-cycle greenhouse gas analysis for the proposed pipeline, alternatives, and baseline scenarios that could occur if the pipeline was not constructed.); U.S. Environmental Protection Agency Region X, Letter from Dennis McLerran, Regional Administrator, to Randel Perry, U.S. Army Corps of

lifecycle emissions analyses in NEPA review of oil and gas infrastructure projects.[106] Courts have upheld the viability and usefulness of lifecycle analyses, and adoption of this trend is clearly reflected in the CEQ Guidance on Climate Change. 81 Fed. Reg. 51, 866 at 11 (Aug. 5, 2016) ("This guidance recommends that agencies quantify a proposed agency action's projected direct and indirect GHG emissions. Agencies should be guided by the principle that the extent of the analysis should be commensurate with the quantity of projected GHG emissions and take into account available data and GHG quantification tools that are suitable for and commensurate with the proposed agency action").[107]

Engineers Seattle District, re Gateway Pacific Projects (Jan 22, 2013) *available* at: http://www.eisgatewaypacificwa.gov/sites/default/files/content/files/EPA_Reg10_McLerran.pdf#overlay-context=resources/project-library (attached as Exhibit 93) (EPA submitted comments on the scope of impacts that should be evaluated in the coal terminal EIS that the Corps is preparing, in which it urged the Corps to conduct a lifecycle emissions analysis of GHG emissions from the coal that would be transported via the terminal.)

[106] U.S. Department of Energy National Renewable Energy Laboratory, Life Cycle Greenhouse Gas Emissions from Electricity Generation Fact Sheet, Pub No. NREL/FS-6A20-57817 (2013) *available at* http://www.nrel.gov/docs/fy13osti/57187.pdf (attached as Exhibit 95); U.S. Department of Energy National Energy Technology Laboratory Role of Alternative Energy Sources: Natural Gas Technology Assessment, Pub No. DOE/NETL- 2012/1539 (NETL, 2012) *available at* https://www.netl.doe.gov/File%20Library/Research/Energy%20Analysis/Life%20Cycle%20Analysis/LCA-2012-1539.pdf (attached as Exhibit 96); U.S. Department of Energy National Energy Technology Laboratory, Life Cycle Greenhouse Gas Inventory of Natural Gas Extraction, Delivery and Electricity Production, Pub No. DOE/NETL-2011/1522 (NETL, 2011) *available at* http://www.fossil.energy.gov/programs/gasregulation/authorizations/2013_applications/sierra_club_13-69_venture/exhibits_44_45.pdf (attached as Exhibit 97); U.S. Department of Energy National Energy Technology Laboratory, Life Cycle Analysis: Natural Gas Combined Cycle (NGCC) Power Plant, Pub No DOE/NETL-403-110509 (Sep 10, 2012) (NETL, 2010) *available at* https://www.netl.doe.gov/energy-analyses/temp/FY13_LifeCycleAnalysisNaturalGasCombinedCycle(NGCC)PowerPlantFinal_060113.pdf (attached as Exhibit 98).

[107] *High Country Conservation Advocates v. United States Forest Serv*., 52 F. Supp. 3d 1174 (D. Colo. 2014) (Court held that the agencies' failure to quantify the effect of greenhouse gas (GHG) emissions from the mining lease modifications was arbitrary in violation of NEPA because the social cost of carbon protocol tool existed for such analysis under 40 C.F.R. § 1502.23 but the agencies did not provide reasons in the final EIS for not using the tool; and that the agencies' decision to forgo calculating the foreseeable GHG emissions was arbitrary in light of their ability to perform such calculations and their decision to include a detailed economic analysis of the benefits.); *see also Dine Citizens Against Ruining Our Env't v. United States Office of Surface Mining Reclamation & Enf't*, 82 F. Supp. 3d 1201, 1213-1218 (D. Colo. 2015) (Court held that the agency failed to adequately consider the reasonably foreseeable combustion-related downstream effects of the proposed action. Also held that that combustion emissions associated with a mine that fed a single power plant were reasonably foreseeable because the agency knew where the coal would be consumed).

The extreme urgency of the climate crisis requires BLM to pursue all means available to limit the climate change effects of its actions, beginning with a robust and accurate quantitative analysis of potential GHG emissions from fossil fuel development proposed in the planning area. Any emissions source, no matter how small, is potentially significant, such that BLM should fully explore mitigation and avoidance options for all sources.

A. BLM Must Address Whether Alternatives Are Consistent with National Climate Goals.

NEPA regulations require agencies to account for conflicts with existing laws and requirements imposed for the protection of the environment when engaging in environmental analysis.[108] In addition, Executive Order 12,866 also requires that "[e]ach agency shall avoid regulations that are inconsistent [or] incompatible" with the regulations of any other agency.[109]

Any subsequently prepared NEPA document must disclose whether each of the proposed plan alternatives would interfere with efforts to meet federal and international greenhouse gas emission reduction targets.[110] As explained by the CEQ in its Climate Guidance, federal agencies evaluating the climate impacts of their decisions should "discuss relevant approved federal, regional, state, tribal, or local plans, policies, or laws for GHG emission reductions or climate adaptation to make clear whether a proposed project's GHG emissions are consistent with such plans or laws."[111]

In November 2014 the President announced a joint U.S.-China agreement aimed at reducing climate pollution that calls for even more aggressively cutting net greenhouse gas emissions to 26-28 percent below 2005 levels by 2025.[112] Further, the BLM must address whether the plan alternatives accord with the Paris Agreement, which represents an international agreement to limit global temperatures to 1.5-2°C below pre-industrial levels, in which the U.S. has pledged to reduce GHG emissions by 26-28% from 2005 levels by 2025, on a path to reduce those emissions by 80% by 2050.

As part of its analysis, BLM should disclose to the public the clearly competing interests at stake: one the one hand, meeting these national and international climate emission reduction targets set by EPA, the President, or agreed upon by 195 nations; and on the other, any plan alternatives that serve to perpetuate dependence on fossil fuel resources largely for the benefit of private companies and oil and gas operators. Any failure to acknowledge this potential conflicts would be arbitrary and capricious, in violation of NEPA and Executive Order 12,866.

---

[108] *See* 40 C.F.R. § 1506.2(d) (EISs must discuss inconsistencies with state law); 40 C.F.R. § 1508.27(b)(10) (when examining whether actions are "significant" within the meaning of NEPA, agencies must consider whether the action "threatens a violation of Federal, State, or local law or *requirements imposed for the protection of the environment*.").

[109] Executive Order 12,866 (Sep. 30, 1993), Sec. 1(b)(10).

[110] *See* 40 C.F.R. § 1506.2(d); 40 C.F.R. § 1508.27(b)(10).

[111] Climate Guidance at 28 (attached as Exhibit 4).

[112] White House Fact Sheet, U.S.-China Joint Announcement on Climate Change and Clean Energy Cooperation (November 11, 2014), available at: https://www.whitehouse.gov/the-press-office/2014/11/11/us-china-joint-announcement-climate-change (attached as Exhibit 46).

B. BLM Must Quantify the Severity of Harm from Greenhouse Gas Emissions

1. Social Cost of Carbon Protocol

Research conducted by the National Research Council has confirmed that the negative impacts of energy generation from fossil fuels are not represented in the market price for such generation.[113] In other words, failing to internalize the externalities of energy generation from fossil fuels—such as the impacts to climate change and human health—has resulted in a market failure that requires government intervention. As aptly summarized by the White House Council of Economic Advisors in 2016:

> Climate change reflects a classic environmental externality. When consumers or producers emit greenhouse gases, they enjoy the benefits from the services provided by the use of the fuels, while not paying the costs of the damages from climate change. Since the price of goods and services whose production emits greenhouse gases does not reflect the economic damages associated with those gases, market forces result in a level of emissions that is too high from a social perspective. Such a market failure can be addressed by policy.[114]

Executive Order 12866 directs federal agencies to assess and quantify such costs and benefits of regulatory action, including the effects on factors such as the economy, environment, and public health and safety, among others. *See* Exec. Order No. 12866, 58 Fed. Reg. 51,735 (Sept. 30, 1993).[115] The Ninth Circuit has ruled that agencies must include the climate benefits of a significant regulatory action in federal cost-benefit analyses to comply with EO 12866.

> [T]he fact that climate change is largely a global phenomenon that includes actions that are outside of [the agency's] control ... does not release the agency from the duty of assessing the effects of its actions on global warming within the context of other actions that also affect global warming.

Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin., 538 F.3d 1172, 1217 (9th Cir. 2008) (quotations and citations omitted); *see also Border Power Plant Working Grp. v. U.S. Dep't of Energy*, 260 F. Supp. 2d 997, 1028-29 (S.D. Cal. 2003) (finding agency failure to disclose project's indirect carbon dioxide emissions violates NEPA).

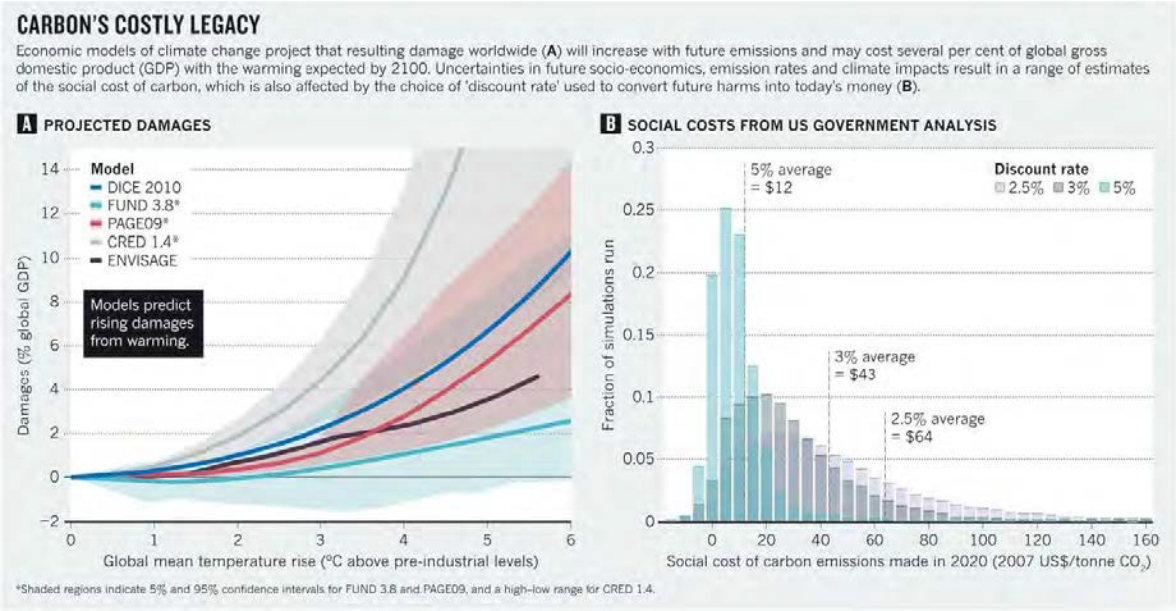
---

[113] *See, e.g.,* National Research Council, *Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use* (2010) (attached as Exhibit 106); Nicholas Muller, et. al., *Environmental Accounting for Pollution in the United States Economy*, AMERICAN ECONOMIC REVIEW (Aug. 2011) (attached as Exhibit 107); *see also* Generation Investment Management, *Sustainable Capitalism,* (Jan. 2012) (attached as Exhibit 108) (advocating a paradigm shift to "a framework that seeks to maximize long-term economic value creation by reforming markets to address real needs while considering *all* costs and stakeholders.").

[114] White House Council of Economic Advisors, The Economic Record of the Obama Administration: Addressing Climate Change at 11 (Sept. 2016) (attached as Exhibit 37).

[115] *See also* Executive Order 13563, 76 Fed. Reg. 3821 (Jan. 18, 2011) (reaffirming the framework of EO 12866 and directing federal agencies to conduct regulatory actions based on the best available science).

In response, an Interagency Working Group ("IWG") was formed to develop a consistent and defensible estimate of the social cost of carbon—allowing agencies to "incorporate the social benefits of reducing carbon dioxide (CO_2) emissions into cost-benefit analyses of regulatory actions that impact cumulative global emissions."[116] In other words, SCC is a measure of the benefit of reducing greenhouse gas emissions now and thereby avoiding costs in the future.[117] The charts below depict, (A) dramatically increasing damages from global warming over time, as well as (B) the social cost of these carbon emissions based on 2013 TDS values.[118]



Leading economic models all point in the same direction: that climate change causes substantial economic harm, justifying immediate action to reduce emissions.[119] The interagency process to develop SCC estimates—originally described in the 2010 interagency technical support document ("TSD"), and updated in 2013 and 2015—developed four values based on the average SCC from three integrated assessment models (DICE, PAGE, and FUND), at discount rates of 2.5, 3, and 5 percent,[120] as well as a fourth value, which represents the 95th percentile

---

[116] *See* Interagency Working Group on the Social Cost of Carbon, United States Government, *Technical Support Document: Technical Update on the Social Cost of Carbon for Regulatory Impact Analysis – Under Executive Order 12866* (May 2013) at 2 (hereinafter 2013 TSD) (attached as Exhibit 109).

[117] *See* Ruth Greenspan and Dianne Callan, *More than Meets the Eye: The Social Cost of Carbon in U.S Climate Policy, in Plain English,* WORLD RESOURCES INSTITUTE (July 2011) (attached as Exhibit 110).

[118] *See* Richard Revesz, *et al., Global warming: Improve economic models of climate change,* NATURE 508, 173-175 (April 10, 2014) (attached as Exhibit 111).

[119] *See id.* at 174.

[120] The choice of which discount rate to apply—translating future costs into current dollars—is critical in calculating the social cost of carbon. The higher the discount rate, the less significant future costs become, which shifts a greater burden to future generations based on the notion that the world will be better able to make climate investments in the future. The underlying

SCC estimate across all three models at a 3 percent discount rate, and demonstrates the cost of worst-case impacts.[121] These models are intended to quantify damages, including health impacts, economic dislocation, agricultural changes, and other effects that climate change can impose on humanity. While these values are inherently speculative, a recent GAO report has confirmed the soundness of the methodology in which the IWG's SCC estimates were developed, therefore further underscoring the importance of integrating SCC analysis into the agency's decisionmaking process.[122] In fact, certain types of damages remain either unaccounted for or poorly quantified in IWG's estimates, suggesting that the SCC values are conservative and should be viewed as a lower bound.[123]

The updated interagency SCC estimates for 2020 are $12, $42, $62 and $123 per ton of CO_2 (in 2007$).[124] The IWG does not instruct federal agencies which discount rate to use, suggesting that the 3 percent discount rate ($42 per ton of CO_2) as the "central value," but further emphasizing "the importance and value of including all four SCC values[;]" i.e., that the agency should use the range of values in developing NEPA alternatives.[125]

In 2014, the district court for the District of Colorado faulted the Forest Service for failing to calculate the social cost of carbon, refusing to accept the agency's explanation that such a calculation was not feasible. *High Country Conservation Advocates v. U.S. Forest Service*, 52 F.Supp.3d 1174 (D.Colo. 2014) (a decision the agency decided not to appeal, thus implicitly recognizing the importance of incorporating a social cost of carbon analysis into NEPA decisionmaking). Notably, the *High Country Conservation Advocates* decision applies to the same geographic area (the North Fork Valley), and to the same coal field (the Somerset),

---

assumption of applying a higher discount rate is that the economy is continually growing. The IWG's "central value" of three percent is consistent with this school of thought—that successive generations will be increasingly wealthy and more able to carry the financial burden of climate impacts. "The difficultly with this argument is that, as climate change science becomes increasingly concerning, it becomes a weaker bet that future generations will be better off. If they are not, lower or negative discount rates are justified." WRI Report, at 9 (attached as Exhibit 110). "Three percent values an environmental cost or benefit occurring 25 years in the future at about half as much as the same benefit today." *Id.*

[121] *See* 2013 TSD at 2 (attached as Exhibit 109).

[122] GAO-14-663, *Social Cost of Carbon* (July 24, 2014).

[123] *See* Peter Howard, et al., *Omitted Damages: What's Missing From the Social Cost of Carbon*, ENVIRONMENTAL DEFENSE FUND, INSTITUTE FOR POLICY INTEGRITY, NATURAL RESOURCES DEFENSE COUNCIL (March 13, 2014) (attached as Exhibit 112) (providing, for example, that damages such as "increases in forced migration, social and political conflict, and violence; weather variability and extreme weather events; and declining growth rates" are either missing or poorly quantified in SCC models).

[124] *See* 2013 TSD (July 2015 Revision) at 3 (attached as Exhibit 109) (including a table of revised SCC estimates from 2010-2050). To put these figures in perspective, in 2009 the British government used a range of $41-$124 per ton of CO_2, with a central value of $85 (during the same period, the 2010 TSD used a central value of $21). WRI Report at 4 (attached as Exhibit 110). The UK analysis used very different assumptions on damages, including a much lower discount rate of 1.4%. The central value supports regulation four times a stringent as the U.S. central value. *Id.*

[125] *See* 2013 TSD at 12 (attached as Exhibit 109).

that is at issue here. In his decision, Judge Jackson identified the IWG's SCC protocol as a tool to "quantify a project's contribution to costs associated with global climate change." *Id.* at 1190.[126] To fulfill this mandate, they agency must disclose the "ecological[,] … economic, [and] social" impacts of the proposed action. 40 C.F.R. § 1508.8(b). Simple calculations applying the SCC to GHG emissions from this project offer a straightforward comparative basis for analyzing impacts, and identifying very significant costs.[127]

Notably, according to the IPCC, the 20-year GWP for methane—which is not only the planning lifespan of the RMP, but the relevant timeframe for consideration if we are to stem the worst of climate change—is 87.[128] BLM has historically used an outdated GWP when calculating methane's warming impact. The agency should avoid that temptation here, as it not only underestimates to relevant emissions and their impacts, but also near term benefits of avoiding this pollution.

CEQ provides that "[i]t is essential … that Federal agencies not rely on boilerplate text to avoid meaningful analysis, including consideration of alternatives or mitigation." *Id.* at 5-6 (citing 40 C.F.R. §§ 1500.2, 1502.2). Indeed, the EPA has also cautioned "against comparing GHG emissions associated with a single project to global GHG emission levels" because it erroneously leads to a conclusion that "on a global scale, emissions are not likely to change" as a result of the project.[129] Applying the SCC, as provided above, takes these abstract emissions and places them in concrete, economic terms. As noted by Judge Jackson, the SCC protocol provides a tool to quantify the costs of these emissions. *See High Country Conservation Advocates,* 52 F.Supp.3d at 1190. By failing to consider the costs of GHG emissions from the Proposed Action, the agency's analysis effectively assumes a price of carbon that is $0. *See id.* at 21 (holding that although there is a "wide range of estimates about the social cost of GHG emissions[,] neither the BLM's economist nor anyone else in the record appears to suggest the cost is as low as $0 per unit. Yet by deciding not to quantify the costs as all, the agencies effectively zeroed out the cost in its quantitative analysis."). The agency's failure to consider the SCC is arbitrary and capricious, and ignores the explicit directive of EO 12866.

An agency must "consider every significant aspect of the environmental impact of a proposed action." *Baltimore Gas & Elec. Co. v. Natural Resources Defense Council*, 462 U.S. 87, 107 (1983) (quotations and citation omitted). This includes the disclosure of direct, indirect, and cumulative impacts of its actions, including climate change impacts and emissions. 40 C.F.R.

---

[126] *See also id.* at 18 (noting the EPA recommendation to "explore other means to characterize the impact of GHG emissions, including an estimate of the 'social cost of carbon' associated with potential increases in GHG emissions.") (citing Sarah E. Light, *NEPA's Footprint: Information Disclosure as a Quasi-Carbon Tax on Agencies*, 87 Tul. L. Rev. 511, 546 (Feb. 2013)).

[127] It is important to note that, although the 2010 IWG SCC protocol did not address methane impacts, the 2013 IWG Technical Update explicitly addresses methane impacts. Thus, it is appropriate to calculate a SCC outcome that takes into account the full CO_2e emissions associated with the proposed leasing.

[128] *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *Working Group I Contribution to the IPCC Fifth Assessment Report Climate Change 2013: The Physical Science Basis,* at 8-58 (Table 8.7) (Sept. 2013) (attached as Exhibit 113).

[129] *See* Light, 87 Tul. L. Rev. 511, 546.

§ 1508.25(c). The need to evaluate such impacts is bolstered by the fact that "[t]he harms associated with climate change are serious and well recognized," and environmental changes caused by climate change "have already inflicted significant harms" to many resources around the globe. *Massachusetts v. EPA*, 549 U.S. 497, 521 (2007); *see also id.* at 525 (recognizing "the enormity of the potential consequences associated with manmade climate change."). Among other things, the agency's analysis must disclose "the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity[,]" including the "energy requirements and conservation potential of various alternatives and mitigation measures." 42 U.S.C. § 4332(c); 40 C.F.R. § 1502.16(e). As explained by CEQ, this requires agencies to "analyze total energy costs, including possible hidden or indirect costs, and total energy benefits of proposed actions." 43 Fed. Red. 55,978, 55,984 (Nov. 29, 2978); *see also* Executive Order 13514, 74 Fed. Reg. 52,117 (Oct. 5, 2009) (requiring government agencies to disclose emissions information annually from direct and indirect activities). Failing to perform such analysis undermines the agency's decisionmaking process and the assumptions made.

Nor can the agency tout the benefits of coal, oil and gas development without similarly disclosing the costs. *See* 40 C.F.R. § 1502.23. For example, BLM identifies "tax impact from coal extraction in the planning area" as a benefit, with revenues "associated with the sales and income earned from extraction and transportation of coal." DEIS at 4-465. Although not quantified in the same way, BLM also assumes that "increased production of oil and gas on BLM-administered lands would result in a comparable increase in contributions to local counties and communities." *Id.* Accordingly, BLM relies on figures in Table 4-90 (Baseline Regional Economic Impacts for Coal), to suggest a substantial net economic benefit, including $556 million in annual output and $175 million in labor income. DEIS at 4-469. Setting aside that this economic data is based on wildly optimistic assumptions on future coal production and employment for 2,518 people—with a current reality of coal mines being shut down and present employment of around 250 people—this type of misleading and one-sided analysis is expressly forbidden under NEPA. *See Hughes River Watershed Conservancy v. Glickman*, 81 F.3d 437, 446-47 (4th Cir. 1996) ("it is essential that the EIS not be based on misleading economic assumptions); *Sierra Club v. Sigler,* 695 F.2d 957, 979 (5th Cir. 1983) (agency choosing to "trumpet" an action's benefits has a duty to disclose its costs).

2. Social Cost of Methane Protocol

In August 2016, the Interagency Working Group ("IWG") provided an update to the social cost of carbon technical support document,[130] and, for the first time, adopted a similar methodology for evaluating the climate impact of each additional ton of methane and nitrogen oxide emissions.[131] Given its recent endorsement by the IWG, BLM should use the social cost of

[130] Interagency Working Group, Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 (August 2016), (attached as Exhibit 324). The August 2016 update added some clarifying information around uncertainties in the modeling that supports the social cost of carbon, but did not adjust the damages values (the costs) published in the 2015 update.

[131] Interagency Working Group, Addendum to Technical Support Document on Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866: Application of the

methane to quantify the expected climate damage caused by the extraction and combustion of oil and gas extracted under BLM's Mancos RMPA.

Similar to the social cost of carbon, the social cost of methane provides a standard methodology that allows state and federal agencies to quantify the social benefits of reducing methane emissions through actions that have comparatively small impacts on cumulative global emission levels. The social cost of methane is intended to "offer a method for improving the analyses of regulatory actions that are projected to influence [methane or nitrogen oxide] emissions in a manner consistent with how [carbon dioxide] emission changes are valued."[132] Like the social cost of carbon, the social cost of methane is presented as a range of figures across four discount rates; it is based on results from three integrated assessment models; displayed in dollars per metric ton of emissions; and increases over time because emissions become more damaging as their atmospheric concentrations increase.[133] Like the social cost of carbon, the social cost of methane has been subject to peer review and will be updated by the IWG to ensure it reflects the best available scientific information.[134] The IWG estimates that each additional ton of methane emitted in 2020 will cause between $540 and $3,200 dollars (measured in $2007).[135]

BLM should use the best tools available to it in order to fully analyze and disclose the climate impacts of its proposal. Given that both the social cost of carbon and social cost of methane have been adopted by the IWG, which includes a dozen federal offices and agencies including the Department of Interior, BLM should use these tools to evaluate the climate impacts of its draft plan for the Uncompahgre planning area, which, as noted, anticipates generating more than half a billion tons of CO2-e over the next two decades.

****

C. *Expert Comments: Economic Scoping for the Mancos RMPA*

CONSERVATION ECONOMICS INSTITUTE, Dr. Evan E. Hjerpe, Executive Director, and Dr. Pete Morton, Advising Economist, prepared the following for Conservation Groups specifically for the Mancos RMPA and EIS:

CLIMATE CHANGE ECONOMICS AND FOSSIL FUEL DEVELOPMENT

The development of oil and gas fields on BLM lands provides both costs and benefits to society. The benefits to society include the fiscal benefits to national taxpayers via lease revenues and royalties paid to the U.S. treasury. The costs to society of fossil fuel development on public lands includes the cost of managing and administering oil and gas leases and a slew of social

---

Methodology to Estimate the Social Cost of Methane and the Social Cost of Nitrous Oxide (August 2016) (attached as Exhibit 325).

[132] *Id*. at 3.

[133] *Id.* at 7.

[134] *Id.* at 3.

[135] *Id.* at 7. For comparison purposes, the current social cost of carbon values for CO2 emissions in 2020 range from $120 to $123 per ton.

costs in terms of environmental and community damages. These economic damages (costs) include social costs associated with boom and bust natural resource extraction, but are heavily comprised of costs related to the pollution and community disruption generated by oil and gas development.

The pollution includes the release of greenhouse gases (GHGs), other volatile organic compounds (VOCs), particulates, degradation of plant and wildlife habitats, and potential acute pollution of water and surrounding environs associated with production and transportation failures. Communities are disrupted by increased traffic, noise, light pollution, and disruption of traditional religious practices. Pollution from oil and gas development is not contained on site. Rather, the pollution adversely affects the surrounding environments, regional environments, and in the case of greenhouse gases, extends globally. In economics jargon, pollution and community disruption are externalities. That is, most of the impacts are external to the production and consumer costs of oil and gas; it is not accounted for in the economic ledgers because it is passed on to other places and people over a period of time.

Externalities create market failures, where the private costs of oil and gas production on public lands (lease and production costs) do not cover the public, or social costs, of fossil fuel development (such as pollution). A.C. Pigou was one of the first economists to isolate and propose accounting for the social costs of externalities such as pollution in the 1920s and 1930s. Since Pigou, and entire field of environmental economics has been developed to account for externalities and to appropriately account for natural amenities. In environmental economics, pollution is characterized as a public "bad" resulting from "waste discharges" associated with the production of private goods.[136]

In cases of pollution and community disruption, as would happen under the proposed expansion of the Mancos Shale/Gallup Formation, the BLM should account for these externalities by estimating the social costs generated from the pollution and comparing them to the benefits of further oil and gas development. Social costs must be considered to whom all they apply. In regards to climate change and GHG emissions, these social costs must be considered locally, domestically, globally, and inter-temporally (future generations).

ACCOUNTING FOR CLIMATE CHANGE DAMAGES WITH THE SOCIAL COST OF CARBON

Emissions of GHGs are the primary cause of anthropogenic climate change. Released GHGs, and the resulting climate change, represents a special case of pollution both temporally and spatially. A number of pollutants, such as heavy metals and fine particulates, have a limited geographic scope of damage typically regional in nature. GHGs, on the other hand, mix with other GHGs in the atmosphere triggering global damages. Temporally, GHGs accumulate and cause climate change long into the future. That is, GHGs emitted today have both a marginal effect in the present and contribute to an increased total pollution effect for many years to come. The dispersed spatial and temporal effects of GHGs have led to specific accounting of their societal damages across the globe and for future generations. The concept of the Social Cost of

[136] Cropper, M. L., & Oates, W. E. (1992). Environmental economics: a survey. *Journal of economic literature*, *30*(2), 675-740.

Carbon (SCC) has been developed by inter-disciplinary biophysical and social scientists to properly account for the negative externalities generated by human activities that lead to climate change. The SCC was developed primarily for regulatory policy to help understand the monetary benefits of avoiding damages caused by releasing additional carbon dioxide into the atmosphere. These values are typically expressed as dollars per metric ton of carbon dioxide. The SCC utilizes integrated assessment models (IAMs) that combine climate science projections for the effect of increasing GHGs on temperatures, sea levels, and climate systems with projections of economic growth and emission controls. The models estimate climate damage functions, or the relationship between CO_2 emissions and the damage caused.[137] Damages include agricultural productivity losses, property damages, and human health effects. There are three primary IAMs (DICE, PAGE, and FUND) that allow for varying sensitivity analysis. The models are generally considered conservative as they have not included numerous other potential damages.

With the welfare of not only current generations, but future generations to come, at stake under escalating climate change scenarios, a contentious component of estimating the SCC (or SCM) is the concept of a discount rate. The discount rate devalues future costs and benefits as compared to current costs and benefits, often close to the long-term average rate of annual inflation (2-6%). As there is a societal preference, or time value, for $100 dollars today as opposed to next year, a discount rate attempts to account for this time preference when bringing future successive years of costs to a present value (PV). That is, the current society must place a value on economic damages caused by climate change to future generations in present dollars. The current generation must also choose whether or not they should pay for damages from current emissions. How far damages are projected into the future, and at what discount rate, have significant influence on the current (PV) value assigned to climate damages. The dramatic differences caused by varying discount rates can completely change the resulting SCC. A quick illustration:

- $1,000,000 of climate change damages in 50 years from now has a present value of $372,000 at a 2% discount rate, but only a present value of $34,000 at a 7% discount rate.

In the case of pollution and long term damages to the earth, some have called for very low discount rates. More equitable intergenerational valuation has been proposed by many, calling for discount rates of zero or approaching zero. Furthermore, a case can be made that costs and benefits related to the earth's natural capital (e.g., natural resources, ecosystems, and climatic/disturbance process) and the pollution/degradation of that natural capital should be assessed with very low discount rates. Critical planetary infrastructure should be devalued less than traditional financial investments. Turns out, they are not substitutes.

Most researchers recommend utilizing the global SCC for BCA in order to account for the externalities of our domestic emissions (e.g., Pizer et al. 2014, Greenstone et al. 2013, and Johnson and Hope 2012). However, a recent pub from Gayer and Viscusi (2016) make a compelling case for inclusion of a domestic SCC for US regulatory analysis in addition to the global SCC.

[137] Bell, R. G., & Callan, D. (2011). More than meets the eye: the social cost of carbon in US climate policy. *Environmental Law*.

For federal regulatory policy, benefit/cost analysis (BCA) is required for Regulatory Impact Analyses (RIA) and is often performed at the regional land management planning level for various alternatives under NEPA analysis. The SCC has been included in a number of federal rulemakings, including some BLM planning documents. However, given the role of fossil fuel development in climate change, it is critical that all planning associated with oil and gas development weigh the social costs of GHGs explicitly in land management planning. Only by fully accounting for reduced societal welfare due to climate change, can the Mancos RMPA examine the most economically efficient development strategy. For example, the most economically efficient alternative may very well be the "no-leasing" alternative, once market failures associated with pollution are fully internalized.

We recommend that the FFO conduct a full benefit/cost analysis that includes the SCC projected into the future. We suggest that the SCC be examined at both a global and domestic level, and that discount rates for the BCA include two levels, one at 3%, and one at the lower recommended discount rate for benefits and costs of critical natural capital changes (1%). We recommend using the 2020 estimates recommended for federal agency use by the IWG.
At the regional planning level, such as the Mancos RMPA, we recommend a further accounting of environmental and social damages resulting from oil and gas development pollution (in addition to the BCA proposed above). From the public's perspective, the benefits of a No-Leasing alternative can be viewed as damage avoided from pollution associated with oil and gas development alternatives. Natural resource damage assessments (NRDA) are an additional framework that can highlight potential damages resulting from pollution. NRDAs are measures of liability, or damage estimates to be paid to replace, offset, or mitigate lost economic values. The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), or Superfund, provided for liability of polluters of hazardous waste. The first legislation to identify injuries to natural resources as compensable damages was the Clean Water Act.[138] After these provisions were enacted, the federal government, states, and others filed legal claims to recoup damages from environmental contaminators and utilized natural resource damage assessments to estimate the value of the damages. The most publicized NRDA was conducted to determine compensation from damages from the Exxon Valdez oil spill to the Prince William Sound ecosystem in Alaska. These compensatory damages included lost use and passive use values to local and Native peoples.

While the FFO may not be able to fully quantify all regional aspects of environmental and social damages resulting from pollution, they can begin to provide a monitoring baseline for key pollutants and degradation that can be developed into overall damage functions. Similar to the damage functions estimated in the IAMs to determine the social costs of carbon, the FFO needs to catalog and quantify key pollutants and degradation stemming from action alternatives. Key categories needing monitoring and presentation to the public include all pollutants stemming from both the development of oil and gas and the eventual combustion of products extracted

[138] Kopp, R. J., & Smith, V. K. (2013). Valuing natural assets: the economics of natural resource damage assessment. Routledge.

from BLM lands, water use, air quality measures, seismic activity, and wildlife habitat fragmentation (more detail in section below).

The proposed baseline monitoring of pollutants and degradation can be initially qualitatively connected to regional economic damage functions, and eventually may be quantitatively estimated as damage functions. As previously noted, climate change is leading to greater drought conditions, wildfire risk, and decreased agricultural productivity in the Southwest. Regional BLM planning efforts cannot ignore the linkage between their leasing of oil and gas extraction to the immediate and surrounding climate change damages and other environmental and social costs.

As compared to further development alternatives from the FFO, a No Lease alternative would yield tremendous benefits in terms of the avoided impacts and resulting avoided social costs. Without a proper economic accounting of these damages, the BLM is unable to assess the economic efficiency of their land management alternatives. For Pareto efficiency gains, it is essential that firms pay not only the costs of their marginal damages, but also the total cost arising from their impacts.[139] If the free market cannot induce these payments, it is up to the BLM to ensure that these environmental damages are covered when leasing out public lands for fossil fuel extraction.

EXAMPLE BCA PARAMETERS FOR THE MANCOS RMPA

For our recommended BCA for the Mancos RMPA, we have reviewed some parameters related to SCC/SCM that will be helpful in conducting the BCA. The following parameters clearly indicate that incorporation of SCC in a BCA of the Mancos RMPA would have a significant effect on determining overall economic efficiency for different alternatives.
Based on GHG equivalencies,[140] the eventual combustion of one barrel of crude oil will produce .43 metric tons of CO_2. For one thousand cubic feet (mcf) of produced natural gas, .055 metric tons of CO_2 will be emitted.
Using the recommended "central value" of $42/metric ton of CO_2 stemming from the latest technical supporting document for the IWG's social cost of carbon (discussed above), we illustrate the economic efficiency effect of properly accounting for the climate change damages resulting from further approval of developing the Mancos Shale/Gallup Formation.
A SCC of $42 in current dollars, roughly translates into $18 of SCC per barrel of crude oil approved in the new Mancos RMPA, or:

- .43 metric tons of CO_2/barrel X $42 SCC = $18 of SCC/barrel of crude

A BCA for the FFO should compare public costs to public benefits. The benefits to the public and the U.S. Treasury include returned royalties of 12.5% per produced barrel of crude and

[139] Cropper, M. L., & Oates, W. E. (1992). Environmental economics: a survey. *Journal of economic literature*, *30*(2), 675-740.
[140] Available at: https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator.

smaller amounts of bonus bids and rental rates.[141] Based on current prices of crude oil ($54/barrel),[142] the public royalty return on investment is:

- $54/barrel X .125 = $6.75 of royalty benefit to the public/barrel of crude

Under these price assumptions, the SCC of new oil production in the Mancos RMPA by itself is 267% greater than the royalty benefits. When including all the other social costs previously described, it is clear that the SCC + additional social costs far outweigh the benefits of further oil and gas expansion in the region.

For natural gas production it is even more dramatic. A SCC of $42 in current dollars, roughly translates into $2.30 per mcf of natural gas approved in the new Mancos RMPA, or:

- .055 metric tons of CO_2/mcf X $42 SCC = $2.30 of SCC/mcf of natural gas

The benefits of returned royalties at 12.5% of natural gas produced, at current gas prices around $3/mcf are:

- $3/mcf X .125 = $.38 of royalty benefit to the public/mcf of natural gas

Under current conditions, the SCC of new natural gas production considered in the Mancos RMPA by itself is 613%, or more than 6 times as great, as the natural gas royalty benefits. The parameters and simple illustrations reviewed above illustrate the importance of the BLM, and specifically the FFO, in accounting for the social costs of further oil and gas development on public lands. On the face of it, the social benefits of further oil and gas production in the Mancos Shale/Gallup Formation do not even come close to exceeding the social costs that will be incurred. Extrapolating these benefit/cost ratios to the potential production of some 1.5 billion barrels of crude oil and 2,000 new gas wells,[143] indicates that the social costs are billions of dollars greater in present value than the benefits of this production.

While there are range of SCC prices to be used, it should be noted that other industrialized nations, such as England, are using a SCC two times greater than the $42 used in this example.[144] Furthermore, the SCC only incorporates a portion of all social costs, and even only a portion of all climate change social costs. We further recommend an accounting of the social cost of methane, a GHG with 25 times the amount of warming power. In this region, a percentage of all natural gas developed is directly leaked into the atmosphere, estimated at 6% of gas production

[141] For example, royalties provided for more than 90% of federal onshore related oil and gas revenues in 2014. See, "Reported Revenues: Federal Onshore in All States for FY 2014 by Accounting Year." Office of Natural Resources Revenue.
[142] Current market prices for oil and gas are greater than the wellhead prices received and thus are an inflated measure of overall royalties returned to the public. We recommend the BLM utilize wellhead pricing and prices that reflect the true rate of royalty return.
[143] See the Reasonable Foreseeable Development (RFD) for Northern New Mexico final report, October 2014.
[144] *See* previous discussion of the Stern Review, etc.

in the San Juan Basin. This leakage, and the subsequent climate change damages, also needs to be included in the BCA.

Sensitivity analysis is recommend to model costs and benefits (and market prices) into the future. Additional estimates of fossil fuel combustion (and additional emitted metric tons of CO_2) that occur during extraction processes and during transportation of products should also be included.[145] Even the inclusion of a reduced domestic SCC would still indicate that the social costs are extremely high, and much greater than the zero price currently projected in the Mancos RMPA. Without proper accounting of social and environmental damages, the FFO planning process is skewed towards the promotion of oil and gas development.

IMPLEMENT FISCALLY RESPONSIBLE OIL AND NATURAL GAS DEVELOPMENT

The Trump Administration should be committed to implementing fiscally responsible oil and gas development on public land. Taxpayers expect economic efficiency and to receive fair market value for oil and gas resource developed on public land. Three significant issues related to fiscal responsibility include: 1) appraising fair market value and minimum bids for oil and gas lease sales based on quantities of oil and gas that is economically recoverable; 2) not offering leases for sale in places where the revenue and does not cover the costs to taxpayers or where natural gas waste is likely to occur; and 3) correctly estimating jobs and royalty revenue from proposed drilling based on economically recoverable resources. These issues should be addressed in the Mancos RMPA.

Implementing a fiscally responsible oil and natural gas development requires a quantitative understanding of the volume of oil and natural gas that can be extracted economically over a wide range of prices. Scientists use the concept of CO2 equivalent (CO2 –eq) to sum their climate change impacts. Estimates of economically recoverable resource can be converted CO2 equivalents (CO2 –eq) for use developing damage functions that provide an approximation of the social costs of carbon from extracting these resources. The revenues, benefits and jobs in local communities from planned oil and natural gas development in the planning area must also be based on quantities of oil and natural gas that are estimated to be economically recoverable based on a range of prices (Rose 2001, Morton and Kerkvliet 2014).[146]

Technically recoverable estimates of oil and gas are much larger than economically recoverable estimates because they ignore the economic and environmental costs from producing commercial quantities of oil and gas. Regardless of the technology chosen, technically recoverable oil and natural gas will not become an economically recoverable resource unless the market prices cover

[145] For example, GHG equivalencies for tanker trucks used to haul oil and gas are available.
[146] Rose, P. 2001. Risk Analysis and Management of Petroleum Exploration Ventures. AAPG Methods in Exploration Series, No 12. American Association of Petroleum Geologists. Morton, P. and J Kerkvliet, 2014. Redefining responsible oil and gas development. Presentation at University of Colorado, Center of the American West, FrackingSENSE Lecture Series, Boulder, CO. https://www.youtube.com/watch?v=KbSy_8KNjcY

the costs of extraction. The cost of extracting the oil or natural gas must be less than the market price in order to be economically recoverable (Morton et al. 2004).[147]

Economists may not agree on much but they do agree that you have to do the math. Continuing to rely on estimates of technically recoverable energy resources biases and distorts the RMP planning process in favor of oil and gas development -- because the economic costs of bringing the energy to market are not being considered. Relying on technically recoverable estimates will bias the RMP by exaggerating the local and regional jobs created and the royalty revenues estimated for oil and natural gas drilling proposals. We recommend that the BLM develop estimates of production from future leasing that may occur based on quantities of oil and gas that are economically recoverable.

A 2011 highly touted report from MIT included estimates of economically recoverable natural gas and indicates that at current wellhead prices less than half of our domestic technically recoverable natural gas is economically recoverable.[148] According to the MIT research, natural gas prices will have to increase dramatically – well past $30/MMBTU to recover all of the technically recoverable gas. Quite simply price matters. If current prices have to increase 8 to 10-fold in order to economically extract our nation's technically recoverable natural gas – taxpayers expect BLM planning to address this significant economic issue in planning documents.

We further recommend the BLM invest in a GIS mapping tools for estimating the volume of oil and gas that is economically recoverable projected to be produced in the future from additional leasing in the planning area. GIS methods using data from the USGS have been used to estimate undiscovered oil and gas by industry groups, government agencies, and environmental organizations (National Petroleum Council 1999, DOI-DOE-USGS 2003, 2006, 2008, Morton et al. 2002, LaTourrette, et al. 2002).[149]
Investing in a GIS based tool will help the BLM develop estimates of economically recoverable oil and natural gas -- which fully account for the market costs as well as the non-market

---

[147] Morton, P., C. Weller, J. Thomson, M. Haefele, and N. Culver. 2004. Drilling in the Rockies: How much and what cost? Special Energy Session of the 69th North American Wildlife and Natural Resources Conference, Spokane, WA. Wildlife Management Institute, Washington, DC.

[148] Massachusetts Institute of Technology, 2011. The Future of Natural Gas. An Interdisciplinary MIT Study.

[149] National Petroleum Council 1999. Natural Gas: Meeting the Challenges of the Nation's Growing Natural Gas Demand. U.S. Department of Interior and U.S. Department of Energy 2003, 2006, 2008. Scientific Inventory of Onshore Federal Lands' Oil and Gas Resources and Reserves and the Extent and Nature of Restrictions or Impediments to their Development. Phase 1, 2 and 3. Morton, P., C. Weller, and J. Thomson. 2002. Energy and Western Wildlands: A GIS analysis of Economically Recoverable Oil and Gas. The Wilderness Society, Washington, DC. LaTourrette, T., M. Bernstein, P. Holtberg, C. Pernin, B. Vollaard, M. Hanson, K. Anderson, and D. Knopman. 2002. Assessing Gas and Oil Resources in the Intermountain West: Review of Methods and Framework for a New Approach. RAND Science and Technology. Santa Monica, CA.

environmental costs (e.g. air and water pollution, loss of wildlife and bird habitat) from extracting and burning fossil fuels – for the basis of NEPA planning at the RMP level. LaTourrette, et al. 2002 in their economic analysis of oil and gas include GIS spatial data as proxies for non-market costs. Such an approach is worth building on.

Fiscally Responsible Leasing

The public expects to receive fair market value for oil and gas resources produced from public land. At the leasing level, implementing responsible oil and natural gas should take advantage of estimates of the volume of oil and natural gas that can be extracted economically to establish fair market value for taxpayers. Such information is critical for among other things, establishing the minimum bid for a lease sale. Estimating the economic value of oil and natural gas from a proposed lease area would make the BLM more consistent with how the U.S. Forest Service established fair market value and minimum bids for commercial timber sales. Taxpayers deserve no less.

The BLM continues to sell leasing rights for oil and gas based on per acre bids. In stark contrast, the USFS sells commercial timber based on an appraisal of the value of the millions of board feet being offered for sale – not the total acres within the sale boundary. We recommend the BLM follow the lead of the USFS and develop a more efficient appraisal process for estimating fair market value and setting minimum lease bids based on the estimated value of economically recoverable oil and gas covered by the lease.

We seriously question whether the current appraisal method of establishing minimum bids based on dollars per acre basis is fiscally responsible as it ignores the economic value of the good to be sold – which is the volume of oil and gas in the ground. Economics and fiscal prudence suggests that selling leasing rights based on estimates of the economically recoverable quantities of oil and gas underground is a more efficient appraisal method for setting minimum bids. We recommend the BLM begin appraising leases and establishing minimum bids based on estimates of the undiscovered economically recoverable oil and gas for a lease sale.

As part of this effort, we also recommend the BLM examine the benefits of a no-leasing alternative. A no new leasing alternative may lower BLM planning, leasing mitigation and enforcement cost in the short run as well as reclamation and monitoring costs in the long. A no new leasing alternative may be a more economically efficient alternative -- especially when non-market costs and budget constraints are considered (discussed below).

Eliminate Below Cost Lease Sales

Below cost timber sales – timber sales where the revenue was less than the cost to taxpayers -- were a huge issue for the Forest Service in the 1990s. The same fiscal arguments apply to the BLM setting minimum bids for oil and gas leasing sales below the cost to taxpayers of offering the lease for sale. When the BLM leases land for just $2 per acre – we question whether the revenue generated from that lease sale covers the BLM administrative costs of setting up the lease sale. Does $2 per acre even cover the social cost of carbon associated with the oil and gas covered by the lease? We doubt that $2 per acres covers the market and non-market costs

associated with extracting and burning the oil and gas covered by the lease. A no more leasing alternative will by design directly eliminate future below cost lease sales and help mitigate climate change damages.

We question the fiscal responsibility of the BLM continuing to offer "below cost lease sales". Relevant questions that we recommend the BLM address is to estimate the administrative and oversight costs associated with offering oil and gas leases for sale. For the planning area, how much does BLM spend when it offers oil and gas leases for sale? Does the revenue from each oil and gas lease sale cover the cost to taxpayers of setting up and administering each lease sale? To the extent does below cost leasing occurs in the planning area, it represents an implicit subsidy that costs taxpayers and undercuts investors in oil and gas on private land. The BLM by offering "below cost leasing" – is distorting the energy markets and not providing taxpayers with a fair return on their resources.

We recommend that the BLM examine the potential for below cost leasing in the planning area by developing a predictive model for estimating where leases with low bids tend to occur. Do lease parcels that the receive $2 per acre bids tend to occur in wild areas far from roads? A well-designed regression model is one approach for examining where and how often below cost leasing occurs. The regression model would be analogous to the "transaction evidence approach" developed by the U.S. Forest Service for appraising the fair market value of timber. In addition to a goal of identifying and eliminating below cost leases, the predictive model could also be used to establish the fair market value of the oil and gas to be leased and for setting minimum bids of those leases.

We also recommend that the BLM eliminate lease sales where the public costs are greater than the public benefits. Again, one possibility is to develop a predictive model that includes spatial consideration of non-markets benefits and costs similar to the one developed by LaTourrette, et al. 2002.[150] The model could be linked to a benefit cost analysis which fully accounts for the social cost of carbon and methane as well as other non-market costs and benefits is needed to address this issue. As discussed above, estimates of economically recoverable oil and gas for a proposed leases sale can be converted to CO2 equivalents (CO2 –eq) for use in provide an approximation of the social costs of offering the proposed lease for sale. Leases should not be sold at a price less than the social costs of carbon associated with the oil and gas estimated to be under the lease.

ACCOUNT FOR COMMUNITY CONCERNS AND POTENTIAL FOR DISRUPTION

Since 2001, when the domestic drilling boom began, more than 400,000 oil and gas wells have been drilled on U.S. public and private land. In retrospect, the current drilling boom, like past drilling booms, was not done in a thoughtful way and caused more damage to communities and the environment than necessary. As has happened in earlier busts, rural towns that overbuilt

[150] LaTourrette, T., M. Bernstein, P. Holtberg, C. Pernin, B. Vollaard, M. Hanson, K. Anderson, and D. Knopman. 2002. Assessing Gas and Oil Resources in the Intermountain West: Review of Methods and Framework for a New Approach. RAND Science and Technology. Santa Monica, CA.

their infrastructure during the boom are now in fiscal trouble. Williston, North Dakota for example, took on $215 million in debt to build infrastructure, including a sewer plant and recreation center for the growing population (Healy 2016).[151] As quoted in Healy (2016), Nancy Hodur a research assistant professor at North Dakota State University stated the following - "Those communities out there were drinking out of a fire hose…A lot of those communities would come right out and say that pace of growth isn't good, isn't sustainable."

Quantifying and understanding the direct, indirect and cumulative effects from the recent drilling boom is key information for successfully implementing responsible oil and gas program in the future. We recommend the BLM quantitatively review economic and environmental data for local communities associated with the recent drilling boom and bust. We recommend the BLM use the planning process to look back and gain an understanding of lessons learned by communities from the extended domestic oil and gas drilling boom.

Economic Development is Different than Economic Impacts

Short term job creation from an oil and gas drilling boom must be balanced with the longer-term perspective represented in economic development plans. Economic development is concerned with an improved standard of living and a diverse economy that can weather downturns in any particular industrial sector. Economic development is concerned with the long-term health of communities and regions. A healthy community includes a diverse economy, public facilities and services, a higher and equitable standard of living, and a clean environment. In contrast, the economic impact is a short-term measure of the jobs created from plans for developing oil and gas resources.

Economic development and healthy communities involve other economic criteria that are not included when estimating economic impact in terms of job creation. Unfortunately, decision-makers and the general public remain unaware of the limitations of economic impact studies and as a result the results are often misunderstood and misused by decision-makers.
The IMPLAN model is a commonly tool used by economists to estimate the jobs associated with oil and gas development as part of an economic impact analysis. The IMPLAN model is typically used to estimate the direct, indirect and induced jobs generated from marginal changes in investments and public policies. Direct jobs are created by direct hiring to perform the activity (i.e. drilling); indirect are jobs created by spending to support the work of direct jobs (e.g. pipe used by drillers to drill wells); and induced are jobs created when direct and indirect job holders spend their wages. So, jobs in the drilling pipe industry are indirect jobs, while bar and restaurant workers are induced jobs.

When reviewing the results of economic impact analysis, it is important to examine the short terms job creation from oil and gas drilling within the context of longer term community plans for sustainable economic development.

[151] J. Healy, 2016. Built Up by Oil Boom, North Dakota Now Has an Emptier Feeling http://www.nytimes.com/2016/02/08/us/built-up-by-oil-boom-north-dakota-now-has-an-emptier-feeling.html?_r=0

Short Term Economic Disruption

In the short term, drilling booms produce the "crowding out effect". Crowding out" can negatively affect agriculture, recreation and tourism, and hunting and fishing business. Higher housing costs, labor competition, air and water pollution can make the resource dependent regions less attractive to other industries than alternative locations. The potential for crowding out and economic displacement has implications for the choices faced by community leaders in distinguishing between short term economic impacts and longer term plans for sustainable development. If the pace and scale of development exceeds the assimilative socio-economic capacity of a county or community, businesses and residents can suffer economically. As pace and scale increase, there will be tradeoffs and non-compatibility issues which can lead to slower net job growth due to economic displacement.

In addition to job creation, the fiscal health of communities is also an issue with oil and gas development. As the scale of the drilling boom for oil and natural gas increases communities experienced an increase in traffic and crime that overwhelmed the assimilative capacity (e.g. roads, wastewater treatment facilities, enforcement staff) and budgets of communities and counties for handling these problems.

Local governments – counties and communities – are subjected to a wide range of demands for new services, staff, equipment, and expertise that impacts budgets. The additional the fiscal costs to local taxpayers from oil and natural gas development include land use planning, hiring additional expertise (i.e. legal counsel, oil and natural gas coordinator, community outreach, inspectors) purchasing monitoring equipment (i.e. infrared camera for emission detection), administration, oversight and inspection, the equipment for and training of emergency services so they are prepared for the kind of fire, accident, or spill incidents associated with drilling operations can produce. Public Health departments must be prepared to receive and respond to incident reports and citizen concerns about environmental health issues

Boxall et al (2005) also found that property values are negatively correlated with the number of gas wells.[152] The study's mean estimates indicate that when residential properties are within 4 km (about 2.5 miles) of oil and gas facilities, property values decline 4-8 percent. The impact can easily be twice that depending upon the level and composition of the nearby industry activities. Any decline in property values may result in a long term drop in tax revenue.

Long Term Economic Disruption

IMPLAN is a tool for estimating jobs in the short run but does not consider fiscal costs from these jobs nor the crowding out effect or business displacement or community disruption. The IMPLAN model also does not consider the long term economic costs associated boom and bust cycles and the resource curse.

[152] Boxall, P.C., W.H. Chan, M.L. McMillan. 2005.The impact of oil and natural gas facilities on rural residential property values: a spatial hedonic analysis. Resource and Energy Economics. 27: 248-269.

Natural resource extraction, including energy development – oil and gas drilling and mining – when properly managed can provide economic opportunities for resource producing regions. But an established and growing body of research indicates that countries, states and communities that are dependent on natural resource extraction suffer socio-economically.

Boom and bust cycles are a longstanding historic challenge for communities impacted by oil and natural gas drilling and production. While energy development can benefit communities, historically drilling booms bring an influx of non-local workers, a rise in crime and emergency service calls, increased demand for public services, more wear and tear on local infrastructure, and upward pressure on local wages and housing costs. Local governments need to provide basic services for a rapidly growing population, along with increased per capita service demand, resulting in fiscal burdens for taxpayers.

Economic theory suggests that an abundance of natural resources should promote economic growth by providing economies with ‘‘natural capital.’’ However, many academic studies have found that economies relying heavily on natural resource extraction are poor performers in terms of growing income, decreasing poverty, and improving lives. This poor performance has become known as the "resource curse". Avoiding the resource curse is a worthy goal for responsible oil and natural gas development.

Recent studies comparing U.S. states and counties find convincing evidence of a resource curse. Papyrakis and Gerlagh (2007) found that all twelve states with more than 5% of state earnings derived from the resource sector experienced negative economic growth during the 1980–1995 period.[153] James and Aadland (2011) found that a typical resource rich county whose economy was 20 percent dependent on resource extraction experienced slower per capital income growth compared to a county with 5 percent dependency.[154] James and Audland (2011) conclude "Although the resource curse appears to be waning over the sample period 1980–2005, it is always negative and statistically significant. The coefficient estimates imply sizable differences in standards of living if one extrapolates the annual growth differences to future generations." The strong evidence of boom and bust cycles and the resources curse shows that energy development is not a panacea. Instead it is a risky business that must be done wisely. If done irresponsibly, energy development threatens the economic health of local communities.

IMPLEMENT PHASED ENERGY DEVELOPMENT TO REDUCE COMMUNITY DISRUPTION

Phased energy development – which involves regulating the pace and scale of leasing and development – provides a cost-effective approach for managing fiscal and environmental risk

[153] Papyrakis, E. and R. Gerlagh. 2007. Resource abundance and economic growth in the United States. European Economic Review. 51: 1011-1039.

[154] James, A. and D. Aadland. 2011. The curse of natural resources: an empirical investigation of U.S. counties. Resources and Energy Economics. 33: 440-453.

(Haefele and Morton 2009).[155] Pace and scale are regulated because they are key variables for reducing and internalizing the externalized damages; managing risk; mitigating boom and bust cycles; and avoiding the resource curse.

A reduced pace will moderate the deluge of energy wealth and the hyperactivity that disrupts normal patterns of business and government. Regulating the pace of drilling is a fiscally and economically sound approach to oil and natural gas development. Slowing the pace and spreading drilling over years or even decades means there will be producing wells in the area for a longer time period, while reducing the dramatic spike in drilling peak in the earlier years. Many of the problems associated with the recent drilling boom in the Rockies are either caused by or exacerbated by the large scale and rapid pace of development (Haefele and Morton 2009). Slowing the pace and scale or oil and natural gas development can help reduce these problems by staying within the assimilative capacity of a community.

A reduced pace will promote carefully considered regulations that allow energy extraction to proceed with less environmental damage. In this regard, a no new leasing alternative can help slow the pace and scale of disruption and displacement in the short run and promote more sustainable economic development and healthier communities in the long run.

ESTIMATE NET FISCAL IMPACTS

Conventional wisdom assumes the net fiscal impacts are positive because of the millions in tax revenue reported. But the revenue reports based on royalties represent only gross revenues. Businesses survive or go broke based on the net revenues from the sale of goods and services. Estimated of gross revenue do not measure profit or the success of a business because they exclude the costs of doing business. Unfortunately, government estimates of oil and natural gas revenue leave out the fiscal and environmental costs of doing business – and therefore only report gross revenues.

Generating oil and natural gas revenues is not a cost-free endeavor – especially for impacted communities. Unfortunately, economic impact analysis does not consider the cumulative fiscal costs associated with oil and gas development. What has been missing from the economic conversation and fiscal calculus are the cumulative costs to taxpayers associated with collecting the gross revenue (i.e. proper oversight, frequent inspections, increased road maintenance costs, declining property value change, etc.). We recommend a new fiscal focus on estimating the net revenues that accrue from oil and natural gas development.

NONMARKET VALUE CONSIDERATIONS

The BLM must evaluate its oil and gas program within the context of the agency's larger legislative mission as steward of America's public land. One of the most important purposes of

[155] Haefele, M. and P. Morton. 2010. The Influence of the Pace and Scale of Energy Development on Communities: Lessons from the Natural Gas Drilling Boom in the Rocky Mountains, Western Economics Forum Vol. VIII, No. 2.

public lands, including BLM lands, is the provision of non-market public goods such as opportunities for solitude, outdoor recreation, clean air, clean water, biodiversity, and the preservation of wilderness and other undeveloped areas that would be underprovided if left entirely to market forces (Loomis 1993).[156] It is incumbent upon the BLM, as the administering body for oil and gas leasing of public lands, to provide for greater accounting of non-market social and environmental costs as well as greater transparency of the processes used to make these calculations.

The Federal Land Policy and Management Act (FLPMA) specifically incorporates such non-market resources as "the long-term needs of future generations" for recreation and "natural scenic, scientific and historical values" into the BLM's multiple use mandate.[157] FLPMA further defines multiple use to require the agency to encompass non-market values into management, directing the BLM to achieve:

> **harmonious** and coordinated management of the various resources without permanent impairment of the productivity of the land and the **quality of the environment** with consideration being given to the relative values of the resources and **not necessarily to the combination of uses that will give the greatest economic return** or the greatest unit output.[158] (emphasis added).

The Trump Administration should be committed to an oil and gas program grounded in stewardship of public land and one that holds oil and gas companies to the highest standard of fiscal and environmental responsibility. To accomplish this goal, the BLM should consider fully and carefully balancing the benefits of oil and gas production with the environmental costs of oil and gas exploration, production, and remediation. While increasing returns to the Treasury and increasing efficiency of oil and gas management are laudable goals, we also know that extracting and burning oil and natural gas has significant social and environmental costs.

Strategically in 2013, the BLM issued guidance for considering nonmarket environmental costs when preparing NEPA analyses for BLM resource management planning and other decision-making. From the document (BLM 2013):

> All BLM managers and staff are directed to utilize estimates of nonmarket environmental values in NEPA analysis supporting planning and other decision-making where relevant and feasible, in accordance with the attached guidance…The use of quantitative valuation methods should contribute to the analysis of one or more issues to be addressed in the environmental analysis supporting planning or other decision-making. A quantitative analysis of

[156] Loomis, J. B. 1993. Integrated Public Lands Management: Principles and Applications to National Forests, Parks, Wildlife Refuges, and BLM Lands. First Edition. Columbia University Press: New York, NY.
[157] 43 U.S.C. § 1702(c).
[158] Id.

> nonmarket values in EIS-level NEPA analyses is strongly encouraged where one or more of the criteria described in the attached guidance apply.[159]

As discussed above, we recommend that the BLM use this guidance to internalize the negative externalities by developing multiple damage functions associated with the social cost of carbon and other non-market costs associated with oil and gas production from public land. The table below provides a comprehensive framework that combines distributional impacts (i.e. jobs) with a total economic valuation of the local and regional damages associated with oil and natural gas extraction.[160] Estimating the local and regional damage functions included in this framework would provide valuable local information to inform and supplement the macro-level damage functions currently used in integrated climate assessment models.

Comprehensive Economic Framework: Jobs and Total Economic Damages from Oil and Natural Gas Development that Spillover into our Communities and Environment		
Cost Category	**Description of Cost**	**Methods for Estimating Cost**
Direct Use Costs	Displacement or loss of land for habitat, recreation opportunities, hunting, farmland, grazing, reclamation costs, water quantity and drought.	Travel cost method, contingent valuation surveys.
Community Concerns	NOx, VOCs, ozone and kids' health, noise pollution, truck traffic and infrastructure costs, property values, loss of local control, displaced jobs and revenues due to "crowding out", natural amenities and quality of life issues, loss of retirement income, displaced farming due to competition for water, boom-bust cycles, revenue lag and fiscal risks, water treatment plants and recycled fracking water, draining of reservoirs for fracking water and the loss of fishing and recreation revenue.	Surveys of residents and businesses. Averting expenditure methods for estimating the costs of mitigating health and noise impacts. Change in recreation visitation, expenditures and business income. Documented migration patterns.
Science Benefits Foregone	Loss of natural areas for scientific study as an experimental control for adaptive ecosystem management.	Change in management costs, loss of information from natural studies foregone.

[159] U.S. Department of the Interior, Bureau of Land Management, 2013. Guidance on Estimating Nonmarket Environmental Values. Instruction Memorandum No. 2013-131, Change 1. http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/2013/IM_2013-131__Ch1.print.html

[160] Morton, P., C. Weller, J. Thomson, M. Haefele, and N. Culver. 2004. Drilling in the Rockies: How much and what cost? Special Energy Session of the 69th North American Wildlife and Natural Resources Conference, Spokane, WA. Wildlife Management Institute, Washington, DC. 33 pages.

Comprehensive Economic Framework: Jobs and Total Economic Damages from Oil and Natural Gas Development that Spillover into our Communities and Environment		
Cost Category	**Description of Cost**	**Methods for Estimating Cost**
Off-site Damages	Fugitive methane emissions, water pollution from spills, noise pollution from compressor stations, visual impacts, erosion from well pads and roads, pipeline explosion risks, road dust on petroglyphs and snowpack, seismic activity from injection wells, decline in property values.	Contingent valuation surveys, hedonic pricing analysis of property values, preventative expenditures, well replacement costs, restoration and environmental mitigation costs.
Biodiversity Impacts	Loss and fragmentation of wildlife habitat by roads and well pads, pipelines are conduits for invasive weeds, endocrine disrupter's impact amphibians and fish, produced water holding ponds and bird deaths, noise impacts on wildlife species.	Replacement costs, restoration and environmental mitigation costs.
Ecosystem Services Lost or Compromised	Water lost from fracking, impacts to aquifer re-charge and wetland function, carbon lost via land use change, fossil fuels and climate change, decline in net primary productivity.	Change in productivity, replacement costs, increased water treatment costs for cities, preventative expenditures.
Passive Use Benefits Foregone	Loss of option, bequest and existence benefits generated by open spaces, parks, and wildlands.	Contingent valuation surveys, opportunity costs of not utilizing future information about the health, safety, and environmental impacts of oil and natural gas drilling.

Source: Adapted from Morton, P., et al. (2004). Drilling in the Rockies: How Much and at What Cost? Proceedings of a Special Energy Session of the 69th North American Wildlife and Natural Resources Conference, Spokane, WA. Wildlife Management Institute

ESTIMATE LOCAL AND REGIONAL DAMAGE FUNCTIONS

Integrated assessment models estimate global climate change damage functions based on increasing CO2 emissions. A goal of integrated assessment models (IAMs) is to estimate the economic efficiency of climate change policies in the context of a cost-benefit analysis. IAMs use mathematical relationships between economic activity and GHG emissions. Climate damage functions subsequently estimate the relationship between CO2 emissions and the global damage caused, in order to approximate how future damages might be reduced if CO2 emissions were also reduced.

In addition to global damage functions, local and regional damage functions should be developed to account for the damages that occur in oil and gas producing regions. We recommend the BLM identify relevant variables and methods appropriate for developing damage functions for

use in regional BLM planning of oil and gas fuel development. Local and regional damage functions can be developed per unit of production (per barrel of oil and per mcf of gas) and for oil and gas development itself. Damage functions can also be estimated on per well basis, for each compressor station, waste pit and storage tank – and linked to an economic model for use in the benefit-cost analysis.

An example of a regional damage function from oil and gas development is the potential damage from earthquakes associated with the underground injection and disposal of waste water from oil and gas development. IAMs include monetary damages functions for floods and droughts – but not for earthquakes. Damage functions for increase regional seismic activity from underground injection could be developed using methods similar to those used in the IAMs. We recommend the BLM develop a predictive model on the relationship between underground injections and increased seismic activity. The results could be linked to an economic model that estimates appropriate damage functions around earthquakes and disposal of waste from oil and gas development based, for example, on the increased costs recorded by the insurance industry. Air pollution damage functions can be used, for example, to examine the health impacts to regional citizens from oil and gas development. IAMs include human health damage functions at the global level, but human health damage functions at the local and regional level are needed. Ozone pollution from oil and gas development exacerbates a range of health problems for local residents including respiratory illnesses and asthma. There are many health studies that can be referenced and used to develop local and regional human health damage functions that will supplement and inform global human health damage functions currently used in IAMs.

We recommend the RMP alternatives include implementation of the BLM's methane capture rule. As part of this analysis the BLM should include the many human health co-benefits generated by implementing the agency's methane capture rule. These human health co-benefits occur because the methane capture requirements also reduce air pollution from volatile organic chemicals (VOC), fine particulate matter (PM) and other hazardous air pollutants (HAP). We recommend that the BLM include these human health co-benefits in the BCA completed for the planning area.

CAPTURING METHANE POLLUTION INCREASES ECONOMIC EFFICIENCY

The BLM's own research on its methane capture rule indicates that implementing climate mitigation measure like capturing methane emissions improves economic efficiency. Morton and Hjerpe (2016)[161] conducted a case study of two counties in the San Juan Basin of northwest New Mexico to better understand regional impacts of the BLM's proposed methane capture rule and focus on natural gas wells as it is the dominant fossil fuel produced in the region. The analysis included: 1) a Net Present Valuation of the costs of complying with proposed LDAR requirements and the new revenues from the methane captured; and 2) estimated change in overall gas production and associated royalty payments to the state. The study examined 13,493

[161] Morton, P. and E. Hjerpe 2016., A Review of the Economic Factors Surrounding the Capture of Methane from Oil and Natural Gas Development on Federal Public Land, Conservation Economics Institute.

active federal gas wells in these two counties and determined that 8,718 (65%) of these wells produced less than 90Mcf per day.

The results indicate that the majority of marginal gas wells will not only reduce methane emissions and natural gas waste, but by capturing the methane for sale, production, revenues, royalties and profits will also increase as a result of the proposed rule. These findings are consistent with the economic literature and with the BLM's findings in the Regulatory Impact Analysis.[162] We therefore recommend the BLM include a plan alternatives that includes implementation of methane emissions mitigation measures in the planning area.

BUDGET CONSTRAINTS MUST BE CONSIDERED IN THE RMPA

The level of damages (non-market costs) associated with each plan alternative are directly influenced by budgets available to fully implement the alternative. If funding is less than planned, and the promised environmental protection measures are not implemented due to budget shortages, the non-market damages and costs will increase. If on the other hand, budgets are flush and environmental protection measures are implemented as planned, the non-market costs will in general be less. The negative externalities (i.e. damages) generated from each plan alternative must be estimated with due consideration of the effect budget constraints – for example, annual funding levels and bonding amounts available for reclamation, inspection mitigation and well closure – have on damage functions.

We recommend that the BLM take steps to reduce methane emissions from oil and gas operations by examining budgets to make sure climate change mitigation measures are enforceable. Without adequate funding, climate mitigation measures included in the RMP are not enforceable and are more likely to fail.

A fiscally and environmentally responsible oil and gas program requires sufficient funding for implementing management plans. Based on numerous investigations we know that the BLM does not have the information, staffing or budget to actually implement responsible oil and gas development (GAO 2010, 2011, 2013a,2013b, and 2014).[163] In addition, efforts to mitigate the

---

[162] U.S. Bureau of Land Management, Regulatory Impact Analysis for Revisions to 43 CFR 3100 (Onshore Oil and Gas Leasing) and 43 CFR 3600 (Onshore Oil and Gas Operations), Additions of 43 CFR 3178 (Royalty-Free Use of Lease Production) and 43 CFR 3179 (Waste Prevention and Resource Conservation) at 39 , (November 10, 2016).

[163] U.S. Government Accountability Office. 2005. Oil and Gas Development: Increased Permitting Has Lessened BLM's Ability to Meet Its Environmental Protection Responsibilities. Report to the Ranking Minority Member, Committee on Homeland Security and Governmental Affairs, U.S. Senate. U.S. Government Accountability Office. 2010. Oil and Gas Bonds: Bonding Requirements and BLM Expenditures to Reclaim Orphaned Wells. GAO-10-245. U.S. Government Accountability Office. 2011. Oil and Gas Bonds: BLM Needs a Comprehensive Strategy to Better Manage Potential Oil and Gas Well Liability. GAO-11-292. U.S. Government Accountability Office. 2013a. Oil and Gas Development: BLM Needs Better Data to Track Permit Processing Times and Prioritize Inspections. GAO-13-572. U.S.

damages from climate change require adequate funding to insure the measures are enforceable. The BLM can include very effective climate change mitigation strategies in the RMP, but if the costs of climate mitigation is not considered in the context of agency budgets, and funding for climate mitigation turns out to be lacking, the mitigation measures will not be enforceable. Unfortunately, history has shown that funding levels clearly affect the timing and implementation of management actions and proposals, often resulting in protective measures such as mitigation and reclamation not being implemented. Because these budgetary shortfalls result in the damage or destruction of sensitive resources, it is imperative to recognize that funding levels *do* affect the findings and decisions made in an RMP.

A decision to lease more land for drilling involves a budget commitment for planning, inspection and mitigation. In contrast, no new leasing may lower BLM planning, leasing mitigation and enforcement cost in the short run as well as reclamation and monitoring costs in the long run. The decision to lease public land is also a commitment to increase surface disturbance and fragment wildlife habitat. Increasing surface disturbance directly increases the risk of damage to cultural resources and wildlife. In contrast a no new leasing alternative will result in less surface disturbing activities and fragmentation of wildlife habitat. As such, the costs of implementing each alternative will vary as the pace and scale of proposed leasing and drilling increases. When the BLM provides a range of alternative in a RMP, the public needs to understand the cost of implementing each alternative will also range. In other words, a range of implementation costs is associated with the range of alternatives. For example, a no new leasing alternative may cost less and be a more efficient alternative when budget constraints are considered.

It is imperative for taxpayers to understand whether the expected budget will be sufficient to cost of implementing each alternative. The total costs of implementation and mitigation must then be compared to the expected budgets to assess the probability of mitigation measures being fully implemented. Management risks can be fully evaluated based on a range of budget expectations, which should be clearly stated and consistent across alternatives.

We recommend the BLM complete a cost-budget analysis to show the feasibility of implementing each alternative. Taxpayers are entitled to know if decision makers are selecting a more damaging and more costly alternative, when a less damaging, less costly alternative is available. For example, what effect might the current federal hiring freeze have on implementation of the plan? And longer term, what are the consequence of a reduction in the federal workforce on the BLM's ability to comply with the law and implement fiscally and environmentally responsible oil and gas development? These are significant questions that must be addressed in the plan.

Historical evidence indicates significant budget shortfalls have prevented the BLM from fully implementing and keeping the promises and environmental commitments made in past

---

Government Accountability Office. 2013b. Oil And Gas Resources: Actions Needed for Interior to Better Ensure a Fair Return. GAO-14-50: U.S. Government Accountability Office. 2014. Oil and Gas: Interior Has Begun to Address Hiring and Retention Challenges but Needs to Do More. GAO-14-205.

management plans. We recommend the BLM fully examine the uncertainty in budgets and the subsequent risks and damages from budget shortfalls. An analysis of costs and budgets is needed to help reduce budget uncertainty associated with each alternative.

There is federal precedence for completing a cost-budget analysis, as the U.S. Forest Service completed one in 2002 for the White River National forest plan in Colorado.[164] The Forest Service used two budget levels in the cost budget analysis used to develop the White River National Forest (WRNF) plan.

> Two budget levels were analyzed for each management alternative. The first is based on the Forest's "experienced budget" level, which represents the average annual budget between 1997 and 2000. The second is the "full budget" level, which represents the funding of all programs at a level one and one-half times as much as the experienced budget level. The purpose of the two budget levels was to describe to the public and the decision maker how production levels and effects change under varying budgets. (Page A3-236).

While an open checkbook would be a nice, public land management plans need to be grounded in fiscal reality. Consider the following statements from the USDA Forest Service in the 2002 FEIS for the WRNF plan:

> ...the purpose of this budget analysis is to show that outputs and achievements are restricted by the amount of funding allocated to the White River National Forest…It is not realistic, however, to have an unconstrained budget level…output levels based on unconstrained budget level would not ever be realized. (Page A1 -35).
>
> ****
>
> Achievement of any strategy or objective is partially based on the staffing and budget resources available…achievement levels in the draft and final documents were estimated using realistic budget estimates. Using budget constraints in achievement estimates help predict a realistic outcome. (Page A1 -31)

We recommend that the BLM present the public with a realistic plan by completing a cost-budget analysis for each alternative. If the U.S. Forest Service can develop a fiscally responsible forest plan in 2002 – a plan the correctly considers implementation costs and budgets – we believe the BLM is also capable of producing a fiscally responsible RMP in 2017. The Forest Service has long used linear programming models for planning, perhaps it's time for the BLM to try such an approach. We recommend the BLM explore the potential to develop a linear programming planning model with an objective function of maximizing net public benefits subject to agency budget constraints. Developing such a planning model would help the BLM

[164] USDA Forest Service, 2002. Final Environmental Impact Statement, Volume 1, White River National Forest, Colorado.

develop fiscally responsible RMPs for oil and gas development that can be implemented with expected budgets.

Since budgets should vary with the pace and scale of development, we recommend budget comparisons based on various levels of the pace and scale of development. If more leasing and drilling is allowed the oversight budgets must correspondingly increase. We recommend developing fully funded budgets at three levels: 1) budgets necessary for implementing responsible oil and gas development for the existing wells and associated road and pipeline infrastructure within the planning area; 2) additional budgets required from responsibly implementing new oil and gas development on public land already under lease but not currently developed; and 3) the additional budgetary commitments associated with continuing to offer additional more acres of public land in the planning area for lease.

Background

In a 1992 report to Congress, the U.S Office of Technology Assessment reviewed federal land management budgets and found that the funding received by public land management agencies had been significantly less than the budgets required to fully implement plans.[165] The lower-than-planned budgets prevented public agencies from producing many of the outputs and resource protections that were promised in land management plans.

The BLM's budget challenge persists today as current funding is insufficient for accomplishing the agency's twin goals of environmentally and fiscally responsible oil and gas development. The environmental risks from oil and gas development increase when mitigation and monitoring measures are not adequately funded (Morton et al. 2004).[166]

The impacts from budget shortfalls with respect to implementing responsible oil and gas development were documented in a June 2005 report issued by the General Accounting Office (GAO).[167] The GAO found that the increased volume of permits has resulted in more BLM staff resources devoted to issuing permits with less attention being paid to monitoring and enforcing compliance with environmental standards that apply to the activities conducted under the permits.

---

[165] U.S. Congress, Office of Technology Assessment (1992). Forest Service Planning: Accommodating uses, producing outputs, and sustaining ecosystems. OTA-F-505, Washington, DC

[166] Morton, P., C. Weller, J. Thomson, M. Haefele, and N. Culver. 2004. Drilling in the Rockies: How much and what cost? Special Energy Session of the 69th North American Wildlife and Natural Resources Conference, Spokane, WA. Wildlife Management Institute, Washington, DC.

[167] U.S. Government Accountability Office. 2005. Oil and Gas Development: Increased Permitting Has Lessened BLM's Ability to Meet Its Environmental Protection Responsibilities. Report to the Ranking Minority Member, Committee on Homeland Security and Governmental Affairs, U.S. Senate.

More evidence of unfunded mandates and broken promises comes from a May 2006 BLM document from the Pinedale Field Office in Wyoming titled "Commitments made in Decision Documents not yet achieved" (Bureau of Land Management, Pinedale Field Office. 2006). The authors found that 580 requirements and commitments had been cumulatively made in recent decision documents – many of which had not been achieved. One of the more prominent commitments BLM made repeatedly in several decision documents was to track NOx emissions from oil and gas development in southwest Wyoming. The authors of the 2006 document concluded that NOx monitoring had not been completed since 2000. The report details dozens of examples where funding was not allocated to successfully implement the plan and achieve the cumulative commitments made by the BLM in decision documents.

We recommend that the BLM fully examine past Mancos planning documents and examine the past commitments promised that were never achieved. Such information is critical for understanding the ability of the BLM to fulfill promises made in future management plans. Such information is needed as the BLM continues to be challenged to find the resources, staffing or budget to implement responsible oil and gas development. A 2013 GAO report stated the following:[168]

> In fiscal year 2012, companies received over $66 billion from the sale of oil and gas produced from federal lands and waters, and they paid $10 billion to the federal government for developing these resources according to the Department of the Interior. The federal government seeks a fair return on its share of revenue from leasing and production activities on federal lands and waters through the federal oil and gas fiscal system….In May 2007, GAO found, based on several studies, that the government received one of the lowest percentages of value of oil and gas produced in the world. In September 2008, GAO found that Interior had not evaluated the federal oil and gas fiscal system for over 25 years and recommended that a periodic assessment was needed.

These challenges were confirmed in a 2014 GAO report which stated:[169]

> Interior employs a wide range of highly-trained specialists and scientists with key skills to oversee oil and gas operations on leased federal lands and waters. GAO and others have reported that Interior has faced challenges hiring and retaining sufficient staff to carry out these responsibilities. In February 2011, GAO added Interior's management of federal oil and gas resources to its list of programs at high risk of fraud, waste, abuse, and mismanagement in part because of Interior's long-standing and continued human capital challenges.

---

[168] U.S. Government Accountability Office. 2013. Oil and Gas Resources: Actions Needed for Interior to Better Ensure a Fair Return. GAO-14-50: U.S. Government Accountability Office. 2014.

[169] U.S. Government Accountability Office. 2014. Oil and Gas: Interior Has Begun to Address Hiring and Retention Challenges but Needs to Do More. GAO-14-205

A 2015 GAO report titled Oil and Gas Resources: Interior's Production Verification Efforts and Royalty Data Have Improved, but Further Actions Needed stated the following:[170]

> The Department of the Interior has made considerable progress in improving both the verification of oil and gas produced from federal leases and the reasonableness and completeness of royalty data. Since fiscal year 2009, Interior has implemented 28 of 36 GAO recommendations made in these areas; however, key challenges remain, including the following:
>
> Interior has not updated its regulations for onshore oil and gas measurement in over 25 years and, as a result, they do not reflect newer measurement technologies and standards adopted by industry, hampering Interior's ability to have reasonable assurance that oil and gas are being measured accurately.

All of which begs the question of how much money BLM needs for its oil and gas program to have fiscally and environmentally sound management? In order to address this question, we recommend the BLM estimate the fully funded budgets necessary for successfully implementing responsible oil and gas development and comparing them with historic budgets. Comparing fully funded budgets with historic budgets provides an estimate of the additional revenue that must be captured in order to implement a fiscally and environmentally responsible oil and gas program.

Legal Mandate

The BLM must consider the impact of budget constraints on its ability to fulfill the promises made in a RMP with respect to protecting ecological and multiple use values. According to a Council of Environmental Quality memorandum on NEPA requirements [cited in NEPA Compliance Manual, 2nd Edition (1994)]:[171]

> [T]o ensure that environmental effects of a proposed action are fairly assessed, the probability of the mitigation measure being implemented must also be discussed. Thus the EIS and the Record of Decision should indicate the likelihood that such measures will be adopted or enforced by the responsible agencies. (Section 1502.16(h), and 1505.2).

The probability that a mitigation measure will be implemented (and that risks will decrease) is largely a function of budgets and funding levels. In order to discuss the probability of mitigation, the agency must examine data and compare the cost of proposed commitments with historic and projected budgets.

---

[170] U.S. Government Accountability Office. 2011. Oil and Gas Bonds: BLM Needs a Comprehensive Strategy to Better Manage Potential Oil and Gas Well Liability. GAO-11-292

[171] Freeman, L.R.; March, F,; Spensley, J.W. 1994. NEPA Compliance Manual, 2nd Edition. Government Institutes, Inc., Rockville MD

In order to fulfill NEPA's mandate and truly take a "hard look" at its actions, the government must do a full assessment of the environmental risks from proposed management. Examining the probability of mitigation measures being funded and implemented is a necessary part of analyzing environmental risks. Environmental risks tend to increase when mitigation measures are not funded and implemented. The relative risk associated with implementing each alternative is essential information for decision makers selecting a preferred alternative.

Assess and Address Bonding Shortfalls

Climate mitigation requires not only adequate implementation funding to insure mitigation requirements are enforceable, but importantly, performance bond dollar amounts that provide the BLM with essential revenue to cover long term mitigation, closure and reclamation costs of oil and gas well pads and infrastructure – including capping wells, decommissioning roads and compressor station sites, and cleanup of containment ponds. These bonds may be surety bonds, a third-party guarantee that an operator purchases from a private insurance company; or personal bonds accompanied by a financial instrument, such as a cashier's check or negotiable Treasury security. Unfortunately, federal bonding amounts are outdated and inadequate. The federal government, for example, only requires $25,000 for a statewide bond or $150,000 for a nationwide bond – no matter how many federal oil and gas wells a company has permitted and drilled.

Anderson et al. (2009) estimated that Wyoming has a current shortfall in bonding of around $814 million – a shortfall that will require taxpayers to clean up the messes. [172] U.S. GAO (2011) found that federal bonding amounts may not be sufficient to encourage operators to comply with reclamation requirements. In order to better internalize the externalities and improve fiscal responsibility, we recommend the BLM assess current reclamation and closure costs in the planning area and contrast those costs with the bonding amounts currently available. Is there a current shortfall in bonding for existing wells and infrastructure? If a bonding shortfall is present, a no new leasing option will help limit the current shortfall. The current shortfall in bonding for existing oil and gas wells should be examined as well as any additional shortfall from new wells proposed in each plan alternative.

If current bonding is less than climate mitigation needs, as well as reclamation and closure costs for current wells and infrastructure, any new additional wells will only serve to increase the fiscal liability for taxpayers. Under such fiscal conditions, a no new leasing option is warranted and should be evaluated in the RMP. for each alternative.

We recommend the BLM complete an analysis of closure and reclamation costs in the planning area and compare those costs with current bonding amounts. As part of this effort we recommend the BLM collect, analyze and make available to researchers site specific data on the closure and reclamation costs -- as well as the success of past reclamation efforts -- for well pads, roads, and pipelines on public land in the planning area.

[172] Andersen, M., R. Coupal, and B. White. 2009. Reclamation Costs and Regulation of Oil and Gas Development with Application to Wyoming. Western Economics Forum, Spring 2009

****

D. The FFO Must Take a Hard Look at Natural Gas Waste and Consider Alternatives to Prevent Waste including Phasing Development to Keep Pace with Gas Capture Infrastructure.

On November 18, 2016, BLM published its final methane waste rule in the Federal Register (Waste Prevention, Production Subject to Royalties, and Resource Conservation) 43 CFR Parts 3100, 3160 and 3170. According to the Preamble to the rule:

> This final regulation aims to reduce the waste of natural gas from mineral leases administered by the BLM. This gas is lost during oil and gas production activities through venting or flaring of the gas, and through equipment leaks. While oil and gas production technology has advanced dramatically in recent years, the BLM's rules to minimize waste of gas have not been updated in over 30 years. The Mineral Leasing Act of 1920 (MLA) requires the BLM to ensure that lessees ''use all reasonable precautions to prevent waste of oil or gas developed in the land,'' 30 U.S.C. 225, and that leases include ''a provision that such rules . . . for the prevention of undue waste as may be prescribed by [the] Secretary shall be observed,'' *id.* at § 187. The BLM believes there are economical, cost effective, and reasonable measures that operators can take to minimize gas waste. These measures will enhance our nation's natural gas supplies, boost royalty receipts for American taxpayers, tribes, and States, reduce environmental damage from venting, flaring, and leaks of gas, and ensure the safe and responsible development of oil and gas resources. 81 CFR 83009

The effective date of the rule is January 17, 2017 and it is now in full force and effect. Compliance dates for many of the requirements of the rule are deferred for one year until January 17, 2018, well within the planning horizon of the RMPA.

In the Preamble, BLM found that there is a significant amount of waste of natural gas on federal lands.

> In 2014, operators vented about 30 Bcf and flared at least 81 Bcf of natural gas from BLM-administered leases, totaling 4.1 percent of the total production from those leases in that year, and sufficient gas to supply nearly 1.5 million households with gas for a year. 81 CFR 83082

The rule was adopted to prevent as much of this waste as possible. The provisions of the rule will cover new leasing and drilling approvals under the RMPA. The rule also applies to existing leases and existing wells within the planning area.

As an initial matter, in the Preamble to the rule, BLM clearly states the critical role that land use planning and NEPA analysis must play in preventing methane waste on public lands. As applied to the RMPA, this language obligates the FFO to identify areas where gas capture

infrastructure is not available to get produced gas to market and where leasing and permitting should be restricted. The Preamble states:

> [T]he land use planning and NEPA processes are critical to achieving our simultaneous goals of responsible oil and gas development, land stewardship and resource conservation, and protection of air quality on (and reduction of air emissions from) Federal lands.
>
> The BLM already has land use planning and NEPA tools and processes in place that can be used to help achieve the specific goals of this rulemaking—to reduce the wasteful and environmentally harmful loss of gas through venting, flaring, and leaks … In particular, the land use planning and NEPA processes for new RMPs and MLPs provide important opportunities to consider the effects of oil and gas development over a larger area and to optimize planned development to minimize impacts from venting and flaring, among other activities. *The planning process gives the BLM the opportunity to consider how a specific land management plan could address the timing and location of development of oil and gas and related infrastructure, such as pipelines, and the projected consequences of such decisions in terms of the quantities of vented and flared gas and the impacts associated with those emissions.*
>
> *Thus, the BLM already has the NEPA processes and tools in place to evaluate the effects of the gas that would be flared, vented, and leaked from proposed oil and gas production, including impacts to wildlife and air quality, as well as GHG emissions, which contribute to climate change. The NEPA analyses can also identify ways to minimize such effects, such as evaluating alternative options for siting and timing of development that would maximize the opportunities for gas capture in lieu of flaring.* [emphasis added]

In addition to BLM's planning and NEPA obligations, the rule establishes ten requirements for operators to prevent natural gas waste on federal lands. These standards are all designed to prevent methane waste from a particular activity that operators conduct or equipment they utilize in the production of oil and gas. These provisions are:

1. Waste Minimization Plan. §3162.3-1 requires that an operator submitting an APD for a new well or multiple wells on a well pad must simultaneously submit a waste minimization plan. This plan must "set forth a strategy for how the operator will comply with the requirements of 43 CFR subpart 3179 regarding control of waste from venting and flaring, and must explain how the operator plans to capture associated gas upon the start of oil production." While the plan is not enforceable, it must be "complete and adequate" or the APD will denied or disapproved.

2. Ban on venting. §3179.6 prohibits operators from venting natural gas, requiring vented gas to be flared while establishing a narrow set of exceptions.

3. Gas capture percentage requirement. §3179.7 establishes gas capture percentage requirement to reduce the amount of flared gas. Capture percentages decline over time, from 85% in 2018-2019 to 98% after 2026. Operators who fail to meet these percentages must pay royalty on the amount of methane exceeding these percentages and are also subject to production curtailments or other enforcement actions.

4. Ban on venting during drilling and completions. §3179.101 and §3179.102 require operators to capture and sell, flare, use on site, or inject all gas that reaches the surface during these activities.

5. Requirement for replacement of pneumatic devices. §3179.201 and §3179.202 require the replacement of pneumatic controllers and pneumatic pumps that release gas over certain thresholds (i.e., high-bleed and intermediate-bleed devices). Replacement devices must release amounts of gas that are below these limits. Devices with releases that are routed to a flare or processing equipment are exempted from the requirements.

6. Requirement to route storage tank vapor gas to a sales line. §3179.203 requires that storage tanks that release gas over a certain threshold must route the gas to a sales line or, in certain circumstances, to a flare.

7. Requirement to minimize venting during liquids unloading. §3179.204 requires operators to minimize venting during downhole maintenance and liquids unloading by optimizing automated systems or, for wells without automated systems, by considering alternatives to manual purging.

8. Requirements for leak detection and repair. §3179.203 requires that operators inspect sites for leaks at least semi-annually and make repairs to eliminate leaks within thirty days of discovering a leak.

9. Requirements to measure vented and flared gas. §3179.9 requires operators to measure all gas that is vented and flared over 50 Mcf/day, and estimate gas volumes vented and flared below this threshold.

The BLM rule places an obligation on the FFO RMPA to take a hard look at natural gas waste both from existing leases and wells and from new leasing, drilling, and production. The RMPA must consider alternatives to prevent waste, including restricting the timing and location of new leasing and drilling to areas where gas capture infrastructure will be available to enable produced gas to be marketed.

The FFO is also obligated to address implementation of the mandatory waste prevention requirements contained in the rule through, among other mechanisms, lease stipulations and conditions of approval on drilling permits.

In 2014 NASA released a report identifying a methane “hot spot” over the San Juan

Basin.[173] The research found emissions through satellite imaging of 590,000 MT of methane annually between 2003-2009 (14,500,000 $MTCO_2e$). This is almost *twice as high* as the 330,000 MT (8,250,000 $MTCO_2e$) reported to the EPA GHG Reporting Program for 2012. In 2016 NASA released a subsequent study on the source of the concentrated methane emissions in the San Juan Basin, identifying 250 large methane plumes emitted from well pads, storage tanks, pipelines, gas processing plants, and venting from the San Juan coal mine.[174] Together these sources make up roughly half of all basin-wide methane emissions, and all but one of these sources is from the oil and gas industry.

Even absent BLM's methane waste rule, existing regulations through NTL-4A direct BLM policy with respect to waste. NTL-4A states unequivocally that "Except as provided in II.C and III above, *gas well gas may not be flared or vented*. The exceptions include emergencies, well purging, initial production testing, and routine well testing." §IV.A With respect to oil well gas, NTL-4A also states that:

> Oil well gas may not be vented or flared unless approved in writing by the Supervisor. The Supervisor may approve an application for the venting or flaring of oil well gas if justified either by the submittal of (1) *an evaluation report* supported by engineering, geologic, and economic data which demonstrates to the satisfaction of theSupervisor that the expenditures necessary to market or beneficially use such gas are not economically justified and that conservation of the gas, if required, would lead to the premature abandonment of recoverable oil reserves and ultimately to a greater loss of equivalent energy than would be recovered if the venting or flaring were permitted to continue or (2) *an action plan* that will eliminate venting or flaring of the gas within 1 year from the date of application. §IV.B [emphasis added]

BLM's implementing regulations—which underlie NTL4a and should inform BLM's revised waste rule—reflect these provisions, providing that "[t]he objective" of its MLA regulations in 43 C.F.R. Subpart 3160 "is to promote the orderly and efficient exploration, development and production of oil and gas." 43 C.F.R. § 3160.0-4. Subpart 3160 specifically requires BLM officials to ensure "that all [oil and gas] operations be conducted in a manner which *protects other natural resources and environmental quality*, protects life and property and results in the *maximum ultimate recovery of oil and gas with minimum waste and with minimum adverse effect on the ultimate recovery of other mineral resources*." 43 C.F.R. § 3161.2. The lease owner and or operator is similarly charged with "conducting all operations in a manner which ensures the proper handling, measurement, disposition, and site security of leasehold

---

[173] *See* NASA Science News, *U.S. Methane 'Hot Spot' Bigger than Expected*, Oct. 9, 2014, available at: http://science.nasa.gov/science-news/science-at-nasa/2014/09oct_methanehotspot/. *See also,* Eric A. Kort, *et al.*, *Four Corners: The largest US methane anomaly viewed from space*, GEOPHYSICAL RESEARCH LETTERS, Vol. 41, Issue 19, Oct 16, 2014 (attached as Exhibit 38).

[174] Christian Frankenberg, et al., *Airborne methane remote measurements reveal heavy-tail flux distribution in Four Corners region*, PNAS, vol. 113 no. 25 (Aug. 30, 2016) (attached as Exhibit 39).

production; which protects other natural resources and environmental quality; which protects life and property; and *which results in maximum ultimate economic recovery of oil and gas with minimum waste and with minimum adverse effect on ultimate recovery of other mineral resources*." 43 C.F.R. § 3162.1(a).

If not replaced by the waste rule, NTL-4A would obligate the FFO to take a hard look at measures to ensure that no gas well gas other than that excepted will be vented or flared from new gas wells. It would also obligate the FFO to take a hard look at procedures to ensure that no oil well gas will be vented or flared without prior approval. The FFO must also take a hard look at procedures that will ensure that evaluation reports or action plans are required to justify those approvals.

E. Managing for Community and Ecosystem Resiliency.

CEQ Guidance requires that agencies address the impacts of climate change on the environmental consequences of a proposed action. As the CEQ Guidance recognizes, "[c]limate change can make a resource, ecosystem, human community, or structure more susceptible to many types of impacts and lessen its resilience to other environmental impacts apart from climate change." Climate Guidance at 21. These effects are already occurring and are expected to increase, resulting in shrinking water resources, extreme flooding events, invasion of more combustible non-native plant species, soil erosion, loss of wildlife habitat, and larger, hotter wildfires. These impacts have been catalogued in recent scientific studies by federal agencies, including the National Climate Assessment,[175] and highlighted by President Obama. *See* Exec. Order No. 13,653, § 1. As the CEQ Guidance recognizes, "GHGs already in the atmosphere will continue altering the climate system into the future, even with current or future emissions control efforts." Climate Guidance at 20. In other words, climate change impacts are and will continue to be part of the new normal, and "managing th[o]se risks requires deliberate preparation, close cooperation, and coordinated planning … to improve climate preparedness and resilience; help safeguard our economy, infrastructure, environment, and natural resources; and provide for the continuity of … agency operations, services, and programs." Exec. Order No. 13,653, § 1.

NEPA analyses must account for this reality. While the CEQ Guidance suggests that existing and reasonably foreseeable climate change impacts be considered as part of an agency's hard look at impacts, the guidance must also account for the fact that climate change effects are and will continue to be a key component of the environmental baseline. Agencies are required under NEPA to "describe the environment of the areas to be affected or created by the alternatives under consideration." 40 C.F.R. § 1502.15. The affected environment discussion sets the "baseline" for the impacts analysis and comparison of alternatives. As the Ninth Circuit has recognized, "without establishing…baseline conditions…there is simply no way to determine what effect [an action] will have on the environment, and consequently, no way to comply with NEPA." *Half Moon Bay Fisherman's Marketing Ass'n v. Carlucci*, 857 F.2d 505, 510 (9th Cir. 1988) (explaining further that "[t]he concept of a baseline against which to compare predictions of the effects of the proposed action and reasonable alternatives is critical to the NEPA process").

[175] Available at http://nca2014.globalchange.gov/ (attached as Exhibit 6).

Excluding climate change effects from the environmental baseline ignores the reality that the impacts of proposed actions must be evaluated based on the already deteriorating, climate-impacted state of the resources, ecosystems, human communities, and structures that will be affected. Accordingly, BLM must clarify that existing and reasonably foreseeable climate change impacts as part of the affected environment in the planning area, which then must be assessed as part of the agency's hard look at impacts, and integrated into *each* of the alternatives, including the no action alternative. Put differently, simply acknowledging climate impacts as part of the affected environment is insufficient. BLM must incorporate that information into their hard look at impacts (e.g., the cumulative impact of climate change, the proposed action, and other past, present, and reasonably foreseeable impacts), in particular to help inform the design and consideration of alternatives and mitigation measures.

Critically, the RMPA should emphasize that agencies may not shirk their responsibility to assess climate change merely because of uncertainties. "Reasonable forecasting and speculation is…implicit in NEPA, and we must reject any attempt by agencies to shirk their responsibilities under NEPA by labelling any and all discussion of future environmental effects as 'crystal ball inquiry.'" *Save Our Ecosystems v. Clark*, 747 F.2d 1240, 1246 n.9 (9th Cir. 1984 (quoting *Scientists' Inst. for Pub. Info., Inc. v. Atomic Energy Comm*., 481 F.2d 1079, 1092 (D.C. Cir. 1973)). NEPA's hard look merely requires "a reasonably thorough discussion of the significant aspects of the probable environmental consequences" to "foster both informed decision-making and informed public participation." *Ctr. for Biological Diversity v. NHTSA*, 538 F.3d 1172, 1194 (9th Cir. 2008) (quotations and citations omitted). As here, BLM has refused to address the implications of their actions in the context of climate change on the basis of uncertainties, such as the lack of fine-scale modeling, which has led BLM to take short-sighted, arbitrary, and capricious action that does not, in fact, account for climate change.

In this context, and to accurately account for and integrate climate change impacts into the affected environment, hard look, alternatives, and mitigation analysis, BLM should evaluate the relevant resources, ecosystems, or communities for key vulnerabilities as part of the baseline assessment. The vulnerability of ecosystems and communities, as well as the species and physical elements they comprise, depends on their inherent qualities and their ability to change or adapt to address new climatic conditions. For example, the vulnerability of certain species can be affected by the tolerance of individual organisms to the direct effects of climate change, the ability of populations to adapt to those conditions through the expression of genetic variability, and the ability to adjust behaviorally to changes in the ecosystem, such as prey shifts. A vulnerability assessment would examine the species and physical elements of existing ecosystems and determine which elements are sensitive, which are resilient, which have the ability to adapt, and what the likely consequences would be of anticipated changes in climate. Human infrastructure—bridges, roads, buildings, etc.—should be assessed similarly.

Because ecosystems (including the human communities that rest within such ecosystems) are so complex, it is impossible to evaluate the vulnerabilities of every population, species, community, or other element of the system in question. Instead, risk assessment must focus on particular, high-priority elements or "key vulnerabilities." In its 5th Assessment Report, the IPCC suggested the following criteria for identifying key vulnerabilities:

- Exposure of society, community or social-ecological system to climate stressors.
- Importance of vulnerable system(s).
- Limited ability of society, community, or social-ecological systems to cope with and build adaptive capacities or limit the adverse consequences of climate related hazard.
- Persistence of vulnerable conditions and degree of irreversibility of consequences.
- Presence of conditions that make societies highly susceptible to cumulative stressors in complex and multiple-interacting systems.

In other words, key vulnerabilities are likely to occur where the effects of climate change are large and intense, imminent, long lasting, highly probable, irreversible, and likely to limit the distribution of highly valued systems or system elements. BLM should clarify that understanding and assessing these vulnerabilities, based on existing information and tools,[176] is a key component of the affected environment, hard look at impacts, and the design and consideration of alternatives and mitigation measures.

F. BLM Must Ensure NEPA Documentation Addresses Mitigation for Climate Impacts Consistent with All Relevant Laws and Policies, Including Current Mitigation Guidance.

NEPA's statutory language implicitly charges agencies with mitigating the adverse environmental impacts of their actions. *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 351-52 (1989); *Holy Cross Wilderness Fund v. Madigan*, 960 F.2d 1515, 1522 (10th Cir. 1992). Mitigation measures are required by NEPA's implementing regulations. 40 C.F.R. §§ 1502.14(f), 1502.16(h).

The CEQ has stated: "All relevant, reasonable mitigation measures that could improve the project are to be identified, even if they are outside the jurisdiction of the lead agency or the cooperation agencies ...." Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations, 46 Fed. Reg. 18026, 18031 (March 23, 1981). According to the CEQ, "[a]ny such measures that are adopted must be explained and committed in the ROD." Forty Questions, 46 Fed. Reg. at 18036.

The Tenth Circuit has held that an agency's analysis of mitigation measures "must be 'reasonably complete' in order to 'properly evaluate the severity of the adverse effects' of a proposed project prior to making a final decision." *Colo. Envt'l Coalition v. Dombeck*, 185 F.3d 1162, 1173 (10th Cir. 1999) (quoting Robertson, 490 U.S. at 352). Mitigation "must be discussed in sufficient detail to ensure that environmental consequences have been fairly evaluated." *City of Carmel-by-the-Sea v. U.S. Dep't of Transp.*, 123 F.3d 1142, 1154 (9th Cir. 1997) (quoting *Robertson*, 490 U.S. at 353).

[176] Where there is scientific uncertainty, agencies must satisfy the requirements of 40 C.F.R. § 1502.22.

"[O]mission of a reasonably complete discussion of possible mitigation measures would undermine the 'action-forcing' function of NEPA. Without such a discussion, neither the agency nor other interested groups and individuals can properly evaluate the severity of the adverse effects." *Robertson*, 490 U.S. at 353. A "perfunctory description," of mitigation, without "supporting analytical data" analyzing their efficacy, is inadequate to satisfy NEPA's requirements that an agency take a "hard look" at possible mitigating measures. *Neighbors of Cuddy Mountain v. U.S. Forest Serv.*, 137 F.3d 1372, 1380 (9th Cir. 1998). An agency's "broad generalizations and vague references to mitigation measures ... do not constitute the detail as to mitigation measures that would be undertaken, and their effectiveness, that the Forest Service is required to provide." *Id.* at 1380-81. *See also Northwest Indian Cemetery Protective Association v. Peterson*, 795 F.2d 688, 697 (9th Cir. 1986), rev'd on other grounds, 485 U.S. 439 (1988) ("A mere listing of mitigation measures is insufficient to qualify as the reasoned discussion required by NEPA."); *Idaho Sporting Congress v. Thomas*, 137 F.3d 1146, 1151 (9th Cir. 1988) ("Without analytical data to support the proposed mitigation measures, we are not persuaded that they amount to anything more than a 'mere listing' of good management practices."). Moreover, in its final decision documents, an agency must "[s]tate whether all practicable means to avoid or minimize environmental harm from the alternative selected have been adopted, and if not, why they were not." 40 C.F.R. § 1505.2(c).

CEQ also recognizes that the consideration of mitigation measures and reasonable alternatives is closely related. For example, CEQ's guidance on mitigation and monitoring states that "agencies may commit to mitigation measures considered as alternatives in an EA or EIS so as to achieve an environmentally preferable outcome." Council on Environmental Quality, Appropriate Use of Mitigation and Monitoring and Clarifying the Appropriate Use of Mitigated Findings of No Significant Impact (Jan. 14, 2011) at 1 (hereafter "CEQ Mitigation Guidance"); *see also id.* at 6-7 ("When a Federal agency identifies a mitigation alternative in an EA or an EIS, it may commit to implement that mitigation to achieve an environmentally-preferable outcome.").

Guidance from CEQ specifically directs agencies to consider where appropriate a variety of mitigation measures for actions that will cause climate pollution, including measures that will capture or use methane emissions:

> As Federal agencies evaluate potential mitigation of GHG emissions and the interaction of a proposed action with climate change, the agencies should also carefully evaluate the quality of that mitigation to ensure it is additional, verifiable, durable, enforceable, and will be implemented. Agencies should consider the potential for mitigation measures to reduce or mitigate GHG emissions and climate change effects when those measures are reasonable and consistent with achieving the purpose and need for the proposed action. Such mitigation measures could include enhanced energy efficiency, lower GHG-emitting technology, carbon capture, carbon sequestration (e.g., forest, agricultural soils, and coastal habitat restoration), sustainable land management practices, and capturing or beneficially using GHG emissions such as methane.[177]

[177] Climate Guidance at 19 (attached as Exhibit 4) (citation omitted).

1. Consistent with the Mitigation Hierarchy, BLM Must Avoid, Minimize and Offset Impacts from Fossil Fuels Made Available by the RMPA, Including Climate Change-Related Impacts.

BLM has significant obligations and authority related to mitigation for all unavoidable impacts. Secretarial Order 3330 requires the development of a landscape-scale mitigation policy for the Department of the Interior, which is appropriately done at the field office plan level. Section 4(c) of Secretarial Order 3330 directs the Department of the Interior's Energy and Climate Change Task Force to:

> [I]dentify any new policies or practices, revisions to existing policies or practices, or regulatory or other changes that could be implemented to incorporate landscape-scale planning into mitigation-related decisions… The Task Force will also determine what steps can and should be taken to ensure that mitigation opportunities are identified as early in the permitting process as possible, such as at the scoping or pre-application stage, to maximize predictability and transparency in the review and permitting process.

In a report to the Secretary of the Interior, the Energy and Climate Change Task Force laid out a landscape approach to mitigation.[178] This approach contained the following steps:

> 1. Identifying key landscape attributes, and the conditions, trends and baselines that characterize these attributes;
>
> 2. Developing landscape-scale goals and strategies;
>
> 3. Developing efficient and effective compensatory mitigation programs for impacts that cannot be avoided or minimized; and
>
> 4. Monitoring and evaluating progress and making adjustments, as necessary, to ensure that mitigation is effective despite changing conditions.

BLM's current guidance (IM No. 2013-142 and Draft Manual Section 1794) states that as part of approving specific land uses, mitigation implementation may be "within (onsite) or outside of the area of impact." The manual emphasizes that onsite mitigation is always the first choice, including a "mitigation priority order," then discusses options to provide offsite mitigation by replacing or providing similar or substitute resources or values through "restoration, enhancement, creation, or preservation."

BLM's policy emphasizes that it is designed to "shift the BLM's mitigation focus from a permit-by-permit perspective to a proactive regional-scale mitigation planning perspective" and

---

[178] Clement, J.P. *et al.*, A strategy for improving the mitigation policies and practices of the Department of the Interior. A report to the Secretary of the Interior from the Energy and Climate Change Task Force (April 2014), available at: https://www.doi.gov/sites/doi.gov/files/migrated/news/upload/Mitigation-Report-to-the-Secretary_FINAL_04_08_14.pdf (attached as Exhibit 145).

to cut across jurisdictions and land ownership to "attain the highest mitigation benefit, regardless of land ownership."[179] These key tools from the agency's guidance should also be emphasized as important aspects of incorporating mitigation into land use planning.

BLM is also considering new tools and approaches the agency could use to increase the effectiveness of mitigation on public lands, including layering protective management and designations and exploring creative ways existing authorities could be used for conservation benefits. Effective new mitigation tools and approaches should be integrated into planning as well.

Mitigating climate-related impacts includes avoiding and minimizing generation of GHG emissions through management prescriptions and preventing harm to carbon sinks. The CEQ guidance on considering climate change in NEPA analyses provides that agencies should analyze reasonable alternatives that would mitigate both direct and indirect GHG emissions impacts and the cumulative effects of climate change (e.g., enhanced energy efficiency, carbon sequestration, lower GHG-emitting technology).[180] BLM must address the quality of mitigation measures as well as ensure they are additional, verifiable, durable, enforceable, and will be implemented.

In addition to the legal and policy directions which require mitigation for climate impacts from the Mancos RMPA and provide the agency with ample discretion to require mitigation, it is important to underscore that, as a land manager, the federal government in general and BLM in particular are facing huge and rapidly escalating costs to address the impacts caused by fossil-fuel driven climate change. Forest fires, widespread drought, unusual flooding, rising sea levels, spread of invasive species and spread of disease already result in significant costs to the federal government, and each new fossil fuel production project that BLM authorizes through the Uncompahgre plan will worsen these problems and increase the associated costs. Research from the University of Vermont's Gund Institute for Ecological Economics and The Wilderness Society suggests that total costs in degraded ecosystem services on federal public lands could exceed $14.5 billion annually under a 2-degree Celsius warming scenario.[181] These costs are ultimately borne by all American taxpayers, and BLM has a responsibility to recoup these costs when it makes decisions authorizing activities that cause these impacts and associated costs.

---

[179] BLM, *Draft – Regional Mitigation*, Manual Section 1794 at 1-3 (attached as Exhibit 146).

[180] Climate Guidance at 13, 16 (attached as Exhibit 4).

[181] *See* Esposito, Valerie; Phillips, Spencer; Boumans, Roelof; Moulaert, Azur; Boggs, Jennifer. 2011. "Climate change and ecosystem services: The contribution of and impacts on federal public lands in the United States." In: Watson, Alan; Murrieta-Saldivar, Joaquin; McBride, Brooke, comps. *Science and stewardship to protect and sustain wilderness values: Ninth World Wilderness Congress symposium*; November 6-13, 2009; Merida, Yucatan, Mexico. Proceedings RMRS-P-64. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. p. 155-164, available at: http://www.fs.fed.us/rm/pubs/rmrs_p064.pdf (last viewed Oct. 27, 2016) (attached as Exhibit 147).

2. BLM Should Adopt a Mitigation Strategy as Part of the Mancos RMPA to Address Unavoidable Climate Change Impacts.

To comply with NEPA's mandates, and BLM policy, concerning mitigation, BLM should require compensatory mitigation to offset the unavoidable direct and indirect climate change impacts of the Mancos RMPA. Such mitigation would contain several key features:

- *BLM should quantify and offset emissions through specific compensatory mitigation actions*

Quantifying climate change impacts is becoming increasingly more practical, and the science connecting impacts to temperature changes increasingly more precise. Compensatory mitigation actions can be directed at enhancing the adaptive capacity of human and natural communities in the affected landscape to improve their health and resilience in the face of expected change. Offsetting actions should include investments in land protection to ensure that the FFO's ecological systems have the space and conditions to adapt.

Significant opportunity exists to offset GHG emissions. EPA has repeatedly urged land management agencies to assess carbon offsets in Environmental Assessments and EISs as a way to reduce the climate change impacts of agency actions. For example, EPA specifically recommended that the Forest Service's Lease Modifications EIS for the West Elk Mine "acknowledge that revenues for carbon credits are available via several existing markets."[182] Similarly, EPA has recommended that a Forest Service NEPA analysis of a forest health project "discuss reasonable alternatives and/or potential means to mitigate *or offset* the GHG emissions from the action."[183] Numerous state agencies already use offsets to control GHG emissions.[184] Offsets can include participation in third-party offset markets or renewable energy credits.

In any subsequently prepared NEPA document, the BLM should consider mitigation measures that offset the direct and indirect carbon emissions attributable to the draft plan alternatives – 27 million tons. Specifically, BLM should consider requiring that purchasers of fossil fuel leases be required to purchase offsets from reputable carbon markets that offset the direct and indirect greenhouse gas emissions from the mining and combustion of fossil fuels from their leases.

---

[182] EPA July 2012 Comment Letter at 5 (attached as Exhibit 148) (identifying four U.S. carbon exchanges creating a market for carbon credits).

[183] Letter of L. Svoboda, EPA, to T. Malecek, USFS, at 8 (Oct. 27, 2010) (attached as Exhibit 149).

[184] *See, e.g.*, Settlement Agreement, ConocoPhillips and California (Sept. 10, 2007) (California agency requiring offsets as a condition of approving a project) (attached as Exhibit 150); Minn. Stat. § 216H.03 subd. 4(b) (Minnesota law requiring offsets for certain new coal-fired power plants); Me. Rev. Stat. Ann. tit. 38, § 580-B(4)(c) (Maine law establishing greenhouse gas initiative that includes the use of carbon offsets).

- *BLM should address the full scope of lifecycle emissions through avoidance, minimization, and compensatory mitigation for fossil fuel production, transport and combustion.*

The premise of compensatory mitigation is to address unavoidable harm. In the case of fossil fuel production, the harm from GHG emissions is primarily attributable to end-use combustion. Nevertheless, BLM should at least address the direct emissions that could be avoided or minimized by, for example, requiring the capture or combustion of methane, adopting enforceable mitigation requirements to minimize methane emissions and waste from oil and gas production, etc.

- *BLM should specify whether compensatory mitigation should be paid on an annual basis or paid up front.*

Fees collected for compensatory mitigation are often paid in a lump sum at the beginning of a project's operational life. In the case of climate impacts, however, it may make more sense to consider an annual payment on the basis of production, or an annualized payment schedule based on expected production with corrections on a semi-annual basis. By spreading payments over the life of the project (and tying them to when the impacts actually occur), the system should be both fairer to producers and more true to the spirit of mitigation.

- *BLM must ensure that compensatory mitigation actions are additional and durable, and last for the duration of impacts.*

This is an established principle for the Department's approach to mitigation, but it is particularly important with regard to climate impacts. For example, the Australian Government's Climate Change Authority found that, "Assessing additionality is a key feature of all baseline and credit schemes. An additionality test assesses whether a project or activity creates 'additional' emissions reduction that would not have occurred in the absence of the incentive. The baseline for the project assesses how much emissions have been reduced. Additionality is important to ensure that a baseline and credit scheme does not pay for emissions reductions that would have occurred anyway."[185]

IV. BLM Must Take a Hard Look at the Direct, Indirect and Cumulative Impacts of Oil and Gas Leasing and Development on Resource Values in the Planning Area.

A. The FFO Must Take a Hard Look at Certain Impacts to Air Quality.

1. Air Resource Mitigation Measures

BLM should commit to implementation of specific and enforceable management actions that ensure no significant impacts to air quality and air quality related values—as determined by

[185] *See* Australian Government Climate Change Authority, *Additionality*, http://www.climatechangeauthority.gov.au/reviews/carbon-farming-initiative-study/additionality.

air quality modeling—in the RMPA/EIS. Specifically, BLM must consider Best Management Practices (BMPs) to ensure that human health and the environment are protected from oil and gas drilling over the life of the new RMPA.

2. Ozone Impacts

Background concentrations of ozone in the Farmington planning area are already at or exceed the National Ambient Air Quality Standards ("NAAQS"), leaving virtually no room for growth in emissions. The RMPA must also include wintertime ozone monitoring information within the planning area. Spikes in ozone levels have been documented to occur in oil and gas producing basins in the Western United States during cold, snowy periods when wintertime "inversions" concentrate air pollutants from oil and gas activities.[186] Adding hundreds of additional oil and wells to the area will add hundreds of tons of additional ozone precursors to the region, threatening considerable exceedances of the ozone NAAQS—especially in wintertime in the region's valleys. *See id.*

BLM may not avoid including winter ozone modeling, even if information about winter ozone levels is incomplete. According to NEPA regulation, if an estimation of reasonably foreseeable significant adverse impacts cannot be obtained because, among other things, the means to obtain it are "not known," BLM has an obligation to include an evaluation "based upon theoretical approaches or research methods generally accepted in the scientific community," provided that "the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason." 40 C.F.R. § 1502.22. These methods of dealing with incomplete information are required under NEPA and must be thoroughly exercised before drawing the conclusion that a wintertime ozone analysis cannot be included in the RMPA/EIS. *See id*.

BLM has, in fact, modeled winter ozone concentrations for other recent NEPA actions. Even though BLM did not perform a winter ozone modeling analysis of the proposed development, modeling results for wintertime ozone concentrations were included as part of the base case modeling performance evaluation for the Continental Divide-Creston (CD-C) DEIS in Wyoming.[187] The DEIS included model performance evaluations for the 2005 and 2006 base case scenarios based on CD-C project modeling and on previously-conducted modeling for the Hiawatha Regional Energy Development Project EIS (Hiawatha). The results of the base case modeling evaluations suggest it is not unreasonable or inappropriate to include wintertime modeling results in BLM's analysis. Specifically, model results are presented in the CD-C DEIS and compared with year-round monitoring data at several sites.[188] In general, the modeling results appear to underestimate winter ozone concentrations, but not in all cases.[189] Generally,

---

[186] Peter M. Edwards et al., *High Winter Ozone Pollution from Carbonyl Photolysis in an Oil and Gas Basin*, 514 Nature 351 (October 16, 2014).
[187] *See* BLM Continental Divide-Creston (CD-C) AQTSD Appendix A.
[188] BLM CD-C AQTSD Appendix A at 68.
[189] *See*, *e.g.*, BLM CD-C AQTSD Appendix A at 68 (Close to the project area, the performance of the CD-C and Hiawatha modeling appears to be reasonably good "with the exception of a few

the results of the CD-C DEIS performance evaluation indicate that there is a tendency towards underestimation, especially at observed maximum concentrations in winter. Even so, if modeled wintertime ozone concentrations are shown to be a problem and the performance evaluation for the modeling indicates that modeled results likely underestimate impacts in winter then, at a minimum, the BLM would have an obligation under NEPA to reduce emissions from the proposed development in order to ensure there will be no significant impacts to wintertime ozone levels based on the modeling, as evaluated (with an underestimation bias). BLM should consider a similar approach for the RMPA/EIS. As shown by the high wintertime ozone levels nearby in Rangely, in the Uinta Basin in Utah, as well as in Wyoming's Sublette County, wintertime ozone near concentrated oil and gas development has simply become far too big of an issue, of tremendous public interest and concern, to be ignored in this long-term planning action.

Ozone has long been recognized to cause adverse health effects. Exposure to ozone can cause or exacerbate respiratory health problems—including shortness of breath, asthma, chest pain and coughing—can decrease lung function, and can even lead to long-term lung damage. *See also* EPA's National Ambient Air Quality Standards for Particulates and Ozone, 62 FR 38,856 (July 18, 1997). Short term exposure to ozone causes multiple negative respiratory effects, from inflammation of airways to more serious respiratory effects that can lead to use of medication, absences from school and work, hospital admissions, emergency room visits, and chronic obstructive pulmonary disease ("COPD"). According to a recent report by the National Research Council ("NRC"), short-term exposure to current levels of ozone in many areas is likely to contribute to premature deaths.[190] As described in more detail below, even ozone concentrations as low as 60 ppb can be harmful to human health. Long-term exposure to elevated levels of ozone results in numerous negative harmful effects, such as permanent lung damage and abnormal lung development in children. Long-term exposure may also increase risk of death from respiratory problems. Short- and long-term exposure to elevated levels of ozone can also harm people's hearts and cardiovascular systems. *See* 79 Fed. Reg. 75234-311.

On October 26, 2015, EPA published a final rule to revise the NAAQS for ozone to 70 parts per billion (ppb) from the current 75 ppb. National Ambient Air Quality Standards for Ozone, 80 Fed. Reg. 65292 (Oct. 26, 2015). This decision was driven by significant recent scientific evidence that the standard of 75 ppb was not adequately protecting public health. *Id.* at 136. In fact, recent studies have documented decreased lung functioning and airway inflammation in young, healthy adults at ozone concentrations as low as 60 ppb. *Id.* at 146.

Additionally, climate change is likely to worsen ozone pollution, offsetting the improvements in air quality and public health that would be expected from reductions in emissions of ozone precursors. As described by the EPA in its recent ozone rulemaking:

> In addition to being affected by changing emissions, future O_3 concentrations may also be affected by climate change. Modeling studies in the EPA's Interim

---

days, the two base case simulations reproduce the observed ozone at [the OCI monitor] reasonably well.").

[190] National Research Council, *Link Between Ozone Air Pollution and Premature Death Confirmed,* (April 2008), available at: http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=12198.

> Assessment (U.S. EPA, 2009a) that are cited in support of the 2009 Endangerment Finding under CAA section 202(a) (74 FR 66496, Dec. 15, 2009) as well as a recent assessment of potential climate change impacts (Fann et al., 2015) project that climate change may lead to future increases in summer O_3 concentrations across the contiguous U.S. While the projected impact is not uniform, climate change has the potential to increase average summertime O_3 concentrations by as much as 1-5 ppb by 2030, if greenhouse gas emissions are not mitigated. Increases in temperature are expected to be the principal factor in driving any O_3 increases, although increases in stagnation frequency may also contribute (Jacob and Winner, 2009). If unchecked, climate change has the potential to offset some of the improvements in O_3 air quality, and therefore some of the improvements in public health, that are expected from reductions in emissions of O_3 precursors.

80 Fed. Reg. 65292, 65300 (October 26, 2015). For example, climate change impacts include an increase in the area burned by wildfires, which, in turn are sources of O_3 precursors. *Id.* at 65371.

3. Hazardous Air Pollutant Impacts

The FFO should look at additional hazardous air pollutant impacts from projected development, including the impacts from 1,3-butadiene and secondary formaldehyde that will result from the proposed development. The BLM has completed a more comprehensive analysis of HAPs in other recent NEPA actions which resulted in significant impacts from HAPs. Specifically, the Gasco EIS in Utah evaluated short-term and long-term impacts from numerous HAPs, including methanol, chlorinated solvents and acrolein.[191] The Gasco EIS analysis found elevated cancer risks for acetaldehyde, 1,3-butadiene, and ethylene dibromide.[192] The Gasco EIS also reported acrolein emissions that exceeded the acute Reference Exposure Level (REL) and the Reference Concentration for Chronic Inhalation (RfC).[193] BLM must include a more comprehensive analysis of HAP impacts and, in addition to the HAPs identified above, the BLM should also assess any HAP impacts associated with volatile emissions from hydraulic fracturing fluids. It is important to continue to improve upon the HAP analyses conducted under NEPA in order to ensure there are no significant health impacts from near-field exposure to HAPs from the proposed development in the planning area. *See* 40 C.F.R. §1508.27(b)(2).

4. Visibility and Ecosystem Impacts

Much of air pollution from oil and gas development and operations also degrades visibility. Section 169A of the Clean Air Act ("CAA"), 42, U.S.C. § 7401 *et seq.* (1970) sets forth a national goal for visibility, which is the "prevention of any future, and the remedying of any existing, impairment of visibility in Class I areas which impairment results from manmade air pollution." Congress adopted the visibility provisions in the CAA to protect visibility in "areas of great scenic importance." H.R. Rep. No. 294, 95th Cong. 1st Sess. at 205 (1977). In

[191] *See* BLM Gasco Energy Project FEIS, Table 4-12, Table 4-19 and Appendix H. April 2010.
[192] BLM Gasco FEIS Table 4-19.
[193] BLM Gasco FEIS Appendix H, at H-45.

promulgating its Regional Haze Regulations, 64 Fed. Reg. 35,714 (July 1, 1999), the U.S. Environmental Protection Agency ("EPA") provided:

> Regional haze is visibility impairment that is produced by a multitude of sources and activities which emit fine particles and their precursors and which are located across a broad geographic area. Twenty years ago, when initially adopting the visibility protection provisions of the CAA, Congress specifically recognized that the "visibility problem is caused primarily by emission into the atmosphere of SO2, oxides of nitrogen, and particulate matter, especially fine particulate matter, from inadequate[ly] controlled sources." H.R. Rep. No. 95-294 at 204 (1977). The fine particulate matter (PM) (e.g., sulfates, nitrates, organic carbon, elemental carbon, and soil dust) that impairs visibility by scattering and absorbing light can cause serious health effects and mortality in humans, and contribute to environmental effects such as acid deposition and eutrophication.

The visibility protection program under sections 169A, 169B, and 110(a)(2)(J) of the CAA is designed to protect Class I areas from impairment due to man-made air pollution. The current regulatory program addresses visibility impairment in these areas that is "reasonably attributable" to a specific source or small group of sources, such as, here, air pollution resulting from oil and gas development and operations authorized by the RMP. *See* 64 Fed. Reg. 35,714.

Moreover, EPA finds the visibility protection provisions of the CAA to be quite broad. Although EPA is addressing visibility protection in phases, the national visibility goal in section 169A calls for addressing visibility impairment generally, including regional haze. *See e.g., State of Maine v. Thomas*, 874 F.2d 883, 885 (1st Cir. 1989) ("EPA's mandate to control the vexing problem of regional haze emanates directly from the CAA, which 'declares as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in Class I areas which impairment results from manmade air pollution.' ") (citation omitted).

5. Air Quality Impacts on Human Health

Although adherence to air quality mitigation and NAAQS standards will have a positive relationship to human health, poor baseline air quality conditions due to direct, indirect and cumulative impacts in the planning area warrants an independent hard look analysis at human health; and, moreover, such analysis is required by NEPA and CEQ implementing regulations.

Ozone is just one air-related byproduct of oil and gas development that may pose serious impacts to human health. Recent studies in Garfield County confirm that air toxics are generated during every stage of oil and gas development and can have potentially significant health impacts even at concentrations below regulatory thresholds.[194] Another recent study undertaken in rural Colorado locations found that women who lived close to gas wells were more likely to have

[194] Theo Colborn et al., *An exploratory study of air quality near natural gas operations*, HUM. ECOL. RISK ASSESS (Nov. 9, 2012) (attached as Exhibit 156).

children born with a variety of defects, from oral clefts to heart issues.[195] And, yet another recent study found that people who lived less than half a mile from a gas well had a higher risk of health issues. The research found a small increase in cancer risk and alleged that exposure to benzene was a major contributor to the risk.[196]

Oil and gas development is one of the largest sources of VOCs, ozone, and sulfur dioxide emissions in the United States. The relationship between air quality and human health must be analyzed in the RMPA/EIS. The failure of the FFO to do so would represent a fundamental shortcoming in the agency's analysis. "The agency must examine the relevant data and articulate a satisfactory explanation for its action including a 'rational connection between the facts found and the choice made.'" *Motor Vehicle Mfrs.,* 463 U.S. at 43 (1983).

B. The BLM Must to Take a Hard Look at Impacts to Human Health.

As introduced above, emissions from oil and gas development are not limited only to the combustion stage but, rather, occur throughout the chain of production. These emissions not only impact the critical resource values of the FFO – as detailed throughout these Comments – but also can result in serious harm to human health. BLM must fully consider the potential human health impacts that may be caused by oil and gas operations approved under the RMPA, as required by NEPA.[197] Congress stated that "…it is the continuing responsibility of the Federal Government to use all practicable means…to attain the widest range of beneficial uses of the environment **without degradation, risk to health or safety**, or other undesirable and unintended consequences…" 42 U.S.C. § 4331 (emphasis added). NEPA implementing regulations direct agencies to consider "the degree to which the proposed action affects public health or safety." 40 C.F.R. § 1508.27(b). These regulations also state: "Federal agencies shall to the fullest extent possible…. Use all practicable means, consistent with the requirements of the Act and other essential considerations of national policy, to restore and enhance the quality of the human environment and avoid or minimize any possible adverse effects of their actions upon the quality of the human environment." 40 C.F.R. § 1500.2(f).

1. The FFO Must Conduct a Health Impact Assessment.

BLM must conduct a health impact assessment, or equivalent analysis, as required by NEPA and its implementing regulations. NEPA requires that the BLM employ at least the same level of effort to analyze human health impacts as it does to promote industry's interest in development when preparing the RFD and associated analyses regarding projected drilling levels.

---

[195] Lisa M. McKenzie et al., *Birth Outcomes and Maternal Residential Proximity to Natural Gas Development in Rural Colorado,* ENVIRONMENTAL HEALTH PERSPECTIVES (April 2014) (attached as Exhibit 157).
[196] McKenzie *et al*.
[197] *See* Second Community Health Impact Report (HIR-2) Oil Well Exposure, Counselor Chapter Residents (attached as Exhibit 35); Testimonial from Daniel Tso, Community Member, Counselor Chapter (attached as Exhibit 36); Testimonial from Kendra Pinto, Community Member (attached as Exhibit 44).

A health impact assessment ("HIA") or equivalent analysis would fulfill the regulations governing NEPA, to examine human health impacts "to the fullest extent possible." A HIA would be forward-looking and attempt to identify all of the potential direct, indirect, and cumulative links between a proposed activity and the health and well-being of affected communities, and to develop mitigation measures to minimize harms and maximize benefits. The RMPA must include this type of analysis of human health impacts.

The U.S. EPA has posted on its website an excellent document on the utility of an HIA as part of the NEPA analysis of federal agencies where public health impacts are at issue.[198] HIA "provides a systematic process and methodology to anticipate and proactively address the potential health consequences of a program or policy in order to maximize the potential benefits and minimize adverse outcomes."[199] Steps in the HIA process include:

1. Screening: Determines whether an HIA is necessary, and whether it is likely to be useful.
2. Scoping: Establish the population to which the HIA applies, the scope of health problems to be analyzed, the HIA team, methods to be used in the assessment, and data sources.
3. Assessment: describe the baseline health status and determinants of health in the population and assess likely impacts through a literature review and qualitative or quantitative analysis.
4. Decision and recommendations to minimize adverse impacts and maximize benefits.
5. Monitoring and reassessment plan: select a set of outcomes likely to be sensitive/accurate indicators of the changes predicted, such as health outcomes and develop a plan to monitor and then reassess if needed.

The BLM did not conduct these steps, and did not analyze the impacts to the population within the planning area, considering how many people might be exposed to health impacts, analyze where development would take place relative to water sources or residences, or assess the likely impacts to the actual population in the area, including particularly vulnerable populations. It also omitted significant potential impacts. For example, the agency did not include any potential impacts from vehicle accidents or other safety issues, or the illness caused by the stress and mental anguish associated with living near intensive oil and gas development.

According to the U.S. Centers for Disease Control, "HIA can be used to evaluate objectively the potential health effects of a project or policy before it is built or implemented. It can provide recommendations to increase positive health outcomes and minimize adverse health outcomes. A major benefit of the HIA process is that it brings public health issues to the

---

[198] *See* EPA, Human Impact Partners, *Frequently Asked Questions About Integrating Health Impact Assessment into Environmental Impact Statement,* available at: http://www.epa.gov/region9/nepa/PortsHIA/pdfs/FAQIntegratingHIA-EIA.pdf (attached as Exhibit 281).

[199] *See* Aaron Wernham, *Inupiat Health and Proposed Alaskan Oil Development: Results of the First Integrated Health Impact Assessment/Environmental Impact Statement for Proposed Oil Development on Alaska's North Slope*, ECOHEALTH, 2007 (attached as Exhibit 282).

attention of persons who make decisions about areas that fall outside of traditional public health arenas, such as transportation or land use."[200]

BLM must also include impacts to water resources from fracking in its examination of health effects. Any later, site-specific analysis and application of mitigation measures is no substitute for analysis of impacts and development of alternatives and mitigation measures at the RMPA/EIS level. Waiting for the approval of site-specific projects forecloses not only analysis of the true impacts of the agency action that is actually being proposed, but in so doing, forecloses the ability of BLM, other agencies, and the public to identify at an early stage the significant environmental issues that are deserving of study in this EIS. This RMPA is a major point in the leasing decisionmaking process, requiring analysis of all of the impacts at this stage.

2. Health data

In Colorado, symptoms reported in the state's inspection/incident database by residents living within a half mile of well development included headaches, nausea, upper respiratory irritation, and nosebleeds.[201] In Pennsylvania, the following symptoms were reported by over half the people living near gas development who responded to a health survey. They included fatigue (62%), nasal irritation (61%), throat irritation (60%), sinus problems (58%), burning eyes (53%), shortness of breath (52%), joint pain (52%), feeling weak and tired (52%), severe headaches (51%), and sleep disturbance (51%). The survey was completed by 108 individuals (in 55 households) in 14 counties across Pennsylvania.[202]

These and additional recent studies that were not considered by BLM include:

1. Lisa M. McKenzie et al., *Birth Outcomes and Maternal Residential Proximity to Natural Gas Development in Rural Colorado,* Environmental Health Perspectives (April 2014) (attached above as Exhibit 157).

2. Jessica Gilman, *et al., Source signature of volatile organic compounds (VOCs) from oil and natural gas operations in northeastern Colorado*, ENVIRONMENTAL SCIENCE & TECHNOLOGY (2013) (attached as Exhibit 286).

3. John L. Adgate, *et al., Potential Public Health Hazards, Exposures and Health Effects from Unconventional Natural Gas Development*, ENVIRONMENTAL SCIENCE & TECHNOLOGY (2014) (attached as Exhibit 295).

---

[200] Centers for Disease Control, *Health Impact Assessment*, available at: http://www.cdc.gov/healthyplaces/hia.htm (attached as Exhibit 283).
[201] Roxana Z. Witter, *et al., The Use of Health Impact Assessment for a Community Undergoing Natural Gas Development,* FRAMING HEALTH MATTERS (2013) (attached as Exhibit 284).
[202] Nadia Steinzor, *et al*., *Investigating links between shale gas development and health impacts through a community survey project in Pennsylvania*, NEW SOLUTIONS, vol. 23 iss. 1. (2013) (attached as Exhibit 285).

4. Seth Shonkoff, *et al., Environmental Public Health Dimensions of Shale and Tight Gas Development*, ENVIRONMENTAL HEALTH PERSPECTIVES (2014) (attached as Exhibit 287).

5. Christopher W. Moore, *et al., Air Impacts of Increased Natural Gas Acquisition, Processing, and Use: A Critical Review*, ENVIRONMENTAL SCIENCE & TECHNOLOGY (2014) (attached as Exhibit 288).

6. Avner Vengosh, *et al., The effects of shale gas exploration and hydraulic fracturing on the quality of water resources in the United States*, PROCEDIA EARTH AND PLANETARY SCIENCE (2014) (attached as Exhibit 289).

7. Christopher D. Kassotis, *et al., Estrogen and Androgen Receptor Activities of Hydraulic Fracturing Chemicals and Surface and Ground Water in a Drilling-Dense Region*, Endocrinolgy (2014) (attached as Exhibit 176). (attached above as Exhibit 176).

8. Brian E. Fontenot, *et al., An Evaluation of Water Quality in Private Drinking Water Wells Near Natural Gas Extraction Sites in the Barnett Shale Formation*, ENVIRONMENTAL SCIENCE & TECHNOLOGY (2013) (attached as Exhibit 290).

9. Sherilyn A. Gross, *et al., Analysis of BTEX Groundwater Concentrations from Surface Spills Associated with Hydraulic Fracturing Operations*, JOURNAL OF THE AIR & WASTE MANAGEMENT ASSOCIATION (2013) (attached as Exhibit 291).

10. K.D. Retzer, *et al., Motor vehicle fatalities among oil and gas extraction workers,* ACCIDENT ANALYSIS & PREVENTION (2013) (attached as Exhibit 292).

11. Eric J. Esswein, *et al, Occupational exposures to respirable crystalline silica during hydraulic fracturing*, JOURNAL OF OCCUPATIONAL AND ENVIRONMENTAL HYGIENE (2013) (attached as Exhibit 293).

12. R.Z. Witter, *et al., Occupational exposures in the oil and gas extraction industry: state of the science and research recommendations*, AMERICAN JOURNAL OF INDUSTRIAL MEDICINE (2014) (attached as Exhibit 294).

13. Physicians for Social Responsibility, *Compendium of Scientific, Medical, and Media Findings Demonstrating Risks and Harms of Fracking (Unconventional Oil and Gas Extraction)*, Third Edition (October 14, 2015), available at: http://www.psr.org/assets/pdfs/fracking-compendium.pdf (attached as Exhibit 326).

14. Gayathri Vaidyanathan, *Fracking Can Contaminate Drinking Water*, Climate Wire (April 4, 2016), available at: https://www.scientificamerican.com/article/fracking-can-contaminate-drinking-water/ (last visited November 1, 2016).

15. A. Austin, et al., *Associations Between Unconventional Natural Gas Development and Nasal and Sinus, Migraine Headache, and Fatigue Symptoms in Pennsylvania*, Environmental Health Perspectives (July 31, 2016), available at:

http://ehp.niehs.nih.gov/wp-content/uploads/advpub/2016/8/EHP281.acco.pdf (attached as Exhibit 327).

EPA is also currently investigating the potential impacts of hydraulic fracturing on drinking water resources due to concerns about its potential environmental and human health impacts. Until such research is completed, there is insufficient information to fully understand the potential impacts on human health, an uncertainty that the BLM must take into consideration. The EPA is still in the process of completing this study. Nevertheless, the BLM ignored the uncertainty of the impacts of hydraulic fracturing on drinking water. BLM must consider these studies in any subsequently prepared NEPA document to ensure that it took the required hard look at health impacts.

3. Cumulative impacts on human health

BLM must also fully consider cumulative health impacts of different alternatives. Because the BLM will be leasing minerals located directly beneath and adjacent to private property, and because thousands of people live in close proximity to the industrial activity that will be permitted by the agency, BLM has the responsibility to consider potential impacts on human health from all development, and look at them cumulatively. For example, an individual exposed to both air and water pollution will have different health impacts than an individual exposed only to air pollution.

The assessment of cumulative impacts in NEPA documents is required by CEQ regulations. *See* 40 C.F.R. §1508.25 (Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act). Oil and gas development involves multiple sources of pollutants and disturbance caused by connected actions, including the operations of wellpads, trucks, wells, compressors, pipelines, tanks, pits, separators, dehydrators, rigs and more. Oil and gas development also includes hundreds of potential pollutants, both man-made and naturally occurring. When considered together, pollutants emitted with common timing and/or common geography may create additional health impacts that should be assessed. Also, oil and gas development may create health impacts from air pollution, water contamination, soil contamination, or a combination of all three. Due to the multiple variables and factors involved in oil and gas development, it is essential that the BLM ensure a health impact assessment that fully considers all cumulative impacts to comply with federal regulations and to appropriately assess health impacts and inform the public.

If the full cumulative health impacts are not considered by BLM at this stage it is unlikely that BLM would consider them adequately in connection with individual lease sales, or in project-level and site-specific EAs. This type of shell game, whereby the agency avoids an analysis of the cumulative impacts of the entire project (in this case, 15,000 plus wells) is in contravention of NEPA. *See e.g. Blue Mountains Biodiversity Project v. U.S. Forest Service*, 161 F.3d 1208, 1215 (9th Cir. 2008).

4. Ozone

Background concentrations of ozone in the RMPA planning area are already at or exceed the National Ambient Air Quality Standards ("NAAQS"), leaving virtually no room for growth in emissions. Several studies that measured and/or modeled natural gas related air emissions in various states have identified significant increases in ground level ozone as a result of natural gas development.[203] Ozone was once a summertime urban phenomenon but is now being seen increasingly in western rural areas during the winter due to the natural gas boom, so much so that some relatively small cities are no longer in compliance with the federal regulations that set allowable ozone levels.[204]

Ozone can cause difficulty breathing, coughing and sore throat. It can also inflame and damage the airways. It aggravates lung diseases like asthma, emphysema, and chronic bronchitis. It can make the lungs more susceptible to infection and it can continue to damage the lungs even when the symptoms have disappeared.[205]

Children are particularly vulnerable because their lungs are still developing until about age 18. As their lungs grow in the presence of ozone, their alveoli production is reduced, and they can end up with smaller, more brittle lungs. Women exposed during pregnancy deliver preterm, low birth weight babies with a high probability of developing asthma. In a letter to former EPA Administrator Lisa Jackson, a group of five national medical and public health groups wrote that the most vulnerable individuals, including children, teens, senior citizens, people who exercise or work outdoors, and people with chronic lung diseases like asthma, COPD, and emphysema, are most in danger of being sickened by ozone and that children who grow up in areas of high ozone pollution may never develop their full lung capacity as adults, which can put them at greater risk of lung disease throughout their lives.[206]

5. Naturally Occurring Radioactive Materials

Processes used to produce oil and gas often generate radioactive waste containing concentrations of naturally occurring radioactive materials (NORM). Radioactive wastes from oil and gas production can be found in produced water, flowback water from hydraulic fracturing, drilling waste including cuttings and mud, and/or sludge. This material can concentrate in pipes, storage tanks and facilities, and on other extraction equipment, and may be left on site or be emitted into the environment. Some of these materials can penetrate the skin and raise the risk of cancer. The RMP includes no discussion on potential health impacts associated with NORM that may be released into the environment due to oil and gas extraction activities.

---

[203] *See, e.g.,* Seth Lyman and Howard Shorthill, *Final Report: 2012 Uintah Basin Winter Ozone & Air Quality Study*, UTAH STATE UNIVERSITY, February 1, 2013.
[204] Gabrielle Pétron, *et al*., *Estimation of emissions from oil and natural gas operations in northeastern Colorado*, Power Point available at: http://www.epa.gov/ttnchie1/conference/ei20/session6/gpetron_pres.pdf (attached as Exhibit 296).
[205] *See* EPA, *Ozone – Good Up High Bad Nearby*, available at: http://www.epa.gov/oar/oaqps/gooduphigh/bad.html#7.
[206] *See* American Lung Association (attached above as Exhibit 276).

C. National Historic Preservation Act, San Juan County Road 7950 Improvements and BLM Authorities

The National Historic Preservation Act ("NHPA") imposes the requirement on federal agencies to "take into account the effect[s] of [their] undertaking[s] on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register." 16 U.S.C. § 470f ("Section 106"). *The RMPA is a federal undertaking subject to NHPA compliance*. The regulations implementing Section 106 of the NHPA prescribe the steps agencies must follow to adequately evaluate the effects of undertakings on historic properties. These steps include identifying historic properties in the area of potential effect, assessing whether the undertaking will adversely affect eligible historic properties, and resolving any adverse effects to historic properties from the undertaking. 36 C.F.R. §§ 800.4, 800.5, 800.6.

In addition to the detailed information provided in Conservation Groups' original scoping comments, BLM must also consider, analyze, and respond to information specifically concerning San Juan County Road 7950—the primary entrance into Chaco Culture National Historical Park ("CCNHP" or "Park"), a World Heritage Site.

First, any road improvements beyond basic maintenance may result in harm to CCNHP by increasing visitation, and must be considered. These concerns were first raised with the Federal Highway Administration ("FHWA") through the NEPA process in 2006, when they intended to authorize improvements trough a categorical exclusion. By this time, FHWA had already chip-sealed the first three miles without consideration of the NHPA or conducting required consultation. Although BLM was not a party in the original 2006 improvement, it was nevertheless a required party. Moreover, the New Mexico State Historic Preservation Office ("SHPO") wanted Section 106 requirements met, but San Jan County performed the work without consultation. The FHWA's attempt to chip seal the second section of road was analyzed under NEPA, but this attempt was abandoned in 2012 after years of conflict. San Juan County offered a compromise in early 2012 to use stabilized aggregate as the preferred alternative, but the NEPA process was ultimately abandoned entirely in November of 2012. The stabilized aggregate alternative would have adversely affected six eligible sites under the NHPA according to the final Cultural Resources Survey in 2012. To re-iterate, stabilized aggregate was in fact the final chosen alternative of the NEPA process, and BLM was included as part of that NEPA process. San Juan County initiated the second phase of improvements in 2014, remarkably, despite the NEPA and NHPA processes being abandoned. Although no federal funding was used for these improvements, BLM and BIA remained indispensible parties given the nexus to federal lands and CCNHP. To date, funding for the 2014 remain a mystery, and we have been unable to track it through the NM system. These past improvements likely destroyed NHPA eligible sites, in violation of the law. Any future authorizations for road improvements in the Greater Chaco region—given the dispersed nature of historical properties and sacred sites—and in particular improvements to facilitate the development of oil and gas resources, must fully comply with NEPA and the NHPA.

Second, none of the work on CR7950 since 2006 was ever permitted under NHPA. No consultation with the Hopi (or SHPO) occurred under NHPA Section 106 for the 2006 improvement (chip sealing) or for the 2014 improvement (stabilized aggregate). The later

improvement was done after the NEPA project was abandoned. This failure to consult is documented in a Hopi letter, which clearly states they had no consultation since 2012.[207] Although it was assumed that San Juan County had claimed RS2477 ROW for both improvements, subsequent correspondence confirms that no applications were ever submitted by San Juan County, and thus none of the work was permitted.[208] There are four archeological sites in the first three-mile improvement, six sites in the stretch of road covered in the 2014 improvement. BLM contends that because they were never asked for a permit, and therefore had no responsibility.[209] This self-serving claim offers no defense. San Juan County and BLM worked hand in hand to promote an easy path for development in and around Chaco and may be continuing this pattern on countless other roads in San Juan County. BIA also should have been involved from the beginning. It remains unclear whether the Navajo THPO was ever consulted in the 2006 project or the 2014 improvement.

The Mancos RMPA/EIS must address the fact that BLM has, for many years, been ignoring their obligations under federal law with regard to road improvements in the Greater Chaco region. BLM has instead worked with San Juan County to facilitate improvements and expedite development. The agency has allowed archeological sites be damaged or destroyed. Road improvement is a large part of the energy development scenario. The EIS must take a hard look at how BLM has approached its responsibilities and attempt to outline proper procedure in the future.

V. Conclusion

The Conservation Groups appreciate your consideration of the information and concerns addressed herein, as well as the information included in the attached exhibits. This information is critical and must be reflected in the agency's formulation of alternatives and in its draft RMPA and EIS. For the reasons described above, we urge BLM to: (1) fully consider a range of alternatives, including a "no-leasing" alternative; (2) fully consider the problem of methane waste, and takes steps to control methane waste; (3) fully consider current scientific and economic information, especially regarding climate change; and (4) provide a true "hard look" at impacts to air, water, and human health, including by conducting a Health Impact Assessment.

Should you have any questions, please do not hesitate to contact me.

Sincerely,

[207] Letter from Leigh Kuwanwisiwma, Hopi Cultural Preservation Office to Jeff Pappas, NM SHPO (Aug. 25, 2014) (attached as Exhibit 40).
[208] Letter from Anon Wright, Chaco Alliance to Jeff Pappas, NM SHPO (July 21, 2014) (attached as Exhibit 41); Email from Jillian Aragon, San Juan County to Rick Wessel, NMDOT (May 10, 2016) (attached as Exhibit 42).
[209] Letter from Victoria Bar, BLM to Anson Wright, Chaco Alliance (Jun. 23, 2016) (attached as Exhibit 43).

Kyle Tisdel
WESTERN ENVIRONMENTAL LAW CENTER
208 Paseo del Pueblo Sur, Unit 602
Taos, New Mexico 87571
575.751.0351
tisdel@westernlaw.org

Along with:

Rachel Conn
AMIGOS BRAVOS
PO Box 238
Taos, NM 87571
575.758.3874
rconn@amigosbravos.org

Michael Saul
CENTER FOR BIOLOGICAL DIVERSITY
1536 Wynkoop St., Ste. 421
Denver, CO 80202
msaul@biologicaldiversity.org

Anson Wight
CHACO ALLIANCE
4990 SW Hewett Blvd.
Portland, OR97221
503.709.0038
ansonw@comcast.net

Carol Davis
DINÉ CARE
Dilkon, on Navajo Nation
HRC 63 Box 272
Winslow, AZ 86047
caroljdavis.2004@gmail.com

Allyson Siwik
GILA RESOURCES INFORMATION PROJECT
305A North Cooper St.
Silver City, NM 88061
575.538.8078
allysonsiwik@gmail.com

Mike Eisenfeld
SAN JUAN CITIZENS ALLIANCE
PO Box 6655

Farmington, NM 87499
970.259.3583
meisenfeld@frontier.net

Nathaniel Shoaff
SIERRA CLUB ENVIRONMENTAL LAW PROGRAM
2100 Webster Street, Suite 1300
Oakland, CA 94612
415.997.5610
nathaniel.shaoff@sierraclub.org

Jeremy Nichols
WILDEARTH GUARDIANS
1536 Wynkoop St., Ste. 301
Denver, CO 80202
303.437.7663
jnichols@wildearthguardians.org

From:	Kyle Tisdel
To:	Hoffman, Amanda; Mark Ames
Cc:	blm_nm_ffo_rmp@blm.gov; anisula@blm.gov
Subject:	Re: Mancos RMPA_Scoping Comments 2.0
Date:	Tuesday, February 21, 2017 1:15:39 PM
Attachments:	Mancos RMPA_Scoping 2.0 (final).pdf

Thanks for the follow up, Amanda, and best of luck in your future endeavors. Please note that you're still listed on BLM's website as the contact.

Mark, I submitted the attached comments yesterday, but received a response email from the DOI postmaster that delivery was delayed, so I re-submitted this morning. In particular because of the federal holiday, I'm assuming this won't be a problem. I'm also sending a hard copy and disc with exhibits via certified mail today. If you have any questions please let me know.

Kyle

_____

Kyle J. Tisdel
Attorney, Climate & Energy Program Director
Western Environmental Law Center
208 Paseo del Pueblo Sur, #602
Taos, New Mexico 87571
Ph: 575.613.8050

tisdel@westernlaw.org

www.westernlaw.org

Defending the West

_____

From: "Hoffman, Amanda" <alhoffman@blm.gov>
Date: Tuesday, February 21, 2017 at 11:01 AM
To: Kyle Tisdel <tisdel@westernlaw.org>, Mark Ames <mames@blm.gov>
Cc: <blm_nm_ffo_rmp@blm.gov>, <anisula@blm.gov>
Subject: Re: Mancos RMPA_Scoping Comments 2.0

Hi Kyle,

I no longer work for the Farmington Field Office. I've cc'ed the project manager for the project, Mark Ames.

Thanks,

Amanda Hoffman
Morley Nelson Snake River Birds of Prey

National Conservation Area Manager
208-384-3336
alhoffman@blm.gov

On Mon, Feb 20, 2017 at 5:55 PM, Kyle Tisdel <tisdel@westernlaw.org> wrote:

Dear Ms. Nisula,

Please find the attached Scoping Comments 2.0 submitted by Western Environmental Law Center on behalf of Conservation Groups, Amigos Bravos, Center for Biological Diversity, Chaco Alliance, Diné CARE, Gila Resources Information Project, San Juan Citizens Alliance, Sierra Club, and WildEarth Guardians. Given the federal holiday, a hard copy of comments and a disc containing the attached exhibits will be sent by certified mail tomorrow. Should you have any questions, please do not hesitate to contact me.

Regards.

_____

Kyle J. Tisdel
Attorney, Climate & Energy Program Director
Western Environmental Law Center
208 Paseo del Pueblo Sur, #602
Taos, New Mexico 87571
Ph: 575.613.8050

tisdel@westernlaw.org

www.westernlaw.org

Defending the West

_____

Northwest
1216 Lincoln Street
Eugene, Oregon 97401
(541) 485-2471

Rocky Mountains
103 Reeder's Alley
Helena, Montana 59601
(406) 443-3501

Southwest
208 Paseo del Pueblo Sur #602
Taos, New Mexico 87571
(575) 751-0351

Defending the West www.westernlaw.org

Western Environmental Law Center

February 20, 2017

Sent via Electronic Mail (scoping comments only) and Certified Mail (comments and exhibits)

U.S. Bureau of Land Management
Farmington Field Office
Attn: Amanda Nisula
6251 College Blvd., Suite A
Farmington, New Mexico 87402
Email: anisula@blm.gov
Email: blm_nm_ffo_rmp@blm.gov

Re: Scoping Comments 2.0 – Farmington Resource Management Plan Amendment

Dear RMP Amendment Project Manager:

The Western Environmental Law Center, along with Amigos Bravos, Center for Biological Diversity, Chaco Alliance, Diné Citizens Against Ruining our Environment, Gila Resources Information Project, San Juan Citizens Alliance, Sierra Club, and WildEarth Guardians (together "Conservation Groups"), submit the following Scoping Comments 2.0 regarding the Bureau of Land Management ("BLM") Farmington Field Office ("FFO") Resource Management Plan Amendment ("RMPA") and associated Environmental Impact Statement ("EIS") encompassing approximately 4 million acres, and an analysis area of approximately 6 million acres, in northwest New Mexico. The RMPA is intended to analyze impacts of additional oil and gas development in the Mancos Shale/Gallup Formation that were not anticipated in the 2002 Reasonable Foreseeable Development ("RFD") Scenario or considered in the 2003 Farmington RMP/EIS.

Given the critical and fundamental role that the RMPA plays in determining land use values for the area, and specifically the FFO's management of oil and gas resources, we appreciate the opportunity to participate in Scoping, as well as the FFO's commitment to integrate of the following concerns into the forthcoming Draft RMPA/EIS. *See* 43 C.F.R. § 1610.2; 42 U.S.C. § 4332. In announcing the RMPA process, BLM has recognized that "[a]s full-field development occurs, especially in the shale oil play, additional impacts may occur that previously were not anticipated in the RFD or analyzed in the current 2003 RMP/EIS which will require an EIS-level plan amendment and revision of the RFD for complete analysis of the Mancos Shale/Gallup Formation." 79 Fed. Reg. 10,548 (Feb. 25, 2014). Conservation Groups submitted extensive technical and legal comments and exhibits on May 28, 2014 in response to

BLM's request for scoping. Those Scoping Comments remain relevant to the agency's decisionmaking and are hereby incorporated by this reference. BLM subsequently reinitiated the scoping process for the Mancos RMPA "specific to the extension of analysis in that EIS to BIA decision-making where BIA manages mineral leasing and associated activities in the RMPA Planning Area." 81 Fed. Reg. 72,819 (Oct. 21, 2016). Conservation Groups accordingly provide the following Scoping Comments responsive to that request, as well as to provide "significant new circumstances [and] information relevant to environmental concerns and bearing on the proposed action and its impacts" which have occurred during the pendency of BLM's first scoping period, and which must be considered and included within BLM's range of alternatives for the RMPA. 40 C.F.R. §§ 1502.9 (c)(1)(ii), 1502.14.

This letter focuses on the BLM's failure to adequately analyze and disclose the direct, indirect, and landscape scale impacts of fossil fuel leasing and development authorized and made available by BLM throughout the Farmington Field Office—a planning area that is already over 90% leased for oil and gas—and in particular those impacts to the Greater Chaco region. On behalf of members and supporters that live, work, recreate, worship, and otherwise rely on the land, air, and water in Greater Chaco for their wellbeing, the Conservation Groups call on the BLM to reconsider the wisdom of the fossil fuel leasing and development considered by the Mancos RMPA. Specifically, Conservation Groups request that:

- BLM must consider and analyze a "no-leasing" alternative that would bar new fossil fuel leases in the Farmington planning area.
- BLM must take steps to reduce methane emissions from oil and gas operations, including (1) by undertaking a true hard-look analysis of methane waste and global warming potential; and (2) by adopting enforceable mitigation requirements to minimize methane emissions and waste. Such analysis is both critical and necessary to address to "methane hotspot" that plagues the region and our communities.
- BLM must address new scientific and economic information, including regarding (1) the impacts of climate change on the Farmington planning area; (2) the social burden, or cost, of carbon and methane waste that would be authorized by the RMPA; and (3) fossil fuel production and employment, including a just transition away from the regions long dependence on fossil fuel development.
- BLM must take a hard look at impacts to air, water, and human health, which must include a detailed Health Impact Assessment.

The **Western Environmental Law Center** ("WELC") uses the power of the law to defend and protect the American West's treasured landscapes, iconic wildlife and rural communities. WELC combines legal skills with sound conservation biology and environmental science to address major environmental issues in the West in the most strategic and effective manner. WELC works at the national, regional, state, and local levels; and in all three branches of government. WELC integrates national policies and regional perspective with the local knowledge of our 100+ partner groups to implement smart and appropriate place-based actions.

Amigos Bravos is a statewide river conservation organization guided by social justice principles. Amigos Bravos' mission is to protect and restore the waters of New Mexico, and ensure that those waters provide a reliable source of clean water to the communities and farmers

that depend on them, as well as a safe place to swim, fish, and go boating. Amigos Bravos works locally, statewide, and nationally to ensure that the waters of New Mexico are protected by the best policy and regulations possible.

Center for Biological Diversity ("Center") is a non-profit environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center also works to reduce greenhouse gas emissions to protect biological diversity, our environment, and public health. The Center has over one million members and activists, including those living in New Mexico who have visited these public lands in the FFO for recreational, scientific, educational, and other pursuits and intend to continue to do so in the future, and are particularly interested in protecting the many native, imperiled, and sensitive species and their habitats that may be affected by the proposed oil and gas leasing.

Chaco Alliance is a grassroots citizens group dedicated to protecting and preserving Chaco Culture National Historical Park. We are interested in all threats to the park and its surrounding landscape, especially the threat created by energy development in the area.

Diné Citizens Against Ruining our Environment ("Diné C.A.R.E.") is an all-Navajo organization comprised of a federation of grassroots community activists in Arizona, New Mexico and Utah who strive to educate and advocate for our traditional teachings derived from our Diné Fundamental Laws. Our goal is to protect all life in our ancestral homeland by empowering local and traditional people to organize, speak out, and determine the outlook of the environment through civic involvement and engagement in decision-making process relating to tribal development.

Gila Resources Information Project ("GRIP") has the mission to promote community health by protecting our environment and natural resources. GRIP achieves its mission by facilitating informed public participation in natural resource use decisions, engaging our diverse communities in education and stewardship of our natural resources, and advocating at the local, state and federal level for protection of our land, air, ecosystems and water resources. GRIP is very concerned about the environmental, community health, and cultural impacts of oil and gas development in the Greater Chaco area.

Founded in 1986, **San Juan Citizens Alliance** ("SJCA") organizes people to protect our water and air, our lands, and the character of our rural communities in the San Juan Basin. SJCA focuses on four program areas, including the *San Juan Basin Energy Reform Campaign*, which ensures proper regulation and enforcement of the oil, gas, and coal industry and transitioning to a renewable energy economy. SJCA has been active in BLM and National Forest oil and gas issues in the San Juan Basin since the early 1990s, and has commented on virtually every multi-well drilling program, lease sale, and programmatic environmental review conducted in the region by the federal land management agencies since the early 1990s. SJCA's members live, work, and recreate throughout the San Juan Basin and San Juan Mountains. SJCA's members' health, use and enjoyment of this region is directly impacted by the decisions identified in this protest.

Sierra Club was founded in 1892 and is the nation's oldest grassroots environmental organization. The Sierra Club is incorporated in California, and has approximately 600,000 members nationwide and is dedicated to the protection and preservation of the environment. The Sierra Club's mission is to explore, enjoy and protect the wild places of the earth; to practice and promote the responsible use of the earth's ecosystems and resources; and to educate and enlist humanity to protect and restore the quality of the natural and human environments. The Sierra Club has a New Mexico chapter, known as the Rio Grande chapter, with members that live in and use this area for recreation such as hiking, climbing, backpacking, camping, fishing and wildlife viewing, as well as for business, scientific, spiritual, aesthetic and environmental purposes.

WildEarth Guardians protects and restores wildlife, wild places, and wild rivers in the American West. As part of its Climate and Energy Program, Guardians works to advance clean energy and expose the true cost of fossil fuels. Guardians works to protect and restore the San Juan Basin in northwestern New Mexico in order to safeguard its cultural heritage, natural values, communities, and open spaces.

TABLE OF CONTENTS

I. BLM Must Consider Existing, New, and Revised National Policy on Climate Change Into RMP Decisionmaking. 1

A. BLM Must Consider National Policy on Climate Change in Agency Decisionmaking on the RMPA, as well as Consider Recent Climate Science and Carbon Budgeting. 4

B. Projected Enegy Demands, International Finance, and Stranded Assets 15

II. BLM Must Consider All Reasonable Alternatives. 19

A. BLM Has a Legal Obligation to Consider All Reasonable Alternatives. 19

B. BLM Must Consider a No Leasing Alternative in Response to Threats Posed by Climate Change. 23

C. BLM Must Explicitly Consider a Renewable Energy Alternative or Include Renewable Energy as a Priority Element in Each Alternative. 25

III. The FFO Must to Take a Hard Look at Greenhouse Gas Emissions and Impacts to Climate Change. 26

A. BLM Must Address Whether Alternatives Are Consistent with National Climate Goals. 31

B. BLM Must Quantify the Severity of Harm from Greenhouse Gas Emissions 32

1. Social Cost of Carbon Protocol 32

2. Social Cost of Methane Protocol 36

C. Expert Comments: Economic Scoping for the Mancos RMPA 37

D. The FFO Must Take a Hard Look at Natural Gas Waste and Consider Alternatives to Prevent Waste including Phasing Development to Keep Pace with Gas Capture Infrastructure. 62

E. Managing for Community and Ecosystem Resiliency. 66

F. BLM Must Ensure NEPA Documentation Addresses Mitigation for Climate Impacts Consistent with All Relevant Laws and Policies, Including Current Mitigation Guidance. 68

1. Consistent with the Mitigation Hierarchy, BLM Must Avoid, Minimize and Offset Impacts from Fossil Fuels Made Available by the RMPA, Including Climate Change-Related Impacts. 70

2. BLM Should Adopt a Mitigation Strategy as Part of the Mancos RMPA to Address Unavoidable Climate Change Impacts. 72

IV. BLM Must Take a Hard Look at the Direct, Indirect and Cumulative Impacts of Oil and Gas Leasing and Development on Resource Values in the Planning Area. 73

A. The FFO Must Take a Hard Look at Certain Impacts to Air Quality. 73

1. Air Resource Mitigation Measures 73

2. Ozone Impacts 74

3. Hazardous Air Pollutant Impacts 76
4. Visibility and Ecosystem Impacts 76
5. Air Quality Impacts on Human Health 77
B. The BLM Failed to Take a Hard Look at Impacts to Human Health 78
1. The FFO Must Conduct a Health Impact Assessment. 78
2. Health data 80
3. Cumulative impacts on human health 82
4. Ozone 82
5. Naturally Occurring Radioactive Materials 83
C. National Historic Preservation Act, San Juan County Road 7950 Improvements and BLM Authorities 84
V. Conclusion 85

I. BLM Must Consider Existing, New, and Revised National Policy on Climate Change Into RMP Decisionmaking.

The National Environmental Policy Act ("NEPA") is our "basic national charter for the protection of the environment," achieving its purpose through "action forcing procedures. . . requir[ing] that agencies take a *hard look* at environmental consequences." 40 C.F.R. § 1500.1; *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989) (citations omitted) (emphasis added). This includes the consideration of best available information and data, as well as disclosure of any inconsistencies with federal policies and plans.

In 2014, President Obama described climate change as an "urgent and growing threat . . . that will define the contours of this century more dramatically than any other."[1] In that same year, the U.S. pledged to reduce its greenhouse gas ("GHG") emissions 26-28 percent below 2005 levels by 2020.[2] Since then, the President has also announced a new goal to cut methane emissions from the oil and gas sector by 40-45 percent below 2012 levels by 2025,[3] and set standards to reduce carbon dioxide emissions from the electricity sector by 32 percent from 2005 levels by 2030.[4] In 2015, President Obama recognized, "ultimately, if we're going to prevent large parts of this Earth from becoming not only inhospitable but uninhabitable in our lifetimes, we're going to have to keep some fossil fuels in the ground rather than burn them and release more dangerous pollution into the sky."[5] In his final State of the Union address, President Obama again noted the federal government's commitment to fighting climate change, vowing "to accelerate the transition away from old, dirtier energy sources," and making a powerful promise "to change the way we manage our oil and coal resources so that they better reflect the costs they impose on taxpayers and our planet."[6] These statements culminated in December, 2015 when the President joined with 194 other nations in recognizing "that climate change represents an urgent and potentially irreversible threat to human societies and the planet" and setting the goal of "holding the increase in the global average temperature to well below 2°C above pre-industrial

---

[1] The White House, Remarks by the President at U.N. Climate Change Summit (Sept. 23, 2014), available at: https://www.whitehouse.gov/the-press-office/2014/09/23/remarks-president-un-climate-change-summit.

[2] U.S.-China Joint Announcement on Climate Change (Nov. 11, 2014), available at: https://www.whitehouse.gov/the-press-office/2014/11/11/us-china-joint-announcement-climate-change (attached as Exhibit 46).

[3] The White House, Climate Action Plan: Strategy to Reduce Methane Emissions (March 2014), available at: https://www.whitehouse.gov/blog/2014/03/28/strategy-cut-methane-emissions (attached as Exhibit 1).

[4] Environmental Protection Agency, Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64662 (Oct. 23, 2015).

[5] The White House, Statement by the President on the Keystone XL Pipeline (Nov. 6, 2015), available at: https://www.whitehouse.gov/the-press-office/2015/11/06/statement-president-keystone-xl-pipeline.

[6] President Barack Obama, State of the Union (Jan. 12, 2016), available at: https://www.whitehouse.gov/sotu.

levels and pursuing efforts to limit the temperature increase to 1.5°C."[7] The President ratified the Paris Agreement, along with China, on September 3, 2016.[8] The President has also recognized that "the Paris Agreement alone will not solve the climate crisis. Even if we meet every target embodied in the agreement, we'll only get to part of where we need to go."[9]

Although the Trump administration, in public comments and rhetoric, has suggested a different set of priorities with respect to action on climate change, this does not alter the fundamental math and science of the challenges we face. Indeed, even if the Trump administration were to back out of the United States' many commitments to reduce greenhouse gas emissions and to create a pathway that limits warming—which, to date, has not occurred—that does not absolve the agency from considering the best available information and taking a hard look at impacts, as well as to have its decisionmaking be reflective of this analysis.

It should further be recognized that while national policy and statements addressing climate change accelerated during the Obama presidency—as they should given the narrowing window of time to take meaningful action—the federal government's recognition of climate change is not new. The Secretary of the United States Department of the Interior stated, in Secretarial Order 3226, *Evaluating Climate Change Impacts in Management Planning* (January 19, 2001), that "[t]here is a consensus in the international community that global climate change is occurring and that it should be addressed in governmental decision making." Order 3226 established the responsibility of agencies to "consider and analyze potential climate change impacts when undertaking long-range planning exercises, when setting priorities for scientific research and investigations, when developing multi-year management plans, and/or when making major decisions regarding potential utilization of resources under the Department's purview."

In a 2007 report entitled *Climate Change: Agencies Should Develop Guidance for Addressing the Effects on Federal Land and Water Resources,* the GAO concluded that the Department of the Interior had not provided specific guidance to implement Secretarial Order 3226, that officials were not even aware of Secretarial Order 3226, and that Secretarial Order 3226 had effectively been ignored. This report led to Secretarial Order 3289, *Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources* (September 14, 2009), which reinstated the provisions of Order 3226, and recognized that "the realities of climate change require us to change how we manage land, water, fish and

---

[7] United Nations Framework Convention on Climate Change, Conference of the Parties (Nov 30-Dec. 11, 2015), Adoption of the Paris Agreement, Art. 2, U.N. Doc. FCCC/CP/2015/L.9 (Dec. 12, 2015), available at: http://unfccc.int/resource/docs/2015/cop21/eng/l09.pdf ("Paris Agreement") (attached as Exhibit 2).

[8] The White House, President Obama: The United States Formally Enters the Paris Agreement (Sept. 3, 2016), available at: https://www.whitehouse.gov/blog/2016/09/03/president-obama-united-states-formally-enters-paris-agreement.

[9] The White House, Office of the Press Secretary, Remarks by the President on the Paris Agreement (Oct. 5, 2016), attached as Exhibit 3, and available at https://www.whitehouse.gov/the-press-office/2016/10/05/remarks-president-paris-agreement (last viewed Oct. 26, 2016).

wildlife, and cultural heritage and tribal lands and resources we oversee," and acknowledged that the Department of the Interior is "responsible for helping protect the nation from the impacts of climate change." A month later, in Executive Order No. 13514, *Federal Leadership in Environmental, Energy, and Economic Performance* (Oct. 5, 2009), the President called on all federal agencies to "measure, report, and reduce their greenhouse gas emissions from direct and indirect activities." 74 Fed. Reg. 52,117 (Oct. 8, 2009). This directive was followed by Executive Order No. 13693, *Planning for Federal Sustainability in the Next Decade* (March 25, 2015), which reaffirmed the federal government's commitment to reducing GHG emissions. 80 Fed. Reg. 15,871 (March 25, 2015).

In 2009, the Environmental Protection Agency ("EPA") issued a finding that the changes in our climate caused by elevated concentrations of greenhouse gases in the atmosphere are reasonably anticipated to endanger the public health and welfare of current and future generations. 74 Fed. Reg. 66496 (Dec. 15, 2009). In 2015, EPA acknowledged more recent scientific assessments that "highlight the urgency of addressing the rising concentrations of CO_2 in the atmosphere." 80 Fed. Reg. 64661 (Oct. 23, 2015).

Recently, the White House Council on Environmental Quality ("CEQ")—the federal agency tasked with managing the federal government's implementation of NEPA—recognized the unique nature of climate change and the challenges it imposed on NEPA compliance. On August 1, 2016, CEQ released *Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* (hereafter, "Climate Guidance") (attached as Exhibit 4). The guidance applies to all proposed federal agency actions, "including land and resource management actions." *Id*. at 9. Notably, CEQ's guidance is intended to "facilitate compliance with existing NEPA requirements." *Id.* at 1. In other words, the Climate Guidance is meant to underscore BLM's existing legal obligations to disclose and consider the foreseeable effects that, for example, oil and gas leasing and development has on climate change. On January 12, 2017, BLM issued a Permanent Instruction Memorandum to all Washington Office and Field Officials requiring that "[a]ll relevant NEPA documents must be consistent with the CEQ guidance." IM No. 2017-003 (attached as Exhibit 26). BLM is accordingly required to incorporate Climate Guidance into its RMPA. In its Climate Guidance, the CEQ recognized that:

> Climate change results from the incremental addition of GHG emissions from millions of individual sources, which collectively have a large impact on a global scale. CEQ recognizes that the totality of climate change impacts is not attributable to any single action, but are exacerbated by a series of actions including actions taken pursuant to decisions of the Federal Government. Therefore, a statement that emissions from a proposed Federal action represent only a small fraction of global emissions is essentially a statement about the nature of the climate change challenge, and is not an appropriate basis for deciding whether or to what extent to consider climate change impacts under NEPA. Moreover, these comparisons are also not an appropriate method for characterizing the potential impacts associated with a proposed action and its alternatives and mitigations because this approach does not reveal anything beyond the nature of the climate change challenge itself: the fact that diverse

> individual sources of emissions each make a relatively small addition to global atmospheric GHG concentrations that collectively have a large impact.

Id. at 10-11. CEQ's Climate Guidance also explains the application of NEPA principles and practices to the analysis of GHG emissions and climate change, including: (1) that agencies quantify a proposed action's projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools; (2) that agencies use projected GHG emissions as a proxy for assessing potential climate change effects when preparing a NEPA analysis; (3) where GHG emission tools, methodologies, or data inputs are not reasonably available, that agencies include a qualitative analysis in the NEPA document and explain the basis for determining that quantification is not reasonably available; (4) that agencies analyze foreseeable direct, indirect, and cumulative GHG emissions and climate effects; (5) that agencies consider reasonable alternatives and the short- and long-term effect and benefits in the alternatives and mitigation analysis; (6) that agencies consider alternatives that would make the actions and affected communities more resilient to the effects of a changing climate; and (7) that agencies assess the broad-scale effects of GHG emissions and climate change, either to inform programmatic decisions, or at both the programmatic and project-level. *See id.* at 4-6.

A. BLM Must Consider National Policy on Climate Change in Agency Decisionmaking on the RMPA, as well as Consider Recent Climate Science and Carbon Budgeting.

NEPA requires BLM to consider national policy in its decisionmaking process.[10] The FFO has historically adopted a position in its decisionmaking that reflects a fundamental disconnect with regard to how our public lands are managed for energy production and national policies to limit GHG emissions. The agency has not only failed to take informed action to address climate change, as required by Order 3226 and Order 3289, but has signaled a deep misunderstanding of basic climate science as well as the "tools and methodologies for quantifying GHG emissions and comparing GHG quantities across alternative scenarios." *See* Climate Guidance at 11.[11] As stated in Order 3289, BLM must "appl[y] scientific tools to increase understanding of climate change and to coordinate an effective response to its impacts," and "management decisions made in response to climate change impacts must be informed by [this] science."

---

[10] *See generally* section III.A. NEPA regulations direct federal agencies, "to discuss any inconsistency of a proposed action with any approved State or local plan and laws (whether or not federally sanctioned)," 40 C.F.R. § 1506.2(d), and require agencies to address "possible conflicts between the proposed action and the objectives of Federal, regional, State, and local (and in the case of a reservation, Indian tribe) land use plans, policies and controls for the area concerned." 40 C.F.R. § 1502.16(c). CEQ's NEPA Climate Guidance interprets these regulations to encompass the requirement to address "approved federal, regional, state, tribal, or local plans, policies, or laws for GHG emission reductions or climate adaptation to make clear whether a proposed project's GHG emissions are consistent with such plans or laws." Climate Guidance at 28-29.

[11] *See also*, Climate Guidance at 12 n. 28 (linking to quantification tools that "are widely available, and are already in broad use in the Federal and private sectors").

Through statements that have been offered to avoid any actual analysis, BLM has historically failed to take a hard look at the climate impacts of fossil fuel leasing and development on public lands in the planning area, as required by NEPA and underscored by the CEQ. These mistakes must not be repeated here. The FFO must also consider alternatives that would meaningfully address greenhouse gas emissions and climate change impacts in the planning area—including a no-leasing alternative—and that are reflective of current science and national policy. The FFO planning area is already over 90% leased for oil and gas. Over 40,000 oil and gas wells have historically been drilled, with at least 21,725 wells currently in production. This legacy of exploitation has resulted in vast impacts to the regions land, air, and water—including a methane hotspot that drapes over the basin—which people and our communities have been forced to endure. To correct past failures, BLM must, at a minimum, ensure it uses the best and most up-to-date climate science available, much of which is summarized below.

Since the dawn of the industrial revolution a century ago, the average global temperature has risen some 1.6 degrees Fahrenheit. Most climatologists agree that, while the warming to date is already causing environmental problems, another 0.4 degree Fahrenheit rise in temperature, representing a global average atmospheric concentration of carbon dioxide ("CO_2") of 450 parts per million ("ppm"), could set in motion unprecedented changes in global climate and a significant increase in the severity of natural disasters—and could represent the point of no return.[12] In August 2016, the atmospheric concentration of CO_2 was approximately 402.25 ppm, up from 398.93 ppm the same month a year earlier.[13]

Climate change has been intensively studied and acknowledged at the global, national, and regional scales. Climate change is being fueled by the human-caused release of greenhouse gas emissions, in particular carbon dioxide and methane. The Intergovernmental Panel on Climate Change ("IPCC") is a Nobel Prize-winning scientific body within the United Nations that reviews and assesses the most recent scientific, technical, and socio-economic information relevant to our understanding of climate change. In its most recent report to policymakers in 2014, the IPCC provided a summary of our understanding of human-caused climate change. Among other things, the IPCC summarized:[14]

- Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems.

[12] *See* David Johnston, *Have We Passed the Point of No Return on Climate Change?*, Scientific American (April 2015), available at: http://www.scientificamerican.com/article/have-we-passed-the-point-of-no-return-on-climate-change/.
[13] NOAA, Earth System Research Laboratory, *Trends in Atmospheric Carbon Dioxide*, available at: http://www.esrl.noaa.gov/gmd/ccgg/trends/.
[14] IPCC AR5*, Summary for Policymakers* (March 2014) available at: http://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf (attached as Exhibit 5).

- Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen.

- Anthropogenic greenhouse gas emissions have increased since the pre-industrial era, driven largely by economic and population growth, and are now higher than ever. This has led to atmospheric concentrations of carbon dioxide, methane, and nitrous oxide that are unprecedented in at least the last 800,000 years. Their effects, together with those of other anthropogenic drivers, have been detected throughout the climate system and are extremely likely to have been the dominant cause of the observed warming since the mid-20th century.

- In recent decades, changes in climate have caused impacts on natural and human systems on all continents and across the oceans. Impacts are due to observed climate change, irrespective of its cause, indicating the sensitivity of natural and human systems to changing climate.

- Continued emission of greenhouse gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive, and irreversible impacts for people and ecosystems. Limiting climate change would require substantial and sustained reductions in greenhouse gas emissions which, together with adaptation, can limit climate change risks.

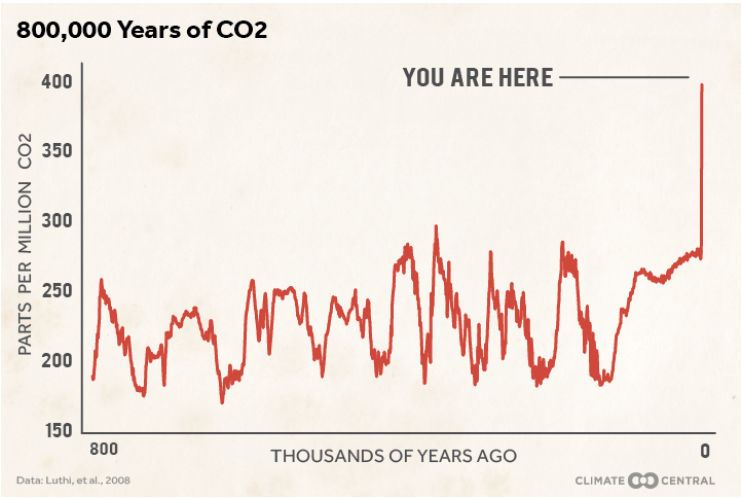
- Surface temperature is projected to rise over the 21st century under all assessed emission scenarios. It is very likely that heat waves will occur more often and last longer, and that extreme precipitation events will become more intense and frequent in many regions. The ocean will continue to warm and acidify, and global mean sea level to rise.

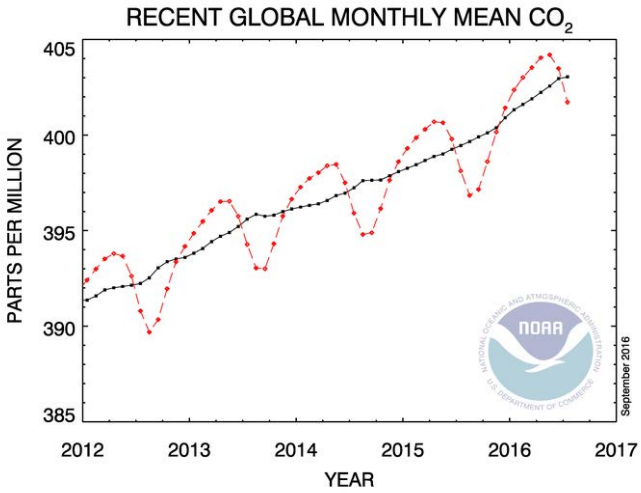
Carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are recognized as the key greenhouse gases contributing to climate change. In 2009, the EPA found that these "six greenhouse gases taken in combination endanger both the public health and the public welfare of current and future generations."[15] The D.C. Circuit has upheld this decision as supported by the vast body of scientific evidence on the subject. *See Coal. for Responsible Regulation, Inc. v. EPA.*, 684 F.3d 102, 120-22 (D.C. Cir. 2012).

According to the National Oceanic and Atmospheric Administration ("NOAA"), "[t]he combined average temperature over global land and ocean surfaces for August 2016 was the highest for August in the 137-year period of record, marking the 16th consecutive month of

[15] Environmental Protection Agency, *Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act* 74 Fed. Reg. 66,496 (Dec. 15, 2009).

record warmth for the globe." [16] The global climate crisis is happening and it may well be accelerating quickly.





The graphs show globally averaged historic and monthly mean carbon dioxide.

The IPCC in 2013 affirmed: "Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased" causing "widespread impacts on human and natural systems."[17] This is consistent with the findings of the United States' 2014 Third National Climate Assessment, stating: "That the planet has warmed is 'unequivocal,' and is corroborated through multiple lines of evidence, as is the conclusion that the causes are very likely human in origin."[18] With particular regard to the Southwest Region—which includes Colorado, New Mexico, Utah, Arizona, Nevada, and California—the National Climate Assessment included in the following overview:[19]

- Snowpack and streamflow amounts are projected to decline in parts of the Southwest, decreasing surface water supply reliability for cities, agriculture, and ecosystems.
- The Southwest produces more than half of the nation's high-value specialty crops, which are irrigation-dependent and particularly vulnerable to extremes of moisture, cold, and heat. Reduced yields from increasing temperatures and increasing competition for scarce water supplies will displace jobs in some rural communities.

---

[16] NOAA, Global Analysis – August 2016, available at: https://www.ncdc.noaa.gov/sotc/global/201608.
[17] IPCC AR5 Synthesis Report at 2 (attached as Exhibit 5).
[18] Jerry M. Melillo, *et al.*, Climate Change Impacts in the United States: The Third National Climate Assessment (2014) at 61, available at: http://nca2014.globalchange.gov (attached as Exhibit 6).
[19] *See id.* at 463-86.

- Increased warming, drought, and insect outbreaks, all caused by or linked to climate change, have increased wildfires and impacts to people and ecosystems in the Southwest. Fire models project more wildfire and increased risks to communities across extensive areas.
- Flooding and erosion in coastal areas are already occurring even at existing sea levels and damaging some California coastal areas during storms and extreme high tides. Sea level rise is projected to increase as Earth continues to warm, resulting in major damage as wind-driven waves ride upon higher seas and reach farther inland.
- Projected regional temperature increases, combined with the way cities amplify heat, will pose increased threats and costs to public health in southwestern cities, which are home to more than 90% of the region's population. Disruptions to urban electricity and water supplies will exacerbate these health problems.

Immediate and substantial greenhouse gas reductions are required to avoid catastrophic impacts to people and communities. "Following the warmest year on record in 2014 according to most estimates, 2015 reached record warmth yet again, surpassing the previous record by more than 0.1°C."[20] This record warming was again surpassed in 2016. "Globally-averaged temperatures in 2016 were 1.78 degrees Fahrenheit (0.99 degrees Celsius) warmer than the mid-20th century mean. This makes 2016 the third year in a row to set a new record for global average surface temperatures."[21]

> Most of the warming occurred in the past 35 years, with 16 of the 17 warmest years on record occurring since 2001. Not only was 2016 the warmest year on record, but eight of the 12 months that make up the year – from January through September, with the exception of June – were the warmest on record for those respective months. October, November, and December of 2016 were the second warmest of those months on record – in all three cases, behind records set in 2015.[22]

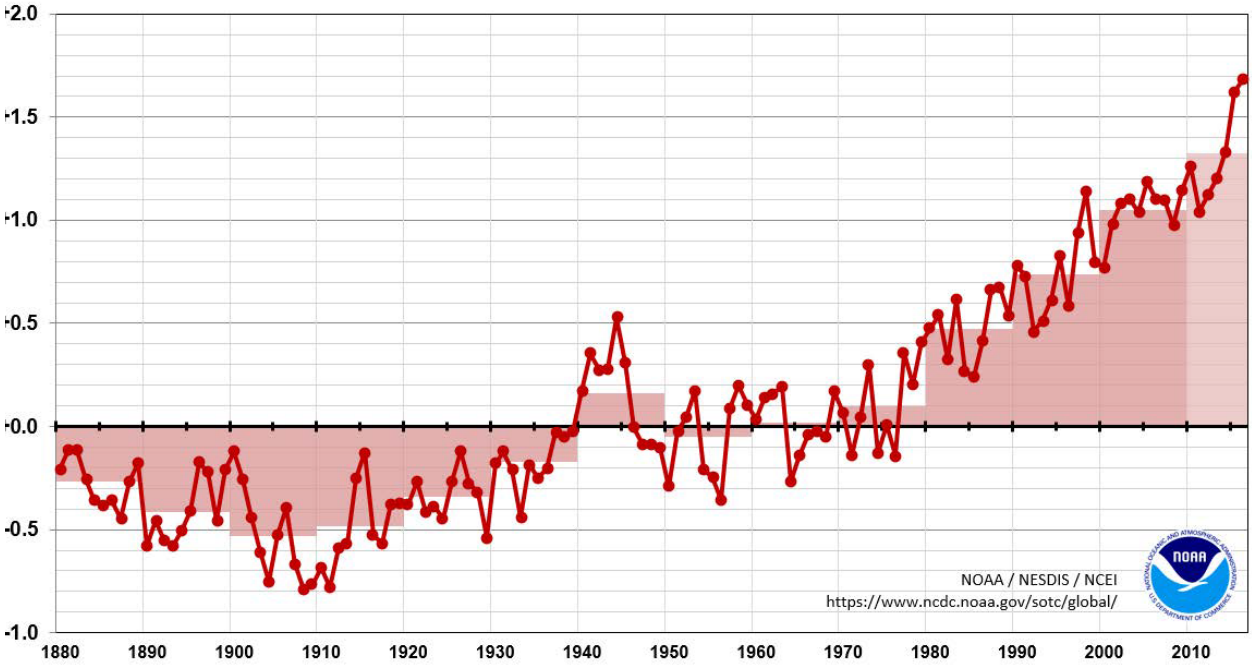
Earlier this year, researchers developed a mathematical equation to describe the impacts of human activity on the Earth.[23] The equation shows that astronomical and geophysical forces on the Earth system, while complex, tend to zero over time because of their slow nature and rarity. Whereas GHG emissions caused by humans over the past 45 years have increased the rate of temperature rise to 1.7 degrees Celsius per century,

---

[20] American Meteorological Society, *State of the Climate in 2015*, Vol.97, No.8 (Aug. 2016), at S7 (attached as Exhibit 7).
[21] NASA, *NASA NOAA Data Show 2016 Warmest Year on Record Globally* (Jan. 18, 2017), available at: https://www.nasa.gov/press-release/nasa-noaa-data-show-2016-warmest-year-on-record-globally.
[22] *Id.*; *see also* NOAA/NASA, *Annual Global Analysis for 2016* (Jan 2017) (attached as Exhibit 27).
[23] Owen Gaffney and Will Steffen, *The Anthropocene Equation*, The Anthropocene Review (2017) (attached as Exhibit 28).

representing a change to the climate that is 170 times faster than the natural background rate.[24] The researchers conclude that failing to reduce anthropological climate change "could trigger societal collapse."[25]

Annual Global Temperature: Difference from 20th Century Average, in °F



As noted above, the Paris Agreement commits all signatories—including the United States—to a target holding long-term global average temperature "to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels."[26] As articulated by a team of international climate scientists, including Dr. James Hansen, in a 2013 report: "The widely accepted target of limiting human-made global warming to 2 degrees Celsius (3.6 degrees Fahrenheit) above preindustrial level is too high and would subject young people, future generations and nature to irreparable harm…. Observational data reveal that some climate extremes are already increasing in response to warming of several tenths of a degree in recent decades; these extremes would likely be much enhanced with warming of 2°C or more."[27] "Runaway climate change—in which feedback loops drive ever-worsening climate change, regardless of human activities—are now seen as a risk even at 2°C of warming."[28] "[T]here is an unacceptable risk that before 2°C of warming, significant 'long-term'

[24] Gaffney at 3.
[25] Gaffney at 7.
[26] Paris Agreement at Art. 2 (attached as Exhibit 2).
[27] James Hansen, *et al., Assessing "Dangerous Climate Change": Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature,* 8 PLoS ONE 8 e81648 (2013) (attached as Exhibit 8).
[28] Greg Muttitt, *et al.*, *The Sky's Limit: Why the Paris Climate Goals Require a Managed Decline of Fossil Fuel Production*, Oil Change International (Sept. 2016) at 6 (attached as Exhibit 9).

feedbacks will be triggered, in which warming produces conditions that generate more warming, so that carbon sinks such as the oceans and forests become less efficient in storing carbon, and polar warming triggers the release of significant permafrost and clathrate carbon stores. Such an outcome could render ineffective human efforts to control the level of future warming to manageable proportions."[29] Indeed, the impacts of 2°C temperature rise have been "revised upwards, sufficiently so that 2°C now more appropriately represents the threshold between 'dangerous' and 'extremely dangerous' climate change."[30] "[T]he risks previously believed to be associated with an increase of around 4°C in global temperatures are now associated with the rise of a little over 2°C, while the risks previously associated with 2°C are now thought to occur with only 1°C rise."[31]

Although the Paris Agreement has underscored that immediate action is needed to avoid 'extremely dangerous' warming, meeting the voluntary commitments adopted in Paris alone will be insufficient to meet goal of limiting temperature change to between 1.5°C and 2.0°C above pre-industrial levels. As noted by a 2015 UNEP technical report:

> The emissions gap between what the full implementation of the unconditional [intended nationally determined contributions (INDCs)] contribute and the least-cost emission level for a pathway to stay below 2°C, is estimated to be 14 $GtCO_2e$ (range: 12-17) in 2030 and 7 $GtCO_2e$ (range: 5-10) in 2025. When conditional INDCs are included as fully implemented, the emissions gap in 2030 is estimated to be 12 GtCO2e (range: 10-15) and 5 $GtCO_2e$ (range: 4-8) in 2025.[32]

In other words, far greater emissions reductions are necessary to stay below and 2.0°C, let alone aspire to 1.5°C of warming. If no further progress were made beyond the Paris Agreement, expected warming by 2100 would be 3.5°C.[33] In the alternative, if no action is taken and the status quo is maintained—a position long reflected in BLM's management of public lands in the San Juan Basin—estimated warming by 2100 is upwards of 4.5°C.[34] To achieve an outcome consistent with a 50% chance of keeping warming to 2.0°C, the growth in global-energy related CO_2 emissions needs to halt and start to reverse within the current decade.[35] Delaying stronger climate action to 2020 would come at a cost: $1.5 trillion in low-carbon investments are avoided

---

[29] David Spratt, *Climate Reality Check: After Paris, Counting the Cost* (March 2016) at 8 (attached as Exhibit 10).
[30] Kevin Anderson and Alice Bows, *Beyond 'Dangerous' Climate Change: Emission Scenarios for a New World*, Phil. Trans. R. Soc. (2011) (attached as Exhibit 11).
[31] International Energy Agency, *Redrawing the Energy-Climate Map* (June 2013) at 14, (attached as Exhibit 29).
[32] United Nations Environment Programme (UNEP), *The Emissions Gap Report 2015: A UNEP Synthesis Report* (Nov. 2015) at xviii (attached as Exhibit 12).
[33] Spratt, *Climate Reality Check* at 2 (attached as Exhibit 10).
[34] *See* Climate Interactive, Climate Scorecard, available at: https://www.climateinteractive.org/programs/scoreboard/*; see also,* Andrew P. Schurer, *et al., Separating Forced from Chaotic Climate Variability over the Past Millennium*, Journal of Climate, Vol. 26 (March 2013) (attached as Exhibit 13).
[35] IEA (2013) at 13.

before 2020, but $5 trillion in additional investments would be required between 2020-2035 to get back on track.[36]

With specific regard to United States commitments under the Paris Agreement, the U.S. INDC set specific greenhouse gas emissions reduction target for 2025 of a 26% to 28% reduction below the 2005 emission levels, producing a range in 2005 net GHG emissions from 6,323 to 7,403 $MTCO_2e$.[37] The difference between this target and the estimated 2025 emissions without INDC policies results in an 'emissions gap' ranging from 896 to 2,121 $MTCO_2e$.[38]

Both the IPCC and National Climate Assessment recognize the dominant role of fossil fuels in driving climate change:

> While scientists continue to refine projections of the future, observations unequivocally show that climate is changing and that the warming of the past 50 years is primarily due to human-induced emissions of heat-trapping gases. These emissions come mainly from burning coal, oil, and gas, with additional contributions from forest clearing and some agricultural practices.[39]
>
> ***
>
> CO_2 emissions from fossil fuel combustion and industrial processes contributed about 78% to the total GHG emission increase between 1970 and 2010, with a contribution of similar percentage over the 2000–2010 period (*high confidence*).[40]

The energy sector accounts for around two-thirds of GHG emissions, and more than 80% of global energy consumption is based on fossil fuels.[41] To keep open a realistic chance of meeting the 2°C target, intensive action is required before 2020. As summarized in a recent report:

> The Paris Agreement aims to help the world avoid the worst effects of climate change and respond to its already substantial impacts. The basic climate science involved is simple: cumulative carbon dioxide (CO_2) emissions over time are the key determinant of how much global warming occurs. This gives us a finite *carbon budget* of how much may be emitted in total without surpassing dangerous temperature limits.[42]

---

[36] IEA (2013) at 114.
[37] Jeffery Greenblatt & Max Wei, *Assessment of the climate commitments and additional mitigation policies of the Unites States*, Nature Climate Change (Sept. 2016), available at: http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate3125.html (attached as Exhibit 14).
[38] *Id.* at 2; *see also* UNEP, Emissions Gap Report (attached as Exhibit 12).
[39] Third National Climate Assessment at 2 (attached as Exhibit 6).
[40] IPCC AR5 Synthesis Report at 46 (attached as Exhibit 5).
[41] IEA (2013) at 9.
[42] *The Sky's Limit* at 6 (attached as Exhibit 9).

According to the IPCC, as of 2011, the remaining carbon budget of cumulative CO_2 emissions from all anthropogenic sources must remain below 1,000 $GtCO_2$ to provide a 66% probability of limiting warming to 2°C above pre-industrial levels.[43] For years 2012-2014, approximately 107 $GtCO_2$ was emitted, averaging approximately 36 $GtCO_2$ per year, which left us at the start of 2016 with a carbon budget of only 850 $GtCO_2$.[44] These emissions were the highest in human history and 60% higher than in 1990 (the Kyoto Protocol reference year). Of course, the Paris Agreement aim of limiting global warming to 1.5°C requires adherence to a more stringent carbon budget of only 400 $GtCO_2$ from 2011 onward, of which about 250 $GtCO_2$ remained at the start of 2016.[45] "With global annual emissions amounting to 36 $GtCO_2$ in 2015, scientists predict that at current rates global emissions will exceed the carbon budgets necessary to stay under the 1.5°C target by 2021 and the 2°C target by 2036.[46]

The potential carbon emissions from *existing* fossil fuel reserves—the known belowground stock of extractable fossil fuels—considerably exceed both 2°C and 1.5°C of warming. "Estimated total fossil carbon reserves exceed this remaining [carbon budget] by a factor of 4 to 7."[47] "For the 2°C or 1.5°C limits, respectively 68% or 85% of reserves must remain in the ground."[48] The reserves in currently operating oil and gas field alone, even with no coal, would take the world beyond 1.5°C.[49]

---

[43] IPCC AR5 Synthesis Report at 63-64 & Table 2.2 (attached as Exhibit 5). For an 80% probability of staying below 2°C, the budget from 2000 is 890 $GtCO_2$, with less than 430 $GtCO_2$ remaining. Malte Meinshausen *et al., Greenhouse-gas emission targets for limiting global warming to 2°C*, Nature (2009) at 1159 (attached as Exhibit 15). Other sources offer slightly different calculations in order to have a 50% probability of keeping warming below 2°C, with total emissions to 2050 below 1,440 $GtCO_2$ from 2000 onward, of which 420 $GtCO_2$ has already been emitted (as of 2011). It is estimated that another 136 $GtCO_2$ will be emitted from non-energy sources up to 2050, meaning the energy sector can emit a maximum of 884 $GtCO_2$ by 2050. IEA (2013) at 16-17.

[44] *See* Annual Global Carbon Emissions, available at: https://www.co2.earth/global-co2-emissions; *see also* C. Le Quéré, *et al., Global Carbon Budget 2015*, Earth Syst. Sci. Data (Dec. 2015) (attached as Exhibit 16).

[45] Dustin Mulvaney, *et al.*, *Over-Leased: How Production Horizons of Already Leased Federal Fossil Fuels Outlast Global Carbon Budgets,* EcoShift Consulting (July 2016) (attached as Exhibit 17) at 2 (citing Joeri Rogelj, *et al., Difference between carbon budget estimates unraveled*, Nature Climate Change (2016) (attached as Exhibit 18).

[46] Mulvaney at 2 (citing Oak Ridge National Laboratories, Carbon Dioxide Information Analysis Center (2015), available at: http://cdiac.ornl.gov/GCP/).

[47] IPCC AR5 Synthesis Report at 63 (attached as Exhibit 5).

[48] The Sky's Limit at 6 (attached as Exhibit 9); *see also* Kevin Anderson and Alice Bows, *Reframing the climate change challenge in light of post-2000 emission trends*, Phil. Trans. R. Soc. (2008) (attached as Exhibit 19) ("to provide a 93% mid-value probability of not exceeding 2°C, the concentration (of atmospheric greenhouse gases) would need to be stabilized at or below 350 parts per million carbon dioxide equivalent (ppm CO_2e)" compared to the current level of ~485 ppm CO_2e.).

[49] The Sky's Limit at 5, 17 (attached as Exhibit 9).

In order for the world to stay within a carbon budget consistent with Paris Agreement goals—"holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C"[50]—significant fossil fuel resources must remain in the ground. More specifically, to meet the target of 2°C, globally "a third of oil reserves, half of gas reserves and over 80 percent of current coal reserves should remain unused from 2010-2050."[51] These fossil fuel reserves represent "unburnable carbon" and as such would be are stranded assets in which countries, industries, and companies are heavily invested but on which they would be unable to recoup returns. Citigroup warned investors that "the total value of stranded assets could be over $100 trillion based on current market prices."[52] Studies estimate that global coal, oil and gas resources considered currently economically recoverable contain potential greenhouse gas emissions of 4,196 $GtCO_2$,[53] with other estimates as high as 7,120 $GtCO_2$.[54]

Critically, the United States carbon quota—equivalent to 11% of the global carbon budget needed for a 50% chance of limiting warming to 2°C—allocates approximately 158 $GtCO_2$ to the United States as of 2011.[55] By way of comparison, federal and non-federal fossil fuel emissions together would produce between 697 and 1,070 $GtCO_2$.[56] Regarding just federal fossil fuel resources, the United States contains enough recoverable coal, oil and gas that, if extracted and burned, would result in as much as 492 $GtCO_2$, far surpassing the entire global carbon budget for a 1.5°C target and nearly eclipsing the 2°C target—to say nothing of the United States 'share' of global emissions.[57] Unleased federal fossil fuels comprise 91% of these potential emissions, with already leased federal fossil fuels accounting for as much as 43 $GtCO_2$.[58]

In 2012, "the GHG emissions resulting from the extraction of fossil fuels from federal lands by private leaseholders totaled approximately 1,344 $MMTCO_2e$."[59] Between 2003 and 2014, approximately 25% of all United States and 3-4% of global fossil fuel greenhouse gas emissions are attributable to federal minerals leased and developed by the Department of the

---

[50] Paris Agreement at Art. 2 (attached as Exhibit 2).
[51] Christophe McGlade & Paul Ekins, *The geographical distribution of fossil fuels unused when limiting global warming to 2°C*, Nature (Jan 2015) (attached as Exhibit 20).
[52] Jason Channell, *et al.*, *Energy Darwinism II*, Citi GPS: Global Perspectives & Solutions (August 2015) at 118 (attached as Exhibit 30).
[53] Michael Raupach, *et al., Sharing a quota on cumulative carbon emissions*, Nature Climate Change (Sept. 2014) (attached as Exhibit 21).
[54] IPCC AR5, Mitigation of Climate Change, Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (2014) at Table 7.2 (attached as Exhibit 22).
[55] Raupach at 875 (attached as Exhibit 21).
[56] Dustin Mulvaney, *et al.*, *The Potential Greenhouse Gas Emissions from U.S. Federal Fossil Fuels*, EcoShift Consulting (Aug. 2015) at 16 (attached as Exhibit 23).
[57] *Id.*
[58] *Id.*
[59] Stratus Consulting, *Greenhouse Gas Emissions from Fossil Energy Extracted from Federal Lands and Waters: An Update* (Dec. 2014) at 9 (attached as Exhibit 24).

Interior.[60] Continued leasing and development of federal fossil fuel resources commits the world to 'extremely dangerous' warming well beyond the 2°C threshold. As one study put it, "the disparity between what resources and reserves exist and what can be emitted while avoiding a temperature rise greater than the agreed 2°C limit is therefore stark."[61] In short, *any* new leasing of federal fossil fuel resources is inconsistent with a carbon budget that would seek to avoid catastrophic climate change.

The production horizons for already leased federal fossil fuel resources underscore how unwarranted any additional leasing is, and in turn the reasonableness of the FFO's consideration of a no-leasing alternative. Comparing these production horizons to dates at which carbon budgets would be exceeded if current emission levels continue:

- Federal crude oil already leased will continue producing for 34 years beyond the 1.5°C threshold and 19 years beyond the 2°C threshold;
- Federal natural gas already leased will continue producing 23 years beyond the 1.5°C threshold and 8 years beyond the 2°C threshold;
- Federal coal already leased will continue producing 20 years beyond the 1.5°C threshold and 5 years beyond the 2°C threshold.[62]

Not only can the federal government not afford to lease *any* additional public lands for fossil fuel development—underscoring the need to consider a no leasing alternative—but substantial efforts must also be made to limit the production horizon of fossil fuel resources already leased. Accordingly, the FFO must also consider taking an aggressive position on the non-renewal and expiration of non-producing leases, as well as review of agency policy on lease suspensions and unitization.

If new leasing and renewal of existing non-producing leases continues, by 2040 it will contribute about two-thirds of expected federal fossil fuel production (forecast based on EIA and other sources).[63] On the other hand, if new leasing ceases and existing non-producing leases are not renewed, 40% of forecast coal production could be avoided in 2025 and 74% of coal production could be avoided in 2040. As for oil and gas, 12% of oil production could be avoided in 2025 and 65% could be avoided by 2040 while 6% of natural gas production could be avoided in 2025 and 59% could be avoided by 2040.[64]

This avoided production would significantly reduce future U.S. emissions. Cessation of new and renewed leases for federal fossil fuel extraction could reduce CO_2 emissions by about

---

[60] *See* Energy Information Administration, *Sales of Fossil Fuels Produced from Federal and Indian Lands, FY 2003 through FY 2014* (July 2015) (attached as Exhibit 25); *see also* Stratus Consulting (attached as Exhibit 24).
[61] McGlade at 188.
[62] Mulvaney (2016) at 5.
[63] Peter Erickson and Michael Lazarus, *How Would Phasing Out U.S. Federal Leases for Fossil Fuel Extraction Affect CO2 Emissions and 2°C Goals?,* Stockholm Environmental Institute (2016) at 12 (attached as Exhibit 323).
[64] Erickson and Lazarus at 16.

100 Mt per year by 2030. Annual emission reductions could become greater than that over time as production declines on existing leases and maintaining or increasing production becomes dependent on yet-to-be issued leases.[65]

A comparison with other measures shows that "no leasing" could be a very significant part of U.S. efforts to address climate change. The 100 Mt CO_2 emissions savings that could result from no leasing in 2030 compares favorably with EPA standards for light- and medium-vehicles that are expected to yield 200 Mt in CO_2 savings in 2030, and with standards for heavy-duty vehicles that are expected to yield 70 Mt in CO_2 savings in the same year. The 100 Mt CO_2 emissions reduction from leasing restrictions would be greater than either the emission reductions that the EPA expects to achieve through its existing regulation of oil and gas industry emissions or reductions the BLM expects to achieve from its proposed methane waste standards on oil and gas operations on federal land. Clearly, cessation of new and renewed leases could make an important contribution to U.S. climate change mitigation efforts.[66]

Also, importantly, avoided production through no new leasing and the non-renewal of existing non-producing leases could help avoid further carbon lock-in in terms of investment in both fossil fuel-producing and fossil fuel-using infrastructure.[67] Simply put, the timeframe to avoid catastrophic climate change is short, and the management of our federal minerals is dangerously out of step with this reality.

B. Projected Energy Demands, International Finance, and Stranded Assets

The world's energy needs continue to grow, with projections of a 30% rise in global energy demand to 2040. The International Energy Agency ("IEA") has estimated that for this increasing demand to be met, a cumulative $48 trillion in investment is needed in global energy supply,[68] of which 60% is comprised of fossil fuels and nearly 20% to renewables, with an additional $23 trillion invested in improvements in energy efficiency.[69] "Countries are generally on track to achieve, and even exceed in some instances, many of the targets set in their Paris Agreement pledges; this is sufficient to slow the projected rise in global energy-related CO_2 emissions, but not nearly enough to limit warming to less than 2°C."[70] By contrast, it would be exceedingly difficult to chart a course toward a 2°C pathway. A major reallocation of investment capital going to the energy sector would be needed, requiring an estimated $40 trillion in cumulative energy supply investment moving away from fossil fuels and toward renewables.[71] The more ambitious target of limiting warming to less than 1.5°C would be even more difficult to achieve, demanding net-zero emissions between 2040 and 2060, a goal that would require

[65] Erickson and Lazarus at 26.
[66] Erickson and Lazarus at 27.
[67] Erickson and Lazarus at 30.
[68] International Energy Agency, *World Energy Investment Outlook* (2014), at 3 (attached as Exhibit 31).
[69] International Energy Agency, *World Energy Outlook 2016: Executive Summary* (2016), at 2 (attached as Exhibit 32).
[70] IEA (2016) at 2.
[71] IEA (2016) at 5.

radical near-term reductions in energy sector CO_2 emissions.[72] IEA estimates that "$53 trillion in cumulative investment in energy supply and efficiency is required over the period to 2035 in order to get the world onto a 2°C emissions path."[73]

The liability exposure from not acting is enormous, with cumulative 'lost' GDP from the impacts of climate change equating to $44 trillion.[74] Yet, investment decisions being taken today are not consistent with a 2°C climate goal and are not aimed at creating infrastructure that is sufficiently resilient to withstand the increased physical risks that are expected to result from future climate change.[75] "[O]ur current energy infrastructure has already 'locked-in' future carbon-dioxide emissions."[76] Even as this energy infrastructure is quickly sealing our climate fate in the near term, it will become obsolete in the slightly longer term. Indeed, many new energy sector assets are destined to become stranded when carbon reduction policies that limit the utilization of those assets are inevitably adopted in response to climate change impacts. As of 2013, emissions from existing global fossil fuel energy infrastructure already represented four-fifths, or 550 $GtCO_2$, of the total volume of CO_2 emissions that the earth can accommodate under a 2°C trajectory.[77] With delayed climate action to date, in 2017 we now find ourselves at an investment watershed, where energy infrastructure now locks in the entire remaining carbon budget to 2035.[78] From this point forward, far more costly actions are going to be required to subsequently undo the lock-in effect, and every additional investment in the energy sector committed to fossil fuels would become stranded assets under policies to achieve a 2°C pathway.

At the same time, the capital expenditures required to maintain current energy sector demand for fossil fuels have more than doubled since 2000, to $950 billion annually.[79] In other words, more capital investment is being required to maintain our current reliance on fossil fuels at a time, paradoxically, when from a climate perspective all of the new investment must be redirected towards renewable energy sources to effect a radical transformation of the energy sector, as necessary to avoid catastrophic warming. The market value of oil and gas produced globally was around $4.2 trillion in 2012, which was almost double what it was in 2005.[80] Yet, this has not resulted in a financial windfall to the oil and gas industry, as costs and royalties have more than kept pace with increased revenues.[81] In short, oil and gas companies are merely maintaining a fossil fuel treadmill where increasingly costly investments are needed to meet demand but lead to rising costs for the oil and gas industry as well as significant costs to society as reliance on oil and gas fuels climate change, an irrational system. In the face of these increasing capital requirements, there is growing awareness of significant financial exposure for individual companies from the possible future stranding of new fossil fuel investments. For

[72] IEA (2016) at 5.
[73] IEA (2014) at 14.
[74] Citi at 8.
[75] IEA (2013) at 84.
[76] IEA (2013) at 98.
[77] IEA (2013) at 99.
[78] IEA (2013) at 113.
[79] IEA (2014) at 51, 52.
[80] IEA (2014) at 54.
[81] IEA (2014) at 54.

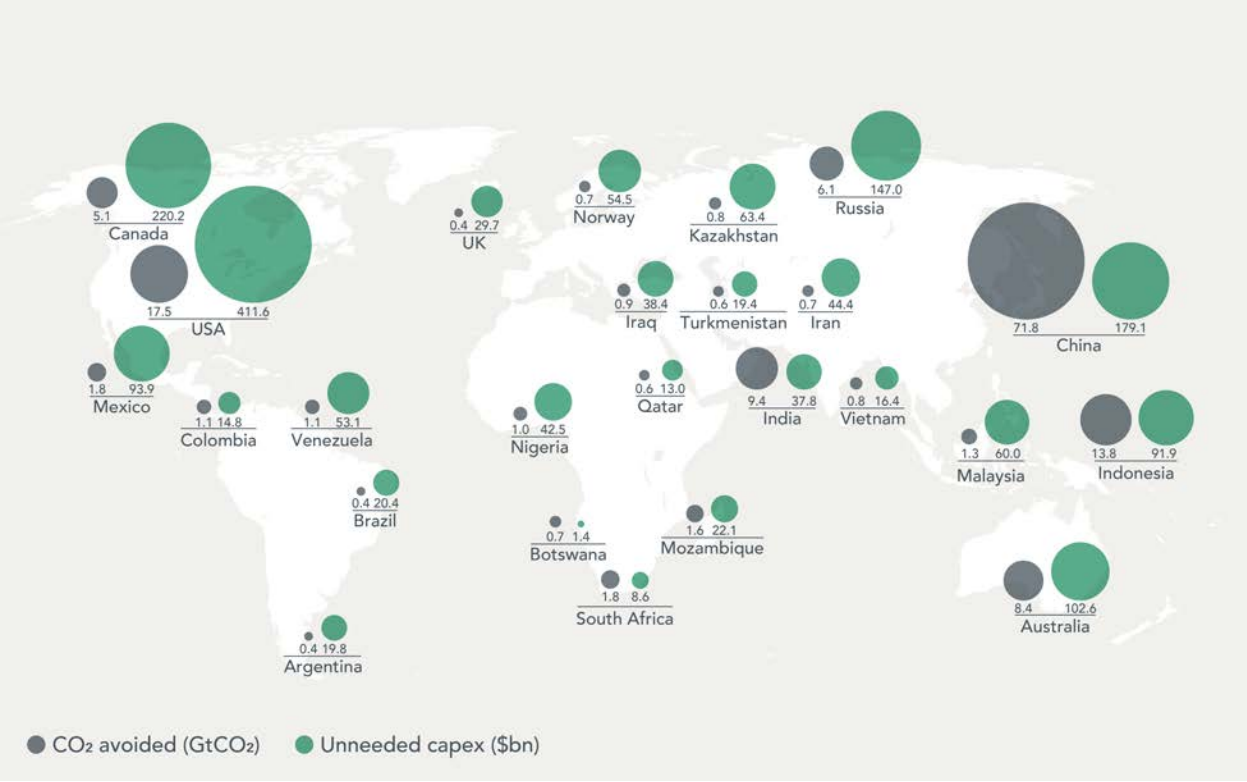
example, among major oil and gas companies, the estimated cost of stranded assets over the next decade ranges from $21.5 billion for ConocoPhillips to $76.9 billion for Shell.[82] Nevertheless, the global capital markets have yet to internalize these risks and charge premiums that would steer investment towards renewable energy.

"Analysis of the entire energy system shows that delaying action on climate change is a false economy. Investments of around $1.5 trillion are avoided in the period to 2020, but an additional $5 trillion of investments are required between 2020 and 2035."[83]

According to the 2°C pathway modeled by IEA, from 2015-2035 the carbon budget for energy-based emissions from all fossil fuels is 593 $GtCO_2$.[84] If global energy investment continues on its current course, there will be over $2 trillion in investment in energy sources that will emit around 156 $GtCO_2$ of emissions over the 2°C target of 593 $GtCO_2$.[85] This can also be viewed through the lens of specific fossil fuel demand to 2035 under a 2°C pathway. For coal, zero additional capital investment is needed, as production from existing coalmines would exceed demand.[86] For gas, approximately $460 billion—or over 40% of anticipated capital expenditures—is unneeded, resulting in 9.3 $GtCO_2$ of avoided emissions.[87] For oil, it is projected that demand peaks around 2020, meaning that the oil sector does not need to continue to grow. Based on current Paris Agreement commitments, oil production required in the period to 2035 amounts to around 760 billion barrels, but falls to 690 billion barrels to maintain a course for 2°C.[88] Yet the estimated level of proven oil reserves are close to 1.7 trillion barrels.[89] This results to between a 940 and 1,010 billion barrel surplus of proven reserves that cannot be burned. Avoided capital expenditures for oil are nearly $1.5 trillion, avoiding 27.6 $GtCO_2$ of emissions.[90]

[82] Carbon Tracker Initiative, *The $2 trillion stranded assets danger zone: How fossil fuel firms risk destroying investor returns* (Nov. 2015) at 23, (attached as Exhibit 33).
[83] IEA (2013) at 114.
[84] Carbon Tracker (2015) at 7.
[85] Carbon Tracker (2015) at 2.
[86] Carbon Tracker (2015) at 10.
[87] Carbon Tracker (2015) at 14.
[88] IEA (2014) at 87.
[89] IEA (2014) at 87.
[90] Carbon Tracker (2015) at 18.

Unneeded capital expenditures to 2025 and related CO_2 to 2035 under a 2°C pathway



It is cheaper for the world to address climate change than bear its economic consequences. As detailed above, there are enough coal, oil and gas reserves that are technically recoverable to equal up to 7,120 $GtCO_2$ of emissions.[91] Only a portion of this carbon is already locked-in—i.e., total reserves held by fossil fuel companies and state owned assets—but this 'embedded' carbon still amounts to 2,860 $GtCO_2$—already enough to take us beyond 3°C of warming.[92] Only 20% of these fossil fuel reserves can be burned to 2050 if the world is to have a chance of not exceeding global warming of 2°C.[93]

The total coal, oil and gas reserves listed on the world's stock exchanges equaled 762 $GtCO_2$ in 2013—an amount that continues to grow.[94] "If listed fossil fuel companies have a pro-rata allocation of the global carbon budget, this would amount to around 125–275 $GtCO_2$, or 20 - 40% of the 762 $GtCO_2$ currently booked as reserves. The scale of this carbon budget deficit poses a major risk for investors. They need to understand that 60 - 80% of coal, oil and gas reserves of listed firms are unburnable."[95] The systemic risks threatening the stability of financial markets related to unburnable carbon are growing more entrenched, with 200 fossil fuel

[91] IPCC AR5 at Table 7.2.
[92] Carbon Tracker Initiative, *Unburnable Carbon 2013: Wasted capital and stranded assets* (2013), at 14 (attached as Exhibit 34).
[93] Carbon Tracker (2013) at 4.
[94] Carbon Tracker (2013) at 4.
[95] Carbon Tracker (2013) at 4.

companies having a market value of $4 trillion and debt of $1.5 trillion.[96]

> As provided by Citigroup in a warning to investors:
>
> > Emissions contained in current 'reserves' figures are around three times higher than the so called 'carbon budget'. Some studies suggest that globally a third of oil reserves, half of gas reserves and over 80% of current coal reserves would have to remain unused from 2010 to 2050 in order to have a chance of meeting the 2°C target. In financial terms, we estimate that the value of unburnable reserves could amount to over $100 trillion out to 2050.[97]

The longer climate action is delayed the more expensive it becomes to avoid each additional ton of GHG emissions, and the more capital expenditures will become stranded. [98] In other words, climate action is directly tied to economic resilience, and the longer action is delayed the larger the lead balloon becomes. This is not only a problem for the fossil fuel industry, but for our economy and the wellbeing of our communities. These financial implications also bear directly on BLM's decisionmaking relative to the leasing and development of our public lands for fossil fuel resources. Not only do each additional acre leased and well authorized contribute to societies collective carbon burden, but inherent financial risk and market instability has far reaching implications for public lands remediation. When fossil fuel resources become stranded it is the public, not financially struggling fossil fuel companies, who are left holding the bag.

II. BLM Must Consider All Reasonable Alternatives.

A. BLM Has a Legal Obligation to Consider All Reasonable Alternatives.

The centerpiece of environmental regulation in the United States, the National Environmental Policy Act ("NEPA") requires federal agencies to pause before committing resources to a project and consider the likely environmental impacts of the preferred course of action as well as reasonable alternatives. *See* 42 U.S.C. § 4331(b) (congressional declaration of national environmental policy); *U.S. Dep't of Transp. v. Public Citizen,* 541 U.S. 752, 756–57 (2004). BLM must "rigorously explore and objectively evaluate all reasonable alternatives" to the proposed action in comparative form, so as to provide a "clear basis for choice among the options" open to the agency. 40 C.F.R. § 1502.14. At a minimum, the agency must identify and analyze its preferred alternative, as well as a null or "no action" alternative that would occur if the agency elected to maintain the current state of affairs unchanged. *Id.* In addition, the agency should address all other reasonable alternatives to the proposed action. *See Colorado Envtl. Coal. v. Salazar*, 875 F. Supp. 2d 1233, 1245 (D. Colo. 2012).

Through the RMP planning process, the FFO is required to "estimate and display the physical, biological, economic, and social effects of implementing each alternative considered in detail. The estimation of effects shall be guided by the planning criteria and procedures

[96] Carbon Tracker (2013) at 5, 30.
[97] Citi at 82.
[98] IEA (2014) at 43.

implementing [NEPA]." 43 C.F.R. § 1610.4-6. Essential to any NEPA process is a robust analysis of alternatives to the proposed action. Consideration of reasonable alternatives is necessary to ensure that the agency has before it and takes into account all possible approaches to, and potential environmental impacts of, a particular project. NEPA's alternatives requirement, therefore, ensures that the "most intelligent, optimally beneficial decision will ultimately be made." *Calvert Cliffs' Coordinating Comm., Inc. v. U.S. Atomic Energy Comm'n,* 449 F.2d 1109, 1114 (D.C. Cir. 1971).

"[T]he heart" of an environmental analysis under NEPA is the analysis of alternatives to the proposed project, and agencies must evaluate all reasonable alternatives to a proposed action." *Colorado Environmental Coalition*, 185 F.3d at 1174 (quoting 40 C.F.R. § 1502.14). An agency must gather "information sufficient to permit a reasoned choice of alternatives as far as environmental aspects are concerned." *Greater Yellowstone*, 359 F.3d at 1277 (citing *Colorado Environmental Coalition*, 185 F.3d at 1174); *see also Holy Cross Wilderness Fund v. Madigan*, 960 F.2d 1515, 1528 (10th Cir. 1992). Thus, agencies must "ensure that the statement contains sufficient discussion of the relevant issues and opposing viewpoints to enable the decisionmaker to take a 'hard look' at environmental factors, and to make a reasoned decision." *Izaak Walton League of America v. Marsh,* 655 F.2d 346, 371 (D.C. Cir. 1981) (citing *Kleppe v. Sierra Club,* 427 U.S. 390, 410 n. 21 (1976)).

When determining whether an EIS analyzed sufficient alternatives to allow BLM to take a hard look at the available options, courts apply the "rule of reason." *New Mexico ex rel. Richardson v. Bureau of Land Mgmt.*, 565 F.3d 683, 709 (10th Cir. 2009) (citing *Westlands Water Dist. v. U.S. Dep't of the Interior*, 376 F.3d 853, 868 (9th Cir. 2004)). The reasonableness of the alternatives considered is measured against two guideposts. First, when considering agency actions taken pursuant to a statute, an alternative is reasonable only if it falls within the agency's statutory mandate. *Westlands,* 376 F.3d at 866. Second, reasonableness is judged with reference to an agency's objectives for a particular project.[99] *See Dombeck,* 185 F.3d at 1174–75; *Simmons v. U.S. Army Corps of Eng'rs,* 120 F.3d 664, 668–69 (7th Cir. 1997); *Idaho Conservation League v. Mumma,* 956 F.2d 1508, 1520 (9th Cir. 1992).

On the first point, FLPMA is BLM's organic act and delegates authority to the agency to create and amend land use plans. FLPMA's congressional declaration states:

> It is the policy of the United States that … the public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use;

[99] While an agency may restrict its analysis to alternatives that suit the "basic policy objectives" of a planning action, *Seattle Audubon Soc'y v. Moseley,* 80 F.3d 1401, 1404 (9th Cir. 1996), it may do so only as long as "the statements of purpose and need drafted to guide the environmental review process ... are not unreasonably narrow," *Dombeck*, 185 F.3d at 1175.

43 U.S.C. § 1701(a)(8) (emphasis added). Indeed, BLM is duty bound to develop and revise land use plans according to this congressional mandate, so as to "observe the principles of multiple use." 43 U.S.C. § 1712(c)(1). "Multiple use" means "a combination of balanced and diverse resource uses that takes into account the long-term needs of future generations for renewable and nonrenewable resources, including, but not limited to, recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific and historical values." 43 U.S.C. § 1702(c).

The RMP revision process, undertaken pursuant to FLPMA, requires BLM to engage in the type of foundational land use planning that is intended to give context to the agency's multiple use mandate. Accordingly, FLPMA provides specific criteria for land use plan revisions, requiring consideration of things such as: observation of the principles of multiple use and sustained yield; integrated consideration of physical, biological, economic, and other sciences; reliance on public lands resources and other values; consideration of present and future uses of the public lands; consideration of the relative scarcity of resource values; and weighing the long-term benefits to the public against the short-term benefits. *See* 43 U.S.C. § 1712(c)(1)-(9). Consideration of these criteria must drive the RMP revision.

Critically, FLPMA does not mandate that every use be accommodated on every piece of land; rather, delicate balancing is required. *See Norton v. S. Utah Wilderness Alliance*, 542 U.S. 55, 58 (2004). "'Multiple use' requires management of the public lands and their numerous natural resources so that they can be used for economic, recreational, and scientific purposes without the infliction of permanent damage." *Public Lands Council v. Babbitt*, 167 F.3d 1287, 1290 (10th Cir. 1999) (citing 43 U.S.C. § 1702 (c)). As held by the Tenth Circuit, "[i]f all the competing demands reflected in FLPMA were focused on one particular piece of public land, in many instances only one set of demands could be satisfied. A parcel of land cannot both be preserved in its natural character and mined." *Rocky Mtn. Oil & Gas Ass'n v. Watt,* 696 F.2d 734, 738 n. 4 (10th Cir.1982) (quoting *Utah v. Andrus,* 486 F.Supp. 995, 1003 (D.Utah 1979)); *see also* 43 U.S.C. § 1701(a)(8) (stating, as a goal of FLPMA, the necessity to "preserve and protect certain public lands in their natural condition"); *Pub. Lands Council,* 167 F.3d at 1299 (citing § 1701(a)(8)). As further provided by the Tenth Circuit:

> It is past doubt that the principle of multiple use does not require BLM to prioritize development over other uses… BLM's obligation to manage for multiple use does not mean that development *must* be allowed on [a particular piece of public lands]. Development is a *possible* use, which BLM must weigh against other possible uses—including conservation to protect environmental values, which are best assessed through the NEPA process. Thus, an alternative that closes the [proposed public lands] to development does not necessarily violate the principle of multiple use, and the multiple use provision of FLPMA is not a sufficient reason to exclude more protective alternatives from consideration.

New Mexico ex rel. Richardson, 565 F.3d at 710. Accordingly, the RMP amendment must consider, on equal footing, the value of permanent protection and preservation of public lands in the planning area, along with industry pressure to lease and develop public lands for fossil fuel resources. It is incumbent on the FFO to re-evaluate these competing resources and give suitable

weight to FLPMA's mandate to preserve and protect public lands in their natural condition. *See* 43 U.S.C. § 1701(a)(8). This is, after all, the agency's statutory mandate. *See New Mexico ex rel. Richardson,* 565 F.3d at 709.

By the measures detailed above, BLM must develop a range of alternatives to satisfy its statutory obligation under FLPMA, which necessarily includes alternatives that would close remaining lands to fossil fuel leasing and development. Over 91% of the FFO planning area is already leased. We are past the point where any reasonable balance can be made between oil and gas development and other resources, including land, water, air, and cultural values they community relies on.

BLM's alternatives must account for current resource conditions, changes in circumstances, and new or revised national-level policy, in particular with regard to climate change. BLM must consider all reasonable alternatives, including alternatives that would significantly reduce planning area greenhouse gas emissions, and in particular an alternative that considers not leasing public lands for fossil fuel development. 40 C.F.R. § 1502.14.

Courts have interpreted BLM's authority under the MLA as discretionary and not as an absolute mandate to lease. In fact, the Ninth Circuit held that the MLA "allows the Secretary to lease such lands, but does not require him to do so.... [T]he Secretary has discretion to refuse to issue any lease at all on a given tract . . . we affirm the district court's holding that the agencies failed to give the no action alternative meaningful consideration and thereby violated NEPA." *Bob Marshall All. v. Hodel*, 852 F.2d 1223, 1229-30 (9th Cir. 1988) (internal citations omitted). In an analogous case, the district court in *Wilderness Soc., Ctr. For Native Ecosystems v. Wisely* found:

> [T]he BLM's rejection of the 'no surface occupancy' alternative violated NEPA in both a technical and substantive sense. The Court finds that final September 2005 EA does not adequately explain why the 'no surface occupancy' alternative was dropped. 40 C.F.R. § 1502.14(a) requires that the EA 'briefly discuss the reasons' why an alternative was eliminated. Moreover, even if the BLM had fully articulated the reasons for excluding the 'no surface occupancy' alternative, the Court would nevertheless find that, on the present record, the decision to eliminate that alternative was arbitrary and capricious.

524 F. Supp. 2d 1285, 1311–12 (D. Colo. 2007). Moreover, because BLM is conducting an EIS review for this RMP, the requirement for analyzing or dismissing no action or no-leasing alternatives is heightened. *See W. Watersheds Project v. Bureau of Land Mgmt.*, 721 F.3d 1264, 1274-75 (10th Cir. 2013) ("Regulations require both documents to incorporate a range of reasonable alternatives, but the depth of discussion and analysis required is different depending on whether the document is an EIS or an EA. For example, section 40 C.F.R. §1502.14 provides that an EIS should '[r]igorously explore . . . all reasonable alternatives,' and '[d]evote substantial treatment to each alternative' with 'detail.' *Id*. at (a)-(b).")

Thus, BLM's consideration of a no-leasing alternative reasonable in light of new information, science, and national policy related to climate change, and therefore must be

included in the FFO's RMPA. BLM should resist any inclination toward maintaining a status quo approach to federal lands management in the San Juan Basin, which would be unhinged from current reality and the demands of the time.

B. BLM Must Consider a No Leasing Alternative in Response to Threats Posed by Climate Change.

Climate change has fundamentally altered the paradigm of public lands management—a reality reflected in new national policy as well as international commitments—but long ignored by the FFO in its management of the planning area. The business-as-usual approach fails to meet the needs of present and future generations—the agency's core mandate in managing public lands and minerals. 43 C.F.R. § 1702(c). Both science and common sense dictate that perpetuating a management approach which has substantially contributed to climate change is no longer sufficient. The agency must consider alternatives that are responsive to this reality, including not leasing fossil fuel minerals.

Every ton of carbon dioxide added to the atmosphere worsens climate change. So any additional oil and gas production permitted on BLM land managed by the FFO and the combustion of those fossil fuels will worsen climate change. Due to the urgent need to protect mankind and federal public lands from the potentially devastating impacts of catastrophic global warming, BLM must consider and analyze an alternative that reduces or eliminates the number of new fossil fuel leases in the Farmington planning area.

The BLM has explicit legal authority under FLPMA, the MLA and NEPA to adopt a no-leasing alternative as necessary to respond to the threats posed by climate change. BLM has broad discretion in determining when, how, and if fossil fuel resources are made available for leasing.

With regard to oil and gas, the MLA states: "All lands subject to disposition under this Act which are known or believed to contain oil or gas deposits *may* be leased by the Secretary." 30 US.C. § 226(a) (emphasis added); *see also Udall v. Tallman,* 30 U.S. 1, 4 (1965) (MLA "left the Secretary discretion to refuse to issue any lease at all on a given tract"); *Burglin v. Morton*, 527 F.2d 486, 488 (9th Cir. 1975) ("The permissive word 'may' in Section 226(a) allows the Secretary to lease such lands, but does not require him to do so."); *Pease v. Udall*, 332 F.2d 62, 63 (9th Cir. 1964) ("[T]he Mineral Leasing Act has consistently been construed as leaving to the Secretary, within his discretion, a determination as to what lands are to be leased thereunder.").

Although the MLA states that, for oil and gas, "[l]ease sales shall be held for each State where eligible lands are available at least quarterly and more frequently *if* the Secretary of the Interior determines such sales are necessary," quarterly leasing is *not required* if no lands are "eligible" and "available" due to factors including withdrawal from the operation of the MLA under FLPMA, allocation decisions under an applicable land management plan, need for additional environmental review, or exercise of Secretarial discretion. 30 U.S.C. § 226(b)(1)(A); *see also* 43 C.F.R. § 3120.1-1; U.S. Bureau of Land Management, Oil and Gas Leasing Reform, Instruction Memorandum No. 2010-117 ("Eligible lands include those identified in 43 C.F.R. § 3120.1-1 as being available for leasing (BLM Manual 3120, Competitive Leases). They are

considered available for leasing when all statutory requirements have been met, including compliance with the NEPA, appropriate reviews have been conducted, and *lands have been allocated for leasing in the RMP* (BLM Handbook H-3101-1, Issuance of Leases).") (emphasis added). Thus, a decision to allocate an area as ineligible for leasing through the planning process is contemplated by BLM's regulations, contradicting any perceived requirement that BLM must lease the area.

The Federal Onshore Oil and Gas Leasing Reform Act ("FOOGLRA")—while not altering the fundamental leasing structure of the MLA—imposed a competitive bidding requirement on all offered leases. 30 U.S.C. §§ 188, 195, 226. Critically, FOOGLRA did not repeal or alter Secretarial discretion of *whether* to offer any particular lands for lease. *See Western Energy Alliance v. Salazar*, 709 F.3d 1040, 1044 (10th Cir. 2013) ("Before the MLA was amended by the [FOOGLRA]…it was well established that the Secretary had extremely broad discretion and was not obligated to issue any lease on public lands…. The MLA, as amended by the Reform Act of 1987, continues to vest the Secretary with considerable discretion to determine which lands are 'to be leased' under § 226(b)(1)(A)."). As held by the Court of Appeals in *Bob Marshall Alliance v. Hodel*:

> the Mineral Leasing Act gives the Interior Secretary discretion to determine which lands are to be leased under the statute. 30 U.S.C. §226(a) (1982); *see Mountain States,* 499 F.Supp. at 391-92. We have held that the Mineral Leasing Act "allows the Secretary to lease such lands, but does not require him to do so.... [T]he Secretary has discretion to refuse to issue any lease at all on a given tract." *Burglin v. Morton*, 527 F.2d 486, 488 (9th Cir. 1975) (citing *Udall v. Tallman*, 380 U.S. 1, 4 (1965), *cert denied,* 425 U.S. 973 (1976)).

852 F.2d 1223, 1230 (9th Cir. 1988).

The Secretary of the Interior also has authority under FLPMA to "withdraw" an area of federal land from oil and gas leasing to "maintain . . . public values" or for a "particular public purpose." FLPMA defines a withdrawal as:

> withholding an area of Federal land from settlement, sale, location, or entry, under some or all of the general land laws, for the purpose of limiting activities under those laws in order to maintain other public values in the area or reserving the area for a particular public purpose or program . . .

43 U.S.C. § 1702(j). FLPMA further provides that Congress declares that it is the policy of the United States that "the public lands [shall] be managed in a manner that will protect the quality of … air and atmospheric … values." 43 U.S.C. § 1701(a)(8).

Under FLPMA's "multiple use and sustained yield" management directive, *id.* § 1701(a)(7), the federal government must manage public lands and resources in a manner that "takes into account the long-term needs of future generations for renewable and nonrenewable resources, including, but not limited to, recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific and historical values; and harmonious and coordinated

management of the various resources without permanent impairment of the productivity of the land[,]" *id.* § 1702(3). Further, "[i]n managing the public lands the Secretary shall … take any action necessary to prevent unnecessary or undue degradation of the lands." *Id.* § 1732(b).

Under these authorities, BLM is required not only to evaluate the impacts of federal leasing to public lands, water, and wildlife resources, but to avoid harm to those resources whenever possible. Accordingly, the MLA and FLPMA provide BLM the legal authority to either decide not to lease particular lands, or to withdraw large tracts from leasing.[100]

Further, the Tenth Circuit Court of Appeals has explicitly rejected arguments that FLPMA's multiple use mandate requires that public lands be made available for fossil fuel extraction.

> BLM's obligation to manage for multiple use does not mean that development *must* be allowed on [a particular piece of public lands]. Development is a *possible* use, which BLM must weigh against other possible uses – including conservation to protect environmental values, which are best assessed through the NEPA process. Thus, an alternative that closes the [proposed public lands] to development does not necessarily violate the principle of multiple use, and the multiple use provision of FLPMA is not a sufficient reason to exclude more protective alternatives from consideration.

New Mexico ex rel. Richardson, 565 F.3d at 710 (emphasis in original).

C. BLM Must Explicitly Consider a Renewable Energy Alternative or Include Renewable Energy as a Priority Element in Each Alternative.

A transition to clean energy is critical to achieving the national climate goals discussed in Section I of these comments. Several statements of national policy in regulations and executive orders create an obligation for BLM to look more closely at renewable energy as a resource in the Farmington Field Office planning area. As of 2010, these include:

---

[100] Even if BLM concludes that the agency lacks authority to bar new oil and gas leasing throughout the planning area, it should still consider such an alternative because it is otherwise reasonable. Federal courts hold that agencies have the duty to consider reasonable alternatives that are outside the jurisdiction of the agency or that require a change of law to implement. *See* 40 C.F.R. § 1502.14(c) (an EIS "shall" "[i]nclude reasonable alternatives not within the jurisdiction of the lead agency"); Council on Environmental Quality, Executive Office of the President, Publication of Memorandum to Agencies Containing Answers to 40 Most Asked Questions on NEPA Regulations, 46 Fed. Reg. 18,026–01 at 18,027 (1981) ("An alternative that is outside the legal jurisdiction of the lead agency must still be analyzed in the EIS if it is reasonable. A potential conflict with local or federal law does not necessarily render an alternative unreasonable"); *Muckleshoot Indian Tribe v. U.S. Forest Serv.*, 177 F.3d 800, 814 (9th Cir. 1999) (setting aside EIS for failure to address alternative requiring Congressional action).

- The Energy Policy Act of 2005 (Title II, Sec. 211), which requires the DOI to approve at least 10,000 megawatts of non-hydropower renewable energy on public lands by 2015. The President has requested that BLM produce an additional 10,000 megawatts beyond that mandated in the Energy Policy Act of 2005.

- Secretarial Order 3285, which requires the DOI to identify and prioritize specific locations best suited for large-scale renewable energy production.

- Instruction Memorandum 2007-097, Solar Energy Development Policy (BLM 2007), establishes policy for the processing of right-of-way (ROW) applications for solar energy development projects on BLM-administered lands and evaluating the feasibility of installing solar energy systems on BLM administrative facilities and projects.

- Instruction Memorandum 2006-216, Wind Energy Development Policy (BLM 2006), provides guidance on implementing the Record of Decision for the Programmatic Environmental Impact Statement (EIS) on Wind Energy Development (BLM 2005) and processing ROW applications for wind energy projects on BLM-administered lands. Instruction Memorandum 2009-043, Wind Energy Development Policy (BLM 2009b), provides updated guidance on processing ROW applications for wind energy projects on BLM-administered lands.

- Instruction Memorandum 2004-227, Biomass Utilization Strategy (BLM 2004), updated in July 2005, provides sets of goals to help focus and increase utilization of biomass from BLM lands. In June 2005, the final rule in the *Federal Register* revised the authority of 48 Code of Federal Regulations (CFR) Part 1452 by adding 1452.237-71, which is a new contract clause for removal and utilization of woody biomass generated as a result of land management service contracts whenever ecologically and lawfully appropriate. The BLM issued Instruction Memorandum 2009-120 in May 2009, which updated the contract clause for utilization for woody biomass.

The Farmington planning area has long been a sacrifice zone for extractive industry, and in particular for oil and gas—with over 40,000 historic wells drilled and at least 21,725 wells currently in production. Not only have local communities been forced to endure the effects of this development on their land, air, water, but they have also long suffered from the industry's boom and bust cycles. The federal government must consider alternatives that would allow for a just transition of local and state economies, and which support community independence from fossil fuels.

III. The FFO Must to Take a Hard Look at Greenhouse Gas Emissions and Impacts to Climate Change.

Conservation Groups provided detailed technical information on the agency's need to take a hard look at GHG emissions and impacts to climate change in previously submitted scoping comments, which are again incorporated by reference. This additional and supplemental information must also be considered. NEPA mandates that EISs contain "high quality" information and "[a]ccurate scientific analysis" sufficient to "help public officials make

decisions that are based on understanding environmental consequences." 40 C.F.R. § 1500.1(b), (c). Moreover, agencies have a duty to "insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements." 40 C.F.R. § 1502.24. NEPA therefore prohibits BLM from relying on outdated data.

Federal courts have long held that agency reliance on data that is stale or inaccurate invalidates environmental review. *See, e.g.*, *Northern Plains Resource Council, Inc. v. Surface Transp. Bd.*, 668 F.3d 1067, 1085-86 (9th Cir. 2011) (ten-year old survey data for wildlife "too stale" thus reliance on it in EIS was arbitrary and capricious); *Lands Council v. Powell*, 395 F.3d 1019, 1031 (9th Cir. 2005) (six year-old survey data for cutthroat trout was "too outdated to carry the weight assigned to it" and reliance on that data violated NEPA); *Seattle Audubon Soc. v. Espy*, 998 F.2d 699, 704-05 (9th Cir. 1993) (reliance on "stale scientific evidence" regarding owl population data without adequate discussion of scientific uncertainty violated NEPA).

As introduced above, the CEQ's Climate Guidance provides a framework for BLM to employ in its review of GHG emissions and climate change in the RMPA. First and foremost, the agency must resist the temptation of dismissing planning area emissions by comparing them on a scale with national and global emissions—which the FFO has frequently done in the past. The CEQ explained that these comparisons do not reveal anything beyond "the nature of the climate change challenge itself"; i.e., the fact that many individual sources together make a big impact on the climate:

> Climate change results from the incremental addition of GHG emissions from millions of individual sources, which collectively have a large impact on a global scale. CEQ recognizes that the totality of climate change impacts is not attributable to any single action, but are exacerbated by a series of actions including actions taken pursuant to decisions of the Federal Government. Therefore, a statement that emissions from a proposed Federal action represent only a small fraction of global emissions is essentially a statement about the nature of the climate change challenge, and is not an appropriate basis for deciding whether or to what extent to consider climate change impacts under NEPA. Moreover, these comparisons are also not an appropriate method for characterizing the potential impacts associated with a proposed action and its alternatives and mitigations because this approach does not reveal anything beyond the nature of the climate change challenge itself: the fact that diverse individual sources of emissions each make a relatively small addition to global atmospheric GHG concentrations that collectively have a large impact. When considering GHG emissions and their significance, agencies should use appropriate tools and methodologies for quantifying GHG emissions and comparing GHG quantities across alternative scenarios. Agencies should not limit themselves to calculating a proposed action's emissions as a percentage of sector, nationwide, or global emissions in deciding whether or to what extent to consider climate change impacts under NEPA.[101]

[101] Climate Guidance at 9 (attached as Exhibit 4).

Meaningful consideration of GHG emissions is clearly within the scope of required NEPA review. *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin*., 538 F.3d 1172, 1217 (9th Cir. 2008). As the Ninth Circuit has held, in the context of fuel economy standard rules:

> The impact of greenhouse gas emissions on climate change is precisely the kind of cumulative impacts analysis that NEPA requires agencies to conduct. Any given rule setting a CAFE standard might have an "individually minor" effect on the environment, but these rules are "collectively significant actions taking place over a period of time" *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin*., 538 F.3d 1172, 1216 (9th Cir. 2008)(quoting 40 C.F.R. § 1508.7).

The courts have ruled that federal agencies should consider indirect GHG emissions resulting from agency policy, regulatory, planning and leasing decisions. For example, agencies cannot ignore the indirect air quality and climate change impact of decisions that would open up access to coal reserves. *See Mid States Coal. For Progress v. Surface Transp. Bd*., 345 F.3d 520, 532, 550 (8th Cir. 2003); *High Country Conservation Advocates v. U.S. Forest Serv*., 52 F.Supp. 3d 1174, 1197-98 (D.Colo. 2014).

The CEQ Climate Guidance is dispositive on the issue of federal agency review of GHG emissions as foreseeable direct and indirect effects of the proposed action. 81 Fed. Reg. 51,866 (Aug. 5, 2016). The CEQ guidance provides clear direction for BLM to conduct a lifecycle greenhouse gas analysis because the modeling and tools to conduct this type of analysis are readily available to the agency:

> If the direct and indirect GHG emissions can be quantified based on available information, including reasonable projections and assumptions, agencies should consider and disclose the reasonably foreseeable direct and indirect emissions when analyzing the direct and indirect effects of the proposed action. Agencies should disclose the information and any assumptions used in the analysis and explain any uncertainties. To compare a project's estimated direct and indirect emissions with GHG emissions from the no-action alternative, agencies should draw on existing, timely, objective, and authoritative analyses, such as those by the Energy Information Administration, the Federal Energy Management Program, or Office of Fossil Energy of the Department of Energy. In the absence of such analyses, agencies should use other available information.

81 Fed. Reg. 51,866 at 16 (Aug. 5, 2016)(citations omitted).

CEQ's guidance even provides an example of where a lifecycle analysis is appropriate in a leasing context:

> The indirect effects of such an action that are reasonably foreseeable at the time would vary with the circumstances of the proposed action. For actions such as a Federal lease sale of coal for energy production, the impacts associated with the

> end-use of the fossil fuel being extracted would be the reasonably foreseeable combustion of that coal.[102]

The volume of potential oil and gas from the new parcels available for lease in the FFO projected by the RFD, and the lifecycle GHG emissions impact from these new lease parcels is also quantifiable.

The agency can easily generate an accurate, site-specific impact analysis for each alternative by utilizing BLM's own Energy Policy and Conservation Act phase III Oil and Gas Inventory Model geodatabase and the RMPA alternatives GIS shapefiles to establish future extractible oil and gas volume from the planning area. This information can then be used to generate potential lifecycle GHG emissions for resultant oil and gas volumes using a peer-reviewed carbon calculator and lifecycle GHG emissions model developed by EcoShift consulting.[103] This model is not novel in its development or methodology. Numerous greenhouse gas calculation tools exist to develop lifecycle analyses, particularly for fossil fuel extraction, operations, transport and end-user emissions.[104]

State and federal agencies frequently recognize the obligation to employ upstream, downstream and lifecycle GHG emissions analyses for NEPA review of energy-related projects.[105] For example, the Department of Energy has historically utilized these types of

---

[102] *Id.* at 16, n. 42 (attached as Exhibit 4).
[103] *See* Mulvaney (attached as Exhibit 23).
[104] *See* Council on Environmental Quality, Revised draft guidance for greenhouse gas emissions and climate change impacts (2014).
[105] In addition to those cited below, a recent but by no means exhaustive list of life-cycle analyses that incorporate energy market modeling and comparison of greenhouse gas emissions across alternatives include the U.S. Forest Service's Supplemental EIS on the Colorado Roadless Rule (2016); the Surface Transportation Board's DEIS for the Tongue River Railroad (2015); EPA's regulatory impact analysis of the Clean Power Plan; and the Washington State Department of Ecology's DEIS for the proposed Millenium Export Bulk Terminal (2016); *see also* U.S. Forest Service, Record of Decision and Final Environmental Impact Statement, Oil and Gas Leasing Analysis, Fishlake National Forest, 169 (Aug 2013) (attached as Exhibit 90) (Table 3.12-7: shows GHG emissions from transportation, offsite refining and end use; and total direct and indirect emissions); *see also id*. at Appendix E/SIR-2 (more detailed calculations of direct and indirect emissions); U.S. Army Corps of Engineers, Final Environmental Impact Statement: Alaska Stand Alone Gas Pipeline, Volume 2 Sec. 5.20-70–71 (Oct. 2012) (attached as Exhibit 91) (The Corps, in a 2012 EIS for an intrastate natural gas pipeline in Alaska, estimated downstream emissions from combustion of the natural gas that would be transported, and also discussed the potential for natural gas to displace other, dirtier fuel sources such as coal and oil.); U.S. Department of State, Final Supplemental Environmental Impact Statement for the Keystone XL Project, § 4.14.3, Appendix U (Jan. 2014) (attached as Exhibit 92) (The Department of State, as lead agency on the Keystone XL Pipeline Review conducted a relatively comprehensive life-cycle greenhouse gas analysis for the proposed pipeline, alternatives, and baseline scenarios that could occur if the pipeline was not constructed.); U.S. Environmental Protection Agency Region X, Letter from Dennis McLerran, Regional Administrator, to Randel Perry, U.S. Army Corps of

lifecycle emissions analyses in NEPA review of oil and gas infrastructure projects.[106] Courts have upheld the viability and usefulness of lifecycle analyses, and adoption of this trend is clearly reflected in the CEQ Guidance on Climate Change. 81 Fed. Reg. 51, 866 at 11 (Aug. 5, 2016) ("This guidance recommends that agencies quantify a proposed agency action's projected direct and indirect GHG emissions. Agencies should be guided by the principle that the extent of the analysis should be commensurate with the quantity of projected GHG emissions and take into account available data and GHG quantification tools that are suitable for and commensurate with the proposed agency action").[107]

Engineers Seattle District, re Gateway Pacific Projects (Jan 22, 2013) *available* at: http://www.eisgatewaypacificwa.gov/sites/default/files/content/files/EPA_Reg10_McLerran.pdf#overlay-context=resources/project-library (attached as Exhibit 93) (EPA submitted comments on the scope of impacts that should be evaluated in the coal terminal EIS that the Corps is preparing, in which it urged the Corps to conduct a lifecycle emissions analysis of GHG emissions from the coal that would be transported via the terminal.)

[106] U.S. Department of Energy National Renewable Energy Laboratory, Life Cycle Greenhouse Gas Emissions from Electricity Generation Fact Sheet, Pub No. NREL/FS-6A20-57817 (2013) *available at* http://www.nrel.gov/docs/fy13osti/57187.pdf (attached as Exhibit 95); U.S. Department of Energy National Energy Technology Laboratory Role of Alternative Energy Sources: Natural Gas Technology Assessment, Pub No. DOE/NETL- 2012/1539 (NETL, 2012) *available at* https://www.netl.doe.gov/File%20Library/Research/Energy%20Analysis/Life%20Cycle%20Analysis/LCA-2012-1539.pdf (attached as Exhibit 96); U.S. Department of Energy National Energy Technology Laboratory, Life Cycle Greenhouse Gas Inventory of Natural Gas Extraction, Delivery and Electricity Production, Pub No. DOE/NETL-2011/1522 (NETL, 2011) *available at* http://www.fossil.energy.gov/programs/gasregulation/authorizations/2013_applications/sierra_club_13-69_venture/exhibits_44_45.pdf (attached as Exhibit 97); U.S. Department of Energy National Energy Technology Laboratory, Life Cycle Analysis: Natural Gas Combined Cycle (NGCC) Power Plant, Pub No DOE/NETL-403-110509 (Sep 10, 2012) (NETL, 2010) *available at* https://www.netl.doe.gov/energy-analyses/temp/FY13_LifeCycleAnalysisNaturalGasCombinedCycle(NGCC)PowerPlantFinal_060113.pdf (attached as Exhibit 98).

[107] *High Country Conservation Advocates v. United States Forest Serv*., 52 F. Supp. 3d 1174 (D. Colo. 2014) (Court held that the agencies' failure to quantify the effect of greenhouse gas (GHG) emissions from the mining lease modifications was arbitrary in violation of NEPA because the social cost of carbon protocol tool existed for such analysis under 40 C.F.R. § 1502.23 but the agencies did not provide reasons in the final EIS for not using the tool; and that the agencies' decision to forgo calculating the foreseeable GHG emissions was arbitrary in light of their ability to perform such calculations and their decision to include a detailed economic analysis of the benefits.); *see also Dine Citizens Against Ruining Our Env't v. United States Office of Surface Mining Reclamation & Enf't*, 82 F. Supp. 3d 1201, 1213-1218 (D. Colo. 2015) (Court held that the agency failed to adequately consider the reasonably foreseeable combustion-related downstream effects of the proposed action. Also held that that combustion emissions associated with a mine that fed a single power plant were reasonably foreseeable because the agency knew where the coal would be consumed).

The extreme urgency of the climate crisis requires BLM to pursue all means available to limit the climate change effects of its actions, beginning with a robust and accurate quantitative analysis of potential GHG emissions from fossil fuel development proposed in the planning area. Any emissions source, no matter how small, is potentially significant, such that BLM should fully explore mitigation and avoidance options for all sources.

A. BLM Must Address Whether Alternatives Are Consistent with National Climate Goals.

NEPA regulations require agencies to account for conflicts with existing laws and requirements imposed for the protection of the environment when engaging in environmental analysis.[108] In addition, Executive Order 12,866 also requires that "[e]ach agency shall avoid regulations that are inconsistent [or] incompatible" with the regulations of any other agency.[109]

Any subsequently prepared NEPA document must disclose whether each of the proposed plan alternatives would interfere with efforts to meet federal and international greenhouse gas emission reduction targets.[110] As explained by the CEQ in its Climate Guidance, federal agencies evaluating the climate impacts of their decisions should "discuss relevant approved federal, regional, state, tribal, or local plans, policies, or laws for GHG emission reductions or climate adaptation to make clear whether a proposed project's GHG emissions are consistent with such plans or laws."[111]

In November 2014 the President announced a joint U.S.-China agreement aimed at reducing climate pollution that calls for even more aggressively cutting net greenhouse gas emissions to 26-28 percent below 2005 levels by 2025.[112] Further, the BLM must address whether the plan alternatives accord with the Paris Agreement, which represents an international agreement to limit global temperatures to 1.5-2°C below pre-industrial levels, in which the U.S. has pledged to reduce GHG emissions by 26-28% from 2005 levels by 2025, on a path to reduce those emissions by 80% by 2050.

As part of its analysis, BLM should disclose to the public the clearly competing interests at stake: one the one hand, meeting these national and international climate emission reduction targets set by EPA, the President, or agreed upon by 195 nations; and on the other, any plan alternatives that serve to perpetuate dependence on fossil fuel resources largely for the benefit of private companies and oil and gas operators. Any failure to acknowledge this potential conflicts would be arbitrary and capricious, in violation of NEPA and Executive Order 12,866.

---

[108] *See* 40 C.F.R. § 1506.2(d) (EISs must discuss inconsistencies with state law); 40 C.F.R. § 1508.27(b)(10) (when examining whether actions are "significant" within the meaning of NEPA, agencies must consider whether the action "threatens a violation of Federal, State, or local law or *requirements imposed for the protection of the environment*.").

[109] Executive Order 12,866 (Sep. 30, 1993), Sec. 1(b)(10).

[110] *See* 40 C.F.R. § 1506.2(d); 40 C.F.R. § 1508.27(b)(10).

[111] Climate Guidance at 28 (attached as Exhibit 4).

[112] White House Fact Sheet, U.S.-China Joint Announcement on Climate Change and Clean Energy Cooperation (November 11, 2014), available at: https://www.whitehouse.gov/the-press-office/2014/11/11/us-china-joint-announcement-climate-change (attached as Exhibit 46).

B. BLM Must Quantify the Severity of Harm from Greenhouse Gas Emissions

1. Social Cost of Carbon Protocol

Research conducted by the National Research Council has confirmed that the negative impacts of energy generation from fossil fuels are not represented in the market price for such generation.[113] In other words, failing to internalize the externalities of energy generation from fossil fuels—such as the impacts to climate change and human health—has resulted in a market failure that requires government intervention. As aptly summarized by the White House Council of Economic Advisors in 2016:

> Climate change reflects a classic environmental externality. When consumers or producers emit greenhouse gases, they enjoy the benefits from the services provided by the use of the fuels, while not paying the costs of the damages from climate change. Since the price of goods and services whose production emits greenhouse gases does not reflect the economic damages associated with those gases, market forces result in a level of emissions that is too high from a social perspective. Such a market failure can be addressed by policy.[114]

Executive Order 12866 directs federal agencies to assess and quantify such costs and benefits of regulatory action, including the effects on factors such as the economy, environment, and public health and safety, among others. *See* Exec. Order No. 12866, 58 Fed. Reg. 51,735 (Sept. 30, 1993).[115] The Ninth Circuit has ruled that agencies must include the climate benefits of a significant regulatory action in federal cost-benefit analyses to comply with EO 12866.

> [T]he fact that climate change is largely a global phenomenon that includes actions that are outside of [the agency's] control ... does not release the agency from the duty of assessing the effects of its actions on global warming within the context of other actions that also affect global warming.

Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin., 538 F.3d 1172, 1217 (9th Cir. 2008) (quotations and citations omitted); *see also Border Power Plant Working Grp. v. U.S. Dep't of Energy*, 260 F. Supp. 2d 997, 1028-29 (S.D. Cal. 2003) (finding agency failure to disclose project's indirect carbon dioxide emissions violates NEPA).

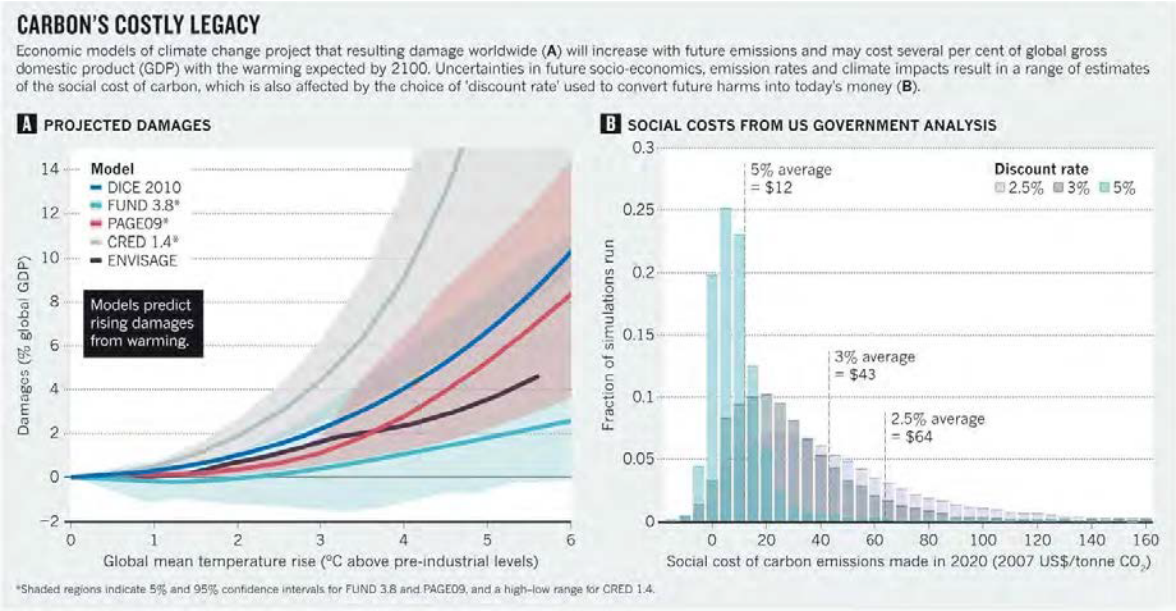
---

[113] *See, e.g.,* National Research Council, *Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use* (2010) (attached as Exhibit 106); Nicholas Muller, et. al., *Environmental Accounting for Pollution in the United States Economy*, AMERICAN ECONOMIC REVIEW (Aug. 2011) (attached as Exhibit 107); *see also* Generation Investment Management, *Sustainable Capitalism,* (Jan. 2012) (attached as Exhibit 108) (advocating a paradigm shift to "a framework that seeks to maximize long-term economic value creation by reforming markets to address real needs while considering *all* costs and stakeholders.").

[114] White House Council of Economic Advisors, The Economic Record of the Obama Administration: Addressing Climate Change at 11 (Sept. 2016) (attached as Exhibit 37).

[115] *See also* Executive Order 13563, 76 Fed. Reg. 3821 (Jan. 18, 2011) (reaffirming the framework of EO 12866 and directing federal agencies to conduct regulatory actions based on the best available science).

In response, an Interagency Working Group ("IWG") was formed to develop a consistent and defensible estimate of the social cost of carbon—allowing agencies to "incorporate the social benefits of reducing carbon dioxide (CO_2) emissions into cost-benefit analyses of regulatory actions that impact cumulative global emissions."[116] In other words, SCC is a measure of the benefit of reducing greenhouse gas emissions now and thereby avoiding costs in the future.[117] The charts below depict, (A) dramatically increasing damages from global warming over time, as well as (B) the social cost of these carbon emissions based on 2013 TDS values.[118]



Leading economic models all point in the same direction: that climate change causes substantial economic harm, justifying immediate action to reduce emissions.[119] The interagency process to develop SCC estimates—originally described in the 2010 interagency technical support document ("TSD"), and updated in 2013 and 2015—developed four values based on the average SCC from three integrated assessment models (DICE, PAGE, and FUND), at discount rates of 2.5, 3, and 5 percent,[120] as well as a fourth value, which represents the 95th percentile

---

[116] *See* Interagency Working Group on the Social Cost of Carbon, United States Government, *Technical Support Document: Technical Update on the Social Cost of Carbon for Regulatory Impact Analysis – Under Executive Order 12866* (May 2013) at 2 (hereinafter 2013 TSD) (attached as Exhibit 109).

[117] *See* Ruth Greenspan and Dianne Callan, *More than Meets the Eye: The Social Cost of Carbon in U.S Climate Policy, in Plain English,* WORLD RESOURCES INSTITUTE (July 2011) (attached as Exhibit 110).

[118] *See* Richard Revesz, *et al., Global warming: Improve economic models of climate change,* NATURE 508, 173-175 (April 10, 2014) (attached as Exhibit 111).

[119] *See id.* at 174.

[120] The choice of which discount rate to apply—translating future costs into current dollars—is critical in calculating the social cost of carbon. The higher the discount rate, the less significant future costs become, which shifts a greater burden to future generations based on the notion that the world will be better able to make climate investments in the future. The underlying

SCC estimate across all three models at a 3 percent discount rate, and demonstrates the cost of worst-case impacts.[121] These models are intended to quantify damages, including health impacts, economic dislocation, agricultural changes, and other effects that climate change can impose on humanity. While these values are inherently speculative, a recent GAO report has confirmed the soundness of the methodology in which the IWG's SCC estimates were developed, therefore further underscoring the importance of integrating SCC analysis into the agency's decisionmaking process.[122] In fact, certain types of damages remain either unaccounted for or poorly quantified in IWG's estimates, suggesting that the SCC values are conservative and should be viewed as a lower bound.[123]

The updated interagency SCC estimates for 2020 are $12, $42, $62 and $123 per ton of CO_2 (in 2007$).[124] The IWG does not instruct federal agencies which discount rate to use, suggesting that the 3 percent discount rate ($42 per ton of CO_2) as the "central value," but further emphasizing "the importance and value of including all four SCC values[;]" i.e., that the agency should use the range of values in developing NEPA alternatives.[125]

In 2014, the district court for the District of Colorado faulted the Forest Service for failing to calculate the social cost of carbon, refusing to accept the agency's explanation that such a calculation was not feasible. *High Country Conservation Advocates v. U.S. Forest Service*, 52 F.Supp.3d 1174 (D.Colo. 2014) (a decision the agency decided not to appeal, thus implicitly recognizing the importance of incorporating a social cost of carbon analysis into NEPA decisionmaking). Notably, the *High Country Conservation Advocates* decision applies to the same geographic area (the North Fork Valley), and to the same coal field (the Somerset),

---

assumption of applying a higher discount rate is that the economy is continually growing. The IWG's "central value" of three percent is consistent with this school of thought—that successive generations will be increasingly wealthy and more able to carry the financial burden of climate impacts. "The difficultly with this argument is that, as climate change science becomes increasingly concerning, it becomes a weaker bet that future generations will be better off. If they are not, lower or negative discount rates are justified." WRI Report, at 9 (attached as Exhibit 110). "Three percent values an environmental cost or benefit occurring 25 years in the future at about half as much as the same benefit today." *Id.*

[121] *See* 2013 TSD at 2 (attached as Exhibit 109).

[122] GAO-14-663, *Social Cost of Carbon* (July 24, 2014).

[123] *See* Peter Howard, et al., *Omitted Damages: What's Missing From the Social Cost of Carbon*, ENVIRONMENTAL DEFENSE FUND, INSTITUTE FOR POLICY INTEGRITY, NATURAL RESOURCES DEFENSE COUNCIL (March 13, 2014) (attached as Exhibit 112) (providing, for example, that damages such as "increases in forced migration, social and political conflict, and violence; weather variability and extreme weather events; and declining growth rates" are either missing or poorly quantified in SCC models).

[124] *See* 2013 TSD (July 2015 Revision) at 3 (attached as Exhibit 109) (including a table of revised SCC estimates from 2010-2050). To put these figures in perspective, in 2009 the British government used a range of $41-$124 per ton of CO_2, with a central value of $85 (during the same period, the 2010 TSD used a central value of $21). WRI Report at 4 (attached as Exhibit 110). The UK analysis used very different assumptions on damages, including a much lower discount rate of 1.4%. The central value supports regulation four times a stringent as the U.S. central value. *Id.*

[125] *See* 2013 TSD at 12 (attached as Exhibit 109).

that is at issue here. In his decision, Judge Jackson identified the IWG's SCC protocol as a tool to "quantify a project's contribution to costs associated with global climate change." *Id.* at 1190.[126] To fulfill this mandate, they agency must disclose the "ecological[,] … economic, [and] social" impacts of the proposed action. 40 C.F.R. § 1508.8(b). Simple calculations applying the SCC to GHG emissions from this project offer a straightforward comparative basis for analyzing impacts, and identifying very significant costs.[127]

Notably, according to the IPCC, the 20-year GWP for methane—which is not only the planning lifespan of the RMP, but the relevant timeframe for consideration if we are to stem the worst of climate change—is 87.[128] BLM has historically used an outdated GWP when calculating methane's warming impact. The agency should avoid that temptation here, as it not only underestimates to relevant emissions and their impacts, but also near term benefits of avoiding this pollution.

CEQ provides that "[i]t is essential … that Federal agencies not rely on boilerplate text to avoid meaningful analysis, including consideration of alternatives or mitigation." *Id.* at 5-6 (citing 40 C.F.R. §§ 1500.2, 1502.2). Indeed, the EPA has also cautioned "against comparing GHG emissions associated with a single project to global GHG emission levels" because it erroneously leads to a conclusion that "on a global scale, emissions are not likely to change" as a result of the project.[129] Applying the SCC, as provided above, takes these abstract emissions and places them in concrete, economic terms. As noted by Judge Jackson, the SCC protocol provides a tool to quantify the costs of these emissions. *See High Country Conservation Advocates,* 52 F.Supp.3d at 1190. By failing to consider the costs of GHG emissions from the Proposed Action, the agency's analysis effectively assumes a price of carbon that is $0. *See id.* at 21 (holding that although there is a "wide range of estimates about the social cost of GHG emissions[,] neither the BLM's economist nor anyone else in the record appears to suggest the cost is as low as $0 per unit. Yet by deciding not to quantify the costs as all, the agencies effectively zeroed out the cost in its quantitative analysis."). The agency's failure to consider the SCC is arbitrary and capricious, and ignores the explicit directive of EO 12866.

An agency must "consider every significant aspect of the environmental impact of a proposed action." *Baltimore Gas & Elec. Co. v. Natural Resources Defense Council*, 462 U.S. 87, 107 (1983) (quotations and citation omitted). This includes the disclosure of direct, indirect, and cumulative impacts of its actions, including climate change impacts and emissions. 40 C.F.R.

---

[126] *See also id.* at 18 (noting the EPA recommendation to "explore other means to characterize the impact of GHG emissions, including an estimate of the 'social cost of carbon' associated with potential increases in GHG emissions.") (citing Sarah E. Light, *NEPA's Footprint: Information Disclosure as a Quasi-Carbon Tax on Agencies*, 87 Tul. L. Rev. 511, 546 (Feb. 2013)).

[127] It is important to note that, although the 2010 IWG SCC protocol did not address methane impacts, the 2013 IWG Technical Update explicitly addresses methane impacts. Thus, it is appropriate to calculate a SCC outcome that takes into account the full CO_2e emissions associated with the proposed leasing.

[128] *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *Working Group I Contribution to the IPCC Fifth Assessment Report Climate Change 2013: The Physical Science Basis,* at 8-58 (Table 8.7) (Sept. 2013) (attached as Exhibit 113).

[129] *See* Light, 87 Tul. L. Rev. 511, 546.

§ 1508.25(c). The need to evaluate such impacts is bolstered by the fact that "[t]he harms associated with climate change are serious and well recognized," and environmental changes caused by climate change "have already inflicted significant harms" to many resources around the globe. *Massachusetts v. EPA*, 549 U.S. 497, 521 (2007); *see also id.* at 525 (recognizing "the enormity of the potential consequences associated with manmade climate change."). Among other things, the agency's analysis must disclose "the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity[,]" including the "energy requirements and conservation potential of various alternatives and mitigation measures." 42 U.S.C. § 4332(c); 40 C.F.R. § 1502.16(e). As explained by CEQ, this requires agencies to "analyze total energy costs, including possible hidden or indirect costs, and total energy benefits of proposed actions." 43 Fed. Red. 55,978, 55,984 (Nov. 29, 2978); *see also* Executive Order 13514, 74 Fed. Reg. 52,117 (Oct. 5, 2009) (requiring government agencies to disclose emissions information annually from direct and indirect activities). Failing to perform such analysis undermines the agency's decisionmaking process and the assumptions made.

Nor can the agency tout the benefits of coal, oil and gas development without similarly disclosing the costs. *See* 40 C.F.R. § 1502.23. For example, BLM identifies "tax impact from coal extraction in the planning area" as a benefit, with revenues "associated with the sales and income earned from extraction and transportation of coal." DEIS at 4-465. Although not quantified in the same way, BLM also assumes that "increased production of oil and gas on BLM-administered lands would result in a comparable increase in contributions to local counties and communities." *Id.* Accordingly, BLM relies on figures in Table 4-90 (Baseline Regional Economic Impacts for Coal), to suggest a substantial net economic benefit, including $556 million in annual output and $175 million in labor income. DEIS at 4-469. Setting aside that this economic data is based on wildly optimistic assumptions on future coal production and employment for 2,518 people—with a current reality of coal mines being shut down and present employment of around 250 people—this type of misleading and one-sided analysis is expressly forbidden under NEPA. *See Hughes River Watershed Conservancy v. Glickman*, 81 F.3d 437, 446-47 (4th Cir. 1996) ("it is essential that the EIS not be based on misleading economic assumptions); *Sierra Club v. Sigler,* 695 F.2d 957, 979 (5th Cir. 1983) (agency choosing to "trumpet" an action's benefits has a duty to disclose its costs).

2. Social Cost of Methane Protocol

In August 2016, the Interagency Working Group ("IWG") provided an update to the social cost of carbon technical support document,[130] and, for the first time, adopted a similar methodology for evaluating the climate impact of each additional ton of methane and nitrogen oxide emissions.[131] Given its recent endorsement by the IWG, BLM should use the social cost of

[130] Interagency Working Group, Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 (August 2016), (attached as Exhibit 324). The August 2016 update added some clarifying information around uncertainties in the modeling that supports the social cost of carbon, but did not adjust the damages values (the costs) published in the 2015 update.

[131] Interagency Working Group, Addendum to Technical Support Document on Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866: Application of the

methane to quantify the expected climate damage caused by the extraction and combustion of oil and gas extracted under BLM's Mancos RMPA.

Similar to the social cost of carbon, the social cost of methane provides a standard methodology that allows state and federal agencies to quantify the social benefits of reducing methane emissions through actions that have comparatively small impacts on cumulative global emission levels. The social cost of methane is intended to "offer a method for improving the analyses of regulatory actions that are projected to influence [methane or nitrogen oxide] emissions in a manner consistent with how [carbon dioxide] emission changes are valued."[132] Like the social cost of carbon, the social cost of methane is presented as a range of figures across four discount rates; it is based on results from three integrated assessment models; displayed in dollars per metric ton of emissions; and increases over time because emissions become more damaging as their atmospheric concentrations increase.[133] Like the social cost of carbon, the social cost of methane has been subject to peer review and will be updated by the IWG to ensure it reflects the best available scientific information.[134] The IWG estimates that each additional ton of methane emitted in 2020 will cause between $540 and $3,200 dollars (measured in $2007).[135]

BLM should use the best tools available to it in order to fully analyze and disclose the climate impacts of its proposal. Given that both the social cost of carbon and social cost of methane have been adopted by the IWG, which includes a dozen federal offices and agencies including the Department of Interior, BLM should use these tools to evaluate the climate impacts of its draft plan for the Uncompahgre planning area, which, as noted, anticipates generating more than half a billion tons of CO2-e over the next two decades.

****

C. *Expert Comments: Economic Scoping for the Mancos RMPA*

CONSERVATION ECONOMICS INSTITUTE, Dr. Evan E. Hjerpe, Executive Director, and Dr. Pete Morton, Advising Economist, prepared the following for Conservation Groups specifically for the Mancos RMPA and EIS:

CLIMATE CHANGE ECONOMICS AND FOSSIL FUEL DEVELOPMENT

The development of oil and gas fields on BLM lands provides both costs and benefits to society. The benefits to society include the fiscal benefits to national taxpayers via lease revenues and royalties paid to the U.S. treasury. The costs to society of fossil fuel development on public lands includes the cost of managing and administering oil and gas leases and a slew of social

---

Methodology to Estimate the Social Cost of Methane and the Social Cost of Nitrous Oxide (August 2016) (attached as Exhibit 325).

[132] *Id*. at 3.

[133] *Id.* at 7.

[134] *Id.* at 3.

[135] *Id.* at 7. For comparison purposes, the current social cost of carbon values for CO2 emissions in 2020 range from $120 to $123 per ton.

costs in terms of environmental and community damages. These economic damages (costs) include social costs associated with boom and bust natural resource extraction, but are heavily comprised of costs related to the pollution and community disruption generated by oil and gas development.

The pollution includes the release of greenhouse gases (GHGs), other volatile organic compounds (VOCs), particulates, degradation of plant and wildlife habitats, and potential acute pollution of water and surrounding environs associated with production and transportation failures. Communities are disrupted by increased traffic, noise, light pollution, and disruption of traditional religious practices. Pollution from oil and gas development is not contained on site. Rather, the pollution adversely affects the surrounding environments, regional environments, and in the case of greenhouse gases, extends globally. In economics jargon, pollution and community disruption are externalities. That is, most of the impacts are external to the production and consumer costs of oil and gas; it is not accounted for in the economic ledgers because it is passed on to other places and people over a period of time.

Externalities create market failures, where the private costs of oil and gas production on public lands (lease and production costs) do not cover the public, or social costs, of fossil fuel development (such as pollution). A.C. Pigou was one of the first economists to isolate and propose accounting for the social costs of externalities such as pollution in the 1920s and 1930s. Since Pigou, and entire field of environmental economics has been developed to account for externalities and to appropriately account for natural amenities. In environmental economics, pollution is characterized as a public "bad" resulting from "waste discharges" associated with the production of private goods.[136]

In cases of pollution and community disruption, as would happen under the proposed expansion of the Mancos Shale/Gallup Formation, the BLM should account for these externalities by estimating the social costs generated from the pollution and comparing them to the benefits of further oil and gas development. Social costs must be considered to whom all they apply. In regards to climate change and GHG emissions, these social costs must be considered locally, domestically, globally, and inter-temporally (future generations).

ACCOUNTING FOR CLIMATE CHANGE DAMAGES WITH THE SOCIAL COST OF CARBON

Emissions of GHGs are the primary cause of anthropogenic climate change. Released GHGs, and the resulting climate change, represents a special case of pollution both temporally and spatially. A number of pollutants, such as heavy metals and fine particulates, have a limited geographic scope of damage typically regional in nature. GHGs, on the other hand, mix with other GHGs in the atmosphere triggering global damages. Temporally, GHGs accumulate and cause climate change long into the future. That is, GHGs emitted today have both a marginal effect in the present and contribute to an increased total pollution effect for many years to come. The dispersed spatial and temporal effects of GHGs have led to specific accounting of their societal damages across the globe and for future generations. The concept of the Social Cost of

[136] Cropper, M. L., & Oates, W. E. (1992). Environmental economics: a survey. *Journal of economic literature*, *30*(2), 675-740.

Carbon (SCC) has been developed by inter-disciplinary biophysical and social scientists to properly account for the negative externalities generated by human activities that lead to climate change. The SCC was developed primarily for regulatory policy to help understand the monetary benefits of avoiding damages caused by releasing additional carbon dioxide into the atmosphere. These values are typically expressed as dollars per metric ton of carbon dioxide. The SCC utilizes integrated assessment models (IAMs) that combine climate science projections for the effect of increasing GHGs on temperatures, sea levels, and climate systems with projections of economic growth and emission controls. The models estimate climate damage functions, or the relationship between CO_2 emissions and the damage caused.[137] Damages include agricultural productivity losses, property damages, and human health effects. There are three primary IAMs (DICE, PAGE, and FUND) that allow for varying sensitivity analysis. The models are generally considered conservative as they have not included numerous other potential damages.

With the welfare of not only current generations, but future generations to come, at stake under escalating climate change scenarios, a contentious component of estimating the SCC (or SCM) is the concept of a discount rate. The discount rate devalues future costs and benefits as compared to current costs and benefits, often close to the long-term average rate of annual inflation (2-6%). As there is a societal preference, or time value, for $100 dollars today as opposed to next year, a discount rate attempts to account for this time preference when bringing future successive years of costs to a present value (PV). That is, the current society must place a value on economic damages caused by climate change to future generations in present dollars. The current generation must also choose whether or not they should pay for damages from current emissions. How far damages are projected into the future, and at what discount rate, have significant influence on the current (PV) value assigned to climate damages. The dramatic differences caused by varying discount rates can completely change the resulting SCC. A quick illustration:

- $1,000,000 of climate change damages in 50 years from now has a present value of $372,000 at a 2% discount rate, but only a present value of $34,000 at a 7% discount rate.

In the case of pollution and long term damages to the earth, some have called for very low discount rates. More equitable intergenerational valuation has been proposed by many, calling for discount rates of zero or approaching zero. Furthermore, a case can be made that costs and benefits related to the earth's natural capital (e.g., natural resources, ecosystems, and climatic/disturbance process) and the pollution/degradation of that natural capital should be assessed with very low discount rates. Critical planetary infrastructure should be devalued less than traditional financial investments. Turns out, they are not substitutes.

Most researchers recommend utilizing the global SCC for BCA in order to account for the externalities of our domestic emissions (e.g., Pizer et al. 2014, Greenstone et al. 2013, and Johnson and Hope 2012). However, a recent pub from Gayer and Viscusi (2016) make a compelling case for inclusion of a domestic SCC for US regulatory analysis in addition to the global SCC.

[137] Bell, R. G., & Callan, D. (2011). More than meets the eye: the social cost of carbon in US climate policy. *Environmental Law*.

For federal regulatory policy, benefit/cost analysis (BCA) is required for Regulatory Impact Analyses (RIA) and is often performed at the regional land management planning level for various alternatives under NEPA analysis. The SCC has been included in a number of federal rulemakings, including some BLM planning documents. However, given the role of fossil fuel development in climate change, it is critical that all planning associated with oil and gas development weigh the social costs of GHGs explicitly in land management planning. Only by fully accounting for reduced societal welfare due to climate change, can the Mancos RMPA examine the most economically efficient development strategy. For example, the most economically efficient alternative may very well be the "no-leasing" alternative, once market failures associated with pollution are fully internalized.

We recommend that the FFO conduct a full benefit/cost analysis that includes the SCC projected into the future. We suggest that the SCC be examined at both a global and domestic level, and that discount rates for the BCA include two levels, one at 3%, and one at the lower recommended discount rate for benefits and costs of critical natural capital changes (1%). We recommend using the 2020 estimates recommended for federal agency use by the IWG.
At the regional planning level, such as the Mancos RMPA, we recommend a further accounting of environmental and social damages resulting from oil and gas development pollution (in addition to the BCA proposed above). From the public's perspective, the benefits of a No-Leasing alternative can be viewed as damage avoided from pollution associated with oil and gas development alternatives. Natural resource damage assessments (NRDA) are an additional framework that can highlight potential damages resulting from pollution. NRDAs are measures of liability, or damage estimates to be paid to replace, offset, or mitigate lost economic values. The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), or Superfund, provided for liability of polluters of hazardous waste. The first legislation to identify injuries to natural resources as compensable damages was the Clean Water Act.[138] After these provisions were enacted, the federal government, states, and others filed legal claims to recoup damages from environmental contaminators and utilized natural resource damage assessments to estimate the value of the damages. The most publicized NRDA was conducted to determine compensation from damages from the Exxon Valdez oil spill to the Prince William Sound ecosystem in Alaska. These compensatory damages included lost use and passive use values to local and Native peoples.

While the FFO may not be able to fully quantify all regional aspects of environmental and social damages resulting from pollution, they can begin to provide a monitoring baseline for key pollutants and degradation that can be developed into overall damage functions. Similar to the damage functions estimated in the IAMs to determine the social costs of carbon, the FFO needs to catalog and quantify key pollutants and degradation stemming from action alternatives. Key categories needing monitoring and presentation to the public include all pollutants stemming from both the development of oil and gas and the eventual combustion of products extracted

[138] Kopp, R. J., & Smith, V. K. (2013). Valuing natural assets: the economics of natural resource damage assessment. Routledge.

from BLM lands, water use, air quality measures, seismic activity, and wildlife habitat fragmentation (more detail in section below).

The proposed baseline monitoring of pollutants and degradation can be initially qualitatively connected to regional economic damage functions, and eventually may be quantitatively estimated as damage functions. As previously noted, climate change is leading to greater drought conditions, wildfire risk, and decreased agricultural productivity in the Southwest. Regional BLM planning efforts cannot ignore the linkage between their leasing of oil and gas extraction to the immediate and surrounding climate change damages and other environmental and social costs.

As compared to further development alternatives from the FFO, a No Lease alternative would yield tremendous benefits in terms of the avoided impacts and resulting avoided social costs. Without a proper economic accounting of these damages, the BLM is unable to assess the economic efficiency of their land management alternatives. For Pareto efficiency gains, it is essential that firms pay not only the costs of their marginal damages, but also the total cost arising from their impacts.[139] If the free market cannot induce these payments, it is up to the BLM to ensure that these environmental damages are covered when leasing out public lands for fossil fuel extraction.

EXAMPLE BCA PARAMETERS FOR THE MANCOS RMPA

For our recommended BCA for the Mancos RMPA, we have reviewed some parameters related to SCC/SCM that will be helpful in conducting the BCA. The following parameters clearly indicate that incorporation of SCC in a BCA of the Mancos RMPA would have a significant effect on determining overall economic efficiency for different alternatives.
Based on GHG equivalencies,[140] the eventual combustion of one barrel of crude oil will produce .43 metric tons of CO_2. For one thousand cubic feet (mcf) of produced natural gas, .055 metric tons of CO_2 will be emitted.
Using the recommended "central value" of $42/metric ton of CO_2 stemming from the latest technical supporting document for the IWG's social cost of carbon (discussed above), we illustrate the economic efficiency effect of properly accounting for the climate change damages resulting from further approval of developing the Mancos Shale/Gallup Formation.
A SCC of $42 in current dollars, roughly translates into $18 of SCC per barrel of crude oil approved in the new Mancos RMPA, or:

- .43 metric tons of CO_2/barrel X $42 SCC = $18 of SCC/barrel of crude

A BCA for the FFO should compare public costs to public benefits. The benefits to the public and the U.S. Treasury include returned royalties of 12.5% per produced barrel of crude and

[139] Cropper, M. L., & Oates, W. E. (1992). Environmental economics: a survey. *Journal of economic literature*, *30*(2), 675-740.
[140] Available at: https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator.

smaller amounts of bonus bids and rental rates.[141] Based on current prices of crude oil ($54/barrel),[142] the public royalty return on investment is:

- $54/barrel X .125 = $6.75 of royalty benefit to the public/barrel of crude

Under these price assumptions, the SCC of new oil production in the Mancos RMPA by itself is 267% greater than the royalty benefits. When including all the other social costs previously described, it is clear that the SCC + additional social costs far outweigh the benefits of further oil and gas expansion in the region.

For natural gas production it is even more dramatic. A SCC of $42 in current dollars, roughly translates into $2.30 per mcf of natural gas approved in the new Mancos RMPA, or:

- .055 metric tons of CO_2/mcf X $42 SCC = $2.30 of SCC/mcf of natural gas

The benefits of returned royalties at 12.5% of natural gas produced, at current gas prices around $3/mcf are:

- $3/mcf X .125 = $.38 of royalty benefit to the public/mcf of natural gas

Under current conditions, the SCC of new natural gas production considered in the Mancos RMPA by itself is 613%, or more than 6 times as great, as the natural gas royalty benefits. The parameters and simple illustrations reviewed above illustrate the importance of the BLM, and specifically the FFO, in accounting for the social costs of further oil and gas development on public lands. On the face of it, the social benefits of further oil and gas production in the Mancos Shale/Gallup Formation do not even come close to exceeding the social costs that will be incurred. Extrapolating these benefit/cost ratios to the potential production of some 1.5 billion barrels of crude oil and 2,000 new gas wells,[143] indicates that the social costs are billions of dollars greater in present value than the benefits of this production.

While there are range of SCC prices to be used, it should be noted that other industrialized nations, such as England, are using a SCC two times greater than the $42 used in this example.[144] Furthermore, the SCC only incorporates a portion of all social costs, and even only a portion of all climate change social costs. We further recommend an accounting of the social cost of methane, a GHG with 25 times the amount of warming power. In this region, a percentage of all natural gas developed is directly leaked into the atmosphere, estimated at 6% of gas production

[141] For example, royalties provided for more than 90% of federal onshore related oil and gas revenues in 2014. See, "Reported Revenues: Federal Onshore in All States for FY 2014 by Accounting Year." Office of Natural Resources Revenue.
[142] Current market prices for oil and gas are greater than the wellhead prices received and thus are an inflated measure of overall royalties returned to the public. We recommend the BLM utilize wellhead pricing and prices that reflect the true rate of royalty return.
[143] See the Reasonable Foreseeable Development (RFD) for Northern New Mexico final report, October 2014.
[144] *See* previous discussion of the Stern Review, etc.

in the San Juan Basin. This leakage, and the subsequent climate change damages, also needs to be included in the BCA.

Sensitivity analysis is recommend to model costs and benefits (and market prices) into the future. Additional estimates of fossil fuel combustion (and additional emitted metric tons of CO_2) that occur during extraction processes and during transportation of products should also be included.[145] Even the inclusion of a reduced domestic SCC would still indicate that the social costs are extremely high, and much greater than the zero price currently projected in the Mancos RMPA. Without proper accounting of social and environmental damages, the FFO planning process is skewed towards the promotion of oil and gas development.

IMPLEMENT FISCALLY RESPONSIBLE OIL AND NATURAL GAS DEVELOPMENT

The Trump Administration should be committed to implementing fiscally responsible oil and gas development on public land. Taxpayers expect economic efficiency and to receive fair market value for oil and gas resource developed on public land. Three significant issues related to fiscal responsibility include: 1) appraising fair market value and minimum bids for oil and gas lease sales based on quantities of oil and gas that is economically recoverable; 2) not offering leases for sale in places where the revenue and does not cover the costs to taxpayers or where natural gas waste is likely to occur; and 3) correctly estimating jobs and royalty revenue from proposed drilling based on economically recoverable resources. These issues should be addressed in the Mancos RMPA.

Implementing a fiscally responsible oil and natural gas development requires a quantitative understanding of the volume of oil and natural gas that can be extracted economically over a wide range of prices. Scientists use the concept of CO2 equivalent (CO2 –eq) to sum their climate change impacts. Estimates of economically recoverable resource can be converted CO2 equivalents (CO2 –eq) for use developing damage functions that provide an approximation of the social costs of carbon from extracting these resources. The revenues, benefits and jobs in local communities from planned oil and natural gas development in the planning area must also be based on quantities of oil and natural gas that are estimated to be economically recoverable based on a range of prices (Rose 2001, Morton and Kerkvliet 2014).[146]

Technically recoverable estimates of oil and gas are much larger than economically recoverable estimates because they ignore the economic and environmental costs from producing commercial quantities of oil and gas. Regardless of the technology chosen, technically recoverable oil and natural gas will not become an economically recoverable resource unless the market prices cover

[145] For example, GHG equivalencies for tanker trucks used to haul oil and gas are available.
[146] Rose, P. 2001. Risk Analysis and Management of Petroleum Exploration Ventures. AAPG Methods in Exploration Series, No 12. American Association of Petroleum Geologists. Morton, P. and J Kerkvliet, 2014. Redefining responsible oil and gas development. Presentation at University of Colorado, Center of the American West, FrackingSENSE Lecture Series, Boulder, CO. https://www.youtube.com/watch?v=KbSy_8KNjcY

the costs of extraction. The cost of extracting the oil or natural gas must be less than the market price in order to be economically recoverable (Morton et al. 2004).[147]

Economists may not agree on much but they do agree that you have to do the math. Continuing to rely on estimates of technically recoverable energy resources biases and distorts the RMP planning process in favor of oil and gas development -- because the economic costs of bringing the energy to market are not being considered. Relying on technically recoverable estimates will bias the RMP by exaggerating the local and regional jobs created and the royalty revenues estimated for oil and natural gas drilling proposals. We recommend that the BLM develop estimates of production from future leasing that may occur based on quantities of oil and gas that are economically recoverable.

A 2011 highly touted report from MIT included estimates of economically recoverable natural gas and indicates that at current wellhead prices less than half of our domestic technically recoverable natural gas is economically recoverable.[148] According to the MIT research, natural gas prices will have to increase dramatically – well past $30/MMBTU to recover all of the technically recoverable gas. Quite simply price matters. If current prices have to increase 8 to 10-fold in order to economically extract our nation's technically recoverable natural gas – taxpayers expect BLM planning to address this significant economic issue in planning documents.

We further recommend the BLM invest in a GIS mapping tools for estimating the volume of oil and gas that is economically recoverable projected to be produced in the future from additional leasing in the planning area. GIS methods using data from the USGS have been used to estimate undiscovered oil and gas by industry groups, government agencies, and environmental organizations (National Petroleum Council 1999, DOI-DOE-USGS 2003, 2006, 2008, Morton et al. 2002, LaTourrette, et al. 2002).[149]
Investing in a GIS based tool will help the BLM develop estimates of economically recoverable oil and natural gas -- which fully account for the market costs as well as the non-market

---

[147] Morton, P., C. Weller, J. Thomson, M. Haefele, and N. Culver. 2004. Drilling in the Rockies: How much and what cost? Special Energy Session of the 69th North American Wildlife and Natural Resources Conference, Spokane, WA. Wildlife Management Institute, Washington, DC.

[148] Massachusetts Institute of Technology, 2011. The Future of Natural Gas. An Interdisciplinary MIT Study.

[149] National Petroleum Council 1999. Natural Gas: Meeting the Challenges of the Nation's Growing Natural Gas Demand. U.S. Department of Interior and U.S. Department of Energy 2003, 2006, 2008. Scientific Inventory of Onshore Federal Lands' Oil and Gas Resources and Reserves and the Extent and Nature of Restrictions or Impediments to their Development. Phase 1, 2 and 3. Morton, P., C. Weller, and J. Thomson. 2002. Energy and Western Wildlands: A GIS analysis of Economically Recoverable Oil and Gas. The Wilderness Society, Washington, DC. LaTourrette, T., M. Bernstein, P. Holtberg, C. Pernin, B. Vollaard, M. Hanson, K. Anderson, and D. Knopman. 2002. Assessing Gas and Oil Resources in the Intermountain West: Review of Methods and Framework for a New Approach. RAND Science and Technology. Santa Monica, CA.

environmental costs (e.g. air and water pollution, loss of wildlife and bird habitat) from extracting and burning fossil fuels – for the basis of NEPA planning at the RMP level. LaTourrette, et al. 2002 in their economic analysis of oil and gas include GIS spatial data as proxies for non-market costs. Such an approach is worth building on.

Fiscally Responsible Leasing

The public expects to receive fair market value for oil and gas resources produced from public land. At the leasing level, implementing responsible oil and natural gas should take advantage of estimates of the volume of oil and natural gas that can be extracted economically to establish fair market value for taxpayers. Such information is critical for among other things, establishing the minimum bid for a lease sale. Estimating the economic value of oil and natural gas from a proposed lease area would make the BLM more consistent with how the U.S. Forest Service established fair market value and minimum bids for commercial timber sales. Taxpayers deserve no less.

The BLM continues to sell leasing rights for oil and gas based on per acre bids. In stark contrast, the USFS sells commercial timber based on an appraisal of the value of the millions of board feet being offered for sale – not the total acres within the sale boundary. We recommend the BLM follow the lead of the USFS and develop a more efficient appraisal process for estimating fair market value and setting minimum lease bids based on the estimated value of economically recoverable oil and gas covered by the lease.

We seriously question whether the current appraisal method of establishing minimum bids based on dollars per acre basis is fiscally responsible as it ignores the economic value of the good to be sold – which is the volume of oil and gas in the ground. Economics and fiscal prudence suggests that selling leasing rights based on estimates of the economically recoverable quantities of oil and gas underground is a more efficient appraisal method for setting minimum bids. We recommend the BLM begin appraising leases and establishing minimum bids based on estimates of the undiscovered economically recoverable oil and gas for a lease sale.

As part of this effort, we also recommend the BLM examine the benefits of a no-leasing alternative. A no new leasing alternative may lower BLM planning, leasing mitigation and enforcement cost in the short run as well as reclamation and monitoring costs in the long. A no new leasing alternative may be a more economically efficient alternative -- especially when non-market costs and budget constraints are considered (discussed below).

Eliminate Below Cost Lease Sales

Below cost timber sales – timber sales where the revenue was less than the cost to taxpayers -- were a huge issue for the Forest Service in the 1990s. The same fiscal arguments apply to the BLM setting minimum bids for oil and gas leasing sales below the cost to taxpayers of offering the lease for sale. When the BLM leases land for just $2 per acre – we question whether the revenue generated from that lease sale covers the BLM administrative costs of setting up the lease sale. Does $2 per acre even cover the social cost of carbon associated with the oil and gas covered by the lease? We doubt that $2 per acres covers the market and non-market costs

associated with extracting and burning the oil and gas covered by the lease. A no more leasing alternative will by design directly eliminate future below cost lease sales and help mitigate climate change damages.

We question the fiscal responsibility of the BLM continuing to offer "below cost lease sales". Relevant questions that we recommend the BLM address is to estimate the administrative and oversight costs associated with offering oil and gas leases for sale. For the planning area, how much does BLM spend when it offers oil and gas leases for sale? Does the revenue from each oil and gas lease sale cover the cost to taxpayers of setting up and administering each lease sale? To the extent does below cost leasing occurs in the planning area, it represents an implicit subsidy that costs taxpayers and undercuts investors in oil and gas on private land. The BLM by offering "below cost leasing" – is distorting the energy markets and not providing taxpayers with a fair return on their resources.

We recommend that the BLM examine the potential for below cost leasing in the planning area by developing a predictive model for estimating where leases with low bids tend to occur. Do lease parcels that the receive $2 per acre bids tend to occur in wild areas far from roads? A well-designed regression model is one approach for examining where and how often below cost leasing occurs. The regression model would be analogous to the "transaction evidence approach" developed by the U.S. Forest Service for appraising the fair market value of timber. In addition to a goal of identifying and eliminating below cost leases, the predictive model could also be used to establish the fair market value of the oil and gas to be leased and for setting minimum bids of those leases.

We also recommend that the BLM eliminate lease sales where the public costs are greater than the public benefits. Again, one possibility is to develop a predictive model that includes spatial consideration of non-markets benefits and costs similar to the one developed by LaTourrette, et al. 2002.[150] The model could be linked to a benefit cost analysis which fully accounts for the social cost of carbon and methane as well as other non-market costs and benefits is needed to address this issue. As discussed above, estimates of economically recoverable oil and gas for a proposed leases sale can be converted to CO2 equivalents (CO2 –eq) for use in provide an approximation of the social costs of offering the proposed lease for sale. Leases should not be sold at a price less than the social costs of carbon associated with the oil and gas estimated to be under the lease.

ACCOUNT FOR COMMUNITY CONCERNS AND POTENTIAL FOR DISRUPTION

Since 2001, when the domestic drilling boom began, more than 400,000 oil and gas wells have been drilled on U.S. public and private land. In retrospect, the current drilling boom, like past drilling booms, was not done in a thoughtful way and caused more damage to communities and the environment than necessary. As has happened in earlier busts, rural towns that overbuilt

[150] LaTourrette, T., M. Bernstein, P. Holtberg, C. Pernin, B. Vollaard, M. Hanson, K. Anderson, and D. Knopman. 2002. Assessing Gas and Oil Resources in the Intermountain West: Review of Methods and Framework for a New Approach. RAND Science and Technology. Santa Monica, CA.

their infrastructure during the boom are now in fiscal trouble. Williston, North Dakota for example, took on $215 million in debt to build infrastructure, including a sewer plant and recreation center for the growing population (Healy 2016).[151] As quoted in Healy (2016), Nancy Hodur a research assistant professor at North Dakota State University stated the following - "Those communities out there were drinking out of a fire hose…A lot of those communities would come right out and say that pace of growth isn't good, isn't sustainable."

Quantifying and understanding the direct, indirect and cumulative effects from the recent drilling boom is key information for successfully implementing responsible oil and gas program in the future. We recommend the BLM quantitatively review economic and environmental data for local communities associated with the recent drilling boom and bust. We recommend the BLM use the planning process to look back and gain an understanding of lessons learned by communities from the extended domestic oil and gas drilling boom.

Economic Development is Different than Economic Impacts

Short term job creation from an oil and gas drilling boom must be balanced with the longer-term perspective represented in economic development plans. Economic development is concerned with an improved standard of living and a diverse economy that can weather downturns in any particular industrial sector. Economic development is concerned with the long-term health of communities and regions. A healthy community includes a diverse economy, public facilities and services, a higher and equitable standard of living, and a clean environment. In contrast, the economic impact is a short-term measure of the jobs created from plans for developing oil and gas resources.

Economic development and healthy communities involve other economic criteria that are not included when estimating economic impact in terms of job creation. Unfortunately, decision-makers and the general public remain unaware of the limitations of economic impact studies and as a result the results are often misunderstood and misused by decision-makers.
The IMPLAN model is a commonly tool used by economists to estimate the jobs associated with oil and gas development as part of an economic impact analysis. The IMPLAN model is typically used to estimate the direct, indirect and induced jobs generated from marginal changes in investments and public policies. Direct jobs are created by direct hiring to perform the activity (i.e. drilling); indirect are jobs created by spending to support the work of direct jobs (e.g. pipe used by drillers to drill wells); and induced are jobs created when direct and indirect job holders spend their wages. So, jobs in the drilling pipe industry are indirect jobs, while bar and restaurant workers are induced jobs.

When reviewing the results of economic impact analysis, it is important to examine the short terms job creation from oil and gas drilling within the context of longer term community plans for sustainable economic development.

[151] J. Healy, 2016. Built Up by Oil Boom, North Dakota Now Has an Emptier Feeling http://www.nytimes.com/2016/02/08/us/built-up-by-oil-boom-north-dakota-now-has-an-emptier-feeling.html?_r=0

Short Term Economic Disruption

In the short term, drilling booms produce the "crowding out effect". Crowding out" can negatively affect agriculture, recreation and tourism, and hunting and fishing business. Higher housing costs, labor competition, air and water pollution can make the resource dependent regions less attractive to other industries than alternative locations. The potential for crowding out and economic displacement has implications for the choices faced by community leaders in distinguishing between short term economic impacts and longer term plans for sustainable development. If the pace and scale of development exceeds the assimilative socio-economic capacity of a county or community, businesses and residents can suffer economically. As pace and scale increase, there will be tradeoffs and non-compatibility issues which can lead to slower net job growth due to economic displacement.

In addition to job creation, the fiscal health of communities is also an issue with oil and gas development. As the scale of the drilling boom for oil and natural gas increases communities experienced an increase in traffic and crime that overwhelmed the assimilative capacity (e.g. roads, wastewater treatment facilities, enforcement staff) and budgets of communities and counties for handling these problems.

Local governments – counties and communities – are subjected to a wide range of demands for new services, staff, equipment, and expertise that impacts budgets. The additional the fiscal costs to local taxpayers from oil and natural gas development include land use planning, hiring additional expertise (i.e. legal counsel, oil and natural gas coordinator, community outreach, inspectors) purchasing monitoring equipment (i.e. infrared camera for emission detection), administration, oversight and inspection, the equipment for and training of emergency services so they are prepared for the kind of fire, accident, or spill incidents associated with drilling operations can produce. Public Health departments must be prepared to receive and respond to incident reports and citizen concerns about environmental health issues

Boxall et al (2005) also found that property values are negatively correlated with the number of gas wells.[152] The study's mean estimates indicate that when residential properties are within 4 km (about 2.5 miles) of oil and gas facilities, property values decline 4-8 percent. The impact can easily be twice that depending upon the level and composition of the nearby industry activities. Any decline in property values may result in a long term drop in tax revenue.

Long Term Economic Disruption

IMPLAN is a tool for estimating jobs in the short run but does not consider fiscal costs from these jobs nor the crowding out effect or business displacement or community disruption. The IMPLAN model also does not consider the long term economic costs associated boom and bust cycles and the resource curse.

[152] Boxall, P.C., W.H. Chan, M.L. McMillan. 2005.The impact of oil and natural gas facilities on rural residential property values: a spatial hedonic analysis. Resource and Energy Economics. 27: 248-269.

Natural resource extraction, including energy development – oil and gas drilling and mining – when properly managed can provide economic opportunities for resource producing regions. But an established and growing body of research indicates that countries, states and communities that are dependent on natural resource extraction suffer socio-economically.

Boom and bust cycles are a longstanding historic challenge for communities impacted by oil and natural gas drilling and production. While energy development can benefit communities, historically drilling booms bring an influx of non-local workers, a rise in crime and emergency service calls, increased demand for public services, more wear and tear on local infrastructure, and upward pressure on local wages and housing costs. Local governments need to provide basic services for a rapidly growing population, along with increased per capita service demand, resulting in fiscal burdens for taxpayers.

Economic theory suggests that an abundance of natural resources should promote economic growth by providing economies with ‘‘natural capital.’’ However, many academic studies have found that economies relying heavily on natural resource extraction are poor performers in terms of growing income, decreasing poverty, and improving lives. This poor performance has become known as the "resource curse". Avoiding the resource curse is a worthy goal for responsible oil and natural gas development.

Recent studies comparing U.S. states and counties find convincing evidence of a resource curse. Papyrakis and Gerlagh (2007) found that all twelve states with more than 5% of state earnings derived from the resource sector experienced negative economic growth during the 1980–1995 period.[153] James and Aadland (2011) found that a typical resource rich county whose economy was 20 percent dependent on resource extraction experienced slower per capital income growth compared to a county with 5 percent dependency.[154] James and Audland (2011) conclude "Although the resource curse appears to be waning over the sample period 1980–2005, it is always negative and statistically significant. The coefficient estimates imply sizable differences in standards of living if one extrapolates the annual growth differences to future generations." The strong evidence of boom and bust cycles and the resources curse shows that energy development is not a panacea. Instead it is a risky business that must be done wisely. If done irresponsibly, energy development threatens the economic health of local communities.

IMPLEMENT PHASED ENERGY DEVELOPMENT TO REDUCE COMMUNITY DISRUPTION

Phased energy development – which involves regulating the pace and scale of leasing and development – provides a cost-effective approach for managing fiscal and environmental risk

[153] Papyrakis, E. and R. Gerlagh. 2007. Resource abundance and economic growth in the United States. European Economic Review. 51: 1011-1039.

[154] James, A. and D. Aadland. 2011. The curse of natural resources: an empirical investigation of U.S. counties. Resources and Energy Economics. 33: 440-453.

(Haefele and Morton 2009).[155] Pace and scale are regulated because they are key variables for reducing and internalizing the externalized damages; managing risk; mitigating boom and bust cycles; and avoiding the resource curse.

A reduced pace will moderate the deluge of energy wealth and the hyperactivity that disrupts normal patterns of business and government. Regulating the pace of drilling is a fiscally and economically sound approach to oil and natural gas development. Slowing the pace and spreading drilling over years or even decades means there will be producing wells in the area for a longer time period, while reducing the dramatic spike in drilling peak in the earlier years. Many of the problems associated with the recent drilling boom in the Rockies are either caused by or exacerbated by the large scale and rapid pace of development (Haefele and Morton 2009). Slowing the pace and scale or oil and natural gas development can help reduce these problems by staying within the assimilative capacity of a community.

A reduced pace will promote carefully considered regulations that allow energy extraction to proceed with less environmental damage. In this regard, a no new leasing alternative can help slow the pace and scale of disruption and displacement in the short run and promote more sustainable economic development and healthier communities in the long run.

ESTIMATE NET FISCAL IMPACTS

Conventional wisdom assumes the net fiscal impacts are positive because of the millions in tax revenue reported. But the revenue reports based on royalties represent only gross revenues. Businesses survive or go broke based on the net revenues from the sale of goods and services. Estimated of gross revenue do not measure profit or the success of a business because they exclude the costs of doing business. Unfortunately, government estimates of oil and natural gas revenue leave out the fiscal and environmental costs of doing business – and therefore only report gross revenues.

Generating oil and natural gas revenues is not a cost-free endeavor – especially for impacted communities. Unfortunately, economic impact analysis does not consider the cumulative fiscal costs associated with oil and gas development. What has been missing from the economic conversation and fiscal calculus are the cumulative costs to taxpayers associated with collecting the gross revenue (i.e. proper oversight, frequent inspections, increased road maintenance costs, declining property value change, etc.). We recommend a new fiscal focus on estimating the net revenues that accrue from oil and natural gas development.

NONMARKET VALUE CONSIDERATIONS

The BLM must evaluate its oil and gas program within the context of the agency's larger legislative mission as steward of America's public land. One of the most important purposes of

[155] Haefele, M. and P. Morton. 2010. The Influence of the Pace and Scale of Energy Development on Communities: Lessons from the Natural Gas Drilling Boom in the Rocky Mountains, Western Economics Forum Vol. VIII, No. 2.

public lands, including BLM lands, is the provision of non-market public goods such as opportunities for solitude, outdoor recreation, clean air, clean water, biodiversity, and the preservation of wilderness and other undeveloped areas that would be underprovided if left entirely to market forces (Loomis 1993).[156] It is incumbent upon the BLM, as the administering body for oil and gas leasing of public lands, to provide for greater accounting of non-market social and environmental costs as well as greater transparency of the processes used to make these calculations.

The Federal Land Policy and Management Act (FLPMA) specifically incorporates such non-market resources as "the long-term needs of future generations" for recreation and "natural scenic, scientific and historical values" into the BLM's multiple use mandate.[157] FLPMA further defines multiple use to require the agency to encompass non-market values into management, directing the BLM to achieve:

> **harmonious** and coordinated management of the various resources without permanent impairment of the productivity of the land and the **quality of the environment** with consideration being given to the relative values of the resources and **not necessarily to the combination of uses that will give the greatest economic return** or the greatest unit output.[158] (emphasis added).

The Trump Administration should be committed to an oil and gas program grounded in stewardship of public land and one that holds oil and gas companies to the highest standard of fiscal and environmental responsibility. To accomplish this goal, the BLM should consider fully and carefully balancing the benefits of oil and gas production with the environmental costs of oil and gas exploration, production, and remediation. While increasing returns to the Treasury and increasing efficiency of oil and gas management are laudable goals, we also know that extracting and burning oil and natural gas has significant social and environmental costs.

Strategically in 2013, the BLM issued guidance for considering nonmarket environmental costs when preparing NEPA analyses for BLM resource management planning and other decision-making. From the document (BLM 2013):

> All BLM managers and staff are directed to utilize estimates of nonmarket environmental values in NEPA analysis supporting planning and other decision-making where relevant and feasible, in accordance with the attached guidance…The use of quantitative valuation methods should contribute to the analysis of one or more issues to be addressed in the environmental analysis supporting planning or other decision-making. A quantitative analysis of

[156] Loomis, J. B. 1993. Integrated Public Lands Management: Principles and Applications to National Forests, Parks, Wildlife Refuges, and BLM Lands. First Edition. Columbia University Press: New York, NY.
[157] 43 U.S.C. § 1702(c).
[158] Id.

> nonmarket values in EIS-level NEPA analyses is strongly encouraged where one or more of the criteria described in the attached guidance apply.[159]

As discussed above, we recommend that the BLM use this guidance to internalize the negative externalities by developing multiple damage functions associated with the social cost of carbon and other non-market costs associated with oil and gas production from public land. The table below provides a comprehensive framework that combines distributional impacts (i.e. jobs) with a total economic valuation of the local and regional damages associated with oil and natural gas extraction.[160] Estimating the local and regional damage functions included in this framework would provide valuable local information to inform and supplement the macro-level damage functions currently used in integrated climate assessment models.

Comprehensive Economic Framework: Jobs and Total Economic Damages from Oil and Natural Gas Development that Spillover into our Communities and Environment		
Cost Category	**Description of Cost**	**Methods for Estimating Cost**
Direct Use Costs	Displacement or loss of land for habitat, recreation opportunities, hunting, farmland, grazing, reclamation costs, water quantity and drought.	Travel cost method, contingent valuation surveys.
Community Concerns	NOx, VOCs, ozone and kids' health, noise pollution, truck traffic and infrastructure costs, property values, loss of local control, displaced jobs and revenues due to "crowding out", natural amenities and quality of life issues, loss of retirement income, displaced farming due to competition for water, boom-bust cycles, revenue lag and fiscal risks, water treatment plants and recycled fracking water, draining of reservoirs for fracking water and the loss of fishing and recreation revenue.	Surveys of residents and businesses. Averting expenditure methods for estimating the costs of mitigating health and noise impacts. Change in recreation visitation, expenditures and business income. Documented migration patterns.
Science Benefits Foregone	Loss of natural areas for scientific study as an experimental control for adaptive ecosystem management.	Change in management costs, loss of information from natural studies foregone.

[159] U.S. Department of the Interior, Bureau of Land Management, 2013. Guidance on Estimating Nonmarket Environmental Values. Instruction Memorandum No. 2013-131, Change 1. http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/2013/IM_2013-131__Ch1.print.html

[160] Morton, P., C. Weller, J. Thomson, M. Haefele, and N. Culver. 2004. Drilling in the Rockies: How much and what cost? Special Energy Session of the 69th North American Wildlife and Natural Resources Conference, Spokane, WA. Wildlife Management Institute, Washington, DC. 33 pages.

Comprehensive Economic Framework: Jobs and Total Economic Damages from Oil and Natural Gas Development that Spillover into our Communities and Environment		
Cost Category	**Description of Cost**	**Methods for Estimating Cost**
Off-site Damages	Fugitive methane emissions, water pollution from spills, noise pollution from compressor stations, visual impacts, erosion from well pads and roads, pipeline explosion risks, road dust on petroglyphs and snowpack, seismic activity from injection wells, decline in property values.	Contingent valuation surveys, hedonic pricing analysis of property values, preventative expenditures, well replacement costs, restoration and environmental mitigation costs.
Biodiversity Impacts	Loss and fragmentation of wildlife habitat by roads and well pads, pipelines are conduits for invasive weeds, endocrine disrupter's impact amphibians and fish, produced water holding ponds and bird deaths, noise impacts on wildlife species.	Replacement costs, restoration and environmental mitigation costs.
Ecosystem Services Lost or Compromised	Water lost from fracking, impacts to aquifer re-charge and wetland function, carbon lost via land use change, fossil fuels and climate change, decline in net primary productivity.	Change in productivity, replacement costs, increased water treatment costs for cities, preventative expenditures.
Passive Use Benefits Foregone	Loss of option, bequest and existence benefits generated by open spaces, parks, and wildlands.	Contingent valuation surveys, opportunity costs of not utilizing future information about the health, safety, and environmental impacts of oil and natural gas drilling.

Source: Adapted from Morton, P., et al. (2004). Drilling in the Rockies: How Much and at What Cost? Proceedings of a Special Energy Session of the 69th North American Wildlife and Natural Resources Conference, Spokane, WA. Wildlife Management Institute

ESTIMATE LOCAL AND REGIONAL DAMAGE FUNCTIONS

Integrated assessment models estimate global climate change damage functions based on increasing CO2 emissions. A goal of integrated assessment models (IAMs) is to estimate the economic efficiency of climate change policies in the context of a cost-benefit analysis. IAMs use mathematical relationships between economic activity and GHG emissions. Climate damage functions subsequently estimate the relationship between CO2 emissions and the global damage caused, in order to approximate how future damages might be reduced if CO2 emissions were also reduced.

In addition to global damage functions, local and regional damage functions should be developed to account for the damages that occur in oil and gas producing regions. We recommend the BLM identify relevant variables and methods appropriate for developing damage functions for

use in regional BLM planning of oil and gas fuel development. Local and regional damage functions can be developed per unit of production (per barrel of oil and per mcf of gas) and for oil and gas development itself. Damage functions can also be estimated on per well basis, for each compressor station, waste pit and storage tank – and linked to an economic model for use in the benefit-cost analysis.

An example of a regional damage function from oil and gas development is the potential damage from earthquakes associated with the underground injection and disposal of waste water from oil and gas development. IAMs include monetary damages functions for floods and droughts – but not for earthquakes. Damage functions for increase regional seismic activity from underground injection could be developed using methods similar to those used in the IAMs. We recommend the BLM develop a predictive model on the relationship between underground injections and increased seismic activity. The results could be linked to an economic model that estimates appropriate damage functions around earthquakes and disposal of waste from oil and gas development based, for example, on the increased costs recorded by the insurance industry. Air pollution damage functions can be used, for example, to examine the health impacts to regional citizens from oil and gas development. IAMs include human health damage functions at the global level, but human health damage functions at the local and regional level are needed. Ozone pollution from oil and gas development exacerbates a range of health problems for local residents including respiratory illnesses and asthma. There are many health studies that can be referenced and used to develop local and regional human health damage functions that will supplement and inform global human health damage functions currently used in IAMs.

We recommend the RMP alternatives include implementation of the BLM's methane capture rule. As part of this analysis the BLM should include the many human health co-benefits generated by implementing the agency's methane capture rule. These human health co-benefits occur because the methane capture requirements also reduce air pollution from volatile organic chemicals (VOC), fine particulate matter (PM) and other hazardous air pollutants (HAP). We recommend that the BLM include these human health co-benefits in the BCA completed for the planning area.

CAPTURING METHANE POLLUTION INCREASES ECONOMIC EFFICIENCY

The BLM's own research on its methane capture rule indicates that implementing climate mitigation measure like capturing methane emissions improves economic efficiency. Morton and Hjerpe (2016)[161] conducted a case study of two counties in the San Juan Basin of northwest New Mexico to better understand regional impacts of the BLM's proposed methane capture rule and focus on natural gas wells as it is the dominant fossil fuel produced in the region. The analysis included: 1) a Net Present Valuation of the costs of complying with proposed LDAR requirements and the new revenues from the methane captured; and 2) estimated change in overall gas production and associated royalty payments to the state. The study examined 13,493

[161] Morton, P. and E. Hjerpe 2016., A Review of the Economic Factors Surrounding the Capture of Methane from Oil and Natural Gas Development on Federal Public Land, Conservation Economics Institute.

active federal gas wells in these two counties and determined that 8,718 (65%) of these wells produced less than 90Mcf per day.

The results indicate that the majority of marginal gas wells will not only reduce methane emissions and natural gas waste, but by capturing the methane for sale, production, revenues, royalties and profits will also increase as a result of the proposed rule. These findings are consistent with the economic literature and with the BLM's findings in the Regulatory Impact Analysis.[162] We therefore recommend the BLM include a plan alternatives that includes implementation of methane emissions mitigation measures in the planning area.

BUDGET CONSTRAINTS MUST BE CONSIDERED IN THE RMPA

The level of damages (non-market costs) associated with each plan alternative are directly influenced by budgets available to fully implement the alternative. If funding is less than planned, and the promised environmental protection measures are not implemented due to budget shortages, the non-market damages and costs will increase. If on the other hand, budgets are flush and environmental protection measures are implemented as planned, the non-market costs will in general be less. The negative externalities (i.e. damages) generated from each plan alternative must be estimated with due consideration of the effect budget constraints – for example, annual funding levels and bonding amounts available for reclamation, inspection mitigation and well closure – have on damage functions.

We recommend that the BLM take steps to reduce methane emissions from oil and gas operations by examining budgets to make sure climate change mitigation measures are enforceable. Without adequate funding, climate mitigation measures included in the RMP are not enforceable and are more likely to fail.

A fiscally and environmentally responsible oil and gas program requires sufficient funding for implementing management plans. Based on numerous investigations we know that the BLM does not have the information, staffing or budget to actually implement responsible oil and gas development (GAO 2010, 2011, 2013a,2013b, and 2014).[163] In addition, efforts to mitigate the

---

[162] U.S. Bureau of Land Management, Regulatory Impact Analysis for Revisions to 43 CFR 3100 (Onshore Oil and Gas Leasing) and 43 CFR 3600 (Onshore Oil and Gas Operations), Additions of 43 CFR 3178 (Royalty-Free Use of Lease Production) and 43 CFR 3179 (Waste Prevention and Resource Conservation) at 39 , (November 10, 2016).

[163] U.S. Government Accountability Office. 2005. Oil and Gas Development: Increased Permitting Has Lessened BLM's Ability to Meet Its Environmental Protection Responsibilities. Report to the Ranking Minority Member, Committee on Homeland Security and Governmental Affairs, U.S. Senate. U.S. Government Accountability Office. 2010. Oil and Gas Bonds: Bonding Requirements and BLM Expenditures to Reclaim Orphaned Wells. GAO-10-245. U.S. Government Accountability Office. 2011. Oil and Gas Bonds: BLM Needs a Comprehensive Strategy to Better Manage Potential Oil and Gas Well Liability. GAO-11-292. U.S. Government Accountability Office. 2013a. Oil and Gas Development: BLM Needs Better Data to Track Permit Processing Times and Prioritize Inspections. GAO-13-572. U.S.

damages from climate change require adequate funding to insure the measures are enforceable. The BLM can include very effective climate change mitigation strategies in the RMP, but if the costs of climate mitigation is not considered in the context of agency budgets, and funding for climate mitigation turns out to be lacking, the mitigation measures will not be enforceable. Unfortunately, history has shown that funding levels clearly affect the timing and implementation of management actions and proposals, often resulting in protective measures such as mitigation and reclamation not being implemented. Because these budgetary shortfalls result in the damage or destruction of sensitive resources, it is imperative to recognize that funding levels *do* affect the findings and decisions made in an RMP.

A decision to lease more land for drilling involves a budget commitment for planning, inspection and mitigation. In contrast, no new leasing may lower BLM planning, leasing mitigation and enforcement cost in the short run as well as reclamation and monitoring costs in the long run. The decision to lease public land is also a commitment to increase surface disturbance and fragment wildlife habitat. Increasing surface disturbance directly increases the risk of damage to cultural resources and wildlife. In contrast a no new leasing alternative will result in less surface disturbing activities and fragmentation of wildlife habitat. As such, the costs of implementing each alternative will vary as the pace and scale of proposed leasing and drilling increases. When the BLM provides a range of alternative in a RMP, the public needs to understand the cost of implementing each alternative will also range. In other words, a range of implementation costs is associated with the range of alternatives. For example, a no new leasing alternative may cost less and be a more efficient alternative when budget constraints are considered.

It is imperative for taxpayers to understand whether the expected budget will be sufficient to cost of implementing each alternative. The total costs of implementation and mitigation must then be compared to the expected budgets to assess the probability of mitigation measures being fully implemented. Management risks can be fully evaluated based on a range of budget expectations, which should be clearly stated and consistent across alternatives.

We recommend the BLM complete a cost-budget analysis to show the feasibility of implementing each alternative. Taxpayers are entitled to know if decision makers are selecting a more damaging and more costly alternative, when a less damaging, less costly alternative is available. For example, what effect might the current federal hiring freeze have on implementation of the plan? And longer term, what are the consequence of a reduction in the federal workforce on the BLM's ability to comply with the law and implement fiscally and environmentally responsible oil and gas development? These are significant questions that must be addressed in the plan.

Historical evidence indicates significant budget shortfalls have prevented the BLM from fully implementing and keeping the promises and environmental commitments made in past

---

Government Accountability Office. 2013b. Oil And Gas Resources: Actions Needed for Interior to Better Ensure a Fair Return. GAO-14-50: U.S. Government Accountability Office. 2014. Oil and Gas: Interior Has Begun to Address Hiring and Retention Challenges but Needs to Do More. GAO-14-205.

management plans. We recommend the BLM fully examine the uncertainty in budgets and the subsequent risks and damages from budget shortfalls. An analysis of costs and budgets is needed to help reduce budget uncertainty associated with each alternative.

There is federal precedence for completing a cost-budget analysis, as the U.S. Forest Service completed one in 2002 for the White River National forest plan in Colorado.[164] The Forest Service used two budget levels in the cost budget analysis used to develop the White River National Forest (WRNF) plan.

> Two budget levels were analyzed for each management alternative. The first is based on the Forest's "experienced budget" level, which represents the average annual budget between 1997 and 2000. The second is the "full budget" level, which represents the funding of all programs at a level one and one-half times as much as the experienced budget level. The purpose of the two budget levels was to describe to the public and the decision maker how production levels and effects change under varying budgets. (Page A3-236).

While an open checkbook would be a nice, public land management plans need to be grounded in fiscal reality. Consider the following statements from the USDA Forest Service in the 2002 FEIS for the WRNF plan:

> ...the purpose of this budget analysis is to show that outputs and achievements are restricted by the amount of funding allocated to the White River National Forest…It is not realistic, however, to have an unconstrained budget level…output levels based on unconstrained budget level would not ever be realized. (Page A1 -35).
>
> ****
>
> Achievement of any strategy or objective is partially based on the staffing and budget resources available…achievement levels in the draft and final documents were estimated using realistic budget estimates. Using budget constraints in achievement estimates help predict a realistic outcome. (Page A1 -31)

We recommend that the BLM present the public with a realistic plan by completing a cost-budget analysis for each alternative. If the U.S. Forest Service can develop a fiscally responsible forest plan in 2002 – a plan the correctly considers implementation costs and budgets – we believe the BLM is also capable of producing a fiscally responsible RMP in 2017. The Forest Service has long used linear programming models for planning, perhaps it's time for the BLM to try such an approach. We recommend the BLM explore the potential to develop a linear programming planning model with an objective function of maximizing net public benefits subject to agency budget constraints. Developing such a planning model would help the BLM

[164] USDA Forest Service, 2002. Final Environmental Impact Statement, Volume 1, White River National Forest, Colorado.

develop fiscally responsible RMPs for oil and gas development that can be implemented with expected budgets.

Since budgets should vary with the pace and scale of development, we recommend budget comparisons based on various levels of the pace and scale of development. If more leasing and drilling is allowed the oversight budgets must correspondingly increase. We recommend developing fully funded budgets at three levels: 1) budgets necessary for implementing responsible oil and gas development for the existing wells and associated road and pipeline infrastructure within the planning area; 2) additional budgets required from responsibly implementing new oil and gas development on public land already under lease but not currently developed; and 3) the additional budgetary commitments associated with continuing to offer additional more acres of public land in the planning area for lease.

Background

In a 1992 report to Congress, the U.S Office of Technology Assessment reviewed federal land management budgets and found that the funding received by public land management agencies had been significantly less than the budgets required to fully implement plans.[165] The lower-than-planned budgets prevented public agencies from producing many of the outputs and resource protections that were promised in land management plans.

The BLM's budget challenge persists today as current funding is insufficient for accomplishing the agency's twin goals of environmentally and fiscally responsible oil and gas development. The environmental risks from oil and gas development increase when mitigation and monitoring measures are not adequately funded (Morton et al. 2004).[166]

The impacts from budget shortfalls with respect to implementing responsible oil and gas development were documented in a June 2005 report issued by the General Accounting Office (GAO).[167] The GAO found that the increased volume of permits has resulted in more BLM staff resources devoted to issuing permits with less attention being paid to monitoring and enforcing compliance with environmental standards that apply to the activities conducted under the permits.

---

[165] U.S. Congress, Office of Technology Assessment (1992). Forest Service Planning: Accommodating uses, producing outputs, and sustaining ecosystems. OTA-F-505, Washington, DC

[166] Morton, P., C. Weller, J. Thomson, M. Haefele, and N. Culver. 2004. Drilling in the Rockies: How much and what cost? Special Energy Session of the 69th North American Wildlife and Natural Resources Conference, Spokane, WA. Wildlife Management Institute, Washington, DC.

[167] U.S. Government Accountability Office. 2005. Oil and Gas Development: Increased Permitting Has Lessened BLM's Ability to Meet Its Environmental Protection Responsibilities. Report to the Ranking Minority Member, Committee on Homeland Security and Governmental Affairs, U.S. Senate.

More evidence of unfunded mandates and broken promises comes from a May 2006 BLM document from the Pinedale Field Office in Wyoming titled "Commitments made in Decision Documents not yet achieved" (Bureau of Land Management, Pinedale Field Office. 2006). The authors found that 580 requirements and commitments had been cumulatively made in recent decision documents – many of which had not been achieved. One of the more prominent commitments BLM made repeatedly in several decision documents was to track NOx emissions from oil and gas development in southwest Wyoming. The authors of the 2006 document concluded that NOx monitoring had not been completed since 2000. The report details dozens of examples where funding was not allocated to successfully implement the plan and achieve the cumulative commitments made by the BLM in decision documents.

We recommend that the BLM fully examine past Mancos planning documents and examine the past commitments promised that were never achieved. Such information is critical for understanding the ability of the BLM to fulfill promises made in future management plans. Such information is needed as the BLM continues to be challenged to find the resources, staffing or budget to implement responsible oil and gas development. A 2013 GAO report stated the following:[168]

> In fiscal year 2012, companies received over $66 billion from the sale of oil and gas produced from federal lands and waters, and they paid $10 billion to the federal government for developing these resources according to the Department of the Interior. The federal government seeks a fair return on its share of revenue from leasing and production activities on federal lands and waters through the federal oil and gas fiscal system….In May 2007, GAO found, based on several studies, that the government received one of the lowest percentages of value of oil and gas produced in the world. In September 2008, GAO found that Interior had not evaluated the federal oil and gas fiscal system for over 25 years and recommended that a periodic assessment was needed.

These challenges were confirmed in a 2014 GAO report which stated:[169]

> Interior employs a wide range of highly-trained specialists and scientists with key skills to oversee oil and gas operations on leased federal lands and waters. GAO and others have reported that Interior has faced challenges hiring and retaining sufficient staff to carry out these responsibilities. In February 2011, GAO added Interior's management of federal oil and gas resources to its list of programs at high risk of fraud, waste, abuse, and mismanagement in part because of Interior's long-standing and continued human capital challenges.

---

[168] U.S. Government Accountability Office. 2013. Oil and Gas Resources: Actions Needed for Interior to Better Ensure a Fair Return. GAO-14-50: U.S. Government Accountability Office. 2014.

[169] U.S. Government Accountability Office. 2014. Oil and Gas: Interior Has Begun to Address Hiring and Retention Challenges but Needs to Do More. GAO-14-205

A 2015 GAO report titled Oil and Gas Resources: Interior's Production Verification Efforts and Royalty Data Have Improved, but Further Actions Needed stated the following:[170]

> The Department of the Interior has made considerable progress in improving both the verification of oil and gas produced from federal leases and the reasonableness and completeness of royalty data. Since fiscal year 2009, Interior has implemented 28 of 36 GAO recommendations made in these areas; however, key challenges remain, including the following:
>
> Interior has not updated its regulations for onshore oil and gas measurement in over 25 years and, as a result, they do not reflect newer measurement technologies and standards adopted by industry, hampering Interior's ability to have reasonable assurance that oil and gas are being measured accurately.

All of which begs the question of how much money BLM needs for its oil and gas program to have fiscally and environmentally sound management? In order to address this question, we recommend the BLM estimate the fully funded budgets necessary for successfully implementing responsible oil and gas development and comparing them with historic budgets. Comparing fully funded budgets with historic budgets provides an estimate of the additional revenue that must be captured in order to implement a fiscally and environmentally responsible oil and gas program.

Legal Mandate

The BLM must consider the impact of budget constraints on its ability to fulfill the promises made in a RMP with respect to protecting ecological and multiple use values. According to a Council of Environmental Quality memorandum on NEPA requirements [cited in NEPA Compliance Manual, 2nd Edition (1994)]:[171]

> [T]o ensure that environmental effects of a proposed action are fairly assessed, the probability of the mitigation measure being implemented must also be discussed. Thus the EIS and the Record of Decision should indicate the likelihood that such measures will be adopted or enforced by the responsible agencies. (Section 1502.16(h), and 1505.2).

The probability that a mitigation measure will be implemented (and that risks will decrease) is largely a function of budgets and funding levels. In order to discuss the probability of mitigation, the agency must examine data and compare the cost of proposed commitments with historic and projected budgets.

---

[170] U.S. Government Accountability Office. 2011. Oil and Gas Bonds: BLM Needs a Comprehensive Strategy to Better Manage Potential Oil and Gas Well Liability. GAO-11-292

[171] Freeman, L.R.; March, F,; Spensley, J.W. 1994. NEPA Compliance Manual, 2nd Edition. Government Institutes, Inc., Rockville MD

In order to fulfill NEPA's mandate and truly take a "hard look" at its actions, the government must do a full assessment of the environmental risks from proposed management. Examining the probability of mitigation measures being funded and implemented is a necessary part of analyzing environmental risks. Environmental risks tend to increase when mitigation measures are not funded and implemented. The relative risk associated with implementing each alternative is essential information for decision makers selecting a preferred alternative.

Assess and Address Bonding Shortfalls

Climate mitigation requires not only adequate implementation funding to insure mitigation requirements are enforceable, but importantly, performance bond dollar amounts that provide the BLM with essential revenue to cover long term mitigation, closure and reclamation costs of oil and gas well pads and infrastructure – including capping wells, decommissioning roads and compressor station sites, and cleanup of containment ponds. These bonds may be surety bonds, a third-party guarantee that an operator purchases from a private insurance company; or personal bonds accompanied by a financial instrument, such as a cashier's check or negotiable Treasury security. Unfortunately, federal bonding amounts are outdated and inadequate. The federal government, for example, only requires $25,000 for a statewide bond or $150,000 for a nationwide bond – no matter how many federal oil and gas wells a company has permitted and drilled.

Anderson et al. (2009) estimated that Wyoming has a current shortfall in bonding of around $814 million – a shortfall that will require taxpayers to clean up the messes. [172] U.S. GAO (2011) found that federal bonding amounts may not be sufficient to encourage operators to comply with reclamation requirements. In order to better internalize the externalities and improve fiscal responsibility, we recommend the BLM assess current reclamation and closure costs in the planning area and contrast those costs with the bonding amounts currently available. Is there a current shortfall in bonding for existing wells and infrastructure? If a bonding shortfall is present, a no new leasing option will help limit the current shortfall. The current shortfall in bonding for existing oil and gas wells should be examined as well as any additional shortfall from new wells proposed in each plan alternative.

If current bonding is less than climate mitigation needs, as well as reclamation and closure costs for current wells and infrastructure, any new additional wells will only serve to increase the fiscal liability for taxpayers. Under such fiscal conditions, a no new leasing option is warranted and should be evaluated in the RMP. for each alternative.

We recommend the BLM complete an analysis of closure and reclamation costs in the planning area and compare those costs with current bonding amounts. As part of this effort we recommend the BLM collect, analyze and make available to researchers site specific data on the closure and reclamation costs -- as well as the success of past reclamation efforts -- for well pads, roads, and pipelines on public land in the planning area.

[172] Andersen, M., R. Coupal, and B. White. 2009. Reclamation Costs and Regulation of Oil and Gas Development with Application to Wyoming. Western Economics Forum, Spring 2009

****

D. The FFO Must Take a Hard Look at Natural Gas Waste and Consider Alternatives to Prevent Waste including Phasing Development to Keep Pace with Gas Capture Infrastructure.

On November 18, 2016, BLM published its final methane waste rule in the Federal Register (Waste Prevention, Production Subject to Royalties, and Resource Conservation) 43 CFR Parts 3100, 3160 and 3170. According to the Preamble to the rule:

> This final regulation aims to reduce the waste of natural gas from mineral leases administered by the BLM. This gas is lost during oil and gas production activities through venting or flaring of the gas, and through equipment leaks. While oil and gas production technology has advanced dramatically in recent years, the BLM's rules to minimize waste of gas have not been updated in over 30 years. The Mineral Leasing Act of 1920 (MLA) requires the BLM to ensure that lessees ''use all reasonable precautions to prevent waste of oil or gas developed in the land,'' 30 U.S.C. 225, and that leases include ''a provision that such rules . . . for the prevention of undue waste as may be prescribed by [the] Secretary shall be observed,'' *id.* at § 187. The BLM believes there are economical, cost effective, and reasonable measures that operators can take to minimize gas waste. These measures will enhance our nation's natural gas supplies, boost royalty receipts for American taxpayers, tribes, and States, reduce environmental damage from venting, flaring, and leaks of gas, and ensure the safe and responsible development of oil and gas resources. 81 CFR 83009

The effective date of the rule is January 17, 2017 and it is now in full force and effect. Compliance dates for many of the requirements of the rule are deferred for one year until January 17, 2018, well within the planning horizon of the RMPA.

In the Preamble, BLM found that there is a significant amount of waste of natural gas on federal lands.

> In 2014, operators vented about 30 Bcf and flared at least 81 Bcf of natural gas from BLM-administered leases, totaling 4.1 percent of the total production from those leases in that year, and sufficient gas to supply nearly 1.5 million households with gas for a year. 81 CFR 83082

The rule was adopted to prevent as much of this waste as possible. The provisions of the rule will cover new leasing and drilling approvals under the RMPA. The rule also applies to existing leases and existing wells within the planning area.

As an initial matter, in the Preamble to the rule, BLM clearly states the critical role that land use planning and NEPA analysis must play in preventing methane waste on public lands. As applied to the RMPA, this language obligates the FFO to identify areas where gas capture

infrastructure is not available to get produced gas to market and where leasing and permitting should be restricted. The Preamble states:

> [T]he land use planning and NEPA processes are critical to achieving our simultaneous goals of responsible oil and gas development, land stewardship and resource conservation, and protection of air quality on (and reduction of air emissions from) Federal lands.
>
> The BLM already has land use planning and NEPA tools and processes in place that can be used to help achieve the specific goals of this rulemaking—to reduce the wasteful and environmentally harmful loss of gas through venting, flaring, and leaks … In particular, the land use planning and NEPA processes for new RMPs and MLPs provide important opportunities to consider the effects of oil and gas development over a larger area and to optimize planned development to minimize impacts from venting and flaring, among other activities. *The planning process gives the BLM the opportunity to consider how a specific land management plan could address the timing and location of development of oil and gas and related infrastructure, such as pipelines, and the projected consequences of such decisions in terms of the quantities of vented and flared gas and the impacts associated with those emissions.*
>
> *Thus, the BLM already has the NEPA processes and tools in place to evaluate the effects of the gas that would be flared, vented, and leaked from proposed oil and gas production, including impacts to wildlife and air quality, as well as GHG emissions, which contribute to climate change. The NEPA analyses can also identify ways to minimize such effects, such as evaluating alternative options for siting and timing of development that would maximize the opportunities for gas capture in lieu of flaring.* [emphasis added]

In addition to BLM's planning and NEPA obligations, the rule establishes ten requirements for operators to prevent natural gas waste on federal lands. These standards are all designed to prevent methane waste from a particular activity that operators conduct or equipment they utilize in the production of oil and gas. These provisions are:

1. Waste Minimization Plan. §3162.3-1 requires that an operator submitting an APD for a new well or multiple wells on a well pad must simultaneously submit a waste minimization plan. This plan must "set forth a strategy for how the operator will comply with the requirements of 43 CFR subpart 3179 regarding control of waste from venting and flaring, and must explain how the operator plans to capture associated gas upon the start of oil production." While the plan is not enforceable, it must be "complete and adequate" or the APD will denied or disapproved.

2. Ban on venting. §3179.6 prohibits operators from venting natural gas, requiring vented gas to be flared while establishing a narrow set of exceptions.

3. Gas capture percentage requirement. §3179.7 establishes gas capture percentage requirement to reduce the amount of flared gas. Capture percentages decline over time, from 85% in 2018-2019 to 98% after 2026. Operators who fail to meet these percentages must pay royalty on the amount of methane exceeding these percentages and are also subject to production curtailments or other enforcement actions.

4. Ban on venting during drilling and completions. §3179.101 and §3179.102 require operators to capture and sell, flare, use on site, or inject all gas that reaches the surface during these activities.

5. Requirement for replacement of pneumatic devices. §3179.201 and §3179.202 require the replacement of pneumatic controllers and pneumatic pumps that release gas over certain thresholds (i.e., high-bleed and intermediate-bleed devices). Replacement devices must release amounts of gas that are below these limits. Devices with releases that are routed to a flare or processing equipment are exempted from the requirements.

6. Requirement to route storage tank vapor gas to a sales line. §3179.203 requires that storage tanks that release gas over a certain threshold must route the gas to a sales line or, in certain circumstances, to a flare.

7. Requirement to minimize venting during liquids unloading. §3179.204 requires operators to minimize venting during downhole maintenance and liquids unloading by optimizing automated systems or, for wells without automated systems, by considering alternatives to manual purging.

8. Requirements for leak detection and repair. §3179.203 requires that operators inspect sites for leaks at least semi-annually and make repairs to eliminate leaks within thirty days of discovering a leak.

9. Requirements to measure vented and flared gas. §3179.9 requires operators to measure all gas that is vented and flared over 50 Mcf/day, and estimate gas volumes vented and flared below this threshold.

The BLM rule places an obligation on the FFO RMPA to take a hard look at natural gas waste both from existing leases and wells and from new leasing, drilling, and production. The RMPA must consider alternatives to prevent waste, including restricting the timing and location of new leasing and drilling to areas where gas capture infrastructure will be available to enable produced gas to be marketed.

The FFO is also obligated to address implementation of the mandatory waste prevention requirements contained in the rule through, among other mechanisms, lease stipulations and conditions of approval on drilling permits.

In 2014 NASA released a report identifying a methane “hot spot” over the San Juan

Basin.[173] The research found emissions through satellite imaging of 590,000 MT of methane annually between 2003-2009 (14,500,000 $MTCO_2e$). This is almost *twice as high* as the 330,000 MT (8,250,000 $MTCO_2e$) reported to the EPA GHG Reporting Program for 2012. In 2016 NASA released a subsequent study on the source of the concentrated methane emissions in the San Juan Basin, identifying 250 large methane plumes emitted from well pads, storage tanks, pipelines, gas processing plants, and venting from the San Juan coal mine.[174] Together these sources make up roughly half of all basin-wide methane emissions, and all but one of these sources is from the oil and gas industry.

Even absent BLM's methane waste rule, existing regulations through NTL-4A direct BLM policy with respect to waste. NTL-4A states unequivocally that "Except as provided in II.C and III above, *gas well gas may not be flared or vented*. The exceptions include emergencies, well purging, initial production testing, and routine well testing." §IV.A With respect to oil well gas, NTL-4A also states that:

> Oil well gas may not be vented or flared unless approved in writing by the Supervisor. The Supervisor may approve an application for the venting or flaring of oil well gas if justified either by the submittal of (1) *an evaluation report* supported by engineering, geologic, and economic data which demonstrates to the satisfaction of theSupervisor that the expenditures necessary to market or beneficially use such gas are not economically justified and that conservation of the gas, if required, would lead to the premature abandonment of recoverable oil reserves and ultimately to a greater loss of equivalent energy than would be recovered if the venting or flaring were permitted to continue or (2) *an action plan* that will eliminate venting or flaring of the gas within 1 year from the date of application. §IV.B [emphasis added]

BLM's implementing regulations—which underlie NTL4a and should inform BLM's revised waste rule—reflect these provisions, providing that "[t]he objective" of its MLA regulations in 43 C.F.R. Subpart 3160 "is to promote the orderly and efficient exploration, development and production of oil and gas." 43 C.F.R. § 3160.0-4. Subpart 3160 specifically requires BLM officials to ensure "that all [oil and gas] operations be conducted in a manner which *protects other natural resources and environmental quality*, protects life and property and results in the *maximum ultimate recovery of oil and gas with minimum waste and with minimum adverse effect on the ultimate recovery of other mineral resources*." 43 C.F.R. § 3161.2. The lease owner and or operator is similarly charged with "conducting all operations in a manner which ensures the proper handling, measurement, disposition, and site security of leasehold

---

[173] *See* NASA Science News, *U.S. Methane 'Hot Spot' Bigger than Expected*, Oct. 9, 2014, available at: http://science.nasa.gov/science-news/science-at-nasa/2014/09oct_methanehotspot/. *See also,* Eric A. Kort, *et al.*, *Four Corners: The largest US methane anomaly viewed from space*, GEOPHYSICAL RESEARCH LETTERS, Vol. 41, Issue 19, Oct 16, 2014 (attached as Exhibit 38).

[174] Christian Frankenberg, et al., *Airborne methane remote measurements reveal heavy-tail flux distribution in Four Corners region*, PNAS, vol. 113 no. 25 (Aug. 30, 2016) (attached as Exhibit 39).

production; which protects other natural resources and environmental quality; which protects life and property; and *which results in maximum ultimate economic recovery of oil and gas with minimum waste and with minimum adverse effect on ultimate recovery of other mineral resources*." 43 C.F.R. § 3162.1(a).

If not replaced by the waste rule, NTL-4A would obligate the FFO to take a hard look at measures to ensure that no gas well gas other than that excepted will be vented or flared from new gas wells. It would also obligate the FFO to take a hard look at procedures to ensure that no oil well gas will be vented or flared without prior approval. The FFO must also take a hard look at procedures that will ensure that evaluation reports or action plans are required to justify those approvals.

E. Managing for Community and Ecosystem Resiliency.

CEQ Guidance requires that agencies address the impacts of climate change on the environmental consequences of a proposed action. As the CEQ Guidance recognizes, "[c]limate change can make a resource, ecosystem, human community, or structure more susceptible to many types of impacts and lessen its resilience to other environmental impacts apart from climate change." Climate Guidance at 21. These effects are already occurring and are expected to increase, resulting in shrinking water resources, extreme flooding events, invasion of more combustible non-native plant species, soil erosion, loss of wildlife habitat, and larger, hotter wildfires. These impacts have been catalogued in recent scientific studies by federal agencies, including the National Climate Assessment,[175] and highlighted by President Obama. *See* Exec. Order No. 13,653, § 1. As the CEQ Guidance recognizes, "GHGs already in the atmosphere will continue altering the climate system into the future, even with current or future emissions control efforts." Climate Guidance at 20. In other words, climate change impacts are and will continue to be part of the new normal, and "managing th[o]se risks requires deliberate preparation, close cooperation, and coordinated planning … to improve climate preparedness and resilience; help safeguard our economy, infrastructure, environment, and natural resources; and provide for the continuity of … agency operations, services, and programs." Exec. Order No. 13,653, § 1.

NEPA analyses must account for this reality. While the CEQ Guidance suggests that existing and reasonably foreseeable climate change impacts be considered as part of an agency's hard look at impacts, the guidance must also account for the fact that climate change effects are and will continue to be a key component of the environmental baseline. Agencies are required under NEPA to "describe the environment of the areas to be affected or created by the alternatives under consideration." 40 C.F.R. § 1502.15. The affected environment discussion sets the "baseline" for the impacts analysis and comparison of alternatives. As the Ninth Circuit has recognized, "without establishing…baseline conditions…there is simply no way to determine what effect [an action] will have on the environment, and consequently, no way to comply with NEPA." *Half Moon Bay Fisherman's Marketing Ass'n v. Carlucci*, 857 F.2d 505, 510 (9th Cir. 1988) (explaining further that "[t]he concept of a baseline against which to compare predictions of the effects of the proposed action and reasonable alternatives is critical to the NEPA process").

[175] Available at http://nca2014.globalchange.gov/ (attached as Exhibit 6).

Excluding climate change effects from the environmental baseline ignores the reality that the impacts of proposed actions must be evaluated based on the already deteriorating, climate-impacted state of the resources, ecosystems, human communities, and structures that will be affected. Accordingly, BLM must clarify that existing and reasonably foreseeable climate change impacts as part of the affected environment in the planning area, which then must be assessed as part of the agency's hard look at impacts, and integrated into *each* of the alternatives, including the no action alternative. Put differently, simply acknowledging climate impacts as part of the affected environment is insufficient. BLM must incorporate that information into their hard look at impacts (e.g., the cumulative impact of climate change, the proposed action, and other past, present, and reasonably foreseeable impacts), in particular to help inform the design and consideration of alternatives and mitigation measures.

Critically, the RMPA should emphasize that agencies may not shirk their responsibility to assess climate change merely because of uncertainties. "Reasonable forecasting and speculation is…implicit in NEPA, and we must reject any attempt by agencies to shirk their responsibilities under NEPA by labelling any and all discussion of future environmental effects as 'crystal ball inquiry.'" *Save Our Ecosystems v. Clark*, 747 F.2d 1240, 1246 n.9 (9th Cir. 1984 (quoting *Scientists' Inst. for Pub. Info., Inc. v. Atomic Energy Comm*., 481 F.2d 1079, 1092 (D.C. Cir. 1973)). NEPA's hard look merely requires "a reasonably thorough discussion of the significant aspects of the probable environmental consequences" to "foster both informed decision-making and informed public participation." *Ctr. for Biological Diversity v. NHTSA*, 538 F.3d 1172, 1194 (9th Cir. 2008) (quotations and citations omitted). As here, BLM has refused to address the implications of their actions in the context of climate change on the basis of uncertainties, such as the lack of fine-scale modeling, which has led BLM to take short-sighted, arbitrary, and capricious action that does not, in fact, account for climate change.

In this context, and to accurately account for and integrate climate change impacts into the affected environment, hard look, alternatives, and mitigation analysis, BLM should evaluate the relevant resources, ecosystems, or communities for key vulnerabilities as part of the baseline assessment. The vulnerability of ecosystems and communities, as well as the species and physical elements they comprise, depends on their inherent qualities and their ability to change or adapt to address new climatic conditions. For example, the vulnerability of certain species can be affected by the tolerance of individual organisms to the direct effects of climate change, the ability of populations to adapt to those conditions through the expression of genetic variability, and the ability to adjust behaviorally to changes in the ecosystem, such as prey shifts. A vulnerability assessment would examine the species and physical elements of existing ecosystems and determine which elements are sensitive, which are resilient, which have the ability to adapt, and what the likely consequences would be of anticipated changes in climate. Human infrastructure—bridges, roads, buildings, etc.—should be assessed similarly.

Because ecosystems (including the human communities that rest within such ecosystems) are so complex, it is impossible to evaluate the vulnerabilities of every population, species, community, or other element of the system in question. Instead, risk assessment must focus on particular, high-priority elements or "key vulnerabilities." In its 5th Assessment Report, the IPCC suggested the following criteria for identifying key vulnerabilities:

- Exposure of society, community or social-ecological system to climate stressors.
- Importance of vulnerable system(s).
- Limited ability of society, community, or social-ecological systems to cope with and build adaptive capacities or limit the adverse consequences of climate related hazard.
- Persistence of vulnerable conditions and degree of irreversibility of consequences.
- Presence of conditions that make societies highly susceptible to cumulative stressors in complex and multiple-interacting systems.

In other words, key vulnerabilities are likely to occur where the effects of climate change are large and intense, imminent, long lasting, highly probable, irreversible, and likely to limit the distribution of highly valued systems or system elements. BLM should clarify that understanding and assessing these vulnerabilities, based on existing information and tools,[176] is a key component of the affected environment, hard look at impacts, and the design and consideration of alternatives and mitigation measures.

F. BLM Must Ensure NEPA Documentation Addresses Mitigation for Climate Impacts Consistent with All Relevant Laws and Policies, Including Current Mitigation Guidance.

NEPA's statutory language implicitly charges agencies with mitigating the adverse environmental impacts of their actions. *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 351-52 (1989); *Holy Cross Wilderness Fund v. Madigan*, 960 F.2d 1515, 1522 (10th Cir. 1992). Mitigation measures are required by NEPA's implementing regulations. 40 C.F.R. §§ 1502.14(f), 1502.16(h).

The CEQ has stated: "All relevant, reasonable mitigation measures that could improve the project are to be identified, even if they are outside the jurisdiction of the lead agency or the cooperation agencies ...." Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations, 46 Fed. Reg. 18026, 18031 (March 23, 1981). According to the CEQ, "[a]ny such measures that are adopted must be explained and committed in the ROD." Forty Questions, 46 Fed. Reg. at 18036.

The Tenth Circuit has held that an agency's analysis of mitigation measures "must be 'reasonably complete' in order to 'properly evaluate the severity of the adverse effects' of a proposed project prior to making a final decision." *Colo. Envt'l Coalition v. Dombeck*, 185 F.3d 1162, 1173 (10th Cir. 1999) (quoting Robertson, 490 U.S. at 352). Mitigation "must be discussed in sufficient detail to ensure that environmental consequences have been fairly evaluated." *City of Carmel-by-the-Sea v. U.S. Dep't of Transp.*, 123 F.3d 1142, 1154 (9th Cir. 1997) (quoting *Robertson*, 490 U.S. at 353).

[176] Where there is scientific uncertainty, agencies must satisfy the requirements of 40 C.F.R. § 1502.22.

"[O]mission of a reasonably complete discussion of possible mitigation measures would undermine the 'action-forcing' function of NEPA. Without such a discussion, neither the agency nor other interested groups and individuals can properly evaluate the severity of the adverse effects." *Robertson*, 490 U.S. at 353. A "perfunctory description," of mitigation, without "supporting analytical data" analyzing their efficacy, is inadequate to satisfy NEPA's requirements that an agency take a "hard look" at possible mitigating measures. *Neighbors of Cuddy Mountain v. U.S. Forest Serv.*, 137 F.3d 1372, 1380 (9th Cir. 1998). An agency's "broad generalizations and vague references to mitigation measures ... do not constitute the detail as to mitigation measures that would be undertaken, and their effectiveness, that the Forest Service is required to provide." *Id.* at 1380-81. *See also Northwest Indian Cemetery Protective Association v. Peterson*, 795 F.2d 688, 697 (9th Cir. 1986), rev'd on other grounds, 485 U.S. 439 (1988) ("A mere listing of mitigation measures is insufficient to qualify as the reasoned discussion required by NEPA."); *Idaho Sporting Congress v. Thomas*, 137 F.3d 1146, 1151 (9th Cir. 1988) ("Without analytical data to support the proposed mitigation measures, we are not persuaded that they amount to anything more than a 'mere listing' of good management practices."). Moreover, in its final decision documents, an agency must "[s]tate whether all practicable means to avoid or minimize environmental harm from the alternative selected have been adopted, and if not, why they were not." 40 C.F.R. § 1505.2(c).

CEQ also recognizes that the consideration of mitigation measures and reasonable alternatives is closely related. For example, CEQ's guidance on mitigation and monitoring states that "agencies may commit to mitigation measures considered as alternatives in an EA or EIS so as to achieve an environmentally preferable outcome." Council on Environmental Quality, Appropriate Use of Mitigation and Monitoring and Clarifying the Appropriate Use of Mitigated Findings of No Significant Impact (Jan. 14, 2011) at 1 (hereafter "CEQ Mitigation Guidance"); *see also id.* at 6-7 ("When a Federal agency identifies a mitigation alternative in an EA or an EIS, it may commit to implement that mitigation to achieve an environmentally-preferable outcome.").

Guidance from CEQ specifically directs agencies to consider where appropriate a variety of mitigation measures for actions that will cause climate pollution, including measures that will capture or use methane emissions:

> As Federal agencies evaluate potential mitigation of GHG emissions and the interaction of a proposed action with climate change, the agencies should also carefully evaluate the quality of that mitigation to ensure it is additional, verifiable, durable, enforceable, and will be implemented. Agencies should consider the potential for mitigation measures to reduce or mitigate GHG emissions and climate change effects when those measures are reasonable and consistent with achieving the purpose and need for the proposed action. Such mitigation measures could include enhanced energy efficiency, lower GHG-emitting technology, carbon capture, carbon sequestration (e.g., forest, agricultural soils, and coastal habitat restoration), sustainable land management practices, and capturing or beneficially using GHG emissions such as methane.[177]

[177] Climate Guidance at 19 (attached as Exhibit 4) (citation omitted).

1. Consistent with the Mitigation Hierarchy, BLM Must Avoid, Minimize and Offset Impacts from Fossil Fuels Made Available by the RMPA, Including Climate Change-Related Impacts.

BLM has significant obligations and authority related to mitigation for all unavoidable impacts. Secretarial Order 3330 requires the development of a landscape-scale mitigation policy for the Department of the Interior, which is appropriately done at the field office plan level. Section 4(c) of Secretarial Order 3330 directs the Department of the Interior's Energy and Climate Change Task Force to:

> [I]dentify any new policies or practices, revisions to existing policies or practices, or regulatory or other changes that could be implemented to incorporate landscape-scale planning into mitigation-related decisions… The Task Force will also determine what steps can and should be taken to ensure that mitigation opportunities are identified as early in the permitting process as possible, such as at the scoping or pre-application stage, to maximize predictability and transparency in the review and permitting process.

In a report to the Secretary of the Interior, the Energy and Climate Change Task Force laid out a landscape approach to mitigation.[178] This approach contained the following steps:

> 1. Identifying key landscape attributes, and the conditions, trends and baselines that characterize these attributes;
>
> 2. Developing landscape-scale goals and strategies;
>
> 3. Developing efficient and effective compensatory mitigation programs for impacts that cannot be avoided or minimized; and
>
> 4. Monitoring and evaluating progress and making adjustments, as necessary, to ensure that mitigation is effective despite changing conditions.

BLM's current guidance (IM No. 2013-142 and Draft Manual Section 1794) states that as part of approving specific land uses, mitigation implementation may be "within (onsite) or outside of the area of impact." The manual emphasizes that onsite mitigation is always the first choice, including a "mitigation priority order," then discusses options to provide offsite mitigation by replacing or providing similar or substitute resources or values through "restoration, enhancement, creation, or preservation."

BLM's policy emphasizes that it is designed to "shift the BLM's mitigation focus from a permit-by-permit perspective to a proactive regional-scale mitigation planning perspective" and

---

[178] Clement, J.P. *et al.*, A strategy for improving the mitigation policies and practices of the Department of the Interior. A report to the Secretary of the Interior from the Energy and Climate Change Task Force (April 2014), available at: https://www.doi.gov/sites/doi.gov/files/migrated/news/upload/Mitigation-Report-to-the-Secretary_FINAL_04_08_14.pdf (attached as Exhibit 145).

to cut across jurisdictions and land ownership to "attain the highest mitigation benefit, regardless of land ownership."[179] These key tools from the agency's guidance should also be emphasized as important aspects of incorporating mitigation into land use planning.

BLM is also considering new tools and approaches the agency could use to increase the effectiveness of mitigation on public lands, including layering protective management and designations and exploring creative ways existing authorities could be used for conservation benefits. Effective new mitigation tools and approaches should be integrated into planning as well.

Mitigating climate-related impacts includes avoiding and minimizing generation of GHG emissions through management prescriptions and preventing harm to carbon sinks. The CEQ guidance on considering climate change in NEPA analyses provides that agencies should analyze reasonable alternatives that would mitigate both direct and indirect GHG emissions impacts and the cumulative effects of climate change (e.g., enhanced energy efficiency, carbon sequestration, lower GHG-emitting technology).[180] BLM must address the quality of mitigation measures as well as ensure they are additional, verifiable, durable, enforceable, and will be implemented.

In addition to the legal and policy directions which require mitigation for climate impacts from the Mancos RMPA and provide the agency with ample discretion to require mitigation, it is important to underscore that, as a land manager, the federal government in general and BLM in particular are facing huge and rapidly escalating costs to address the impacts caused by fossil-fuel driven climate change. Forest fires, widespread drought, unusual flooding, rising sea levels, spread of invasive species and spread of disease already result in significant costs to the federal government, and each new fossil fuel production project that BLM authorizes through the Uncompahgre plan will worsen these problems and increase the associated costs. Research from the University of Vermont's Gund Institute for Ecological Economics and The Wilderness Society suggests that total costs in degraded ecosystem services on federal public lands could exceed $14.5 billion annually under a 2-degree Celsius warming scenario.[181] These costs are ultimately borne by all American taxpayers, and BLM has a responsibility to recoup these costs when it makes decisions authorizing activities that cause these impacts and associated costs.

---

[179] BLM, *Draft – Regional Mitigation*, Manual Section 1794 at 1-3 (attached as Exhibit 146).

[180] Climate Guidance at 13, 16 (attached as Exhibit 4).

[181] *See* Esposito, Valerie; Phillips, Spencer; Boumans, Roelof; Moulaert, Azur; Boggs, Jennifer. 2011. "Climate change and ecosystem services: The contribution of and impacts on federal public lands in the United States." In: Watson, Alan; Murrieta-Saldivar, Joaquin; McBride, Brooke, comps. *Science and stewardship to protect and sustain wilderness values: Ninth World Wilderness Congress symposium*; November 6-13, 2009; Merida, Yucatan, Mexico. Proceedings RMRS-P-64. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. p. 155-164, available at: http://www.fs.fed.us/rm/pubs/rmrs_p064.pdf (last viewed Oct. 27, 2016) (attached as Exhibit 147).

2. BLM Should Adopt a Mitigation Strategy as Part of the Mancos RMPA to Address Unavoidable Climate Change Impacts.

To comply with NEPA's mandates, and BLM policy, concerning mitigation, BLM should require compensatory mitigation to offset the unavoidable direct and indirect climate change impacts of the Mancos RMPA. Such mitigation would contain several key features:

- *BLM should quantify and offset emissions through specific compensatory mitigation actions*

Quantifying climate change impacts is becoming increasingly more practical, and the science connecting impacts to temperature changes increasingly more precise. Compensatory mitigation actions can be directed at enhancing the adaptive capacity of human and natural communities in the affected landscape to improve their health and resilience in the face of expected change. Offsetting actions should include investments in land protection to ensure that the FFO's ecological systems have the space and conditions to adapt.

Significant opportunity exists to offset GHG emissions. EPA has repeatedly urged land management agencies to assess carbon offsets in Environmental Assessments and EISs as a way to reduce the climate change impacts of agency actions. For example, EPA specifically recommended that the Forest Service's Lease Modifications EIS for the West Elk Mine "acknowledge that revenues for carbon credits are available via several existing markets."[182] Similarly, EPA has recommended that a Forest Service NEPA analysis of a forest health project "discuss reasonable alternatives and/or potential means to mitigate *or offset* the GHG emissions from the action."[183] Numerous state agencies already use offsets to control GHG emissions.[184] Offsets can include participation in third-party offset markets or renewable energy credits.

In any subsequently prepared NEPA document, the BLM should consider mitigation measures that offset the direct and indirect carbon emissions attributable to the draft plan alternatives – 27 million tons. Specifically, BLM should consider requiring that purchasers of fossil fuel leases be required to purchase offsets from reputable carbon markets that offset the direct and indirect greenhouse gas emissions from the mining and combustion of fossil fuels from their leases.

---

[182] EPA July 2012 Comment Letter at 5 (attached as Exhibit 148) (identifying four U.S. carbon exchanges creating a market for carbon credits).

[183] Letter of L. Svoboda, EPA, to T. Malecek, USFS, at 8 (Oct. 27, 2010) (attached as Exhibit 149).

[184] *See, e.g.*, Settlement Agreement, ConocoPhillips and California (Sept. 10, 2007) (California agency requiring offsets as a condition of approving a project) (attached as Exhibit 150); Minn. Stat. § 216H.03 subd. 4(b) (Minnesota law requiring offsets for certain new coal-fired power plants); Me. Rev. Stat. Ann. tit. 38, § 580-B(4)(c) (Maine law establishing greenhouse gas initiative that includes the use of carbon offsets).

- *BLM should address the full scope of lifecycle emissions through avoidance, minimization, and compensatory mitigation for fossil fuel production, transport and combustion.*

The premise of compensatory mitigation is to address unavoidable harm. In the case of fossil fuel production, the harm from GHG emissions is primarily attributable to end-use combustion. Nevertheless, BLM should at least address the direct emissions that could be avoided or minimized by, for example, requiring the capture or combustion of methane, adopting enforceable mitigation requirements to minimize methane emissions and waste from oil and gas production, etc.

- *BLM should specify whether compensatory mitigation should be paid on an annual basis or paid up front.*

Fees collected for compensatory mitigation are often paid in a lump sum at the beginning of a project's operational life. In the case of climate impacts, however, it may make more sense to consider an annual payment on the basis of production, or an annualized payment schedule based on expected production with corrections on a semi-annual basis. By spreading payments over the life of the project (and tying them to when the impacts actually occur), the system should be both fairer to producers and more true to the spirit of mitigation.

- *BLM must ensure that compensatory mitigation actions are additional and durable, and last for the duration of impacts.*

This is an established principle for the Department's approach to mitigation, but it is particularly important with regard to climate impacts. For example, the Australian Government's Climate Change Authority found that, "Assessing additionality is a key feature of all baseline and credit schemes. An additionality test assesses whether a project or activity creates 'additional' emissions reduction that would not have occurred in the absence of the incentive. The baseline for the project assesses how much emissions have been reduced. Additionality is important to ensure that a baseline and credit scheme does not pay for emissions reductions that would have occurred anyway."[185]

IV. BLM Must Take a Hard Look at the Direct, Indirect and Cumulative Impacts of Oil and Gas Leasing and Development on Resource Values in the Planning Area.

A. The FFO Must Take a Hard Look at Certain Impacts to Air Quality.

1. Air Resource Mitigation Measures

BLM should commit to implementation of specific and enforceable management actions that ensure no significant impacts to air quality and air quality related values—as determined by

[185] *See* Australian Government Climate Change Authority, *Additionality*, http://www.climatechangeauthority.gov.au/reviews/carbon-farming-initiative-study/additionality.

air quality modeling—in the RMPA/EIS. Specifically, BLM must consider Best Management Practices (BMPs) to ensure that human health and the environment are protected from oil and gas drilling over the life of the new RMPA.

2. Ozone Impacts

Background concentrations of ozone in the Farmington planning area are already at or exceed the National Ambient Air Quality Standards ("NAAQS"), leaving virtually no room for growth in emissions. The RMPA must also include wintertime ozone monitoring information within the planning area. Spikes in ozone levels have been documented to occur in oil and gas producing basins in the Western United States during cold, snowy periods when wintertime "inversions" concentrate air pollutants from oil and gas activities.[186] Adding hundreds of additional oil and wells to the area will add hundreds of tons of additional ozone precursors to the region, threatening considerable exceedances of the ozone NAAQS—especially in wintertime in the region's valleys. *See id.*

BLM may not avoid including winter ozone modeling, even if information about winter ozone levels is incomplete. According to NEPA regulation, if an estimation of reasonably foreseeable significant adverse impacts cannot be obtained because, among other things, the means to obtain it are "not known," BLM has an obligation to include an evaluation "based upon theoretical approaches or research methods generally accepted in the scientific community," provided that "the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason." 40 C.F.R. § 1502.22. These methods of dealing with incomplete information are required under NEPA and must be thoroughly exercised before drawing the conclusion that a wintertime ozone analysis cannot be included in the RMPA/EIS. *See id*.

BLM has, in fact, modeled winter ozone concentrations for other recent NEPA actions. Even though BLM did not perform a winter ozone modeling analysis of the proposed development, modeling results for wintertime ozone concentrations were included as part of the base case modeling performance evaluation for the Continental Divide-Creston (CD-C) DEIS in Wyoming.[187] The DEIS included model performance evaluations for the 2005 and 2006 base case scenarios based on CD-C project modeling and on previously-conducted modeling for the Hiawatha Regional Energy Development Project EIS (Hiawatha). The results of the base case modeling evaluations suggest it is not unreasonable or inappropriate to include wintertime modeling results in BLM's analysis. Specifically, model results are presented in the CD-C DEIS and compared with year-round monitoring data at several sites.[188] In general, the modeling results appear to underestimate winter ozone concentrations, but not in all cases.[189] Generally,

---

[186] Peter M. Edwards et al., *High Winter Ozone Pollution from Carbonyl Photolysis in an Oil and Gas Basin*, 514 Nature 351 (October 16, 2014).
[187] *See* BLM Continental Divide-Creston (CD-C) AQTSD Appendix A.
[188] BLM CD-C AQTSD Appendix A at 68.
[189] *See*, *e.g.*, BLM CD-C AQTSD Appendix A at 68 (Close to the project area, the performance of the CD-C and Hiawatha modeling appears to be reasonably good "with the exception of a few

the results of the CD-C DEIS performance evaluation indicate that there is a tendency towards underestimation, especially at observed maximum concentrations in winter. Even so, if modeled wintertime ozone concentrations are shown to be a problem and the performance evaluation for the modeling indicates that modeled results likely underestimate impacts in winter then, at a minimum, the BLM would have an obligation under NEPA to reduce emissions from the proposed development in order to ensure there will be no significant impacts to wintertime ozone levels based on the modeling, as evaluated (with an underestimation bias). BLM should consider a similar approach for the RMPA/EIS. As shown by the high wintertime ozone levels nearby in Rangely, in the Uinta Basin in Utah, as well as in Wyoming's Sublette County, wintertime ozone near concentrated oil and gas development has simply become far too big of an issue, of tremendous public interest and concern, to be ignored in this long-term planning action.

Ozone has long been recognized to cause adverse health effects. Exposure to ozone can cause or exacerbate respiratory health problems—including shortness of breath, asthma, chest pain and coughing—can decrease lung function, and can even lead to long-term lung damage. *See also* EPA's National Ambient Air Quality Standards for Particulates and Ozone, 62 FR 38,856 (July 18, 1997). Short term exposure to ozone causes multiple negative respiratory effects, from inflammation of airways to more serious respiratory effects that can lead to use of medication, absences from school and work, hospital admissions, emergency room visits, and chronic obstructive pulmonary disease ("COPD"). According to a recent report by the National Research Council ("NRC"), short-term exposure to current levels of ozone in many areas is likely to contribute to premature deaths.[190] As described in more detail below, even ozone concentrations as low as 60 ppb can be harmful to human health. Long-term exposure to elevated levels of ozone results in numerous negative harmful effects, such as permanent lung damage and abnormal lung development in children. Long-term exposure may also increase risk of death from respiratory problems. Short- and long-term exposure to elevated levels of ozone can also harm people's hearts and cardiovascular systems. *See* 79 Fed. Reg. 75234-311.

On October 26, 2015, EPA published a final rule to revise the NAAQS for ozone to 70 parts per billion (ppb) from the current 75 ppb. National Ambient Air Quality Standards for Ozone, 80 Fed. Reg. 65292 (Oct. 26, 2015). This decision was driven by significant recent scientific evidence that the standard of 75 ppb was not adequately protecting public health. *Id.* at 136. In fact, recent studies have documented decreased lung functioning and airway inflammation in young, healthy adults at ozone concentrations as low as 60 ppb. *Id.* at 146.

Additionally, climate change is likely to worsen ozone pollution, offsetting the improvements in air quality and public health that would be expected from reductions in emissions of ozone precursors. As described by the EPA in its recent ozone rulemaking:

> In addition to being affected by changing emissions, future O_3 concentrations may also be affected by climate change. Modeling studies in the EPA's Interim

---

days, the two base case simulations reproduce the observed ozone at [the OCI monitor] reasonably well.").

[190] National Research Council, *Link Between Ozone Air Pollution and Premature Death Confirmed,* (April 2008), available at: http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=12198.

> Assessment (U.S. EPA, 2009a) that are cited in support of the 2009 Endangerment Finding under CAA section 202(a) (74 FR 66496, Dec. 15, 2009) as well as a recent assessment of potential climate change impacts (Fann et al., 2015) project that climate change may lead to future increases in summer O_3 concentrations across the contiguous U.S. While the projected impact is not uniform, climate change has the potential to increase average summertime O_3 concentrations by as much as 1-5 ppb by 2030, if greenhouse gas emissions are not mitigated. Increases in temperature are expected to be the principal factor in driving any O_3 increases, although increases in stagnation frequency may also contribute (Jacob and Winner, 2009). If unchecked, climate change has the potential to offset some of the improvements in O_3 air quality, and therefore some of the improvements in public health, that are expected from reductions in emissions of O_3 precursors.

80 Fed. Reg. 65292, 65300 (October 26, 2015). For example, climate change impacts include an increase in the area burned by wildfires, which, in turn are sources of O_3 precursors. *Id.* at 65371.

3. Hazardous Air Pollutant Impacts

The FFO should look at additional hazardous air pollutant impacts from projected development, including the impacts from 1,3-butadiene and secondary formaldehyde that will result from the proposed development. The BLM has completed a more comprehensive analysis of HAPs in other recent NEPA actions which resulted in significant impacts from HAPs. Specifically, the Gasco EIS in Utah evaluated short-term and long-term impacts from numerous HAPs, including methanol, chlorinated solvents and acrolein.[191] The Gasco EIS analysis found elevated cancer risks for acetaldehyde, 1,3-butadiene, and ethylene dibromide.[192] The Gasco EIS also reported acrolein emissions that exceeded the acute Reference Exposure Level (REL) and the Reference Concentration for Chronic Inhalation (RfC).[193] BLM must include a more comprehensive analysis of HAP impacts and, in addition to the HAPs identified above, the BLM should also assess any HAP impacts associated with volatile emissions from hydraulic fracturing fluids. It is important to continue to improve upon the HAP analyses conducted under NEPA in order to ensure there are no significant health impacts from near-field exposure to HAPs from the proposed development in the planning area. *See* 40 C.F.R. §1508.27(b)(2).

4. Visibility and Ecosystem Impacts

Much of air pollution from oil and gas development and operations also degrades visibility. Section 169A of the Clean Air Act ("CAA"), 42, U.S.C. § 7401 *et seq.* (1970) sets forth a national goal for visibility, which is the "prevention of any future, and the remedying of any existing, impairment of visibility in Class I areas which impairment results from manmade air pollution." Congress adopted the visibility provisions in the CAA to protect visibility in "areas of great scenic importance." H.R. Rep. No. 294, 95th Cong. 1st Sess. at 205 (1977). In

[191] *See* BLM Gasco Energy Project FEIS, Table 4-12, Table 4-19 and Appendix H. April 2010.
[192] BLM Gasco FEIS Table 4-19.
[193] BLM Gasco FEIS Appendix H, at H-45.

promulgating its Regional Haze Regulations, 64 Fed. Reg. 35,714 (July 1, 1999), the U.S. Environmental Protection Agency ("EPA") provided:

> Regional haze is visibility impairment that is produced by a multitude of sources and activities which emit fine particles and their precursors and which are located across a broad geographic area. Twenty years ago, when initially adopting the visibility protection provisions of the CAA, Congress specifically recognized that the "visibility problem is caused primarily by emission into the atmosphere of SO2, oxides of nitrogen, and particulate matter, especially fine particulate matter, from inadequate[ly] controlled sources." H.R. Rep. No. 95-294 at 204 (1977). The fine particulate matter (PM) (e.g., sulfates, nitrates, organic carbon, elemental carbon, and soil dust) that impairs visibility by scattering and absorbing light can cause serious health effects and mortality in humans, and contribute to environmental effects such as acid deposition and eutrophication.

The visibility protection program under sections 169A, 169B, and 110(a)(2)(J) of the CAA is designed to protect Class I areas from impairment due to man-made air pollution. The current regulatory program addresses visibility impairment in these areas that is "reasonably attributable" to a specific source or small group of sources, such as, here, air pollution resulting from oil and gas development and operations authorized by the RMP. *See* 64 Fed. Reg. 35,714.

Moreover, EPA finds the visibility protection provisions of the CAA to be quite broad. Although EPA is addressing visibility protection in phases, the national visibility goal in section 169A calls for addressing visibility impairment generally, including regional haze. *See e.g., State of Maine v. Thomas*, 874 F.2d 883, 885 (1st Cir. 1989) ("EPA's mandate to control the vexing problem of regional haze emanates directly from the CAA, which 'declares as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in Class I areas which impairment results from manmade air pollution.' ") (citation omitted).

5. Air Quality Impacts on Human Health

Although adherence to air quality mitigation and NAAQS standards will have a positive relationship to human health, poor baseline air quality conditions due to direct, indirect and cumulative impacts in the planning area warrants an independent hard look analysis at human health; and, moreover, such analysis is required by NEPA and CEQ implementing regulations.

Ozone is just one air-related byproduct of oil and gas development that may pose serious impacts to human health. Recent studies in Garfield County confirm that air toxics are generated during every stage of oil and gas development and can have potentially significant health impacts even at concentrations below regulatory thresholds.[194] Another recent study undertaken in rural Colorado locations found that women who lived close to gas wells were more likely to have

[194] Theo Colborn et al., *An exploratory study of air quality near natural gas operations*, HUM. ECOL. RISK ASSESS (Nov. 9, 2012) (attached as Exhibit 156).

children born with a variety of defects, from oral clefts to heart issues.[195] And, yet another recent study found that people who lived less than half a mile from a gas well had a higher risk of health issues. The research found a small increase in cancer risk and alleged that exposure to benzene was a major contributor to the risk.[196]

Oil and gas development is one of the largest sources of VOCs, ozone, and sulfur dioxide emissions in the United States. The relationship between air quality and human health must be analyzed in the RMPA/EIS. The failure of the FFO to do so would represent a fundamental shortcoming in the agency's analysis. "The agency must examine the relevant data and articulate a satisfactory explanation for its action including a 'rational connection between the facts found and the choice made.'" *Motor Vehicle Mfrs.,* 463 U.S. at 43 (1983).

B. The BLM Must to Take a Hard Look at Impacts to Human Health.

As introduced above, emissions from oil and gas development are not limited only to the combustion stage but, rather, occur throughout the chain of production. These emissions not only impact the critical resource values of the FFO – as detailed throughout these Comments – but also can result in serious harm to human health. BLM must fully consider the potential human health impacts that may be caused by oil and gas operations approved under the RMPA, as required by NEPA.[197] Congress stated that "…it is the continuing responsibility of the Federal Government to use all practicable means…to attain the widest range of beneficial uses of the environment **without degradation, risk to health or safety**, or other undesirable and unintended consequences…" 42 U.S.C. § 4331 (emphasis added). NEPA implementing regulations direct agencies to consider "the degree to which the proposed action affects public health or safety." 40 C.F.R. § 1508.27(b). These regulations also state: "Federal agencies shall to the fullest extent possible…. Use all practicable means, consistent with the requirements of the Act and other essential considerations of national policy, to restore and enhance the quality of the human environment and avoid or minimize any possible adverse effects of their actions upon the quality of the human environment." 40 C.F.R. § 1500.2(f).

1. The FFO Must Conduct a Health Impact Assessment.

BLM must conduct a health impact assessment, or equivalent analysis, as required by NEPA and its implementing regulations. NEPA requires that the BLM employ at least the same level of effort to analyze human health impacts as it does to promote industry's interest in development when preparing the RFD and associated analyses regarding projected drilling levels.

---

[195] Lisa M. McKenzie et al., *Birth Outcomes and Maternal Residential Proximity to Natural Gas Development in Rural Colorado,* ENVIRONMENTAL HEALTH PERSPECTIVES (April 2014) (attached as Exhibit 157).
[196] McKenzie *et al*.
[197] *See* Second Community Health Impact Report (HIR-2) Oil Well Exposure, Counselor Chapter Residents (attached as Exhibit 35); Testimonial from Daniel Tso, Community Member, Counselor Chapter (attached as Exhibit 36); Testimonial from Kendra Pinto, Community Member (attached as Exhibit 44).

A health impact assessment ("HIA") or equivalent analysis would fulfill the regulations governing NEPA, to examine human health impacts "to the fullest extent possible." A HIA would be forward-looking and attempt to identify all of the potential direct, indirect, and cumulative links between a proposed activity and the health and well-being of affected communities, and to develop mitigation measures to minimize harms and maximize benefits. The RMPA must include this type of analysis of human health impacts.

The U.S. EPA has posted on its website an excellent document on the utility of an HIA as part of the NEPA analysis of federal agencies where public health impacts are at issue.[198] HIA "provides a systematic process and methodology to anticipate and proactively address the potential health consequences of a program or policy in order to maximize the potential benefits and minimize adverse outcomes."[199] Steps in the HIA process include:

1. Screening: Determines whether an HIA is necessary, and whether it is likely to be useful.
2. Scoping: Establish the population to which the HIA applies, the scope of health problems to be analyzed, the HIA team, methods to be used in the assessment, and data sources.
3. Assessment: describe the baseline health status and determinants of health in the population and assess likely impacts through a literature review and qualitative or quantitative analysis.
4. Decision and recommendations to minimize adverse impacts and maximize benefits.
5. Monitoring and reassessment plan: select a set of outcomes likely to be sensitive/accurate indicators of the changes predicted, such as health outcomes and develop a plan to monitor and then reassess if needed.

The BLM did not conduct these steps, and did not analyze the impacts to the population within the planning area, considering how many people might be exposed to health impacts, analyze where development would take place relative to water sources or residences, or assess the likely impacts to the actual population in the area, including particularly vulnerable populations. It also omitted significant potential impacts. For example, the agency did not include any potential impacts from vehicle accidents or other safety issues, or the illness caused by the stress and mental anguish associated with living near intensive oil and gas development.

According to the U.S. Centers for Disease Control, "HIA can be used to evaluate objectively the potential health effects of a project or policy before it is built or implemented. It can provide recommendations to increase positive health outcomes and minimize adverse health outcomes. A major benefit of the HIA process is that it brings public health issues to the

---

[198] *See* EPA, Human Impact Partners, *Frequently Asked Questions About Integrating Health Impact Assessment into Environmental Impact Statement,* available at: http://www.epa.gov/region9/nepa/PortsHIA/pdfs/FAQIntegratingHIA-EIA.pdf (attached as Exhibit 281).

[199] *See* Aaron Wernham, *Inupiat Health and Proposed Alaskan Oil Development: Results of the First Integrated Health Impact Assessment/Environmental Impact Statement for Proposed Oil Development on Alaska's North Slope*, ECOHEALTH, 2007 (attached as Exhibit 282).

attention of persons who make decisions about areas that fall outside of traditional public health arenas, such as transportation or land use."[200]

BLM must also include impacts to water resources from fracking in its examination of health effects. Any later, site-specific analysis and application of mitigation measures is no substitute for analysis of impacts and development of alternatives and mitigation measures at the RMPA/EIS level. Waiting for the approval of site-specific projects forecloses not only analysis of the true impacts of the agency action that is actually being proposed, but in so doing, forecloses the ability of BLM, other agencies, and the public to identify at an early stage the significant environmental issues that are deserving of study in this EIS. This RMPA is a major point in the leasing decisionmaking process, requiring analysis of all of the impacts at this stage.

2. Health data

In Colorado, symptoms reported in the state's inspection/incident database by residents living within a half mile of well development included headaches, nausea, upper respiratory irritation, and nosebleeds.[201] In Pennsylvania, the following symptoms were reported by over half the people living near gas development who responded to a health survey. They included fatigue (62%), nasal irritation (61%), throat irritation (60%), sinus problems (58%), burning eyes (53%), shortness of breath (52%), joint pain (52%), feeling weak and tired (52%), severe headaches (51%), and sleep disturbance (51%). The survey was completed by 108 individuals (in 55 households) in 14 counties across Pennsylvania.[202]

These and additional recent studies that were not considered by BLM include:

1. Lisa M. McKenzie et al., *Birth Outcomes and Maternal Residential Proximity to Natural Gas Development in Rural Colorado,* Environmental Health Perspectives (April 2014) (attached above as Exhibit 157).

2. Jessica Gilman, *et al., Source signature of volatile organic compounds (VOCs) from oil and natural gas operations in northeastern Colorado*, ENVIRONMENTAL SCIENCE & TECHNOLOGY (2013) (attached as Exhibit 286).

3. John L. Adgate, *et al., Potential Public Health Hazards, Exposures and Health Effects from Unconventional Natural Gas Development*, ENVIRONMENTAL SCIENCE & TECHNOLOGY (2014) (attached as Exhibit 295).

---

[200] Centers for Disease Control, *Health Impact Assessment*, available at: http://www.cdc.gov/healthyplaces/hia.htm (attached as Exhibit 283).
[201] Roxana Z. Witter, *et al., The Use of Health Impact Assessment for a Community Undergoing Natural Gas Development,* FRAMING HEALTH MATTERS (2013) (attached as Exhibit 284).
[202] Nadia Steinzor, *et al*., *Investigating links between shale gas development and health impacts through a community survey project in Pennsylvania*, NEW SOLUTIONS, vol. 23 iss. 1. (2013) (attached as Exhibit 285).

4. Seth Shonkoff, *et al., Environmental Public Health Dimensions of Shale and Tight Gas Development*, ENVIRONMENTAL HEALTH PERSPECTIVES (2014) (attached as Exhibit 287).

5. Christopher W. Moore, *et al., Air Impacts of Increased Natural Gas Acquisition, Processing, and Use: A Critical Review*, ENVIRONMENTAL SCIENCE & TECHNOLOGY (2014) (attached as Exhibit 288).

6. Avner Vengosh, *et al., The effects of shale gas exploration and hydraulic fracturing on the quality of water resources in the United States*, PROCEDIA EARTH AND PLANETARY SCIENCE (2014) (attached as Exhibit 289).

7. Christopher D. Kassotis, *et al., Estrogen and Androgen Receptor Activities of Hydraulic Fracturing Chemicals and Surface and Ground Water in a Drilling-Dense Region*, Endocrinolgy (2014) (attached as Exhibit 176). (attached above as Exhibit 176).

8. Brian E. Fontenot, *et al., An Evaluation of Water Quality in Private Drinking Water Wells Near Natural Gas Extraction Sites in the Barnett Shale Formation*, ENVIRONMENTAL SCIENCE & TECHNOLOGY (2013) (attached as Exhibit 290).

9. Sherilyn A. Gross, *et al., Analysis of BTEX Groundwater Concentrations from Surface Spills Associated with Hydraulic Fracturing Operations*, JOURNAL OF THE AIR & WASTE MANAGEMENT ASSOCIATION (2013) (attached as Exhibit 291).

10. K.D. Retzer, *et al., Motor vehicle fatalities among oil and gas extraction workers,* ACCIDENT ANALYSIS & PREVENTION (2013) (attached as Exhibit 292).

11. Eric J. Esswein, *et al, Occupational exposures to respirable crystalline silica during hydraulic fracturing*, JOURNAL OF OCCUPATIONAL AND ENVIRONMENTAL HYGIENE (2013) (attached as Exhibit 293).

12. R.Z. Witter, *et al., Occupational exposures in the oil and gas extraction industry: state of the science and research recommendations*, AMERICAN JOURNAL OF INDUSTRIAL MEDICINE (2014) (attached as Exhibit 294).

13. Physicians for Social Responsibility, *Compendium of Scientific, Medical, and Media Findings Demonstrating Risks and Harms of Fracking (Unconventional Oil and Gas Extraction)*, Third Edition (October 14, 2015), available at: http://www.psr.org/assets/pdfs/fracking-compendium.pdf (attached as Exhibit 326).

14. Gayathri Vaidyanathan, *Fracking Can Contaminate Drinking Water*, Climate Wire (April 4, 2016), available at: https://www.scientificamerican.com/article/fracking-can-contaminate-drinking-water/ (last visited November 1, 2016).

15. A. Austin, et al., *Associations Between Unconventional Natural Gas Development and Nasal and Sinus, Migraine Headache, and Fatigue Symptoms in Pennsylvania*, Environmental Health Perspectives (July 31, 2016), available at:

http://ehp.niehs.nih.gov/wp-content/uploads/advpub/2016/8/EHP281.acco.pdf (attached as Exhibit 327).

EPA is also currently investigating the potential impacts of hydraulic fracturing on drinking water resources due to concerns about its potential environmental and human health impacts. Until such research is completed, there is insufficient information to fully understand the potential impacts on human health, an uncertainty that the BLM must take into consideration. The EPA is still in the process of completing this study. Nevertheless, the BLM ignored the uncertainty of the impacts of hydraulic fracturing on drinking water. BLM must consider these studies in any subsequently prepared NEPA document to ensure that it took the required hard look at health impacts.

3. Cumulative impacts on human health

BLM must also fully consider cumulative health impacts of different alternatives. Because the BLM will be leasing minerals located directly beneath and adjacent to private property, and because thousands of people live in close proximity to the industrial activity that will be permitted by the agency, BLM has the responsibility to consider potential impacts on human health from all development, and look at them cumulatively. For example, an individual exposed to both air and water pollution will have different health impacts than an individual exposed only to air pollution.

The assessment of cumulative impacts in NEPA documents is required by CEQ regulations. *See* 40 C.F.R. §1508.25 (Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act). Oil and gas development involves multiple sources of pollutants and disturbance caused by connected actions, including the operations of wellpads, trucks, wells, compressors, pipelines, tanks, pits, separators, dehydrators, rigs and more. Oil and gas development also includes hundreds of potential pollutants, both man-made and naturally occurring. When considered together, pollutants emitted with common timing and/or common geography may create additional health impacts that should be assessed. Also, oil and gas development may create health impacts from air pollution, water contamination, soil contamination, or a combination of all three. Due to the multiple variables and factors involved in oil and gas development, it is essential that the BLM ensure a health impact assessment that fully considers all cumulative impacts to comply with federal regulations and to appropriately assess health impacts and inform the public.

If the full cumulative health impacts are not considered by BLM at this stage it is unlikely that BLM would consider them adequately in connection with individual lease sales, or in project-level and site-specific EAs. This type of shell game, whereby the agency avoids an analysis of the cumulative impacts of the entire project (in this case, 15,000 plus wells) is in contravention of NEPA. *See e.g. Blue Mountains Biodiversity Project v. U.S. Forest Service*, 161 F.3d 1208, 1215 (9th Cir. 2008).

4. Ozone

Background concentrations of ozone in the RMPA planning area are already at or exceed the National Ambient Air Quality Standards ("NAAQS"), leaving virtually no room for growth in emissions. Several studies that measured and/or modeled natural gas related air emissions in various states have identified significant increases in ground level ozone as a result of natural gas development.[203] Ozone was once a summertime urban phenomenon but is now being seen increasingly in western rural areas during the winter due to the natural gas boom, so much so that some relatively small cities are no longer in compliance with the federal regulations that set allowable ozone levels.[204]

Ozone can cause difficulty breathing, coughing and sore throat. It can also inflame and damage the airways. It aggravates lung diseases like asthma, emphysema, and chronic bronchitis. It can make the lungs more susceptible to infection and it can continue to damage the lungs even when the symptoms have disappeared.[205]

Children are particularly vulnerable because their lungs are still developing until about age 18. As their lungs grow in the presence of ozone, their alveoli production is reduced, and they can end up with smaller, more brittle lungs. Women exposed during pregnancy deliver preterm, low birth weight babies with a high probability of developing asthma. In a letter to former EPA Administrator Lisa Jackson, a group of five national medical and public health groups wrote that the most vulnerable individuals, including children, teens, senior citizens, people who exercise or work outdoors, and people with chronic lung diseases like asthma, COPD, and emphysema, are most in danger of being sickened by ozone and that children who grow up in areas of high ozone pollution may never develop their full lung capacity as adults, which can put them at greater risk of lung disease throughout their lives.[206]

5. Naturally Occurring Radioactive Materials

Processes used to produce oil and gas often generate radioactive waste containing concentrations of naturally occurring radioactive materials (NORM). Radioactive wastes from oil and gas production can be found in produced water, flowback water from hydraulic fracturing, drilling waste including cuttings and mud, and/or sludge. This material can concentrate in pipes, storage tanks and facilities, and on other extraction equipment, and may be left on site or be emitted into the environment. Some of these materials can penetrate the skin and raise the risk of cancer. The RMP includes no discussion on potential health impacts associated with NORM that may be released into the environment due to oil and gas extraction activities.

---

[203] *See, e.g.,* Seth Lyman and Howard Shorthill, *Final Report: 2012 Uintah Basin Winter Ozone & Air Quality Study*, UTAH STATE UNIVERSITY, February 1, 2013.
[204] Gabrielle Pétron, *et al*., *Estimation of emissions from oil and natural gas operations in northeastern Colorado*, Power Point available at: http://www.epa.gov/ttnchie1/conference/ei20/session6/gpetron_pres.pdf (attached as Exhibit 296).
[205] *See* EPA, *Ozone – Good Up High Bad Nearby*, available at: http://www.epa.gov/oar/oaqps/gooduphigh/bad.html#7.
[206] *See* American Lung Association (attached above as Exhibit 276).

C. National Historic Preservation Act, San Juan County Road 7950 Improvements and BLM Authorities

The National Historic Preservation Act ("NHPA") imposes the requirement on federal agencies to "take into account the effect[s] of [their] undertaking[s] on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register." 16 U.S.C. § 470f ("Section 106"). *The RMPA is a federal undertaking subject to NHPA compliance*. The regulations implementing Section 106 of the NHPA prescribe the steps agencies must follow to adequately evaluate the effects of undertakings on historic properties. These steps include identifying historic properties in the area of potential effect, assessing whether the undertaking will adversely affect eligible historic properties, and resolving any adverse effects to historic properties from the undertaking. 36 C.F.R. §§ 800.4, 800.5, 800.6.

In addition to the detailed information provided in Conservation Groups' original scoping comments, BLM must also consider, analyze, and respond to information specifically concerning San Juan County Road 7950—the primary entrance into Chaco Culture National Historical Park ("CCNHP" or "Park"), a World Heritage Site.

First, any road improvements beyond basic maintenance may result in harm to CCNHP by increasing visitation, and must be considered. These concerns were first raised with the Federal Highway Administration ("FHWA") through the NEPA process in 2006, when they intended to authorize improvements trough a categorical exclusion. By this time, FHWA had already chip-sealed the first three miles without consideration of the NHPA or conducting required consultation. Although BLM was not a party in the original 2006 improvement, it was nevertheless a required party. Moreover, the New Mexico State Historic Preservation Office ("SHPO") wanted Section 106 requirements met, but San Jan County performed the work without consultation. The FHWA's attempt to chip seal the second section of road was analyzed under NEPA, but this attempt was abandoned in 2012 after years of conflict. San Juan County offered a compromise in early 2012 to use stabilized aggregate as the preferred alternative, but the NEPA process was ultimately abandoned entirely in November of 2012. The stabilized aggregate alternative would have adversely affected six eligible sites under the NHPA according to the final Cultural Resources Survey in 2012. To re-iterate, stabilized aggregate was in fact the final chosen alternative of the NEPA process, and BLM was included as part of that NEPA process. San Juan County initiated the second phase of improvements in 2014, remarkably, despite the NEPA and NHPA processes being abandoned. Although no federal funding was used for these improvements, BLM and BIA remained indispensible parties given the nexus to federal lands and CCNHP. To date, funding for the 2014 remain a mystery, and we have been unable to track it through the NM system. These past improvements likely destroyed NHPA eligible sites, in violation of the law. Any future authorizations for road improvements in the Greater Chaco region—given the dispersed nature of historical properties and sacred sites—and in particular improvements to facilitate the development of oil and gas resources, must fully comply with NEPA and the NHPA.

Second, none of the work on CR7950 since 2006 was ever permitted under NHPA. No consultation with the Hopi (or SHPO) occurred under NHPA Section 106 for the 2006 improvement (chip sealing) or for the 2014 improvement (stabilized aggregate). The later

improvement was done after the NEPA project was abandoned. This failure to consult is documented in a Hopi letter, which clearly states they had no consultation since 2012.[207] Although it was assumed that San Juan County had claimed RS2477 ROW for both improvements, subsequent correspondence confirms that no applications were ever submitted by San Juan County, and thus none of the work was permitted.[208] There are four archeological sites in the first three-mile improvement, six sites in the stretch of road covered in the 2014 improvement. BLM contends that because they were never asked for a permit, and therefore had no responsibility.[209] This self-serving claim offers no defense. San Juan County and BLM worked hand in hand to promote an easy path for development in and around Chaco and may be continuing this pattern on countless other roads in San Juan County. BIA also should have been involved from the beginning. It remains unclear whether the Navajo THPO was ever consulted in the 2006 project or the 2014 improvement.

The Mancos RMPA/EIS must address the fact that BLM has, for many years, been ignoring their obligations under federal law with regard to road improvements in the Greater Chaco region. BLM has instead worked with San Juan County to facilitate improvements and expedite development. The agency has allowed archeological sites be damaged or destroyed. Road improvement is a large part of the energy development scenario. The EIS must take a hard look at how BLM has approached its responsibilities and attempt to outline proper procedure in the future.

V. Conclusion

The Conservation Groups appreciate your consideration of the information and concerns addressed herein, as well as the information included in the attached exhibits. This information is critical and must be reflected in the agency's formulation of alternatives and in its draft RMPA and EIS. For the reasons described above, we urge BLM to: (1) fully consider a range of alternatives, including a "no-leasing" alternative; (2) fully consider the problem of methane waste, and takes steps to control methane waste; (3) fully consider current scientific and economic information, especially regarding climate change; and (4) provide a true "hard look" at impacts to air, water, and human health, including by conducting a Health Impact Assessment.

Should you have any questions, please do not hesitate to contact me.

Sincerely,

[207] Letter from Leigh Kuwanwisiwma, Hopi Cultural Preservation Office to Jeff Pappas, NM SHPO (Aug. 25, 2014) (attached as Exhibit 40).
[208] Letter from Anon Wright, Chaco Alliance to Jeff Pappas, NM SHPO (July 21, 2014) (attached as Exhibit 41); Email from Jillian Aragon, San Juan County to Rick Wessel, NMDOT (May 10, 2016) (attached as Exhibit 42).
[209] Letter from Victoria Bar, BLM to Anson Wright, Chaco Alliance (Jun. 23, 2016) (attached as Exhibit 43).

Kyle Tisdel
WESTERN ENVIRONMENTAL LAW CENTER
208 Paseo del Pueblo Sur, Unit 602
Taos, New Mexico 87571
575.751.0351
tisdel@westernlaw.org

Along with:

Rachel Conn
AMIGOS BRAVOS
PO Box 238
Taos, NM 87571
575.758.3874
rconn@amigosbravos.org

Michael Saul
CENTER FOR BIOLOGICAL DIVERSITY
1536 Wynkoop St., Ste. 421
Denver, CO 80202
msaul@biologicaldiversity.org

Anson Wight
CHACO ALLIANCE
4990 SW Hewett Blvd.
Portland, OR97221
503.709.0038
ansonw@comcast.net

Carol Davis
DINÉ CARE
Dilkon, on Navajo Nation
HRC 63 Box 272
Winslow, AZ 86047
caroljdavis.2004@gmail.com

Allyson Siwik
GILA RESOURCES INFORMATION PROJECT
305A North Cooper St.
Silver City, NM 88061
575.538.8078
allysonsiwik@gmail.com

Mike Eisenfeld
SAN JUAN CITIZENS ALLIANCE
PO Box 6655

Farmington, NM 87499
970.259.3583
meisenfeld@frontier.net

Nathaniel Shoaff
SIERRA CLUB ENVIRONMENTAL LAW PROGRAM
2100 Webster Street, Suite 1300
Oakland, CA 94612
415.997.5610
nathaniel.shaoff@sierraclub.org

Jeremy Nichols
WILDEARTH GUARDIANS
1536 Wynkoop St., Ste. 301
Denver, CO 80202
303.437.7663
jnichols@wildearthguardians.org

From: Cook, Gerald (Dave)
To: Connie Brooks
Subject: Re: Renewal request
Date: Tuesday, February 21, 2017 3:38:28 PM

Connie,

I have the Bridgeport Transfer about done however I need to get the ten dollar fee.

On Mon, Feb 13, 2017 at 9:16 AM, Connie Brooks <connie@cebrooks.com> wrote:

> Dear Dave,
>
> Thanks.
>
> Connie Brooks
>
> From: Cook, Gerald (Dave) [mailto:gdcook@blm.gov]
> Sent: Monday, February 13, 2017 8:24 AM
> To: Connie Brooks
> Cc: Van Elsbernd (b) (6)); jdickinson@vermillionranchlp.com <mailto:jdickinson@vermillionranchlp.com> ; emccullo@blm.gov
> Subject: Re: Renewal request
>
> Connie,
>
> Got your email, thanks. I think we are on the same page with the transfer. Also, there are some additional terms and conditions that were not included in the application. I will get those to you. The renewal will be a CX under FLPMA.
>
> On Fri, Feb 10, 2017 at 5:15 PM, Connie Brooks <connie@cebrooks.com> wrote:
>
> Connie Brooks
>
> C.E. Brooks & Associates, P.C.
>
> 303 East 17th Avenue, Suite 650
>
> Denver, CO 80203
>
> Phone: (303) 297-9100
>
> Fax: (303) 297-9101
>
> connie@cebrooks.com

Dear Dave,

I am sure you were going to issue Bridgeport Allotment permit as a 10-year permit but I am closing the loop with a formal application. With the 2014 amendment to FLPMA, the renewals are a matter of course upon transfer or expiration until the NEPA analysis is done. Previously the permittee had to ask for renewal and your email indicated it expired in 2016. After the changes in the law, there is no interim direction, so we are asking for renewal just to be clear.

Thanks for your work on this.

Sincerely

Connie Brooks

--

Dave Cook

Branch Chief, Range and Wildlife

Vernal Field Office

435-781-3424

gdcook@blm.gov

--

Dave Cook
Branch Chief, Range and Wildlife
Vernal Field Office
435-781-3424

gdcook@blm.gov

From: Connie Brooks
To: Cook, Gerald (Dave)
Subject: RE: Renewal request
Date: Tuesday, February 21, 2017 3:53:33 PM

Dave, if you take a credit card, Suzanne will call you. If not we will send you the check today.

Connie

From: Cook, Gerald (Dave) [mailto:gdcook@blm.gov]
Sent: Tuesday, February 21, 2017 1:38 PM
To: Connie Brooks
Subject: Re: Renewal request

Connie,

I have the Bridgeport Transfer about done however I need to get the ten dollar fee.

On Mon, Feb 13, 2017 at 9:16 AM, Connie Brooks <connie@cebrooks.com> wrote:

Dear Dave,

Thanks.

Connie Brooks

From: Cook, Gerald (Dave) [mailto:gdcook@blm.gov]
Sent: Monday, February 13, 2017 8:24 AM
To: Connie Brooks
Cc: Van Elsbernd (b) (6) ; jdickinson@vermillionranchlp.com; emccullo@blm.gov
Subject: Re: Renewal request

Connie,

Got your email, thanks. I think we are on the same page with the transfer. Also, there are some additional terms and conditions that were not included in the application. I will get those to you. The renewal will be a CX under FLPMA.

On Fri, Feb 10, 2017 at 5:15 PM, Connie Brooks <connie@cebrooks.com> wrote:

Connie Brooks

C.E. Brooks & Associates, P.C.

303 East 17th Avenue, Suite 650

Denver, CO 80203

Phone: (303) 297-9100

Fax: (303) 297-9101

connie@cebrooks.com

Dear Dave,

I am sure you were going to issue Bridgeport Allotment permit as a 10-year permit but I am closing the loop with a formal application. With the 2014 amendment to FLPMA, the renewals are a matter of course upon transfer or expiration until the NEPA analysis is done. Previously the permittee had to ask for renewal and your email indicated it expired in 2016. After the changes in the law, there is no interim direction, so we are asking for renewal just to be clear.

Thanks for your work on this.

Sincerely

Connie Brooks

--

Dave Cook

Branch Chief, Range and Wildlife

Vernal Field Office

435-781-3424

gdcook@blm.gov

--

Dave Cook

Branch Chief, Range and Wildlife

Vernal Field Office

435-781-3424

gdcook@blm.gov

From: Cook, Gerald (Dave)
To: Connie Brooks
Subject: Re: Renewal request
Date: Tuesday, February 21, 2017 3:56:54 PM

Connie,

Please send a check if that is okay with you. I still have a bit to do.

On Tue, Feb 21, 2017 at 1:53 PM, Connie Brooks <connie@cebrooks.com> wrote:

> Dave, if you take a credit card, Suzanne will call you. If not we will send you the check today.
>
> Connie
>
> From: Cook, Gerald (Dave) [mailto:gdcook@blm.gov]
> Sent: Tuesday, February 21, 2017 1:38 PM
> To: Connie Brooks
> Subject: Re: Renewal request
>
> Connie,
>
> I have the Bridgeport Transfer about done however I need to get the ten dollar fee.
>
> On Mon, Feb 13, 2017 at 9:16 AM, Connie Brooks <connie@cebrooks.com> wrote:
>
> Dear Dave,
>
> Thanks.
>
> Connie Brooks
>
> From: Cook, Gerald (Dave) [mailto:gdcook@blm.gov]
> Sent: Monday, February 13, 2017 8:24 AM
> To: Connie Brooks
> Cc: Van Elsbernd (b) (6) ; jdickinson@vermillionranchlp.com <mailto:jdickinson@vermillionranchlp.com> ; emccullo@blm.gov
> Subject: Re: Renewal request
>
> Connie,

Got your email, thanks. I think we are on the same page with the transfer. Also, there are some additional terms and conditions that were not included in the application. I will get those to you. The renewal will be a CX under FLPMA.

On Fri, Feb 10, 2017 at 5:15 PM, Connie Brooks <connie@cebrooks.com> wrote:

Connie Brooks

C.E. Brooks & Associates, P.C.

303 East 17th Avenue, Suite 650

Denver, CO 80203

Phone: (303) 297-9100

Fax: (303) 297-9101

connie@cebrooks.com

Dear Dave,

I am sure you were going to issue Bridgeport Allotment permit as a 10-year permit but I am closing the loop with a formal application. With the 2014 amendment to FLPMA, the renewals are a matter of course upon transfer or expiration until the NEPA analysis is done. Previously the permittee had to ask for renewal and your email indicated it expired in 2016. After the changes in the law, there is no interim direction, so we are asking for renewal just to be clear.

Thanks for your work on this.

Sincerely

Connie Brooks

--

Dave Cook

Branch Chief, Range and Wildlife

Vernal Field Office

435-781-3424

gdcook@blm.gov

--

Dave Cook

Branch Chief, Range and Wildlife

Vernal Field Office

435-781-3424

gdcook@blm.gov

--

Dave Cook
Branch Chief, Range and Wildlife
Vernal Field Office
435-781-3424

gdcook@blm.gov

From: Steve Bloch
To: "Kent Hoffman"; rbankert@blm.gov; rnaeve@blm.gov
Cc: "Landon Newell"
Subject: FW: Oil and gas leases in Bears Ears National Monument / request for meeting
Date: Friday, February 24, 2017 2:23:22 PM

Kent –

Landon forwarded me your response to our meeting request over SUWA's two letters from several weeks ago about leases in San Juan County and within the Bears Ears National Monument. While we appreciate that your office is busy and has competing priorities, waiting at least 4-6 weeks (in total) to arrange a meeting in which we would discuss our questions about these straightforward lease files is unacceptable.

Compounding our frustration is the delayed response time we have seen over the past few years to other SUWA letters that raise questions regarding BLM's treatment of various leases and unit agreements. For example, we have requested to meet with Utah BLM regarding the Hatch Point Unit (UTU-73394X) without success.

We look forward to hearing from you and/or meeting with you and your team at your earliest convenience.

Steve

---------- Forwarded message ----------
From: Hoffman, Kent <khoffman@blm.gov>
Date: Tue, Feb 21, 2017 at 9:59 AM
Subject: Re: Oil and gas leases in Bears Ears National Monument / request for meeting
To: Landon Newell <landon@suwa.org>
Cc: Roger Bankert <rbankert@blm.gov>, Robin Naeve <rnaeve@blm.gov>

Landon,

I have asked my staff to provide me information and an update regarding the leases and offer you identified in your letters. I will let you know when we are prepared to meet and discuss the issues. It will likely be a couple of weeks out due to several other pressing matters and priorities.

Regards,

Kent

On Wed, Feb 15, 2017 at 2:38 PM, Landon Newell <landon@suwa.org> wrote:

Kent and Roger -

Can you please provide an update regarding any actions taken by BLM to close the oil and gas lease files for each lease discussed in SUWA's letters to your office dated January 31, 2017, and February 1, 2017 (attached for your reference).

We also would like to schedule a meeting next week to discuss these leases. Please let us know what day/time works best for you and your staff.

Thank you,

Landon

--

Landon Newell

Staff Attorney

Southern Utah Wilderness Alliance

425 East 100 South

Salt Lake City, Utah 84111

Phone: 801-428-3991 <tel:(801)%20428-3991>

E-mail: landon@suwa.org

--

Kent Hoffman

Deputy State Director, Lands & Minerals

U. S. Bureau of Land Management

Utah State Office, Salt Lake City, Utah

Phone (801) 539-4063 <tel:(801)%20539-4063>

FLPMA mandates that the BLM manage Public Lands for multiple use and sustained yield.

Continuous exploration, development, and site restoration of energy and mineral resources are necessary to sustain their yield

--

Landon Newell

Staff Attorney

Southern Utah Wilderness Alliance

425 East 100 South

Salt Lake City, Utah 84111

Phone: 801-428-3991

E-mail: landon@suwa.org

From: Cook, Gerald (Dave)
To: Connie Brooks
Subject: Bridgeport
Date: Monday, March 13, 2017 12:04:37 PM
Attachments: 4300735 Transfer Auth. 3_13_2017.pdf

Connie,

Please find attached the Bridgeport Transfer. Please sign and return then I will get the BLM signatures and send you a copy and a copy of all the documents. Thanks

--

Dave Cook
Branch Chief, Range and Wildlife
Vernal Field Office
435-781-3424

gdcook@blm.gov

Form 4130-2a
(July 2016)

U.S. Department of the Interior
BUREAU OF LAND MANAGEMENT

State: UT
Office: LLUTG01000
Preference Code: 03
AUTHORIZATION: 4300735

GRAZING PERMIT

EFFECTIVE: 03/31/2017 TO 03/13/2027

ISSUED TO:

VERMILLION RANCH L P
609 5TH AVENUE WEST
ROCK SPRINGS WY 82901-7621

ISSUED BY:

BUREAU OF LAND MANAGEMENT
VERNAL FIELD OFFICE
170 S 500 E
VERNAL UT 84078-2799

UNDER 43 CFR PART 4100, THE BUREAU OF LAND MANAGEMENT (BLM) OFFERS YOU THIS GRAZING PERMIT BASED ON YOUR RECOGNIZED QUALIFICATIONS. UPON YOUR ACCEPTANCE OF THE TERMS AND CONDITIONS OF THIS GRAZING PERMIT AND PAYMENT OF GRAZING FEES WHEN DUE, YOU ARE AUTHORIZED TO MAKE GRAZING USE OF LANDS UNDER THE JURISDICTION OF THE BLM THAT ARE COVERED BY THIS GRAZING PERMIT. IF YOU HAVE QUESTIONS CONCERNING THIS GRAZING PERMIT, CONTACT YOUR LOCAL BLM OFFICE AT 435-781-4400.

TERMS AND CONDITIONS

ALLOTMENT		PASTURE	LIVESTOCK NUMBER KIND	PERIOD BEGIN	PERIOD END	%PL USE	TYPE USE	AUMS
UT14805	BRIDGEPORT		84 CATTLE	04/11	05/30	100	ACTIVE	138

THIS PERMIT OR LEASE IS ISSUED UNDER THE AUTHORITY OF SECTION 402(C)(2) OF FLPMA, 1976 AS AMENDED, AND CONTAINS THE SAME TERMS AND CONDITIONS AS THE PREVIOUS PERMIT OR LEASE.

OTHER TERMS AND CONDITIONS:

GRAZING WOULD OCCUR WITHIN THE SEASON OF USE AND WOULD NOT EXCEED THE

PERMITTED USE (AUM'S). LIVESTOCK NUMBERS MAY BE INCREASED AND GRAZED

FOR A SHORTER PERIOD TO USE THE PERMITTED 139 ACTIVE AUM'S ANNUALLY.

PLACEMENT OF LIVESTOCK ATTRACTANTS SUCH AS SALT, MINERAL OR MOLASSES,

OR CONSTRUCTION OF RANGELAND IMPROVEMENTS WOULD NOT BE ALLOWED IN

THE IMMEDIATE AREA OF SPECIAL STATUS PLANT SPECIES POPULATIONS.

IF, AT SOMETIME, FUTURING MONITORING INDICATES NON-CONFORMANCE WITH

RANGELAND STANDARDS, THEN THIS PERMIT WILL BE REISSUED SUBJECT TO THE

TERMS AND CONDITIONS THAT WILL RESULT IN CONFORMANCE WITH THE UTAH

STANDARDS FOR RANGELAND HEALTH.

CASE FILE COPY

IF TERMS AND CONDITIIONS ARE NOT MET, THE AUTHORIZED OFFICER MAY MAKE

MANAGE THE ALLOTMENT FOR THE FOLLOWING UTILIZATION LEVELS OF KEY SPECIES. THESE INITIAL USE LEVELS MAY CHANGE WITH THE IMPLEMENTATION OF A GRAZING AGREEMENT:

1. COMBINED LIVESTOCK AND WILDLIFE USE OF KEY UPLAND SPECIES WOULD NOT EXCEED 50% ON GRASSES AND FORBS.
2. TO PROVIDE FOR BANK PROTECTION AND SEDIMENT ENTRAPMENT RIPARIAN AREAS WOULD BE MANAGED FOR THE FOLLOWING UTILIZATION LEVELS:
   A. KEY HERBACEOUS RIPARIAN VEGETATION, WHERE STREAM BANK STABILITY IS DEPENDENT UPON IT, WOULD HAVE A MINIMUM STUBBLE HEIGHT OF FOUR INCHES ON THE STREAM BANK ALONG THE GREEN AT THE END OF THE GROWING SEASON.
   B. THE KEY HERBACEOUS RIPARIAN VEGETATION OTHER THAN THE STREAM BANKS WOULD NOT BE GRAZED MORE THAN 30% DRING THE GROWING SEASON.
   C. KEY RIPARIAN BROWSE VEGETATION WOULD NOT BE USED MORE THAN 30% OF THE CURRENT ANNUAL TWIG GROWTH THAT IS WITHIN THE REACH OF THE GRAZING ANIMALS.

CASE FILE COPY

PERMITTED USE SUMMARY

ALLOTMENT		ACTIVE AUMS	SUSPENDED AUMS	TEMP SUSPENDED AUMS	PERMITTED USE
UT14805	BRIDGEPORT	139	0		139

CASE FILE COPY

TERMS AND CONDITIONS APPLICABLE TO ALL PERMITS AND LEASES

1. Grazing permit or lease terms and conditions and the fees charged for grazing use are established in accordance with the provisions of the grazing regulations now or hereafter approved by the Secretary of the Interior.

2. They are subject to cancellation, in whole or in part, at any time because of:
   a. Noncompliance by the permittee/lessee with rules and regulations.
   b. Loss of control by the permittee/lessee of all or a part of the property upon which it is based.
   c. A transfer of grazing preference by the permittee/lessee to another party.
   d. A decrease in the lands administered by the Bureau of Land Management within the allotment(s) described.
   e. Repeated willful unauthorized grazing use.
   f. Loss of qualifications to hold a permit or lease.

3. They are subject to the terms and conditions of allotment management plans if such plans have been prepared. Allotment management plans MUST be incorporated in permits or leases when completed.

4. Those holding permits or leases MUST own or control and be responsible for the management of livestock authorized to graze.

5. The authorized officer may require counting and/or additional or special marking or tagging of the livestock authorized to graze.

6. The permittee's/lessee's grazing case file is available for public inspection as required by the Freedom of Information Act.

7. Grazing permits or leases are subject to the nondiscrimination clauses set forth in Executive Order 11246 of September 24, 1964, as amended. A copy of this order may be obtained from the authorized officer.

8. Livestock grazing use that is different from that authorized by a permit or lease MUST be applied for prior to the grazing period and MUST be filed with and approved by the authorized officer before grazing use can be made.

9. Billing notices are issued which specify fees due. Billing notices, when paid, become a part of the grazing permit or lease. Grazing use cannot be authorized during any period of delinquency in the payment of amounts due, including settlement for unauthorized use.

10. The holder of this authorization must notify the authorized officer immediately upon the discovery of human remains, funerary objects, sacred objects, or objects of cultural patrimony (cultural items), stop the activity in the area of the discovery and make a reasonable effort to protect the remains and/or cultural items.

11. Grazing fee payments are due on the date specified on the billing notice and MUST be paid in full within 15 days of the due date, except as otherwise provided in the grazing permit or lease. If payment is not made within that time frame, a late fee (the greater of $25 or 10 percent of the amount owed but not more than $250) will be assessed.

12. Members of Congress may not enter into a grazing permit or lease. 41 USC 6306 (2014). Further, no officer, agent, or employee of the Department of the Interior, other than members of Advisory committees appointed in accordance with the Federal Advisory Committee Act (5 U.S.C. App. 1) and Sections 309 of the Federal Land Policy and Management Act of 1976 (42 U.S.C. 1701 et. seq.) shall be admitted to any share or part in a permit or lease for grazing or derive any benefit to arise from a permit or lease for grazing.

CASE FILE COPY

THIS GRAZING PERMIT:

1. CONVEYS NO RIGHT, TITLE OR INTEREST HELD BY THE UNITED STATES IN ANY LANDS OR RESOURCES

2. IS SUBJECT TO (A) MODIFICATION, SUSPENSION OR CANCELLATION AS REQUIRED BY LAND PLANS AND APPLICABLE LAW; (B) ANNUAL REVIEW AND MODIFICATION OF TERMS AND CONDITIONS AS APPROPRIATE; AND (C) THE TAYLOR GRAZING ACT, AS AMENDED, THE FEDERAL LAND POLICY AND MANAGEMENT ACT, AS AMENDED, THE PUBLIC RANGELANDS IMPROVEMENT ACT, AND THE RULES AND REGULATIONS NOW OR HEREAFTER PROMULGATED THEREUNDER BY THE SECRETARY OF THE INTERIOR.

ACCEPTED BY:

_____ _____

OPERATOR SIGNATURE DATE

_____

PRINTED NAME AND TITLE

APPROVED BY:

_____ _____

BLM AUTHORIZED OFFICER SIGNATURE DATE

_____

PRINTED NAME AND TITLE

AUMS: Animal Unit Months. Animal unit month means the amount of forage necessary for the sustenance of one cow or its equivalent for a period of 1 month. For fee calculation purposes, an AUM is one month's use and occupancy of the range by one cow, bull, steer, heifer, horse, burro, mule, 5 sheep or 5 goats that: (1) are over the age of 6 months at the time of entering lands administered by the BLM; (2) are weaned regardless of age; (3) will become 12 months of age during the authorized period of use.

%PL Use: Percent forage from public land use.

Type Use: Categories with specific rules that govern AUM and grazing fee calculation and input on grazing authorizations and bills.

CASE FILE COPY

Form 4130-2a
(July 2016)

U.S. Department of the Interior
BUREAU OF LAND MANAGEMENT

State: UT
Office: LLUTG01000
Preference Code: 03
AUTHORIZATION: 4300735

GRAZING PERMIT

EFFECTIVE: 03/31/2017 TO 03/13/2027

ISSUED TO:

VERMILLION RANCH L P
609 5TH AVENUE WEST
ROCK SPRINGS WY 82901-7621

ISSUED BY:

BUREAU OF LAND MANAGEMENT
VERNAL FIELD OFFICE
170 S 500 E
VERNAL UT 84078-2799

UNDER 43 CFR PART 4100, THE BUREAU OF LAND MANAGEMENT (BLM) OFFERS YOU THIS GRAZING PERMIT BASED ON YOUR RECOGNIZED QUALIFICATIONS. UPON YOUR ACCEPTANCE OF THE TERMS AND CONDITIONS OF THIS GRAZING PERMIT AND PAYMENT OF GRAZING FEES WHEN DUE, YOU ARE AUTHORIZED TO MAKE GRAZING USE OF LANDS UNDER THE JURISDICTION OF THE BLM THAT ARE COVERED BY THIS GRAZING PERMIT. IF YOU HAVE QUESTIONS CONCERNING THIS GRAZING PERMIT, CONTACT YOUR LOCAL BLM OFFICE AT 435-781-4400.

TERMS AND CONDITIONS

ALLOTMENT		PASTURE	LIVESTOCK NUMBER KIND	PERIOD BEGIN	PERIOD END	%PL USE	TYPE USE	AUMS
UT14805	BRIDGEPORT		84 CATTLE	04/11	05/30	100	ACTIVE	138

THIS PERMIT OR LEASE IS ISSUED UNDER THE AUTHORITY OF SECTION 402(C)(2) OF FLPMA, 1976 AS AMENDED, AND CONTAINS THE SAME TERMS AND CONDITIONS AS THE PREVIOUS PERMIT OR LEASE.

OTHER TERMS AND CONDITIONS:

GRAZING WOULD OCCUR WITHIN THE SEASON OF USE AND WOULD NOT EXCEED THE

PERMITTED USE (AUM'S). LIVESTOCK NUMBERS MAY BE INCREASED AND GRAZED

FOR A SHORTER PERIOD TO USE THE PERMITTED 139 ACTIVE AUM'S ANNUALLY.

PLACEMENT OF LIVESTOCK ATTRACTANTS SUCH AS SALT, MINERAL OR MOLASSES,

OR CONSTRUCTION OF RANGELAND IMPROVEMENTS WOULD NOT BE ALLOWED IN

THE IMMEDIATE AREA OF SPECIAL STATUS PLANT SPECIES POPULATIONS.

IF, AT SOMETIME, FUTURING MONITORING INDICATES NON-CONFORMANCE WITH

RANGELAND STANDARDS, THEN THIS PERMIT WILL BE REISSUED SUBJECT TO THE

TERMS AND CONDITIONS THAT WILL RESULT IN CONFORMANCE WITH THE UTAH

STANDARDS FOR RANGELAND HEALTH.

OPERATOR COPY

IF TERMS AND CONDITIIONS ARE NOT MET, THE AUTHORIZED OFFICER MAY MAKE

MANAGE THE ALLOTMENT FOR THE FOLLOWING UTILIZATION LEVELS OF KEY SPECIES. THESE INITIAL USE LEVELS MAY CHANGE WITH THE IMPLEMENTATION OF A GRAZING AGREEMENT:

1. COMBINED LIVESTOCK AND WILDLIFE USE OF KEY UPLAND SPECIES WOULD NOT EXCEED 50% ON GRASSES AND FORBS.
2. TO PROVIDE FOR BANK PROTECTION AND SEDIMENT ENTRAPMENT RIPARIAN AREAS WOULD BE MANAGED FOR THE FOLLOWING UTILIZATION LEVELS:
   A. KEY HERBACEOUS RIPARIAN VEGETATION, WHERE STREAM BANK STABILITY IS DEPENDENT UPON IT, WOULD HAVE A MINIMUM STUBBLE HEIGHT OF FOUR INCHES ON THE STREAM BANK ALONG THE GREEN AT THE END OF THE GROWING SEASON.
   B. THE KEY HERBACEOUS RIPARIAN VEGETATION OTHER THAN THE STREAM BANKS WOULD NOT BE GRAZED MORE THAN 30% DRING THE GROWING SEASON.
   C. KEY RIPARIAN BROWSE VEGETATION WOULD NOT BE USED MORE THAN 30% OF THE CURRENT ANNUAL TWIG GROWTH THAT IS WITHIN THE REACH OF THE GRAZING ANIMALS.

PERMITTED USE SUMMARY

ALLOTMENT		ACTIVE AUMS	SUSPENDED AUMS	TEMP SUSPENDED AUMS	PERMITTED USE
UT14805	BRIDGEPORT	139	0		139

OPERATOR COPY

TERMS AND CONDITIONS APPLICABLE TO ALL PERMITS AND LEASES

1. Grazing permit or lease terms and conditions and the fees charged for grazing use are established in accordance with the provisions of the grazing regulations now or hereafter approved by the Secretary of the Interior.

2. They are subject to cancellation, in whole or in part, at any time because of:
   a. Noncompliance by the permittee/lessee with rules and regulations.
   b. Loss of control by the permittee/lessee of all or a part of the property upon which it is based.
   c. A transfer of grazing preference by the permittee/lessee to another party.
   d. A decrease in the lands administered by the Bureau of Land Management within the allotment(s) described.
   e. Repeated willful unauthorized grazing use.
   f. Loss of qualifications to hold a permit or lease.

3. They are subject to the terms and conditions of allotment management plans if such plans have been prepared. Allotment management plans MUST be incorporated in permits or leases when completed.

4. Those holding permits or leases MUST own or control and be responsible for the management of livestock authorized to graze.

5. The authorized officer may require counting and/or additional or special marking or tagging of the livestock authorized to graze.

6. The permittee's/lessee's grazing case file is available for public inspection as required by the Freedom of Information Act.

7. Grazing permits or leases are subject to the nondiscrimination clauses set forth in Executive Order 11246 of September 24, 1964, as amended. A copy of this order may be obtained from the authorized officer.

8. Livestock grazing use that is different from that authorized by a permit or lease MUST be applied for prior to the grazing period and MUST be filed with and approved by the authorized officer before grazing use can be made.

9. Billing notices are issued which specify fees due. Billing notices, when paid, become a part of the grazing permit or lease. Grazing use cannot be authorized during any period of delinquency in the payment of amounts due, including settlement for unauthorized use.

10. The holder of this authorization must notify the authorized officer immediately upon the discovery of human remains, funerary objects, sacred objects, or objects of cultural patrimony (cultural items), stop the activity in the area of the discovery and make a reasonable effort to protect the remains and/or cultural items.

11. Grazing fee payments are due on the date specified on the billing notice and MUST be paid in full within 15 days of the due date, except as otherwise provided in the grazing permit or lease. If payment is not made within that time frame, a late fee (the greater of $25 or 10 percent of the amount owed but not more than $250) will be assessed.

12. Members of Congress may not enter into a grazing permit or lease. 41 USC 6306 (2014). Further, no officer, agent, or employee of the Department of the Interior, other than members of Advisory committees appointed in accordance with the Federal Advisory Committee Act (5 U.S.C. App. 1) and Sections 309 of the Federal Land Policy and Management Act of 1976 (42 U.S.C. 1701 et. seq.) shall be admitted to any share or part in a permit or lease for grazing or derive any benefit to arise from a permit or lease for grazing.

THIS GRAZING PERMIT:

1. CONVEYS NO RIGHT, TITLE OR INTEREST HELD BY THE UNITED STATES IN ANY LANDS OR RESOURCES

2. IS SUBJECT TO (A) MODIFICATION, SUSPENSION OR CANCELLATION AS REQUIRED BY LAND PLANS AND APPLICABLE LAW; (B) ANNUAL REVIEW AND MODIFICATION OF TERMS AND CONDITIONS AS APPROPRIATE; AND (C) THE TAYLOR GRAZING ACT, AS AMENDED, THE FEDERAL LAND POLICY AND MANAGEMENT ACT, AS AMENDED, THE PUBLIC RANGELANDS IMPROVEMENT ACT, AND THE RULES AND REGULATIONS NOW OR HEREAFTER PROMULGATED THEREUNDER BY THE SECRETARY OF THE INTERIOR.

ACCEPTED BY:

_____ _____

OPERATOR SIGNATURE DATE

_____

PRINTED NAME AND TITLE

APPROVED BY:

_____ _____

BLM AUTHORIZED OFFICER SIGNATURE DATE

_____

PRINTED NAME AND TITLE

AUMS: Animal Unit Months. Animal unit month means the amount of forage necessary for the sustenance of one cow or its equivalent for a period of 1 month. For fee calculation purposes, an AUM is one month's use and occupancy of the range by one cow, bull, steer, heifer, horse, burro, mule, 5 sheep or 5 goats that: (1) are over the age of 6 months at the time of entering lands administered by the BLM; (2) are weaned regardless of age; (3) will become 12 months of age during the authorized period of use.

%PL Use: Percent forage from public land use.

Type Use: Categories with specific rules that govern AUM and grazing fee calculation and input on grazing authorizations and bills.

From:	Laura King
To:	blm_co_si_mail@blm.gov
Subject:	Citizen Groups" NFMMDP Scoping Comments
Date:	Wednesday, March 22, 2017 2:17:34 PM
Attachments:	NFMMDP-Scoping Comments_FINAL.pdf

Dear Bureau of Land Management:

Please find attached detailed scoping comments on the North Fork Mancos Master Development Plan (DOI-BLM-CO-N040-2017-050-EA). We at Western Environmental Law Center are submitting these comments on behalf Citizens for a Healthy Community, High Country Conservation Advocates, Center for Biological Diversity, the Wilderness Society, and Rocky Mountain Wild. Please do not hesitate to let us know if you have any questions about our concerns. These comments will also be arriving by mail, along with CDs of the exhibits.

Best,

Laura

Laura King

Staff Attorney

Western Environmental Law Center

103 Reeder's Alley

Helena, MT 59601

(406) 204-4852 (tel.)

king@westernlaw.org

www.westernlaw.org

Northwest
1216 Lincoln Street
Eugene, Oregon 97401
(541) 485-2471

Rocky Mountains
103 Reeder's Alley
Helena, Montana 59601
(406) 443-3501

Southwest
208 Paseo del Pueblo Sur #602
Taos, New Mexico 87571
(575) 751-0351

Defending the West www.westernlaw.org

Western Environmental Law Center

March 22, 2017

Sent via Electronic Mail (scoping comments only) and Certified Mail (comments and exhibits)

U.S. Bureau of Land Management
Attn: NFMMDP
2300 River Frontage Road
Silt, Colorado 81652
Email: blm_co_si_mail@blm.gov
Fax: (970) 876-9090

Re: Scoping Comments – Proposed Action: North Fork Mancos Master Development Plan for Oil and Gas Exploration and Development, Gunnison and Delta Counties, Colorado (DOI-BLM-CO-N040-2017-050-EA)

Dear Bureau of Land Management:

The Western Environmental Law Center ("WELC"), along with Citizens for a Healthy Community, High Country Conservation Advocates, Wilderness Workshop, WildEarth Guardians, Center for Biological Diversity, the Wilderness Society, and Rocky Mountain Wild (together "Citizen Groups"), submit the following Scoping Comments regarding a proposal (the North Fork Mancos Master Development Plan, or NFMMDP) to drill, complete, and operate 35 horizontal wells from four new well pads and one existing well pad and to construct associated access roads and gathering lines over a 3-year period in Gunnison and Delta Counties, Colorado. The North Fork Mancos Master Development Plan project area includes lands within the Grand Mesa, Uncompahgre and Gunnison National Forests ("GMUG") and the Bureau of Land Management's ("BLM") Uncompahgre Field Office ("UFO"), with a mineral estate managed by the BLM's Colorado River Valley Field Office ("CRVFO"). Currently, the proposed action anticipates commencement of the project in Spring 2017. *Since we are now in Spring 2017, we request that the NFMMDP website be updated with a new timeline.*

This 35-well project, which is the first phase of a potential development of a total of 13 well pads and up to 104 wells, is located near and adjacent to other oil and gas development in the area—and in some cases may share associated pipeline and flowback pit infrastructure with such development.[1] In particular, the agency's cumulative analysis must consider both (1) the

[1] The 35-well project estimates 700 billion cubic feet of natural gas production; the total 13 pad future development estimates 2.1 trillion cubic feet of natural gas.

150-well Bull Mountain Master Development Plan ("Bull Mountain MDP"), for which the UFO released a Final Environmental Impact Statement ("FEIS") in July 2016, and (2) the proposal for the development of 25 federal natural gas wells and associated development in the GMUG, for which NEPA analysis has been completed. Given the proximity and specific relevance of the Bull Mountain MDP and 25-well project with this project, Citizen Groups hereby incorporate by this reference our detailed technical comments submitted on the Bull Mountain DEIS, attached as Exhibit A, our protest of the Bull Mountain MDP FEIS, attached as Exhibit B, our comments on the Environmental Assessment for the 25-well project, attached as Exhibit C, and our objection to the approval of Surface Use Plans of Operation for the 25-well project, attached as Exhibit D, which should be considered in BLM's decisionmaking and incorporated into the record for this 35-well project.

The **Western Environmental Law Center** ("WELC") uses the power of the law to defend and protect the American West's treasured landscapes, iconic wildlife, and rural communities. WELC combines legal skills with sound conservation biology and environmental science to address major environmental issues in the West in the most strategic and effective manner. WELC works at the national, regional, state, and local levels; and in all three branches of government. WELC integrates national policies and regional perspective with the local knowledge of our 100+ partner groups to implement smart and appropriate place-based actions.

Citizens for a Healthy Community ("CHC") is a grass-roots organization with more than 500 members formed in 2010 for the purpose of protecting people and their environment from the impacts of oil and gas development in the Delta County region. CHC's members and supporters include organic farmers, ranchers, vineyard and winery owners, sportsmen, realtors, and other concerned citizens impacted by oil and gas development. CHC members have been actively involved in commenting on BLM's oil and gas activities.

High Country Conservation Advocates ("HCCA") is located in Crested Butte, Colorado with over 800 members. HCCA was founded in 1977 to protect the health and natural beauty of the land, rivers, and wildlife in and around Gunnison County now and for future generations. HCCA has engaged on oil, natural gas, and coal bed methane development in Gunnison County for over a decade to prevent irreparable harm to its members' interests. HCCA's members and supporters live in, use, and enjoy the communities and landscapes that the proposed Bull Mountain development would affect.

Wilderness Workshop ("WW") is a non-profit organization engaged in research, education, legal advocacy and grassroots organizing to protect the ecological integrity of local public lands. WW is based in Carbondale, Colorado and has approximately 800 members. WW not only defends pristine public lands from new threats, but also strives to restore the functional wildness of landscapes fragmented by human activity. WW works to protect and preserve existing wilderness areas, advocate for expanding wilderness, defend roadless areas from development that would destroy their wilderness character, and safeguard the ecological integrity of all federal public lands in the vicinity of the White River National Forest. WW has a long history of participation in forest planning and public land management on the White River National Forest, the Grand Mesa Uncompahgre and Gunnison National Forest, and adjacent

Bureau of Land Management lands. WW has engaged on oil and gas issues in and around the headwaters of the North Fork for years.

The Wilderness Society ("TWS") has a long-standing interest in the management of Bureau of Land Management and National Forest lands in Colorado and engages frequently in the decision-making processes for land use planning and project proposals that could potentially affect wilderness-quality lands and other important natural resources managed by the BLM and USFS in Colorado. TWS members and staff enjoy a myriad of recreation opportunities on public lands, including hiking, biking, nature-viewing, photography, and the quiet contemplation in the solitude offered by wild places. Founded in 1935, our mission is to protect wilderness and inspire Americans to care for our wild places.

WildEarth Guardians ("Guardians") is dedicated to protecting and restoring the wildlife, wild places, wild rivers, and health of the American West. Guardians is a west-wide environmental advocacy organization with thousands of members in Colorado and surrounding states. Guardians members live in and regularly use and enjoy lands in the project area.

The **Center for Biological Diversity** is a non-profit environmental organization with over 48,500 members, many of whom live and recreate in western Colorado. The Center uses science, policy and law to advocate for the conservation and recovery of species on the brink of extinction and the habitats they need to survive. The Center has and continues to actively advocate for increased protections for species and their habitats in Colorado. The lands that will be affected by the proposed project include habitat for listed, rare, and imperiled species that the Center has worked to protect including rare, endangered and threatened species like the Gunnison Sage-Grouse and fish species such as the Colorado Pikeminnow and Razorback Sucker. The Center's board, staff, and members use the public lands in Colorado, including the lands and waters that would be affected by expanded fossil fuel development authorized by this master development plan, for quiet recreation (including hiking and camping), scientific research, aesthetic pursuits, and spiritual renewal.

Rocky Mountain Wild ("RMW") is a non-profit environmental organization based in Denver, Colorado, that works to conserve and recover the native species and ecosystems of the Greater Southern Rockies using the best available science. RMW has a well-established history of participation in Bureau of Land Management ("BLM") planning and management activities. RMW works to save endangered species and preserve landscapes and critical ecosystems. It achieves these goals by working with biologists and landowners, utilizing GIS technology to promote understanding of complex land use issues, and monitoring government agencies whose actions affect endangered and threatened species. Its members and supporters include approximately 1200 outdoor enthusiasts, wildlife conservationists, scientists, and concerned citizens across the country.

Contents

I. National Environmental Policy Act 5

A. The BLM Is Required to Issue a Moratorium on All Oil and Gas Development in the Uncompahgre Area for as Long as the UFO RMP Remains Uncompleted. 5

B. The BLM Must Take a Hard Look at the Direct, Indirect and Cumulative Impacts of Oil and Gas Development on Certain Resource Values in the Planning Area. 7

1. Roadless Values 8

2. Cumulative Impacts. 9

3. Air Quality Impacts. 13

4. Climate Change. 20

5. Farmlands 61

6. Managing for Community and Ecosystem Resiliency. 63

7. Hydraulic Fracturing. 64

8. Wildlife 78

9. Unregulated Gas Gathering Pipelines 117

10. Water Resources. 120

11. Human Health. 128

C. The BLM Must Sufficiently Analyze All Reasonable Alternatives. 132

II. Endangered Species Act 136

A. BLM Must Analyze the Project's Effects on Endangered Fish and Consult Over These Effects Pursuant to ESA Section 7 136

1. Background on ESA Section 7 137

2. BLM and FWS Must Reinitate Consultation over the Programmatic Biological Opinion Governing Fluid Mineral Development Water Depletions 138

3. Approval of the Project While BLM Evaluates New Information Concerning the Endangered Fish Violates BLM's Consultation Duties and Risks Violation of ESA Section 7(d). 155

4. BLM Must Analyze and Consult over the Project's Water Pollution and Contamination Effects on the Endangered Fish. 158

III. FLPMA: Unnecessary and Undue Degradation 160

IV. Conclusion 162

I. National Environmental Policy Act

A. The BLM Is Required to Issue a Moratorium on All Oil and Gas Development in the Uncompahgre Area for as Long as the UFO RMP Remains Uncompleted.

A moratorium on all oil and gas development within the UFO is required, pending revision to the UFO Resource Management Plan ("RMP") and environmental impact statement ("EIS"). Proceeding with oil and gas development while the RMP revision is pending would prejudice the ultimate decision and limit the choice of alternatives considered in the RMP/EIS. Moreover, the existing UFO RMP is completely out-of-date and can no longer serve as the foundation for decisions on oil and gas development within the UFO.

NEPA requires that, until an agency issues a Record of Decision for a pending NEPA document, "no action concerning the proposal shall be taken which would: (1) have an adverse environmental impact; or (2) limit the choice of reasonable alternatives." 40 C.F.R. § 1506.1(a)(1), (2). NEPA prohibits agencies from making an "irreversible and irretrievable commitment of resources." 40 C.F.R. §§ 1502.2(f); *Conner v. Burford*, 848 F.2d 1441, 1446 (9th Cir. 1986); *see also Pacific Rivers Council v. Thomas*, 30 F.3d 1050, 1056-57 (9th Cir. 1994), *cert. denied*, 115 S. Ct. 1793 (1995) (interpreting identical language in ESA). "The purpose of an EIS is to apprise decisionmakers of the disruptive environmental effects that may flow from their decisions at a time when they 'retain[] a maximum range of options.'" *Conner*, 848 F.2d at 1446. Taking actions in the interim which could limit those options undermines the purpose and effectiveness of the NEPA process. As provided by CEQ regulations:

> While work on a required program environmental impact statement is in progress and the action is not covered by an existing program statement, agencies shall not undertake in the interim any major Federal action covered by the program which may significantly affect the quality of the human environment unless such action:
>
> > (1) Is justified independently of the program;
> > (2) Is itself accompanied by an adequate environmental impact statement; and
> > (3) Will not prejudice the ultimate decision on the program. Interim action prejudices the ultimate decision on the program when it tends to determine subsequent development or limit alternatives.

40 C.F.R. §§ 1506.1(c)(1)-(3).

Development associated with the 35-well project proposed by Gunnison Energy LLC would require construction of four new multi-well pads along with one existing well pad and construction of associated access roads and gathering lines. The development would require surface disturbance of approximately 28.6 acres on both federal and private surface. NFMMDP Proposed Action Document at 8. The current 1989 RMP, accompanying EIS, and technical report for oil and gas did not analyze the site-specific impacts of oil and gas development using today's modern extraction techniques—specifically the use of hydraulic fracturing, or

fracking—and failed to anticipate the pace of development now facing the area and, thus, was incapable of incorporating land use designations that encompass BLM and the Forest Service's multiple use mandates. Moreover, there is no updated, current analysis that identifies what overall level of development—and the nature of that development—is reasonably foreseeable. Without this analysis, there is considerable uncertainty and controversy regarding the size, nature, and impacts of further oil and gas development, in particular relative to cumulative impacts. BLM UFO recognizes the shortcomings of the existing RMP and EIS, and has provided that "[p]reparation of the Uncompahgre RMP is necessary in order to respond to changing resource conditions, new issues, and federal policies, as well as to prepare a comprehensive framework for managing public lands administered by the UFO." BLM UFO, *Uncompahgre RMP Newsletter,* Exhibit E. "Management is becoming more complex due to the emergence of new issues of national significance, as well as heightened controversy surrounding certain existing issues. Increased oil, gas, and uranium activity, recreation demands, impacts from a growing population and urban interface, and pressures on wildlife and land health are among the many challenges to be addressed." BLM UFO, *Analysis of the Management Situation: for the BLM Uncompahgre Planning Area,* Exhibit F. Given the significant challenges and management issues that must be addressed in the still pending UFO RMP revision, BLM cannot proceed in allowing oil and gas development in the UFO without prejudicing the ultimate mineral management decisions to be made, and the alternatives considered, in the revised RMP.

In addition, the 35-well project proposed by Gunnison Energy LLC, foresees a future phase of development, which would result in a total of 13 well pads and up to 104 wells in the project area. The North Fork Mancos Delineation MDP Proposed Action would require seven new well pads and associated access roads and gathering lines and expand six existing well pads to access federal oil and gas leases. Eight shale gas wells are proposed for each well pad for a total of 104 wells. The proposed total development would require surface disturbance of approximately 211.1 acres on both federal and private surface. North Fork Mancos Delineation Project Master Development Plan, Proposed Action, June 2016 at page 1 and 8.

Proceeding with the proposed master development plan will result in tangible impacts that cannot be undone, particularly when considered cumulatively with nearby development. Allowing new activity that limits alternatives in the future is exactly the situation that NEPA disallows. *See* 40 C.F.R. §§ 1506.1(c) (3). In the face of significant uncertainty regarding resource management planning in the UFO and GMUG, there also seems little need to hastily approve drilling in these areas. At a minimum, proceeding with the approval of the subject master development plan can wait until the UFO's foundational management documents are completed, thus allowing the necessary level of NEPA analysis to take place. We therefore strongly encourage BLM to not move forward with approval of the 35-well project pending completion of the UFO's RMP and EIS.

We would also like to note similar concerns regarding the GMUG's 22-year old outdated Oil and Gas Leasing Plan Amendment. To our knowledge, the GMUG will start its long-anticipated Forest Plan revision process in 2017. Given the inaccurate underestimations made regarding Reasonable Foreseeable Development and drastic changes in technology, it is only prudent to allow for this process to proceed prior to additional natural gas development approval. Final Oil and Gas Leasing Environmental Impact Statement Summary S-8-9 (Apr. 1993). This document does not appear to account for reasonable foreseeable development that would happen

off the forest, but yet within its vicinity. *Id.* Moreover, it appears that the Forest Service Manual has been amended at least once since the amendment. Such changes need to be fully incorporated in the Forest Service's management document and any review of proposed natural gas development on the forest.

B. The BLM Must Take a Hard Look at the Direct, Indirect and Cumulative Impacts of Oil and Gas Development on Certain Resource Values in the Planning Area.

The National Environmental Policy Act ("NEPA"), 42 U.S.C. § 4321 *et seq*., and its implementing regulations, promulgated by the Council on Environmental Quality ("CEQ"), 40 C.F.R. §§ 1500.1 *et seq*., is our "basic national charter for the protection of the environment." 40 C.F.R. § 1500.1. Recognizing that "each person should enjoy a healthful environment," NEPA ensures that the federal government uses all practicable means to "assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings," and to "attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences," among other policies. 43 U.S.C. § 4331(b).

NEPA regulations explain, in 40 C.F.R. §1500.1(c), that:

> Ultimately, of course, it is not better documents but better decisions that count. NEPA's purpose is not to generate paperwork – even excellent paperwork – but to foster excellent action. The NEPA process is intended to help public officials make decisions that are based on understanding of environmental consequences, and take actions that protect, restore, and enhance the environment.

Thus, while "NEPA itself does not mandate particular results, but simply prescribes the necessary process," *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989), agency adherence to NEPA's action-forcing statutory and regulatory mandates helps federal agencies ensure that they are adhering to NEPA's noble purpose and policies. *See* 42 U.S.C. §§ 4321, 4331.

NEPA imposes "action forcing procedures … requir[ing] that agencies take a *hard look* at environmental consequences." *Methow Valley*, 490 U.S. at 350 (citations omitted) (emphasis added). These "environmental consequences" may be direct, indirect, or cumulative. 40 C.F.R. §§ 1502.16, 1508.7, 1508.8. A cumulative impact—particularly important here—is defined as:

> the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

40 C.F.R. § 1508.7.

Federal agencies determine whether direct, indirect, or cumulative impacts are significant by accounting for both the "context" and "intensity" of those impacts. 40 C.F.R. § 1508.27. Context "means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality" and "varies with the setting of the proposed action." 40 C.F.R. § 1508.27(a). Intensity "refers to the severity of the impact" and is evaluated according to several additional elements, including, for example: unique characteristics of the geographic area such as ecologically critical areas; the degree to which the effects are likely to be highly controversial; the degree to which the possible effects are highly uncertain or involve unique or unknown risks; and whether the action has cumulatively significant impacts. *Id.* §§ 1508.27(b).

Furthermore, the Federal Land Policy and Management Act ("FLPMA"), 43 U.S.C. § 1701 *et seq*., directs that "the public lands be managed in a manner that will protect the quality of [critical resource] values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use." 43 U.S.C. § 1701(a)(8). This substantive mandate requires that the agency not elevate the development of oil and gas resources above other critical resource values in the planning area. To the contrary, FLPMA requires that where oil and gas development would threaten the quality of critical resources, that conservation of these resources should be the preeminent goal. The BLM must incorporate this mandate into the agency's decision-making, consistent with the concerns to the planning area's resource values, as provided herein.

The Forest Service must also manage lands under its jurisdiction for "multiple use," 16 U.S.C.A. § 528, meaning the "management of all various renewable surface resources of the national forest so that they are utilized in the combination that will best meet the needs of the American people . . . some land will be used for less than all of the resources . . . harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output." 16 U.S.C. 531. Thus, the Forest Service must not elevate some values (namely, economic values) above other resource values in the planning area. On the contrary, the Forest Service must manage the land without impairing its productivity, and with the goal of meeting the needs of the American people. *See also* 16 U.S.C. § 528 ("[T]he national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes."); § 16 U.S.C. 529 ("In the administration of the national forests due consideration shall be given to the relative values of the various resources in particular areas.")

1. Roadless Values

More than 5,000 acres of the project area overlap with inventoried roadless areas protected by the Colorado Roadless Rule and, before that, by the 2001 Roadless Rule. These areas provide many social and ecological benefits that must be considered and protected by BLM.

Inventoried roadless areas provide clean drinking water and function as biological strongholds for populations of threatened and endangered species. They provide large, relatively undisturbed landscapes that are important to biological diversity and the long-term survival of many at-risk species. Inventoried roadless areas provide opportunities for dispersed outdoor recreation, opportunities that diminish as open space and natural settings are developed elsewhere. They also serve as bulwarks against the spread of non-native invasive plant species and provide reference areas for study and research. And these areas often serve as important reference landscapes and retain important cultural, historic, and sacred sites.

The roadless values that these areas retain are important and must be protected. BLM must take a hard look at the potential impacts this project will have on roadless areas and (as discussed in the alternatives section below) consider ways to protect those values.

2. Cumulative Impacts.

A cumulative impact is the "impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions." *Ocean Advoc. v. U.S. Army Corps of Engrs.*, 402 F.3d 846, 868 (9th Cir. 2005); 40 C.F.R. § 1508.7. The BLM's cumulative impacts analysis "must be more than perfunctory; it must provide a 'useful analysis of the cumulative impacts of past, present, and future projects.'" *Ocean Advoc.*, 402 F.3d at 868. The BLM must, therefore, "give a realistic evaluation of the total impacts [of the action] and cannot isolate the proposed project, viewing it in a vacuum." *Grand Canyon Trust v. FAA*, 290 F.3d 339, 342 (D.C. Cir. 2002).

CEQ regulations require agencies to consider three types of related actions: "connected actions," "similar actions," and "cumulative actions." 40 C.F.R. § 1508.25(a). Cumulative actions are actions that when viewed with other proposed actions have cumulatively significant impacts. 40 C.F.R. § 1508.25(a)(2). An agency's consideration of cumulative impacts must contain "some quantified or detailed information; . . . general statements about 'possible' effects and 'some risk' do not constitute a 'hard look' absent a justification regarding why more definitive information could not be provided." *Neighbors of Cuddy Mountain*, 137 F.3d 1372, 1379-80 (9th Cir. 1998). The Supreme Court has held that an agency not only has a duty to consider cumulative impacts in a single NEPA process: "proposals for . . . related actions that will have cumulative or synergistic environmental impact upon a region concurrently pending before an agency must be considered together. Only through comprehensive consideration of pending proposals can the agency evaluate the different courses of action." *Kleppe v. Sierra Club*, 427 U.S. 390, 410 (1976).

In 2010, the Ninth Circuit rejected BLM NEPA review for mineral exploration that had failed to include detailed analysis of impacts *from nearby proposed mining operations*, stating:

> In a cumulative impact analysis, an agency must take a "hard look" at all actions. An . . . analysis of cumulative impacts must give a sufficiently detailed catalogue of past, present, and future projects, and provide adequate analysis about how these projects, and differences between the projects, are thought to have impacted the environment. . . . Without such information, neither the courts nor the public .

> . . can be assured that the [agency] provided the hard look that it is required to provide.

Te-Moak Tribe v. U.S. Dep't of Interior, 608 F.3d 592, 603 (9th Cir. 2010). *See also Wyoming Outdoor Council*, 351 F. Supp. 2d at 1243 (failure to review adequately all cumulative impacts is arbitrary and capricious and violates NEPA).

Below is a list of a numerous past, present, and reasonably foreseeable projects and proposals that the BLM must consider in its cumulative impact analysis, in addition to the subject 35-well project:

150-Well Bull Mountain MDP: The Bull Mountain Unit Master Development Plan involves the exploration and development of up to 146 natural gas wells, 4 water disposal wells, and associated infrastructure on federal and private mineral leases.

40 Active Gas Wells in Delta and Gunnison Counties: As of March 17, 2017, Gunnison and Delta Counties contain 40 active gas wells, 47 permitted wells, 7 shut-in wells, the majority of which are located in the Upper North Fork and Muddy Creek areas. The BLM must consider the impacts of these wells in conjunction with the wells in this proposal, given connected infrastructure, access roads and ownership.

Petrox 50-Well Proposal at Pilot Knob:[2] Petrox is proposing up to 50 wells in a 6,400-acre project area that largely overlies the Pilot Knob Roadless Area north of Somerset. This proposal is within close proximity to proposed development at the southern end of the 25-well project.

Fram 108-Well Proposal:[3] BLM approved a proposal for 108 oil wells from Norwegian company Fram, to be located downstream from the Bull Mountain Unit in the Whitewater Unit. In May 2016, BLM remanded the plan to its Grand Junction Field Office for further environmental review based on the fact that the plan did not analyze hydraulic fracturing.

Gunnison Energy 60- to 400-Well Master Plan:[4] Gunnison Energy is proposing large-scale development north of Somerset and west of the Bull Mountain Unit for up to potentially 400 wells. This alone could dwarf the Bull Mountain Unit, and given its proximity to the Unit, cannot be ignored.

---

[2] *See* Dennis Webb, *Roadless Dispute Clouds Drilling Proposal*, THE DAILY SENTINEL, February 28, 2015, available at: http://www.gjsentinel.com/news/articles/roadless-dispute-clouds-drilling-proposal.

[3] *See* Dennis Webb, *Fram Proposal: 108 New Oil Wells South of Palisade*, THE DAILY SENTINEL, June 28, 2013, available at: http://www.gjsentinel.com/news/articles/fram-proposal-8232108-new-oil-wells-8232south-of-p.

[4] *See* Dennis Webb, *North Fork Drilling Plans Remain Small*, THE DAILY SENTINEL, February 15, 2015, available at: http://www.gjsentinel.com/news/articles/north-fork-drilling-plans-remain-small.

Spadafora Waste Disposal Pits: The Spadafora Water Storage Facility was approved by the Gunnison County Planning Commission on March 6, 2015. Three water storage pits, each with a pump station and a volume of about 9,240,000 gallons, will sit on roughly 19 acres and will store and recycle produced water for drilling and gas well operations. [5] This facility is located within the project area and immediately adjacent to the Spadafora well pad for APDs GE 11-90-20-21 H1 and H2.

16-well development in the North Fork/Muddy Creek Planning Unit:[6] In February, 2009 BLM approved a Master Surface Use Plan from Gunnison Energy for 16 wells just to the south of the Bull Mountain Unit. This was not analyzed in coordination with the Bull Mountain MDP analysis.

30,000-Acre Lease Sale:[7] In December of 2011 BLM proposed leasing approximately 30,000 acres of public lands and minerals for oil and gas development in the North Fork Valley. While the lease sale has been deferred, there remains the possibility for future leasing. The impacts of this proposal must be evaluated by the BLM.

Huntsman Unit Proposal: [8] SG has proposed drilling in the Huntsman Unit (COC 74403X), which includes three SG leases (COC 63886, 63888, and 63889). SG has proposed one APD there for well 10-89-31 #1 inside lease COC 63886. That APD was filed in 2010. The unit and the leases are currently suspended pending Forest Service analysis. Nonetheless, with formal proposals on the table, the BLM must consider this a reasonably foreseeable proposal. Drilling the proposed well would require travel on the same roads, new road construction, additional cumulative impacts to wildlife habitat (including critical trout habitat), and additional cumulative impacts to regional air quality and other resources.

---

[5] *See* Adam Broderick, *Fracking Pits Approved for Development Near Paonia Reservoir*, THE CRESTED BUTTE NEWS, March 11, 2015, available at: http://www.crestedbuttenews.com/index.php?option=com_content&task=view&id=6286&Itemid=40.

[6] *See* Seth Mensing, *Gas Developers Propose Three New Water Pits for North Fork*, THE CRESTED BUTTE NEWS, May 4, 2015, available at: http://www.crestedbuttenews.com/index.php?option=com_content&task=view&id=3344&Itemid=40; In the Matter of the Promulgation and Establishment of Field Rules to Govern Operations in West Muddy Creek Field, Gunnison County, Colorado, Cause No. 1, Order No. 1-143, Colorado Oil and Gas Conservation Commission (March 30, 2009), available at: http://cogcc.state.co.us/orders/orders/1/143.html.

[7] *See* Uncompahgre Field Office, *Oil and Gas Lease Sale February 2013*, BUREAU OF LAND MANAGEMENT, available at: http://www.blm.gov/co/st/en/BLM_Information/nepa/ufo/august_lease_sale.html.

[8] A categorical exclusion used for approval of a suspension of this lease is available: BLM, Categorical Exclusion DOI-BLM-CO-SO50-201-0035 CX, available at: http://www.blm.gov/pgdata/etc/medialib/blm/co/information/nepa/uncompahgre_field/ufo_nepa_documents0.Par.60636.File.dat/12-035CX%20SG%20USFS%20Lease%20Susp.pdf.

Pilots Knob APD:[9] SG has proposed an APD (12-89-30#1) in the Pilots Knob CRA on lease COC 64169. Development of that lease would involve the same potential impacts as others described above.

SG APDs in Thompson Divide: In 2012 BLM and the U.S. Forest Service received six APDs from SG Interests in the Thompson Divide Area. Two of the six APDs are currently considered complete. We have also received two additional Notices of Staking (NOSs), which is a step that precedes submitting an APD. These 6 APDs and two NOSs are proposed on a total of five well pad locations. See here: https://www.blm.gov/co/st/en/fo/crvfo/thompson_divide_gas.print.html; see also list of APDs here: https://www.blm.gov/style/medialib/blm/co/field_offices/crvfo/news_release.Par.23419.File.dat/apds%20received%202-13-13.pdf

SG APD in the Wolf Creek Storage Field: On July 28, 2015 BLM received a NOS from SG Interests for a proposed well and well pad in the Wolf Creek Natural Gas Storage Area. SourceGas holds the lease, which was issued in 1954. SG Interests has an agreement with SourceGas allowing them to drill within the boundaries of the storage area. Below is the information SG Interests submitted. See here: https://www.blm.gov/co/st/en/fo/crvfo/thompson_divide_gas.print.html; see also list of APDs; see posted Notice of Staking: https://www.blm.gov/style/medialib/blm/co/field_offices/crvfo/news_release.Par.55991.File.dat/9-90-11-1%20NOS%20posting.pdf

There have been a number of recent lease sales with parcels proposed just over the Muddy Divide.

Coal: There is one active underground coal mine (West Elk), one recently idled mine (Bowie No. 2), and one recently closed mine (Elk Creek) near the project area. All three must be analyzed in the direct, indirect, and cumulative impacts section. The North Fork Coal Mining area exception to the Colorado Roadless Rule is expected to take effect on April 17, 2017.[10] The exception would allow for temporary road construction for coal exploration and/or coal-related surface activities in a 19,100-acre area defined as the North Fork Coal Mining Area.[11] Under the exception, Arch Coal plans to expand its underground West Elk mine, which includes bulldozing an extensive road network and scraping dozens of well pads in the Sunset Roadless Area and potentially other roadless areas as well. On February 23, 2016, a NOI was issued to prepare a supplemental EIS on the Forest Service's proposal to consent to BLM modifying Federal Coal Leases COC-1362 and COC-67232 by adding 800 and 922 acres, respectively, to those leases. The Forest Service also intends to address in that supplemental EIS whether to concur to Arch Coal's Sunset Trail Area Coal Exploration Plan within the Lease Modifications area.[12] The BLM

[9] *See id.*
[10] 82 Fed. Reg. 9973 (Feb. 9, 2017)
[11] 80 Fed. Reg. 18,598-02 (April 7, 2015) (U.S. Forest Service and USDA, Roadless Area Conservation; National Forest System Lands in Colorado).
[12] *See* Notice of Intent to Prepare a Supplemental Environmental Impact Statement, Federal Coal Lease Modifications COC-1362 & COC-67232, 81 Fed. Reg. 8899 (Feb. 23,

must take into account the reasonable foreseeable proposal to expand the West Elk Coal Mine under 1,700 acres of the Sunset Roadless Area to access 10.1 million tons of federal coal and approximately 9 million tons of private coal, with attendant surface, air quality, and climate change impacts.[13] Also notable is the fact that coal mining in the North Fork Valley requires venting of methane, which releases significant amounts of VOCs that should be addressed in any cumulative impacts analysis.

Climate Change: The BLM must consider the impact of the project in light of the additive impacts caused by global warming. For example, the BLM should consider the impact of the project on erosion and sedimentation in light of the additive impacts caused by global warming. This should be done on a resource-by-resource basis.

3. Air Quality Impacts.

The BLM must take a hard look at the air quality impacts from oil and gas development in the planning area. Much of air pollution from oil and gas development and operations, which is specifically discussed below also degrades visibility. Section 169A of the Clean Air Act ("CAA"), 42, U.S.C. § 7401 *et seq.* (1970) sets forth a national goal for visibility, which is the "prevention of any future, and the remedying of any existing, impairment of visibility in Class I areas which impairment results from manmade air pollution." Congress adopted the visibility

---

2016).

[13] We also note that the West Elk mine is developing a proposal to mine existing leases within the "B seam," which will cause additional surface, air, and climate impacts. According to a 2016 memo prepared by the Forest Service:

> Mountain Coal was approved by DRMS [Colorado's Division of Mining, Reclamation and Safety] (in May 2015?) to drive rock slopes from the E seam into the B seam coal reserves underneath the E seam reserves they are currently mining. These B seam reserves roughly underlie the E1 through E4 E seam panels. The mining of these B seam reserves would require the drilling of additional methane drainage wells. It is estimated that a total of 77 methane drainage wells would be required in these B seam panels should the B seam reserves be mined. Roughly six methane drainage wells would be within a one mile radius of the [Sunset Roadless] lease modifications and 47 within a two mile radius.
>
> Mountain Coal [which operates the West Elk Mine] anticipates disturbing 39.5 acres constructing the 77 well pads (1/2 acre per pad) and 7.40 miles of new road construction. They also anticipate re-opening 1.78 miles of existing road that has been previously used for drilling operations, and upgrading 1.37 miles of existing ATV trail to access methane drainage well locations.

See memo of D. Gray, GMUG National Forest to N. Mortenson, Forest Service (Mar. 17, 2016), attached as Exhibit 65. The Forest Service believes these impacts are foreseeable enough that it intends to address them as cumulative effects in its Supplemental Draft EIS for Lease Modifications within the Sunset Roadless Area, to be released in April or May 2017.

provisions in the CAA to protect visibility in "areas of great scenic importance." H.R. Rep. No. 294, 95th Cong. 1st Sess. at 205 (1977). In promulgating its Regional Haze Regulations, 64 Fed. Reg. 35,714 (July 1, 1999), the U.S. Environmental Protection Agency ("EPA") provided:

> Regional haze is visibility impairment that is produced by a multitude of sources and activities which emit fine particles and their precursors and which are located across a broad geographic area. Twenty years ago, when initially adopting the visibility protection provisions of the CAA, Congress specifically recognized that the "visibility problem is caused primarily by emission into the atmosphere of SO2, oxides of nitrogen, and particulate matter, especially fine particulate matter, from inadequate[ly] controlled sources." H.R. Rep. No. 95-294 at 204 (1977). The fine particulate matter (PM) (e.g., sulfates, nitrates, organic carbon, elemental carbon, and soil dust) that impairs visibility by scattering and absorbing light can cause serious health effects and mortality in humans, and contribute to environmental effects such as acid deposition and eutrophication.

The visibility protection program under sections 169A, 169B, and 110(a)(2)(J) of the CAA is designed to protect Class I areas from impairment due to manmade air pollution. The current regulatory program addresses visibility impairment in these areas that is "reasonably attributable" to a specific source or small group of sources, such as, here, air pollution resulting from oil and gas development. *See* 64 Fed. Reg. 35,714.

Moreover, EPA finds the visibility protection provisions of the CAA to be quite broad. Although EPA is addressing visibility protection in phases, the national visibility goal in section 169A calls for addressing visibility impairment generally, including regional haze. *See e.g., State of Maine v. Thomas*, 874 F.2d 883, 885 (1st Cir. 1989) ("EPA's mandate to control the vexing problem of regional haze emanates directly from the CAA, which 'declares as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in Class I areas which impairment results from manmade air pollution.' ") (citation omitted).

Here, there are at least 10 Class I areas near the 35-well project area that may be impacted by the proposed development, including: Maroon Bells-Snowmass Wilderness Area; Arches National Park; Black Canyon of the Gunnison National Park; Eagles Nest Wilderness Area; Flat Tops Wilderness Area; La Garita Wilderness Area; Mount Zirkel Wilderness Area; Rocky Mountain National Park; Weminuche Wilderness Area; and West Elk Wilderness Area. Visibility in nearby Class I areas is already impaired.

In addition to impacts from the proposed development, cumulative air quality impacts from sources in and around the proposed development area may result in serious impairments to air quality standards. For example, there is a tremendous concentration of oil and gas development taking place in the region, including in Utah's Uinta Basin and Colorado's Piceance Basin, which has already elevated ozone and PM concentrations, impacted visibility, and seriously degraded air quality in the region. *See* Megan Williams, Air Quality Review of the Bull Mountain Unit (included as Exhibit G) at 4-14.

The current status of air quality in an area is a fundamental consideration for analysis in

the BLM's NEPA analysis. Background monitored concentrations of all pollutants should be reviewed. Given the increasing development in the area, there may be higher concentrations that should be reflected. Of particular concern, background concentrations of ozone in the area are already at or exceed the National Ambient Air Quality Standards ("NAAQS"), leaving virtually no room for growth in emissions as contemplated by the subject APDs. *See* Williams, Air Quality Review of the Bull Mountain Unit at 4, 7 (attached above as Exhibit G) (providing recent data from ozone monitors in the region). Moreover, there is very little wintertime ozone monitoring in the area, and the scant wintertime monitoring that exists shows elevated ozone concentrations. *See id.* at 9. Thus, even the recently recorded ozone concentrations provided in Exhibit G are likely underestimates of wintertime levels.

There is no room for growth in emissions that contribute to these harmful levels of ozone pollution in the area—namely, nitrogen oxides ("NO_X") and volatile organic compounds ("VOCs"). Any increase in emissions of ozone precursors will exacerbate the negative health effects of ozone in the region, as discussed below, and is almost certain to threaten the area's compliance with the EPA's ozone standard.

Ozone has long been recognized to cause adverse health effects. Exposure to ozone can cause or exacerbate respiratory health problems—including shortness of breath, asthma, chest pain and coughing—can decrease lung function, and can even lead to long-term lung damage. *See also* EPA's National Ambient Air Quality Standards for Particulates and Ozone, 62 FR 38,856 (July 18, 1997). Short-term exposure to ozone causes multiple negative respiratory effects, from inflammation of airways to more serious respiratory effects that can lead to use of medication, absences from school and work, hospital admission, emergency room visits, and chronic obstructive pulmonary disease ("COPD"). According to a recent report by the National Research Council ("NRC"), short-term exposure to current levels of ozone in many areas is likely to contribute to premature deaths.[14] As described in more detail below, even ozone concentrations as low as 60 ppb can be harmful to human health. Long-term exposure to elevated levels of ozone results in numerous negative harmful effects, such as permanent lung damage and abnormal lung development in children. Long-term exposure may also increase risk of death from respiratory problems. Short- and long-term exposure to elevated levels of ozone can also harm people's hearts and cardiovascular systems. *See* 79 Fed. Reg. 75234-311.

According to the US Department of Agriculture, ground-level ozone causes more damage to plants than all other air pollutants combined. Exposure to elevated ozone typically results in suppressed photosynthesis, accelerated senescence, decreased growth and lower yields.[15] Research demonstrates that ground-level ozone is already decreasing crop yields.[16] Impact on

[14] National Research Council, *Link Between Ozone Air Pollution and Premature Death Confirmed,* (April 2008), available at: http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=12198.

[15] Booker, FL, R Muntifering, M McGrath, KO Burkey, D Decoteau, EL Fiscus, W Manning, S Krupa, A Chappelka, DA Grantz. *The ozone component of global change: Potential effects on agricultural and horticultural plant yield, product quality and interactions with invasive species.* Journal of Integrative Plant Biology (2009) 51:337-351 (attached as Exhibit 291).

vegetative growth is of critical importance to the North Fork Valley's agricultural economy as well as wildlife habitat.

On October 26, 2015, EPA published a final rule to revise the NAAQS for ozone to 70 parts per billion (ppb) from the current 75 ppb. National Ambient Air Quality Standards for Ozone, 80 Fed. Reg. 65292 (Oct. 26, 2015). This decision was driven by significant recent scientific evidence that the standard of 75 ppb was not adequately protecting public health. *Id.* at 136. In fact, recent studies have documented decreased lung functioning and airway inflammation in young, healthy adults at ozone concentrations as low as 60 ppb. *Id.* at 146.

Additionally, climate change is likely to worsen ozone pollution, offsetting the improvements in air quality and public health that would be expected from reductions in emissions of ozone precursors. As described by the EPA in its recent ozone rulemaking:

> In addition to being affected by changing emissions, future O_3 concentrations may also be affected by climate change. Modeling studies in the EPA's Interim Assessment (U.S. EPA, 2009a) that are cited in support of the 2009 Endangerment Finding under CAA section 202(a) (74 FR 66496, Dec. 15, 2009) as well as a recent assessment of potential climate change impacts (Fann et al., 2015) project that climate change may lead to future increases in summer O_3 concentrations across the contiguous U.S. While the projected impact is not uniform, climate change has the potential to increase average summertime O_3 concentrations by as much as 1-5 ppb by 2030, if greenhouse gas emissions are not mitigated. Increases in temperature are expected to be the principal factor in driving any O_3 increases, although increases in stagnation frequency may also contribute (Jacob and Winner, 2009). If unchecked, climate change has the potential to offset some of the improvements in O_3 air quality, and therefore some of the improvements in public health, that are expected from reductions in emissions of O_3 precursors.

80 Fed. Reg. 65292, 65300 (October 26, 2015). For example, climate change impacts include an increase in the area burned by wildfires, which, in turn are sources of O_3 precursors. *Id.* at 65371.

Here, BLM must consider the science supporting EPA's revision of the NAAQS, as well as the impacts of climate change on ozone levels, in its preparation of the EA for the 35-well project.

Hydraulic fracturing ("fracking") operations are particularly harmful, emitting especially large amounts of air pollution, including air toxic air pollutants. Permitting fracking and other well stimulation techniques will greatly increase the release of harmful air emissions. BLM must

---

[16] Sally Wilkinson, Gina Mills, Rosemary Illidge and William J. Davies, *How is ozone pollution reducing our food supply?* Journal of Experimental Botany, Vol. 63, No. 2, pp. 527–536, 2012 (attached as Exhibit 295).

analyze air quality impacts from new development in conjunction with the existing air quality landscape for this 35-well project. BLM must analyze increased emissions from foreseeable oil and gas development for this project in order to prevent further degradation of local air quality, respiratory illnesses, premature deaths, hospital visits, as well as missed school and work days.

The BLM must take the necessary steps to analyze the impacts of all foreseeable future air emissions from induced oil and gas development and operations in conjunction with this project, and cumulatively with future oil and gas projects, especially on Front Range ozone non-attainment areas. Studies have shown that oil and gas drilling activities, particularly fracking and horizontal drilling techniques, can pollute air hundreds of miles from the well pad. For example, ethane pollution in Baltimore, Maryland and Washington, D.C., has been attributed to the rapidly increasing natural gas production in the upwind, neighboring states of Pennsylvania and West Virginia.[17]

BLM's also must identify mitigation measures for controlling air pollution emissions, 40 C.F.R. § 1508.25, and consider all reasonable alternatives. *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1217 (9th Cir. 2008) (citing 40 C.F.R. § 1502.14(a)).

The Northern Colorado Front Range (NCFR) has exceeded federal ozone standards (National Ambient Air Quality Standard or NAAQS) during the past decade,[18] a period of time that corresponds to a boom in oil and gas drilling in the Denver-Julesburg oil and gas basin where the number of active wells has nearly doubled.[19] Numerous studies demonstrate that oil and natural gas operations in the region produce high concentrations of toxic VOCs and are a significant source of ozone production. One recent study found that oil and gas operations emit approximately 55 percent of the VOCs in northeastern Colorado. [20] Another study found that 17 to 19 percent of locally created summertime ozone in Colorado's Front Range was created by VOCs and NOx from drilling and fracking operations.[21] Emissions from drilling and fracking in the Denver-Julesburg basin were recently estimated to be responsible for ~65 percent of 1 hour-

[17] Timothy Vinciguerra et al, *Regional Air Quality Impacts of Hydraulic Fracturing and Shale Natural Gas Activities: Evidence From Ambient VOC Observations*, 110 Atmospheric Environment 144 (2015) (attached as Exhibit 326).
[18] Jason M. Evans & Detlev Helmig, *Investigation of the Influence of Transport from Oil and Natural Gas Regions on Elevated Ozone Levels in the Northern Colorado Front Range*, 67 Journal of the Air & Waste Management Association 196 (2017) ("Evans 2017") (attached as Exhibit 327).
[19] Erin E. McDuffie et al., *Influence of Oil and Gas Emissions on Summertime Ozone in the Colorado Northern Front Range*, 121 Journal of Geophysical Research: Atmospheres 8712 (2016) ("McDuffie 2016") (attached as Exhibit 328); University of Colorado at Boulder, *Accounting for Ozone: Study First to Quantify Impact of Oil and Gas Emissions on Denver's Ozone Problem*, ScienceDaily, August 8, 2016, available at https://www.sciencedaily.com/releases/2016/08/160808123832.htm (attached as Exhibit 329).
[20] J.B. Gilman, *Source Signature of Volatile Organic Compounds from Oil and Natural Gas Operations in Northeastern Colorado*, Environmental Science and Technology, 2013 (attached as Exhibit 330).
[21] McDuffie 2016.

averaged elevated ozone levels; the researchers concluded that "transport from areas with O&NG [oil and natural gas] operation has a significant impact on ozone and air quality in the NCFR."[22]

Existing emissions inventories vastly underestimate the contribution of oil and gas operations to hazardous air pollution concentrations in Weld County, Colorado, in the Denver–Julesburg basin, suggesting that the health risk assessments conducted using these inventories are similarly inaccurate and therefore underestimate exposures and health risks.[23] Current inventories estimating benzene emissions from oil and gas operators in the region underestimated emissions by four to nine times. The study suggests that other hazardous air pollutants (such as toluene, ethylbenzene, etc.) could similarly be underestimated and that oil and gas sites could be a bigger source of benzene than vehicle emissions, previously thought to be the largest source in the area.

Residential areas in intensely drilled northeastern Colorado have high levels of fracking-related air pollutants, including benzene.[24] In some cases, air pollutant levels exceed those in large urban centers and are within the range of exposures known to be linked to chronic health effects.[25] Air sampling at a new natural gas well pad in rural western Colorado documented the presence of more than 50 airborne chemicals, 44 of which have known health effects.[26] The toxic solvent methylene chloride, along with several polycyclic aromatic hydrocarbons (PAHs), were at "concentrations greater than those at which prenatally exposed children in urban studies had lower developmental and IQ scores."[27]

Additionally, particulate matter (PM_{10} and $PM_{2.5}$) is another potential area of major health impacts in the area. Particulate matter can become lodged deep in the lungs or can enter the blood stream, worsening the health of asthmatics and even causing premature death in people with heart and lung disease. Even particulate matter concentrations lower than the current NAAQS are a concern for human health. Background PM_{10} values are near the level of the NAAQS, while background $PM_{2.5}$ values are at or above the level of the NAAQS. *See* Williams, Air Quality Review of the Bull Mountain Unit at 10-11 (attached above as Exhibit G). Moreover, it is likely that these levels will increase with continued development in the area. Elevated

[22] Evans 2017.
[23] Gabrielle Pétron, *Hydrocarbon Emissions Characterization in the Colorado Front Range: A Pilot Study*, Journal of Geophysical Research, 2012 (attached as Exhibit 331); Gabrielle Pétron, *A New Look at Methane and Non-Methane Hydrocarbon Emissions from Oil and Natural Gas Operations in the Colorado Denver-Julesburg Basin*, 2014 (attached as Exhibit 332).
[24] Chelsea R. Thompson et al., *Influence of Oil and Gas Emissions on Ambient Atmospheric Nonmethane Hydrocarbons In Residential Areas of Northeastern Colorado*, 2 Science of the Anthropocene 1 (2014) (attached as Exhibit 33).
[25] *Id.*
[26] Theo Colborn et al., *An Exploratory Study of Air Quality Near Natural Gas Operations*, 20 Human and Ecological Risk Assessment: An International Journal 86 (2012) ("Colborn 2012") (attached as Exhibit 334).
[27] Colborn 2012.

wintertime concentrations could become an issue as they have in other areas of concentrated oil and gas development in the West, such as in the Uinta Basin in Utah.[28]

Also critical to the BLM's analysis of air quality impacts is the relationship to human health. Logically, adherence to NAAQS would have a positive relationship to human health, however, the agency cannot rely on these standards or other indicators such as the Air Quality Index ("AQI") or National Air Toxics Assessment ("NATA") and assume that this alone would satisfy the BLM's hard look NEPA obligations—in particular given the poor baseline air quality conditions due to prevailing impacts in the planning area.

Research indicates a strong correlation between oil and gas development and increased ozone concentrations—especially in the summer when warm, stagnant conditions yield an increase in O_3 from oil and gas emissions.[29] Additionally, oil and gas production in the mountain west has recently been linked to *winter* ozone levels that greatly exceed the NAAQS.[30]

As the Endocrine Disruption Exchange has noted:

> In addition to the land and water contamination issues, at each stage of production and delivery tons of toxic volatile compounds, including benzene, toluene, ethylbenzene, xylene, etc., and fugitive natural gas (methane), escape and mix with nitrogen oxides from the exhaust of diesel-driven, mobile and stationary equipment to produce ground-level ozone. Ozone combined with particulate matter less than 2.5 microns produces smog (haze). Gas field produced ozone has created a serious air pollution problem similar to that found in large urban areas, and can spread up to 200 miles beyond the immediate region where gas is being produced. Ozone not only causes irreversible damage to the lungs, it is equally damaging to conifers, aspen, forage, alfalfa, and other crops commonly grown in the West. Adding to this is the dust created by fleets of diesel-driven water trucks

[28] Several very high values of $PM_{2.5}$ were recorded in Vernal, Utah starting in 2007, including six exceedances of the 24-hour $PM_{2.5}$ NAAQS and a maximum 24-hour average $PM_{2.5}$ concentration of 63 $\mu g/m^3$. In 2009, there were three recorded exceedances of the 24-hour average $PM_{2.5}$ NAAQS in Roosevelt, Utah with 24-hour average concentrations reaching 42 $\mu g/m^3$ and four recorded exceedances in Vernal with 24-hour average concentrations as high as 60.9 $\mu g/m^3$.

[29] Marco A Rodriguez, et al., *Regional Impacts of Oil and Gas Development on Ozone Formation in the Western United States*, JOURNAL OF AIR & WASTE MANAGEMENT ASSOCIATION (Sept. 2009) (attached as Exhibit 1).

[30] *See* Gail Tonnesen and Richard Payton, EPA Region 8. *Winter Ozone Formation: Results from the Wyoming Upper Green River Basin Studies and Plans for the 2012, Uintah Basin Study* (seminar abstract) (Jan. 2012), available at: http://www.esrl.noaa.gov/csd/seminars/2012/TonnesenPayton.html (citing, *inter alia*, Schnell, et. al., *Rapid photochemical production ozone at high concentrations in a rural site during winter*, 2 Nature Geosci. 120-122 (2009) (attached as Exhibit 2)).

> working around the clock hauling the constantly accumulating condensate water from well pads to central evaporation pits.[31]

Increases in ground-level ozone not only impact regional haze and visibility, but can also result in dramatic impacts to human health. According to the EPA:

> Breathing ground-level ozone can result in a number of health effects that are observed in broad segments of the population. Some of these effects include:
>
> - Induction of respiratory symptoms
> - Decrements in lung function
> - Inflammation of airways
>
> Respiratory symptoms can include:
>
> - Coughing
> - Throat irritation
> - Pain, burning, or discomfort in the chest when taking a deep breath
> - Chest tightness, wheezing, or shortness of breath
>
> In addition to these effects, evidence from observational studies strongly indicates that higher daily ozone concentrations are associated with increased asthma attacks, increased hospital admissions, increased daily mortality, and other markers of morbidity. The consistency and coherence of the evidence for effects upon asthmatics suggests that ozone can make asthma symptoms worse and can increase sensitivity to asthma triggers.[32]

Oil and gas development is one of the largest sources of VOCs, ozone, and sulfur dioxide emissions in the United States. The relationship between air quality and human health must be analyzed in the agency's NEPA analysis. "The agency must examine the relevant data and articulate a satisfactory explanation for its action including a 'rational connection between the facts found and the choice made.'" *Motor Vehicle Mfrs.*, 463 U.S. at 43 (1983).

4. Climate Change.

If we are to stem the impacts of climate change and manage for sustainable ecosystems, not only must the BLM take a hard look at greenhouse gas ("GHG") emissions stemming from the development it authorizes, but the BLM's decision must be reflective of the challenges we face.

---

[31] The Endocrine Disruption Exchange. Undated. *Chemicals In Natural Gas Operations: Health Effects Spreadsheet and Summary*, available at: http://www.endocrinedisruption.com/chemicals.multistate.php (attached as Exhibit 3).

[32] EPA, *Health Effects of Ozone in the General Population*, available at: http://www.epa.gov/apti/ozonehealth/population.html (attached as Exhibit 4).

The EPA has determined that human emissions of greenhouse gases are causing global warming that is harmful to human health and welfare. *See* 74 Fed. Reg. 66,496 (Dec. 15, 2009), *Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act.* The D.C. Circuit has upheld this decision as supported by the vast body of scientific evidence on the subject. *See Coal. for Responsible Regulation, Inc. v. E.P.A.*, 684 F.3d 102, 120-22 (D.C. Cir. 2012). Indeed, EPA could not have found otherwise, as virtually every climatologist in the world accepts the legitimacy of global warming and the fact that human activity has resulted in atmospheric warming and planetary climate change.[33] The world's leading minds and most respected institutions―guided by increasingly clear science and statistical evidence―agree that dramatic action is necessary to avoid planetary disaster.[34] GHG concentrations have been steadily increasing over the past century,[35] and our insatiable consumption of fossil fuels is pushing the world to a tipping point where, once reached,

[33] *See, e.g., See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *The Science of Climate Change* (1995) (attached as Exhibit 5); U.S. Climate Change Science Program, *Abrupt Climate Change* (Dec. 2008) (attached as Exhibit 6); James Hansen, et. al., *Global Surface Temperature Change*, REVIEWS OF GEOPHYSICS, 48, RG4004 (June 2010) (attached as Exhibit 7); *see also*, Richard A. Muller, *Conversion of a Climate Change Skeptic*, NEW YORK TIMES, July 28, 2012 (attached as Exhibit 8) (citing Richard A. Muller, et. al., *A New Estimate of the Average Earth Surface Temperature, Spanning 1753 to 2011,* (attached as Exhibit 9); Richard A. Muller, et. al., *Decadal Variations in the Global Atmospheric Land Temperatures* (attached as Exhibit 10)).

[34] *See, e.g.*, Rob Atkinson, et. al., *Climate Pragmatism: Innovation, Resilience, and No Regrets* (July 2011) (attached as Exhibit 11); Veerabhadran Ramanathan, et. al., *The Copenhagen Accord for Limiting Global Warming: Criteria, Constraints, and Available Avenues* (Feb. 2010) (attached as Exhibit 12); UNITED NATIONS, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *Climate Change 2007: Synthesis Report* (2007) (attached as Exhibit 13); A.P. Sokolov, et. al., *Probablistic Forecast for Twenty-First-Century Climate Based on Uncertainties in Emissions (without Policy) and Climate Parameters*, MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT) (Oct. 2009) (attached as Exhibit 14); UNITED NATIONS, FRAMEWORK CONVENTION ON CLIMATE CHANGE, *Report of the Conference of the Parties* (Dec. 2011) (attached as Exhibit 15); Bill McKibben, *Global Warming's Terrifying New Math*, ROLLING STONE, July 19, 2012 (attached as Exhibit 16); Elizabeth Muller, *250 Years of Global Warming*, BERKLEY EARTH, July 29, 2012 (attached as Exhibit 17); Marika M. Holland, et. al., *Future abrupt reductions in summer Arctic sea ice*, Geophysical Research Letters, Vol. 33, L23503 (2006) (attached as Exhibit 18).

[35] *See* Randy Strait, et. al., *Final Colorado Greenhouse Gas Inventory and Reference Case Projections: 1990-2020*, CENTER FOR CLIMATE STRATEGIES (Oct. 2007) (attached as Exhibit 19); Robin Segall et. al., *Upstream Oil and Gas Emissions Measurement Project*, U.S. ENVIRONMENTAL PROTECTION AGENCY (attached as Exhibit 20); Lee Gribovicz, *Analysis of States' and EPA Oil & Gas Air Emissions Control Requirements for Selected Basins in the Western United States*, WESTERN REGIONAL AIR PARTNERSHIP (Nov. 2011) (attached as Exhibit 21).

catastrophic change will be unavoidable.[36] In fact, the impacts from climate change are already being experienced, with drought and extreme weather events becoming increasingly common.[37]

Renowned NASA climatologist Dr. James Hansen provides the analogy of loaded dice—suggesting that there still exists some variability, but that climate change is making these extreme events ever more common.[38] In turn, climatic change and GHG emissions are having dramatic impacts on plant and animal species and habitat, threatening both human and species resiliency and the ability to adapt to these changes.[39] According to experts at the Government Accountability Office ("GAO"), federal land and water resources are vulnerable to a wide range of effects from climate change, some of which are already occurring. These effects include, among others, "(1) physical effects, such as droughts, floods, glacial melting, and sea level rise; (2) biological effects, such as increases in insect and disease infestations, shifts in species distribution, and changes in the timing of natural events; and (3) economic and social effects, such as adverse impacts on tourism, infrastructure, fishing, and other resource uses."[40]

---

[36] *See, e.g.,* James Hansen, *Tipping Point: Perspective of a Climatologist,* STATE OF THE WILD 2008-2009 (attached as Exhibit 22); GLOBAL CARBON PROJECT, *A framework for Internationally Co-ordinated Research on the Global Carbon Cycle,* ESSP Report No. 1 (attached as Exhibit 23); INTERNATIONAL ENERGY AGENCY, *CO_2 Emissions from Fuel Combustion,* Highlights 2011 (attached as Exhibit 24); GLOBAL CARBON PROJECT, *10 Years of Advancing Knowledge on the Global Carbon Cycle and its Management* (attached as Exhibit 25); Malte Meinshausen, et. al., *Greenhouse-gas emission targets for limiting global warming to 2° C,* NATURE, Vol. 458, April 30, 2009 (attached as Exhibit 26).

[37] *See, e.g.,* UNITED NATIONS, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* (2011) (attached as Exhibit 27); Aiguo Dai, *Increasing drought under global warming in observations and models,* NATURE: CLIMATE CHANGE (Aug. 2012) (attached as Exhibit 28); Stephen Saunders, et. al., *Hotter and Drier: The West's Changed Climate* (March 2008) (attached as Exhibit 29).

[38] *See,* James Hansen, et. al., *Climate Variability and Climate Change: The New Climate Dice* (Nov. 2011) (attached as Exhibit 30); James Hansen, et. al., *Perception of Climate Change* (March 2012) (attached as Exhibit 31); James Hansen, et. al., *Increasing Climate Extremes and the New Climate Dice* (Aug. 2012) (attached as Exhibit 32).

[39] *See* Fitzgerald Booker, et. al., *The Ozone Component of Climate Change: Potential Effects on Agriculture and Horticultural Plant Yield, Product Quality and Interactions with Invasive Species,* J. INTEGR. PLANT BIOL. 51(4), 337-351 (2009) (attached as Exhibit 33); Peter Reich, *Quantifying plant response to ozone: a unifying theory,* TREE PHYSIOLOGY 3, 63-91 (1987) (attached as Exhibit 34).

[40] GAO Report, *Climate Change: Agencies Should Develop Guidance for Addressing the Effects on Federal Land and Water Resources* (2007) (attached as Exhibit 35); *see also* Committee on Environment and Natural Resources, National Science and Technology Council, *Scientific Assessment of the Effects of Global Climate Change on the United States* (2008) (attached as Exhibit 36); Melanie Lenart, et. al. *Global Warming in the Southwest: Projections, Observations, and Impacts* (2007) (attached as Exhibit 37) (describing impacts from temperature rise, drought, floods and impacts to water supply on the southwest).

Despite the strength of these findings, federal agencies, and GMUG and UFO in particular, have historically failed to take serious action to address these impacts. This type of dismissive approach fails to satisfy the guidance outlined in Department of Interior Secretarial Order 3226, discussed below, or the requirements of NEPA. "Reasonable forecasting and speculation is … implicit in NEPA, and we must reject any attempt by agencies to shirk their responsibilities under NEPA by labelling any and all discussion of future environmental effects as 'crystal ball inquiry.'" *Save Our Ecosystems v. Clark*, 747 F.2d 1240, 1246 n.9 (9th Cir. 1984 (quoting *Scientists' Inst. for Pub. Info., Inc. v. Atomic Energy Comm.*, 481 F.2d 1079, 1092 (D.C. Cir. 1973)).

As noted above, NEPA imposes "action forcing procedures … requir[ing] that agencies take a *hard look* at environmental consequences." *Methow Valley*, 490 U.S. at 350 (citations omitted) (emphasis added). These "environmental consequences" may be direct, indirect, or cumulative. 40 C.F.R. §§ 1502.16, 1508.7, 1508.8. BLM is required to take a hard look at those impacts as they relate to the agency action. "Energy-related activities contribute 70% of global GHG emissions; oil and gas together represent 60% of those energy-related emissions through their extraction, processing and subsequent combustion."[41] Even if science cannot isolate each additional oil or gas well's contribution to these overall emissions, this does not obviate BLM's responsibility to consider oil and gas development in the action area from the cumulative impacts of the oil and gas sector. In other words, the BLM cannot ignore the larger relationship that oil and gas management decisions have to the broader climate crisis that we face. Here, the agency's analysis must include the full scope of GHG emissions. *See Neighbors of Cuddy Mountain v. U.S. Forest Service*, 137 F.3d 1372, 1379 (9th Cir. 1998) ("To 'consider' cumulative effects, some quantified or detailed information is required. Without such information, neither the courts nor the public, in reviewing the [agency's] decisions, can be assured that the [agency] provided the hard look that it is required to provide."). If we are to stem climate disaster—the impacts of which we are already experiencing—the agency's decisionmaking must be reflective of this reality and plan accordingly.

BLM is responsible for the management of 700 million acres of federal onshore subsurface minerals.[42] Indeed, "the ultimate downstream GHG emissions from fossil fuel extraction from federal lands and waters by private leaseholders could have accounted for approximately 23% of total U.S. GHG emissions and 27% of all energy-related GHG emissions."[43] This suggests that "ultimate GHG emissions from fossil fuels extracted from federal lands and waters by private leaseholders in 2010 could be more than 20-times larger than the estimate reported in the CEQ inventory, [which estimates total federal emissions from agencies' operations to be 66.4 million metric tons]. Overall, ultimate downstream GHG emissions resulting from fossil fuel extraction from federal lands and waters by private

[41] International Investors Group on Climate Change, *Global Climate Disclosure Framework for Oil and Gas Companies* (attached as Exhibit 38).
[42] *See* DOI-BLM, *Mineral and Surface Acreage Managed By BLM,* available at: http://www.blm.gov/wo/st/en/info/About_BLM/subsurface.html.
[43] Stratus Consulting, prepared for: The Wilderness Society, *Greenhouse Gas Emissions from Fossil Energy Extracted from Federal Lands and Waters*, Feb. 1, 2012 (attached as Exhibit 39).

leaseholders in 2010 are estimated to total 1,551 [million metric tons of CO_2 equivalent ("$MMTCO_2e$")]." *Id.* In 2010, the GAO estimated that BLM could eliminate up to 40% of methane emissions from federally authorized oil and natural gas development, the equivalent of eliminating 126 Bcf or 46.3 $MMTCO_2e$ of GHG pollution annually and equivalent to roughly 13 coal-fired power plants.[44] To suggest that the BLM does not, here, have to account for GHG pollution from oil and gas development, would be to suggest that the collective 700 million acres of subsurface mineral estate is not relevant to protecting against climate change. This sort of flawed, reductive thinking would be problematic, and contradicted by the agency's very management framework that provides a place-based lens to account for specific pollution sources to ensure that the broader public interest is protected. In discussing the project's climate change impacts, it is insufficient for the BLM to only frame the problem in global terms:

> CEQ recognizes that many agency NEPA analyses to date have concluded that GHG emissions from an individual agency action will have small, if any, potential climate change effects. Government action occurs incrementally, program-by-program and step-by-step, and climate impacts are not attributable to any single action, but are exacerbated by a series of smaller decisions, including decisions made by the government. Therefore, the statement that emissions from a government action or approval represent only a small fraction of global emissions is more a statement about the nature of the climate change challenge, and is not an appropriate basis for deciding whether to consider climate impacts under NEPA. Moreover, these comparisons are not an appropriate method for characterizing the potential impacts associated with a proposed action and its alternatives and mitigations. This approach does not reveal anything beyond the nature of the climate challenge itself: the fact that diverse individual sources of emissions each make relatively small additions to global atmospheric GHG concentrations that collectively have huge impact.[45]

Therefore, even though greenhouse gas emissions from this project may look minor when viewed on the scale of the global climate crisis we face, when considered cumulatively with all of the other GHG emissions from BLM-managed land, they become significant and cannot be ignored. Moreover, the North Fork Valley has already seen the impacts of climate change in terms of early runoff, depleted water resources midway through the growing season, higher temperatures impacting vegetative growth, change in wildlife migration as wildlife adapt to warmer temperatures, and the need for orchards to adapt to shorter winters. There is risk of

---

[44] GAO, *Federal Oil & Gas Leases: Opportunities Exist to Capture Vented and Flared Natural Gas, Which Would Increase Royalty Payments and Reduce Greenhouse Gases*, GAO-11-34 at 12 (Table 1)(October 2010) (attached as Exhibit 47). This GHG equivalence assumes a CH_4 warming potential of 72 (20-year warming period) as per the Intergovernmental Panel on Climate Change's Fourth Assessment Report and using EPA's GHG equivalencies calculator.

[45] Council on Environmental Quality, *Revised Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts* (December 18, 2014) at 9, available at: http://www.whitehouse.gov/administration/eop/ceq/initiatives/nepa/ghg-guidance (attached as Exhibit 201) (hereinafter "CEQ Draft Guidance").

accelerating climate change by contributing methane and other greenhouse gases into the atmosphere.

The 2014 Inventory of U.S. Greenhouse Gas Emissions reports that natural gas systems alone, including production, processing, and transmission and storage, emitted over 100 MMTCO2e of methane in 2012.[46]

i. BLM Must Consider Existing, New, and Revised National Policy on Climate Change

In 2014, President Obama described climate change as an "urgent and growing threat . . . that will define the contours of this century more dramatically than any other."[47] In that same year, the U.S. pledged to reduce its greenhouse gas ("GHG") emissions 26-28 percent below 2005 levels by 2020.[48] President Obama also announced a new goal to cut methane emissions from the oil and gas sector by 40-45 percent below 2012 levels by 2025,[49] and set standards to reduce carbon dioxide emissions from the electricity sector by 32 percent from 2005 levels by 2030.[50] In 2015, President Obama recognized, "ultimately, if we're going to prevent large parts of this Earth from becoming not only inhospitable but uninhabitable in our lifetimes, we're going to have to keep some fossil fuels in the ground rather than burn them and release more dangerous pollution into the sky."[51] In his final State of the Union address, President Obama again noted the federal government's commitment to fighting climate change, vowing "to accelerate the transition away from old, dirtier energy sources," and making a powerful promise "to change the way we manage our oil and coal resources so that they better reflect the costs they impose on taxpayers and our planet."[52] These statements culminated in December, 2015 when the President joined with 194 other nations in recognizing "that climate change represents an urgent and potentially irreversible threat to human societies and the planet" and setting the goal of "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and

---

[46] *See* U.S. EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2012*, at 3-63 (April 2014) (attached as Exhibit 125).
[47] The White House, Remarks by the President at U.N. Climate Change Summit (Sept. 23, 2014), available at: https://www.whitehouse.gov/the-press-office/2014/09/23/remarks-president-un-climate-change-summit.
[48] U.S.-China Joint Announcement on Climate Change (Nov. 11, 2014), available at: https://www.whitehouse.gov/the-press-office/2014/11/11/us-china-joint-announcement-climate-change (attached as Exhibit 46).
[49] The White House, Climate Action Plan: Strategy to Reduce Methane Emissions (March 2014), available at: https://www.whitehouse.gov/blog/2014/03/28/strategy-cut-methane-emissions (attached as Exhibit 1-1).
[50] Environmental Protection Agency, Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64662 (Oct. 23, 2015).
[51] The White House, Statement by the President on the Keystone XL Pipeline (Nov. 6, 2015), available at: https://www.whitehouse.gov/the-press-office/2015/11/06/statement-president-keystone-xl-pipeline.
[52] President Barack Obama, State of the Union (Jan. 12, 2016), available at: https://www.whitehouse.gov/sotu.

pursuing efforts to limit the temperature increase to 1.5°C."[53] The President ratified the Paris Agreement, along with China, on September 3, 2016.[54] President Obama has also recognized that "the Paris Agreement alone will not solve the climate crisis. Even if we meet every target embodied in the agreement, we'll only get to part of where we need to go."[55]

Although national policy and statements addressing climate change have accelerated in recent years—as they should given the narrowing window of time to take meaningful action—the federal government's recognition of climate change is not new. The Secretary of the United States Department of the Interior stated, in Secretarial Order 3226, *Evaluating Climate Change Impacts in Management Planning* (January 19, 2001), that "[t]here is a consensus in the international community that global climate change is occurring and that it should be addressed in governmental decision making." Order 3226 established the responsibility of agencies to "consider and analyze potential climate change impacts when undertaking long-range planning exercises, when setting priorities for scientific research and investigations, when developing multi-year management plans, and/or when making major decisions regarding potential utilization of resources under the Department's purview."

In a 2007 report entitled *Climate Change: Agencies Should Develop Guidance for Addressing the Effects on Federal Land and Water Resources,* the GAO concluded that the Department of the Interior had not provided specific guidance to implement Secretarial Order 3226, that officials were not even aware of Secretarial Order 3226, and that Secretarial Order 3226 had effectively been ignored. This report led to Secretarial Order 3289, *Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources* (September 14, 2009), which reinstated the provisions of Order 3226, and recognized that "the realities of climate change require us to change how we manage land, water, fish and wildlife, and cultural heritage and tribal lands and resources we oversee," and acknowledged that the Department of the Interior is "responsible for helping protect the nation from the impacts of climate change." A month later, in Executive Order No. 13514, *Federal Leadership in Environmental, Energy, and Economic Performance* (Oct. 5, 2009), President Obama called on all federal agencies to "measure, report, and reduce their greenhouse gas emissions from direct and indirect activities." 74 Fed. Reg. 52,117 (Oct. 8, 2009). This directive was followed by Executive Order No. 13693, *Planning for Federal Sustainability in the Next Decade* (March 25, 2015), which reaffirmed the federal government's commitment to reducing GHG emissions. 80 Fed. Reg. 15,871 (March 25, 2015).

---

[53] United Nations Framework Convention on Climate Change, Conference of the Parties (Nov 30-Dec. 11, 2015), Adoption of the Paris Agreement, Art. 2, U.N. Doc. FCCC/CP/2015/L.9 (Dec. 12, 2015), available at: http://unfccc.int/resource/docs/2015/cop21/eng/l09.pdf ("Paris Agreement") (attached as Exhibit 2-1).

[54] The White House, President Obama: The United States Formally Enters the Paris Agreement (Sept. 3, 2016), available at: https://www.whitehouse.gov/blog/2016/09/03/president-obama-united-states-formally-enters-paris-agreement.

[55] The White House, Office of the Press Secretary, Remarks by the President on the Paris Agreement (Oct. 5, 2016), attached as Exhibit 3-1, and available at https://www.whitehouse.gov/the-press-office/2016/10/05/remarks-president-paris-agreement (last viewed Oct. 26, 2016).

In 2009, the Environmental Protection Agency ("EPA") issued a finding that the changes in our climate caused by elevated concentrations of greenhouse gases in the atmosphere are reasonably anticipated to endanger the public health and welfare of current and future generations. 74 Fed. Reg. 66496 (Dec. 15, 2009). In 2015, EPA acknowledged more recent scientific assessments that "highlight the urgency of addressing the rising concentrations of CO_2 in the atmosphere." 80 Fed. Reg. 64661 (Oct. 23, 2015).

The White House Council on Environmental Quality ("CEQ")—the federal agency tasked with managing the federal government's implementation of NEPA—has recognized the unique nature of climate change and the challenges it imposes on NEPA compliance. On August 1, 2016, CEQ released *Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* (hereafter, "Final Climate Guidance") (attached as Exhibit 4-1). The Final Guidance applies to all proposed federal agency actions, "including land and resource management actions." *Id*. at 9. In its Final Guidance, the CEQ recognized that:

> Climate change results from the incremental addition of GHG emissions from millions of individual sources, which collectively have a large impact on a global scale. CEQ recognizes that the totality of climate change impacts is not attributable to any single action, but are exacerbated by a series of actions including actions taken pursuant to decisions of the Federal Government. Therefore, a statement that emissions from a proposed Federal action represent only a small fraction of global emissions is essentially a statement about the nature of the climate change challenge, and is not an appropriate basis for deciding whether or to what extent to consider climate change impacts under NEPA. Moreover, these comparisons are also not an appropriate method for characterizing the potential impacts associated with a proposed action and its alternatives and mitigations because this approach does not reveal anything beyond the nature of the climate change challenge itself: the fact that diverse individual sources of emissions each make a relatively small addition to global atmospheric GHG concentrations that collectively have a large impact.

Id. at 10-11. CEQ's Final Guidance also explains the application of NEPA principles and practices to the analysis of GHG emissions and climate change, including: (1) that agencies quantify a proposed action's projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools; (2) that agencies use projected GHG emissions as a proxy for assessing potential climate change effects when preparing a NEPA analysis; (3) where GHG emission tools, methodologies, or data inputs are not reasonably available, that agencies include a qualitative analysis in the NEPA document and explain the basis for determining that quantification is not reasonably available; (4) that agencies analyze foreseeable direct, indirect, and cumulative GHG emissions and climate effects; (5) that agencies consider reasonable alternatives and the short- and long-term effect and benefits in the alternatives and mitigation analysis; (6) that agencies consider alternatives that would make the actions and affected communities more resilient to the effects of a changing climate; and (7) that agencies assess the

broad-scale effects of GHG emissions and climate change, either to inform programmatic decisions, or at both the programmatic and project-level. *See id.* at 4-6.

ii. BLM Must Consider Recent Climate Science and Carbon Budgeting.

Since the dawn of the industrial revolution a century ago, the average global temperature has risen some 1.6 degrees Fahrenheit. Most climatologists agree that, while the warming to date is already causing environmental problems, another 0.4 degree Fahrenheit rise in temperature, representing a global average atmospheric concentration of carbon dioxide ("CO_2") of 450 parts per million ("ppm"), could set in motion unprecedented changes in global climate and a significant increase in the severity of natural disasters—and could represent the point of no return.[56] In February 2017, the atmospheric concentration of CO_2 was approximately 406.42 ppm, up from 404.04 ppm the same month a year earlier.[57]

Climate change has been intensively studied and acknowledged at the global, national, and regional scales. Climate change is being fueled by the human-caused release of greenhouse gas emissions, in particular carbon dioxide and methane. The Intergovernmental Panel on Climate Change ("IPCC") is a Nobel Prize-winning scientific body within the United Nations that reviews and assesses the most recent scientific, technical, and socio-economic information relevant to our understanding of climate change. In its most recent report to policymakers in 2014, the IPCC provided a summary of our understanding of human-caused climate change. Among other things, the IPCC summarized:[58]

- Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems.

- Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen.

- Anthropogenic greenhouse gas emissions have increased since the pre-industrial era, driven largely by economic and population growth, and are now higher than ever. This has led to atmospheric concentrations of carbon dioxide, methane, and nitrous oxide that are unprecedented in at least the last 800,000 years. Their

[56] *See* David Johnston, *Have We Passed the Point of No Return on Climate Change?*, Scientific American (April 2015), available at: http://www.scientificamerican.com/article/have-we-passed-the-point-of-no-return-on-climate-change/.
[57] NOAA, Earth System Research Laboratory, *Trends in Atmospheric Carbon Dioxide*, available at: http://www.esrl.noaa.gov/gmd/ccgg/trends/.
[58] IPCC AR5, *Summary for Policymakers* (March 2014) available at: http://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf (attached as Exhibit 5).

effects, together with those of other anthropogenic drivers, have been detected throughout the climate system and are extremely likely to have been the dominant cause of the observed warming since the mid-20th century.

- In recent decades, changes in climate have caused impacts on natural and human systems on all continents and across the oceans. Impacts are due to observed climate change, irrespective of its cause, indicating the sensitivity of natural and human systems to changing climate.

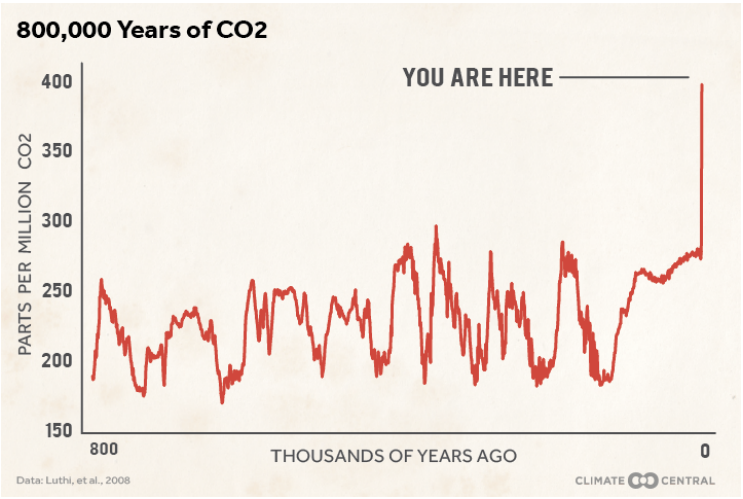
- Continued emission of greenhouse gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive, and irreversible impacts for people and ecosystems. Limiting climate change would require substantial and sustained reductions in greenhouse gas emissions which, together with adaptation, can limit climate change risks.

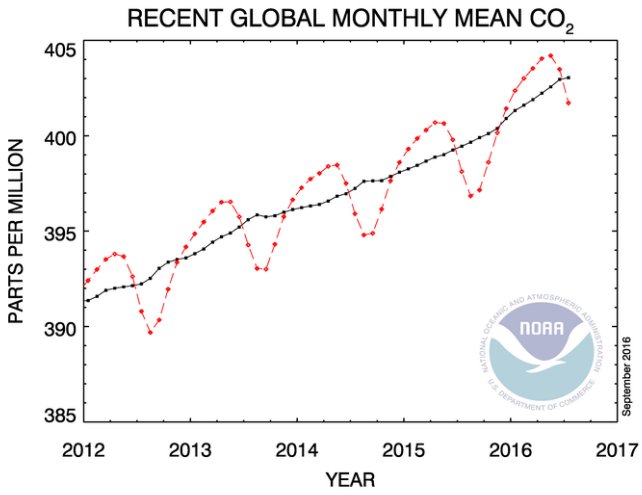
- Surface temperature is projected to rise over the 21st century under all assessed emission scenarios. It is very likely that heat waves will occur more often and last longer, and that extreme precipitation events will become more intense and frequent in many regions. The ocean will continue to warm and acidify, and global mean sea level will continue to rise.

Carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are recognized as the key greenhouse gases contributing to climate change. In 2009, the EPA found that these "six greenhouse gases taken in combination endanger both the public health and the public welfare of current and future generations."[59] The D.C. Circuit has upheld this decision as supported by the vast body of scientific evidence on the subject. *See Coal. for Responsible Regulation, Inc. v. EPA.*, 684 F.3d 102, 120-22 (D.C. Cir. 2012).

According to the National Oceanic and Atmospheric Administration ("NOAA"), "[t]he combined average temperature over global land and ocean surfaces for August 2016 was the highest for August in the 137-year period of record, marking the 16th consecutive month of record warmth for the globe." [60] The global climate crisis is happening and it may well be accelerating quickly.

[59] Environmental Protection Agency, *Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act* 74 Fed. Reg. 66,496 (Dec. 15, 2009).
[60] NOAA, Global Analysis – August 2016, available at: https://www.ncdc.noaa.gov/sotc/global/201608.





The graphs show globally averaged historic and monthly mean carbon dioxide.

The IPCC in 2013 affirmed: "Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased" causing "widespread impacts on human and natural systems."[61] This is consistent with the findings of the United States' 2014 Third National Climate Assessment, stating: "That the planet has warmed is 'unequivocal,' and is corroborated through multiple lines of evidence, as is the conclusion that the causes are very likely human in origin."[62] With particular regard to the Southwest Region—which includes Colorado, New Mexico, Utah, Arizona, Nevada, and California—the National Climate Assessment included in the following overview:[63]

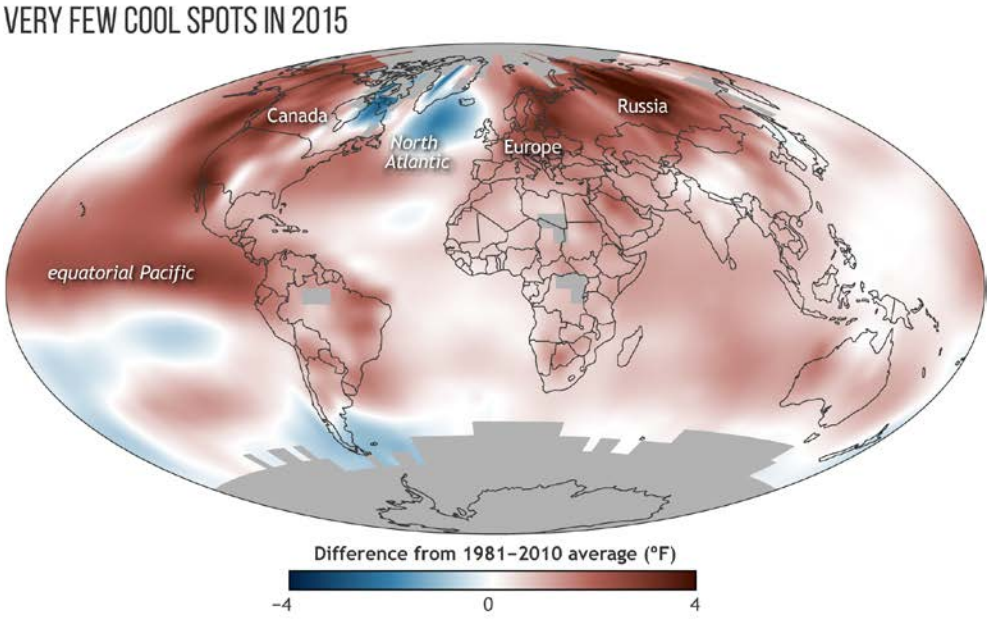
- Snowpack and streamflow amounts are projected to decline in parts of the Southwest, decreasing surface water supply reliability for cities, agriculture, and ecosystems.
- The Southwest produces more than half of the nation's high-value specialty crops, which are irrigation-dependent and particularly vulnerable to extremes of moisture, cold, and heat. Reduced yields from increasing temperatures and increasing competition for scarce water supplies will displace jobs in some rural communities.
- Increased warming, drought, and insect outbreaks, all caused by or linked to climate change, have increased wildfires and impacts to people and ecosystems in the Southwest. Fire models project more wildfire and increased risks to communities across extensive areas.

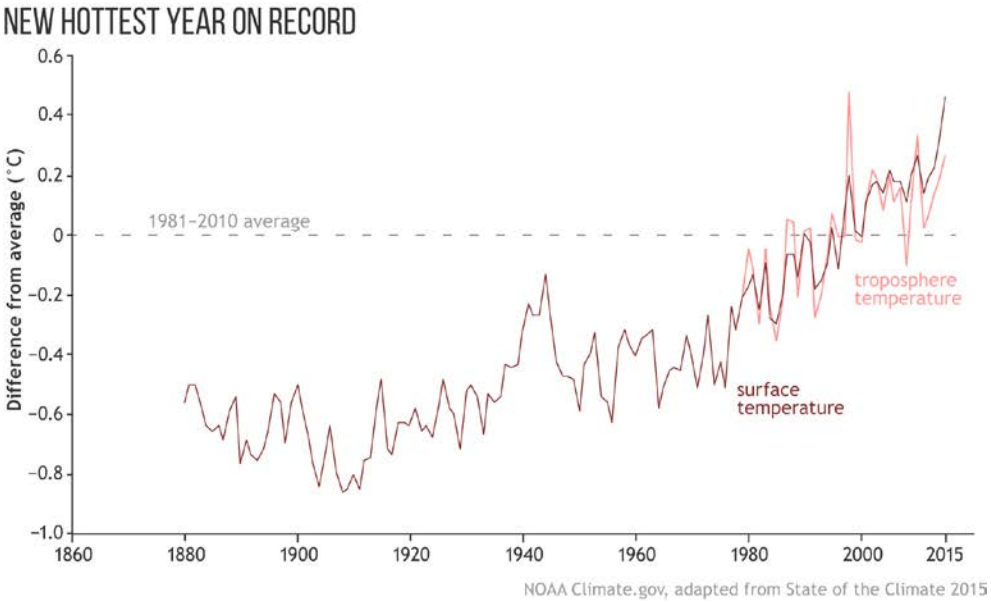
[61] IPCC AR5 Synthesis Report at 2 (attached as Exhibit 5-1).
[62] Jerry M. Melillo, *et al.*, Climate Change Impacts in the United States: The Third National Climate Assessment (2014) at 61, available at: http://nca2014.globalchange.gov (attached as Exhibit 6-1).
[63] *See id.* at 463-86.

- Flooding and erosion in coastal areas are already occurring even at existing sea levels and damaging some California coastal areas during storms and extreme high tides. Sea level rise is projected to increase as Earth continues to warm, resulting in major damage as wind-driven waves ride upon higher seas and reach farther inland.
- Projected regional temperature increases, combined with the way cities amplify heat, will pose increased threats and costs to public health in southwestern cities, which are home to more than 90% of the region's population. Disruptions to urban electricity and water supplies will exacerbate these health problems.

Immediate and substantial greenhouse gas reductions are required to avoid catastrophic impacts to people and communities. "Following the warmest year on record in 2014 according to most estimates, 2015 reached record warmth yet again, surpassing the previous record by more than 0.1°C."[64]

[64] American Meteorological Society, *State of the Climate in 2015*, Vol.97, No.8 (Aug. 2016), at S7 (attached as Exhibit 7-1).





As noted above, the Paris Agreement commits all signatories—including the United States—to a target holding long-term global average temperature "to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels."[65] As articulated by a team of international climate scientists, including Dr. James Hansen, in a 2013 report: "The widely accepted target of limiting human-made global warming to 2 degrees Celsius (3.6 degrees Fahrenheit) above preindustrial level is too high and would subject young people, future generations and nature to irreparable harm…. Observational data reveal that some climate extremes are already increasing in response to warming of several tenths of a degree in recent decades; these extremes would likely be much enhanced with

[65] Paris Agreement at Art. 2 (attached as Exhibit 2-1).

warming of 2°C or more."[66] "Runaway climate change—in which feedback loops drive ever-worsening climate change, regardless of human activities—are now seen as a risk even at 2°C of warming."[67] Indeed, the impacts of 2°C temperature rise have been "revised upwards, sufficiently so that 2°C now more appropriately represents the threshold between 'dangerous' and 'extremely dangerous' climate change."[68]

Although the Paris Agreement has underscored that immediate action is needed to avoid 'extremely dangerous' warming, meeting the voluntary commitments adopted in Paris alone will be insufficient to meet goal of limiting temperature change to between 1.5°C and 2.0°C above pre-industrial levels. As noted by a 2015 UNEP technical report:

> The emissions gap between what the full implementation of the unconditional [intended nationally determined contributions (INDCs)] contribute and the least-cost emission level for a pathway to stay below 2°C, is estimated to be 14 $GtCO_2e$ (range: 12-17) in 2030 and 7 $GtCO_2e$ (range: 5-10) in 2025. When conditional INDCs are included as fully implemented, the emissions gap in 2030 is estimated to be 12 GtCO2e (range: 10-15) and 5 $GtCO_2e$ (range: 4-8) in 2025.[69]

In other words, far greater emissions reductions are necessary to stay below and 2.0°C, let alone aspire to 1.5°C of warming. If no further progress were made beyond the Paris Agreement, expected warming by 2100 would be 3.5°C.[70] In the alternative, if no action is taken and the status quo is maintained estimated warming by 2100 is upwards of 4.5°C.[71]

With specific regard to United States commitments under the Paris Agreement, the U.S.

---

[66] James Hansen, *et al., Assessing "Dangerous Climate Change": Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature*, 8 PLoS ONE 8 e81648 (2013) (attached as Exhibit 8-1).
[67] Greg Muttitt, *et al., The Sky's Limit: Why the Paris Climate Goals Require a Managed Decline of Fossil Fuel Production*, Oil Change International (Sept. 2016) at 6 (attached as Exhibit 9-1); *see also* David Spratt, *Climate Reality Check: After Paris, Counting the Cost* (March 2016) at 8 (attached as Exhibit 10-1) ("there is an unacceptable risk that before 2°C of warming, significant "long-term" feedbacks will be triggered, in which warming produces conditions that generate more warming, so that carbon sinks such as the oceans and forests become less efficient in storing carbon, and polar warming triggers the release of significant permafrost and clathrate carbon stores. Such an outcome could render ineffective human efforts to control the level of future warming to manageable proportions.").
[68] Kevin Anderson and Alice Bows, *Beyond 'Dangerous' Climate Change: Emission Scenarios for a New World*, Phil. Trans. R. Soc. (2011) (attached as Exhibit 11-1).
[69] United Nations Environment Programme (UNEP), *The Emissions Gap Report 2015: A UNEP Synthesis Report* (Nov. 2015) at xviii (attached as Exhibit 12-1).
[70] Spratt, *Climate Reality Check* at 2 (attached as Exhibit 10-1).
[71] *See* Climate Interactive, Climate Scorecard, available at: https://www.climateinteractive.org/programs/scoreboard/*; see also*, Andrew P. Schurer, *et al., Separating Forced from Chaotic Climate Variability over the Past Millennium*, Journal of Climate, Vol. 26 (March 2013) (attached as Exhibit 13-1).

INDC set specific greenhouse gas emissions reduction target for 2025 of a 26% to 28% reduction below the 2005 emission levels, producing a range in 2005 net GHG emissions from 6,323 to 7,403 $MTCO_2e$.[72] The difference between this target and the estimated 2025 emissions without INDC policies results in an 'emissions gap' ranging from 896 to 2,121 $MTCO_2e$.[73]

Both the IPCC and National Climate Assessment recognize the dominant role of fossil fuels in driving climate change:

> While scientists continue to refine projections of the future, observations unequivocally show that climate is changing and that the warming of the past 50 years is primarily due to human-induced emissions of heat-trapping gases. These emissions come mainly from burning coal, oil, and gas, with additional contributions from forest clearing and some agricultural practices.[74]
>
> ***
>
> CO_2 emissions from fossil fuel combustion and industrial processes contributed about 78% to the total GHG emission increase between 1970 and 2010, with a contribution of similar percentage over the 2000–2010 period (*high confidence*).[75]

As summarized in a recent report:

> The Paris Agreement aims to help the world avoid the worst effects of climate change and respond to its already substantial impacts. The basic climate science involved is simple: cumulative carbon dioxide (CO_2) emissions over time are the key determinant of how much global warming occurs. This gives us a finite *carbon budget* of how much may be emitted in total without surpassing dangerous temperature limits.[76]

According to the IPCC, as of 2011, the remaining carbon budget of cumulative CO_2 emissions from all anthropogenic sources must remain below 1,000 $GtCO_2$ to provide a 66% probability of limiting warming to 2°C above pre-industrial levels.[77] For years 2012-2014, approximately 107 $GtCO_2$ was emitted, averaging approximately 36 $GtCO_2$ per year, which left

---

[72] Jeffery Greenblatt & Max Wei, *Assessment of the climate commitments and additional mitigation policies of the Unites States*, Nature Climate Change (Sept. 2016), available at: http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate3125.html (attached as Exhibit 14-1).
[73] *Id.* at 2; *see also* UNEP, Emissions Gap Report (attached as Exhibit 12-1).
[74] Third National Climate Assessment at 2 (attached as Exhibit 6-1).
[75] IPCC AR5 Synthesis Report at 46 (attached as Exhibit 5-1).
[76] *The Sky's Limit* at 6 (attached as Exhibit 9-1).
[77] IPCC AR5 Synthesis Report at 63-64 & Table 2.2 (attached as Exhibit 5-1). For an 80% probability of staying below 2°C, the budget from 2000 is 890 $GtCO_2$, with less than 430 $GtCO_2$ remaining. Malte Meinshausen *et al., Greenhouse-gas emission targets for limiting global warming to 2°C*, Nature (2009) at 1159 (attached as Exhibit 15-1).

us at the start of 2016 with a carbon budget of only 850 $GtCO_2$.[78] These emissions were the highest in human history and 60% higher than in 1990 (the Kyoto Protocol reference year). Of course, the Paris Agreement aim of limiting global warming to 1.5°C requires adherence to a more stringent carbon budget of only 400 $GtCO_2$ from 2011 onward, of which about 250 $GtCO_2$ remained at the start of 2016.[79] "With global annual emissions amounting to 36 $GtCO_2$ in 2015, scientists predict that at current rates global emissions will exceed the carbon budgets necessary to stay under the 1.5°C target by 2021 and the 2°C target by 2036.[80]

The potential carbon emissions from *existing* fossil fuel reserves—the known belowground stock of extractable fossil fuels—considerably exceed both 2°C and 1.5°C of warming. "Estimated total fossil carbon reserves exceed this remaining [carbon budget] by a factor of 4 to 7."[81] "For the 2°C or 1.5°C limits, respectively 68% or 85% of reserves must remain in the ground."[82] The reserves in currently operating oil and gas field alone, even with no coal, would take the world beyond 1.5°C.[83]

In order for the world to stay within a carbon budget consistent with Paris Agreement goals—"holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C"[84]—significant fossil fuel resources must remain in the ground. More specifically, to meet the target of 2°C, globally "a third of oil reserves, half of gas reserves and over 80 percent of current coal reserves should remain unused from 2010-2050."[85] Studies estimate that global coal, oil and gas resources considered currently economically recoverable contain potential greenhouse gas emissions of 4,196 $GtCO_2$,[86] with other estimates as high as 7,120 $GtCO_2$.[87]

---

[78] *See* Annual Global Carbon Emissions, available at: https://www.co2.earth/global-co2-emissions; *see also* C. Le Quéré, *et al., Global Carbon Budget 2015*, Earth Syst. Sci. Data (Dec. 2015) (attached as Exhibit 16-1).
[79] Dustin Mulvaney, *et al., Over-Leased: How Production Horizons of Already Leased Federal Fossil Fuels Outlast Global Carbon Budgets*, EcoShift Consulting (July 2016) (attached as Exhibit 17-1) at 2 (citing Joeri Rogelj, *et al., Difference between carbon budget estimates unraveled*, Nature Climate Change (2016) (attached as Exhibit 18-1).
[80] Mulvaney at 2 (citing Oak Ridge National Laboratories, Carbon Dioxide Information Analysis Center (2015), available at: http://cdiac.ornl.gov/GCP/).
[81] IPCC AR5 Synthesis Report at 63 (attached as Exhibit 5-1).
[82] The Sky's Limit at 6 (attached as Exhibit 9-1); *see also* Kevin Anderson and Alice Bows, *Reframing the climate change challenge in light of post-2000 emission trends*, Phil. Trans. R. Soc. (2008) (attached as Exhibit 19-1) ("to provide a 93% mid-value probability of not exceeding 2°C, the concentration (of atmospheric greenhouse gases) would need to be stabilized at or below 350 parts per million carbon dioxide equivalent (ppm CO_2e)" compared to the current level of ~485 ppm CO_2e.).
[83] The Sky's Limit at 5, 17 (attached as Exhibit 9-1).
[84] Paris Agreement at Art. 2 (attached as Exhibit 2-1).
[85] Christophe McGlade & Paul Ekins, *The geographical distribution of fossil fuels unused when limiting global warming to 2°C*, Nature (Jan 2015) (attached as Exhibit 20-1).
[86] Michael Raupach, *et al., Sharing a quota on cumulative carbon emissions*, Nature Climate Change (Sept. 2014) (attached as Exhibit 21-1).

Critically, the United States carbon quota—equivalent to 11% of the global carbon budget needed for a 50% chance of limiting warming to 2°C—allocates approximately 158 $GtCO_2$ to the United States as of 2011.[88] By way of comparison, federal and non-federal fossil fuel emissions together would produce between 697 and 1,070 $GtCO_2$.[89] Regarding just federal fossil fuel resources, the United States contains enough recoverable coal, oil and gas that, if extracted and burned, would result in as much as 492 $GtCO_2$, far surpassing the entire global carbon budget for a 1.5°C target and nearly eclipsing the 2°C target—to say nothing of the United States 'share' of global emissions.[90] Unleased federal fossil fuels comprise 91% of these potential emissions, with already leased federal fossil fuels accounting for as much as 43 $GtCO_2$.[91]

In 2012, "the GHG emissions resulting from the extraction of fossil fuels from federal lands by private leaseholders totaled approximately 1,344 $MMTCO_2e$."[92] Between 2003 and 2014, approximately 25% of all United States and 3-4% of global fossil fuel greenhouse gas emissions are attributable to federal minerals leased and developed by the Department of the Interior.[93] Continued leasing and development of federal fossil fuel resources commits the world to 'extremely dangerous' warming well beyond the 2°C threshold. As one study put it, "the disparity between what resources and reserves exist and what can be emitted while avoiding a temperature rise greater than the agreed 2°C limit is therefore stark."[94] In short, *any* new leasing of federal fossil fuel resources is inconsistent with a carbon budget that would seek to avoid catastrophic climate change.

The production horizons for already leased federal fossil fuel resources underscore how unwarranted any additional leasing is. Comparing these production horizons to dates at which carbon budgets would be exceeded if current emission levels continue:

- Federal crude oil already leased will continue producing for 34 years beyond the 1.5°C threshold and 19 years beyond the 2°C threshold;
- Federal natural gas already leased will continue producing 23 years beyond the 1.5°C threshold and 8 years beyond the 2°C threshold;

---

[87] IPCC AR5, Mitigation of Climate Change, Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (2014) at Table 7.2 (attached as Exhibit 22).
[88] Raupach at 875 (attached as Exhibit 21-1).
[89] Dustin Mulvaney, *et al.*, *The Potential Greenhouse Gas Emissions from U.S. Federal Fossil Fuels*, EcoShift Consulting (Aug. 2015) at 16 (attached as Exhibit 23-1).
[90] *Id.*
[91] *Id.*
[92] Stratus Consulting, *Greenhouse Gas Emissions from Fossil Energy Extracted from Federal Lands and Waters: An Update* (Dec. 2014) at 9 (attached as Exhibit 24-1).
[93] *See* Energy Information Administration, *Sales of Fossil Fuels Produced from Federal and Indian Lands, FY 2003 through FY 2014* (July 2015) (attached as Exhibit 25-1); *see also* Stratus Consulting (attached as Exhibit 24-1).
[94] McGlade at 188 (attached as Exhibit 20-1).

- Federal coal already leased will continue producing 20 years beyond the 1.5°C threshold and 5 years beyond the 2°C threshold.[95]

Opportunities to reduce GHG emissions through the cessation of new leasing and non-renewal of non-producing leases further underscores how unwarranted continued leasing is.

If new leasing and renewal of existing non-producing leases continues, by 2040 it will contribute about two-thirds of expected federal fossil fuel production (forecast based on EIA and other sources).[96] On the other hand, if new leasing ceases and existing non-producing leases are not renewed, 40% of forecast coal production could be avoided in 2025 and 74% of coal production could be avoided in 2040. As for oil and gas, 12% of oil production could be avoided in 2025 and 65% could be avoided by 2040 while 6% of natural gas production could be avoided in 2025 and 59% could be avoided by 2040.[97]

This avoided production would significantly reduce future U.S. emissions. Cessation of new and renewed leases for federal fossil fuel extraction could reduce CO_2 emissions by about 100 Mt per year by 2030. Annual emission reductions could become greater than that over time as production declines on existing leases and maintaining or increasing production becomes dependent on yet-to-be issued leases.[98]

A comparison with other measures shows that "no leasing" could be a very significant part of U.S. efforts to address climate change. The 100 Mt CO_2 emissions savings that could result from no leasing in 2030 compares favorably with EPA standards for light- and medium-vehicles that are expected to yield 200 Mt in CO2 savings in 2030, and with standards for heavy-duty vehicles that are expected to yield 70 Mt in CO2 savings in the same year. The 100 Mt CO_2 emissions reduction from leasing restrictions would be greater than either the emission reductions that the EPA expects to achieve through its existing regulation of oil and gas industry emissions or reductions the BLM expects to achieve from its proposed methane waste standards on oil and gas operations on federal land. Clearly, cessation of new and renewed leases could make an important contribution to U.S. climate change mitigation efforts.[99]

Also, importantly, avoided production through no new leasing and non-renewal of existing non-producing leases could help avoid further carbon lock-in in terms of investment in both fossil fuel-producing and fossil fuel-using infrastructure.[100]

Simply put, the timeframe to avoid catastrophic climate change is short, and the management of our federal minerals is dangerously out of step with this reality.

---

[95] Mulvaney (2016) at 5 (attached as Exhibit 17-1).
[96] Peter Erickson and Michael Lazarus, *How Would Phasing Out U.S. Federal Leases for Fossil Fuel Extraction Affect CO2 Emissions and 2°C Goals?,* Stockholm Environmental Institute (2016) at 12 (attached as Exhibit 323).
[97] Erickson and Lazarus at 16.
[98] *Id.* at 26.
[99] *Id.* at 27.
[100] *Id.* at 30.

iii. Projected Energy Demands, International Finance, and Stranded Assets

The world's energy needs continue to grow, with projections of a 30% rise in global energy demand to 2040. The International Energy Agency ("IEA") has estimated that for this increasing demand to be met, a cumulative $48 trillion in investment is needed in global energy supply,[101] of which 60% is comprised of fossil fuels and nearly 20% to renewables, with an additional $23 trillion invested in improvements in energy efficiency.[102] "Countries are generally on track to achieve, and even exceed in some instances, many of the targets set in their Paris Agreement pledges; this is sufficient to slow the projected rise in global energy-related CO_2 emissions, but not nearly enough to limit warming to less than 2°C."[103] By contrast, it would be exceedingly difficult to chart a course toward a 2°C pathway. A major reallocation of investment capital going to the energy sector would be needed, requiring an estimated $40 trillion in cumulative energy supply investment moving away from fossil fuels and toward renewables.[104] The more ambitious target of limiting warming to less than 1.5°C would be even more difficult to achieve, demanding net-zero emissions between 2040 and 2060, a goal that would require radical near-term reductions in energy sector CO_2 emissions.[105] IEA estimates that "$53 trillion in cumulative investment in energy supply and efficiency is required over the period to 2035 in order to get the world onto a 2°C emissions path."[106]

The liability exposure from not acting is enormous, with cumulative 'lost' GDP from the impacts of climate change equating to $44 trillion.[107] Yet, investment decisions being taken today are not consistent with a 2°C climate goal and are not aimed at creating infrastructure that is sufficiently resilient to withstand the increased physical risks that are expected to result from future climate change.[108] "[O]ur current energy infrastructure has already 'locked-in' future carbon-dioxide emissions."[109] Even as this energy infrastructure is quickly sealing our climate fate in the near term, it will become obsolete in the slightly longer term. Indeed, many new energy sector assets are destined to become stranded when carbon reduction policies that limit the utilization of those assets are inevitably adopted in response to climate change impacts. As of 2013, emissions from existing global fossil fuel energy infrastructure already represented four-fifths, or 550 $GtCO_2$, of the total volume of CO_2 emissions that the earth can accommodate under a 2°C trajectory.[110] With delayed climate action to date, in 2017 we now find ourselves at an

---

[101] International Energy Agency, *World Energy Investment Outlook* (2014), at 3 (attached as Exhibit 31-1).
[102] International Energy Agency, *World Energy Outlook 2016: Executive Summary* (2016), at 2 (attached as Exhibit 32-1).
[103] IEA (2016) at 2.
[104] IEA (2016) at 5.
[105] IEA (2016) at 5.
[106] IEA (2014) at 14.
[107] Jason Channell, *et al.*, *Energy Darwinism II*, Citi GPS: Global Perspectives & Solutions (August 2015) at 7 (attached as Exhibit 30-1).
[108] IEA (2013) at 84.
[109] IEA (2013) at 98.
[110] IEA (2013) at 99.

investment watershed, where energy infrastructure now locks in the entire remaining carbon budget to 2035.[111] From this point forward, far more costly actions are going to be required to subsequently undo the lock-in effect, and every additional investment in the energy sector committed to fossil fuels would become stranded assets under policies to achieve a 2°C pathway.

At the same time, the capital expenditures required to maintain current energy sector demand for fossil fuels have more than doubled since 2000, to $950 billion annually.[112] In other words, more capital investment is being required to maintain our current reliance on fossil fuels at a time, paradoxically, when from a climate perspective all of the new investment must be redirected towards renewable energy sources to effect a radical transformation of the energy sector, as necessary to avoid catastrophic warming. The market value of oil and gas produced globally was around $4.2 trillion in 2012, which was almost double what it was in 2005.[113] Yet, this has not resulted in a financial windfall to the oil and gas industry, as costs and royalties have more than kept pace with increased revenues.[114] In short, oil and gas companies are merely maintaining a fossil fuel treadmill where increasingly costly investments are needed to meet demand but lead to rising costs for the oil and gas industry as well as significant costs to society as reliance on oil and gas fuels climate change, an irrational system. In the face of these increasing capital requirements, there is growing awareness of significant financial exposure for individual companies from the possible future stranding of new fossil fuel investments. For example, among major oil and gas companies, the estimated cost of stranded assets over the next decade ranges from $21.5 billion for ConocoPhillips to $76.9 billion for Shell.[115] Nevertheless, the global capital markets have yet to internalize these risks and charge premiums that would steer investment towards renewable energy.

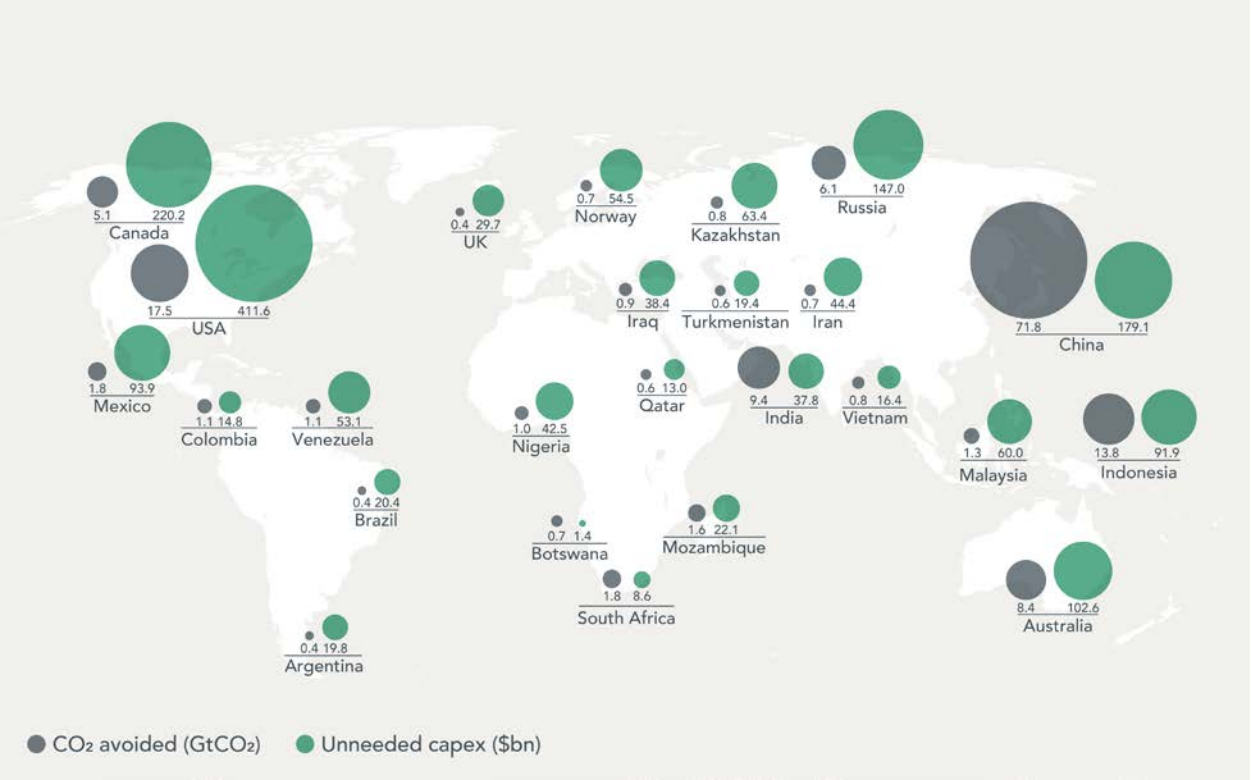
"Analysis of the entire energy system shows that delaying action on climate change is a false economy. Investments of around $1.5 trillion are avoided in the period to 2020, but an additional $5 trillion of investments are required between 2020 and 2035."[116]

According to the 2°C pathway modeled by IEA, from 2015-2035 the carbon budget for energy-based emissions from all fossil fuels is 593 $GtCO_2$.[117] If global energy investment continues on its current course, there will be over $2 trillion in investment in energy sources that will emit around 156 $GtCO_2$ of emissions over the 2°C target of 593 $GtCO_2$.[118] This can also be viewed through the lens of specific fossil fuel demand to 2035 under a 2°C pathway. For coal, zero additional capital investment is needed, as production from existing coalmines would exceed demand.[119] For gas, approximately $460 billion—or over 40% of anticipated capital

[111] IEA (2013) at 113.
[112] IEA (2014) at 51, 52.
[113] IEA (2014) at 54.
[114] IEA (2014) at 54.
[115] Carbon Tracker Initiative, *The $2 Trillion Stranded Assets Danger Zone: How Fossil Fuel Firms Risk Destroying Investor Returns* (Nov. 2015) at 23, (attached as Exhibit 33-1).
[116] IEA (2013) at 114.
[117] Carbon Tracker (2015) at 7.
[118] Carbon Tracker (2015) at 2.
[119] Carbon Tracker (2015) at 10.

expenditures—is unneeded, resulting in 9.3 $GtCO_2$ of avoided emissions.[120] For oil, it is projected that demand peaks around 2020, meaning that the oil sector does not need to continue to grow. Based on current Paris Agreement commitments, oil production required in the period to 2035 amounts to around 760 billion barrels, but falls to 690 billion barrels to maintain a course for 2°C.[121] Yet the estimated level of proven oil reserves are close to 1.7 trillion barrels.[122] This results to between a 940 and 1,010 billion barrel surplus of proven reserves that cannot be burned. Avoided capital expenditures for oil are nearly $1.5 trillion, avoiding 27.6 $GtCO_2$ of emissions.[123]

Unneeded capital expenditures to 2025 and related CO_2 to 2035 under a 2°C pathway



It is cheaper for the world to address climate change than bear its economic consequences. As detailed above, there are enough coal, oil and gas reserves that are technically recoverable to equal up to 7,120 $GtCO_2$ of emissions.[124] Only a portion of this carbon is already locked-in—i.e., total reserves held by fossil fuel companies and state owned assets—but this 'embedded' carbon still amounts to 2,860 $GtCO_2$—already enough to take us beyond 3°C of

[120] Carbon Tracker (2015) at 14.
[121] IEA (2014) at 87.
[122] IEA (2014) at 87.
[123] Carbon Tracker (2015) at 18.
[124] IPCC AR5 at Table 7.2.

warming.[125] Only 20% of these fossil fuel reserves can be burned to 2050 if the world is to have a chance of not exceeding global warming of 2°C.[126]

The total coal, oil and gas reserves listed on the world's stock exchanges equaled 762 $GtCO_2$ in 2013—an amount that continues to grow.[127] "If listed fossil fuel companies have a pro-rata allocation of the global carbon budget, this would amount to around 125–275 $GtCO_2$, or 20 - 40% of the 762 $GtCO_2$ currently booked as reserves. The scale of this carbon budget deficit poses a major risk for investors. They need to understand that 60 - 80% of coal, oil and gas reserves of listed firms are unburnable."[128] The systemic risks threatening the stability of financial markets related to unburnable carbon are growing more entrenched, with 200 fossil fuel companies having a market value of $4 trillion and debt of $1.5 trillion.[129]

As provided by Citigroup in a warning to investors:

> Emissions contained in current 'reserves' figures are around three times higher than the so called 'carbon budget'. Some studies suggest that globally a third of oil reserves, half of gas reserves and over 80% of current coal reserves would have to remain unused from 2010 to 2050 in order to have a chance of meeting the 2°C target. In financial terms, we estimate that the value of unburnable reserves could amount to over $100 trillion out to 2050.[130]

The longer climate action is delayed the more expensive it becomes to avoid each additional ton of GHG emissions, and the more capital expenditures will become stranded. [131] In other words, climate action is directly tied to economic resilience, and the longer action is delayed the larger the lead balloon becomes. This is not only a problem for the fossil fuel industry, but for our economy and the wellbeing of our communities. These financial implications also bear directly on BLM's decisionmaking relative to the leasing and development of our public lands for fossil fuel resources. Not only do each additional acre leased and well authorized contribute to societies collective carbon burden, but inherent financial risk and market instability has far reaching implications for public lands remediation. When fossil fuel resources become stranded it is the public, not financially struggling fossil fuel companies, who are left holding the bag.

iv. Social Cost of Carbon

Research conducted by the National Research Council has confirmed that the negative impacts of energy generation from fossil fuels are not represented in the market price for such

[125] Carbon Tracker Initiative, *Unburnable Carbon 2013: Wasted capital and stranded assets* (2013), at 14 (attached as Exhibit 34-1).
[126] Carbon Tracker (2013) at 4.
[127] Carbon Tracker (2013) at 4.
[128] Carbon Tracker (2013) at 4.
[129] Carbon Tracker (2013) at 5, 30.
[130] Citi at 82.
[131] IEA (2014) at 43.

generation.[132] In other words, failing to internalize the externalities of energy generation from fossil fuels—such as the impacts to climate change and human health—has resulted in a market failure that requires government intervention. Executive Order 12866 directs federal agencies to assess and quantify such costs and benefits of regulatory action, including the effects on factors such as the economy, environment, and public health and safety, among others. *See* Exec. Order No. 12866, 58 Fed. Reg. 51,735 (Sept. 30, 1993).[133] The Ninth Circuit has ruled that agencies must include the climate costs and benefits of a significant regulatory action in federal cost-benefit analyses to comply with EO 12866:

> [T]he fact that climate change is largely a global phenomenon that includes actions that are outside of [the agency's] control . . . does not release the agency from the duty of assessing the effects of its actions on global warming within the context of other actions that also affect global warming.

Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin., 538 F.3d 1172, 1217 (9th Cir. 2008) (quotations and citations omitted); *see also Border Power Plant Working Grp. v. U.S. Dep't of Energy*, 260 F. Supp. 2d 997, 1028-29 (S.D. Cal. 2003) (finding agency failure to disclose project's indirect carbon dioxide emissions violates NEPA). As detailed above, climate change is the preeminent threat to human health and welfare today, the overwhelming cause of which is human emissions of greenhouse gases. *See* 74 Fed. Reg. 66,496 (Dec. 15, 2009), Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act.

An Interagency Working Group ("IWG"), consisting of eleven federal agencies, was formed to develop a consistent and defensible dollar estimate of the social cost of carbon ("SCC") – allowing agencies to "incorporate the social benefits of reducing carbon dioxide (CO_2) emissions into cost-benefit analyses of regulatory actions that impact cumulative global emissions."[134] The SCC estimates the benefit to be achieved, expressed in monetary value, by

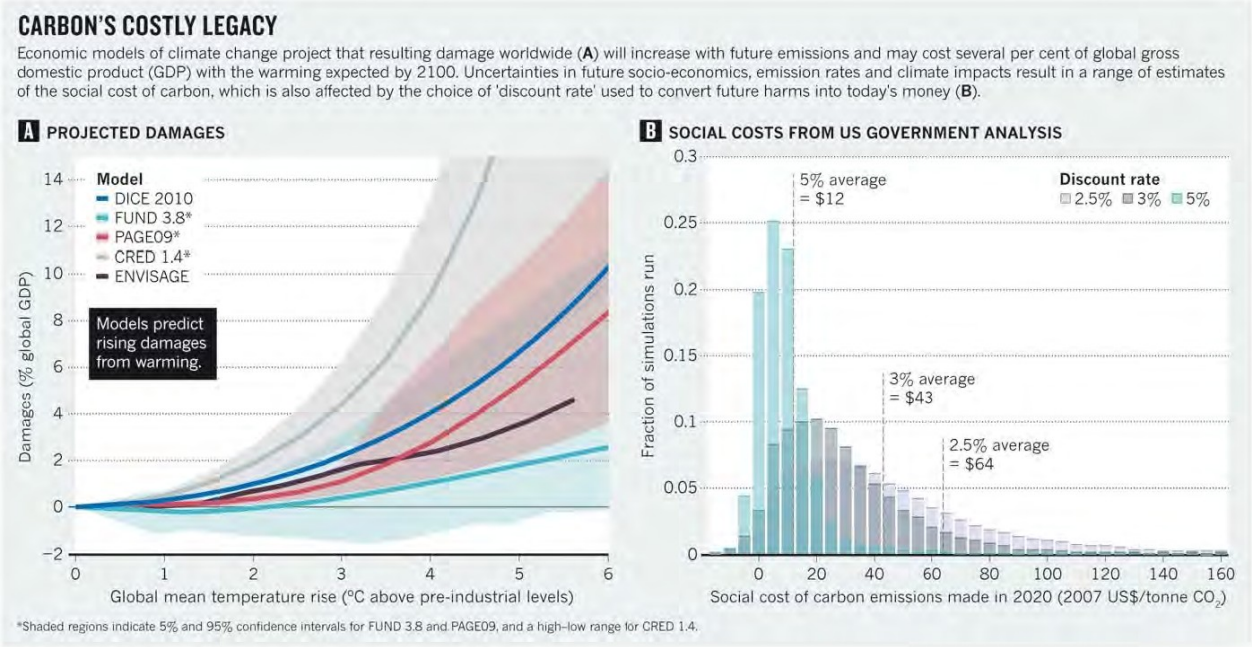
---

[132] *See, e.g.*, National Research Council, *Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use* (2010) (attached as Exhibit 40); Nicholas Muller, et. al., *Environmental Accounting for Pollution in the United States Economy*, AMERICAN ECONOMIC REVIEW at 1649-1675 (Aug. 2011) (attached as Exhibit 41); *see also*, Generation Investment Management, *Sustainable Capitalism*, (Jan. 2012) (advocating a paradigm shift to *Sustainable Capitalism*; "a framework that seeks to maximize long-term economic value creation by reforming markets to address real needs while considering *all* costs and stakeholders.") (attached as Exhibit 42).

[133] *See also* Executive Order 13563, 76 Fed. Reg. 3821 (Jan. 18, 2011) (reaffirming the framework of EO 12866 and directing federal agencies to conduct regulatory actions based on the best available science).

[134] Interagency Working Group on the Social Cost of Carbon, United States Government, Technical Support Document: Technical Update on the Social Cost of Carbon for Regulatory Impact Analysis—Under Executive Order 12866, at 2 (May 2013) (hereinafter 2013 TSD) (attached as Exhibit 204); Interagency Working Group on the Social Cost of Carbon, United States Government, Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis—Under Executive Order 12866 (February 2010) (hereinafter 2010 TSD) (attached as Exhibit 205).

avoiding the damage caused by each additional metric ton (tonne) of carbon dioxide (CO_2) released into the atmosphere.[135] These costs are created when greenhouse gas emissions force climate change, increasing global temperatures. This leads to sea level rise, increased intensity of storms, drought, and other changes, which have negative economic impacts including property damage from storms and floods, reduced agricultural productivity, impacts on human health, and reduced ecosystem services. The SCC estimates the dollar value of these negative economic impacts and recognizes that every marginal ton of CO_2 carries with it a social cost of carbon. The graphic below depicts (a) dramatically increasing damages from global warming over time (expressed as the percent decline in global GDP), as well as (b) the distribution of the social cost of carbon across a range of future economic conditions and discount rates:[136]



Leading economic models all point in the same direction: that climate change causes substantial net economic harm, justifying immediate action to reduce emissions.[137] The interagency process to develop SCC estimates—originally described in the 2010 TSD—utilized three discount rates to calculate the SCC in constant dollars, using three integrated assessment models (DICE, PAGE, and FUND).[138] In addition to the resulting three SCC estimates, a fourth value is included to estimate the SCC when impacts are higher than expected.[139]

---

[135] Ruth Greenspan and Dianne Callan, WORLD RESOURCES INSTITUTE, *More than Meets the Eye: The Social Cost of Carbon in U.S Climate Policy, in Plain English* (July 2011) at 1 (attached as Exhibit 206).

[136] Richard Revesz, et al., *Global Warming: Improve Economic Models of Climate Change*, 508 NATURE 173-175 (April 10, 2014) (attached as Exhibit 207).

[137] *Id*. at 174.

[138] The choice of which discount rate to apply—translating future costs into base year dollars—is critical in calculating the social cost of carbon. Higher discount rates reduce the dollar value of future costs thereby shifting a greater burden to future generations based on the notion that

These models are intended to quantify damages, including health impacts, economic dislocation, agricultural changes, and other effects that climate change can impose on humanity. While these values involve a degree of uncertainty, a recent GAO report has confirmed the soundness of the methodology in which the IWG's SCC estimates were developed, therefore further underscoring the importance of integrating SCC analysis into the agency's decision-making process.[140] In fact, additional damages have been identified that remain either unaccounted for or poorly quantified in the SCC estimates, suggesting that the estimated values are conservative and should be viewed as a lower bound.[141]

The updated interagency SCC estimates for 2020 are $12, $42, $62 and $123 per ton of CO_2 (in 2007$).[142] The IWG does not instruct federal agencies which discount rate to use, suggesting the 3 percent discount rate ($43 per ton of CO2) as the "central value," but further emphasizing "the importance and value of including all four SCC values."[143] Moreover, recent outside research conducted by Stanford University has suggested that the numbers currently used

---

economic growth will make the world better able to make climate investments in the future. The IWG's "central value" of three percent is consistent with this school of thought—that successive generations will be increasingly wealthy and more able to carry the financial burden of climate impacts. "The difficultly with this argument is that, as climate change science becomes increasingly concerning, it becomes a weaker bet that future generations will be better off. If they are not, lower or negative discount rates are justified." WRI Report (attached above as Exhibit 206). "Three percent values an environmental cost or benefit occurring 25 years in the future at about half as much as the same benefit today." *Id.*

[139] 2013 TSD (attached above as Exhibit 204). This SCC is based on the 95th percentile estimates derived from scenario runs from all three models, discounted at 3%.

[140] GAO-14-663, *Social Cost of Carbon* (July 24, 2014).

[141] *See* Peter Howard, et al., ENVIRONMENTAL DEFENSE FUND, INSTITUTE FOR POLICY INTEGRITY, *Natural Resources Defense Council, Omitted Damages: What's Missing From the Social Cost of Carbon*, (March 13, 2014) (providing, for example, that damages such as "increases in forced migration, social and political conflict, and violence; weather variability and extreme weather events; and declining growth rates" are either missing or poorly quantified in SCC models) (attached as Exhibit 208); Frank Ackerman & Elizabeth A. Stanton, *Climate Risks and Carbon Prices: Revising the Social Cost of Carbon* (2010) (attached as Exhibit 97); Frances C. Moore & Delavane B. Diaz, Temperature impacts on economic growth warrant stringent mitigation policy, NATURE CLIMATE CHANGE (2015) (attached as Exhibit 210) (identifying a central value of $220 for one ton of additional CO2e).

[142] *See* 2013 TSD (July 2015 Revision) at 3 (attached as Exhibit 43) (including a table of revised SCC estimates from 2010-2050). To put these figures in perspective, in 2009 the British government used a range of $41-$124 per ton of CO_2, with a central value of $85 (during the same period, the 2010 TSD used a central value of $21). WRI Report at 4 (attached as Exhibit 206). The UK analysis used very different assumptions on damages, including a much lower discount rate of 1.4%. The central value supports regulation four times a stringent as the U.S. central value. *Id.*

[143] 2013 TSD (attached above as Exhibit 204).

by the EPA to calculate the social cost of carbon are too low. The Stanford study suggests that a more appropriate estimate of the social cost of carbon is $220/ton.[144] This higher value reflects the assumption that climate change can affect not only a country's economic output but also its growth and therefore have a permanent economic effect that accumulates over time.

In 2014, the district court for the District of Colorado faulted the Forest Service for failing to calculate the social cost of carbon, refusing to accept the agency's explanation that such a calculation was not feasible. *High Country Conservation Advocates v. U.S. Forest Service*, 52 F.Supp.3d 1174 (D.Colo. 2014) (a decision the agency decided not to appeal, thus implicitly recognizing the importance of incorporating a social cost of carbon analysis into NEPA decisionmaking). Notably, the *High Country Conservation Advocates* decision applies to the same geographic area (the North Fork Valley) that is at issue here. In his decision, Judge Jackson identified the IWG's SCC protocol as a tool to "quantify a project's contribution to costs associated with global climate change." *Id.* at 1190.[145] To fulfill this mandate, they agency must disclose the "ecological[,] … economic, [and] social" impacts of the proposed action. 40 C.F.R. § 1508.8(b). Simple calculations applying the SCC to GHG emissions from this project offer a straightforward comparative basis for analyzing impacts and identifying costs.[146]

An agency must "consider every significant aspect of the environmental impact of a proposed action." *Baltimore Gas & Elec. Co. v. Natural Resources Defense Council*, 462 U.S. 87, 107 (1983) (quotations and citation omitted). This includes the disclosure of direct, indirect, and cumulative impacts of its actions, including climate change impacts and emissions. 40 C.F.R. § 1508.25(c). The need to evaluate such impacts is bolstered by the fact that "[t]he harms associated with climate change are serious and well recognized," and environmental changes caused by climate change "have already inflicted significant harms" to many resources around the globe. *Massachusetts v. EPA*, 549 U.S. 497, 521 (2007); *see also id.* at 525 (recognizing "the enormity of the potential consequences associated with manmade climate change."). Among other things, the agency's analysis must disclose "the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity[,]" including the "energy requirements and conservation potential of various alternatives and mitigation measures." 42 U.S.C. § 4332(2)(C); 40 C.F.R. § 1502.16(e). And the agency must "insure that presently unquantified environmental amenities and values may be given appropriate consideration in decisionmaking along with economic and technical consideration." 42 U.S.C. § 4332(2)(B). As explained by CEQ, this requires agencies to "analyze total energy costs, including possible hidden or indirect costs, and total energy benefits of proposed actions." 43

---

[144] Moore & Diaz (attached above as Exhibit 210).

[145] *See also id.* at 18 (noting the EPA recommendation to "explore other means to characterize the impact of GHG emissions, including an estimate of the 'social cost of carbon' associated with potential increases in GHG emissions.") (citing Sarah E. Light, *NEPA's Footprint: Information Disclosure as a Quasi-Carbon Tax on Agencies*, 87 Tul. L. Rev. 511, 546 (Feb. 2013)).

[146] It is important to note that, although the 2010 IWG SCC protocol did not address methane impacts, the 2013 IWG Technical Update explicitly addresses methane impacts. Thus, it is appropriate to calculate a SCC outcome that takes into account the full CO_2e emissions associated with the proposed leasing.

Fed. Red. 55,978, 55,984 (Nov. 29, 1978); *see also* Executive Order 13514, 74 Fed. Reg. 52,117 (Oct. 5, 2009) (requiring government agencies to disclose emissions information annually from direct and indirect activities). Failing to perform such analysis undermines the BLM's decisionmaking process and the assumptions made.

v. Social Cost of Methane Protocol

In August 2016, the Interagency Working Group ("IWG") provided an update to the social cost of carbon technical support document,[147] and, for the first time, adopted a similar methodology for evaluating the climate impact of each additional ton of methane and nitrogen oxide emissions.[148] Given its recent endorsement by the IWG, BLM should use the social cost of methane to quantify the expected climate damage caused by the extraction and combustion of natural gas under the 35-well project. Similar to the social cost of carbon, the social cost of methane provides a standard methodology that allows state and federal agencies to quantify the social benefits of reducing methane emissions through actions that have comparatively small impacts on cumulative global emission levels. The social cost of methane is intended to "offer a method for improving the analyses of regulatory actions that are projected to influence [methane or nitrogen oxide] emissions in a manner consistent with how [carbon dioxide] emission changes are valued."[149] Like the social cost of carbon, the social cost of methane is presented as a range of figures across four discount rates; it is based on results from three integrated assessment models; displayed in dollars per metric ton of emissions; and increases over time because emissions become more damaging as their atmospheric concentrations increase.[150] Like the social cost of carbon, the social cost of methane has been subject to peer review and will be updated by the IWG to ensure it reflects the best available scientific information.[151] The IWG estimates that each additional ton of methane emitted in 2020 will cause between $540 and $3,200 dollars (measured in $2007).[152]

---

[147] Interagency Working Group, Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 (August 2016), available at https://www.whitehouse.gov/sites/default/files/omb/inforeg/scc_tsd_final_clean_8_26_16.pdf (last visited November 1, 2016) (attached as Exhibit 324). The August 2016 update added some clarifying information around uncertainties in the modeling that supports the social cost of carbon, but did not adjust the damages values (the costs) published in the 2015 update.

[148] Interagency Working Group, Addendum to Technical Support Document on Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866: Application of the Methodology to Estimate the Social Cost of Methane and the Social Cost of Nitrous Oxide (August 2016), available at https://www.whitehouse.gov/sites/default/files/omb/inforeg/august_2016_sc_ch4_sc_n2o_addendum_final_8_26_16.pdf (last visited October 30, 2016) (attached as Exhibit 325).

[149] *Id.* at 3.

[150] *Id.* at 7.

[151] *Id.* at 3.

[152][152] *Id.* at 7. For comparison purposes, the current social cost of carbon values for CO2 emissions in 2020 range from $120 to $123 per ton.

BLM should use the best tools available to it in order to fully analyze and disclose the climate impacts of its proposal. Given that both the social cost of carbon and social cost of methane have been adopted by the IWG, which includes a dozen federal offices and agencies including the Department of Interior, BLM should use these tools to evaluate the climate impacts of its draft plan for the Uncompahgre planning area, which, as noted, anticipates generating more than half a billion tons of CO2-e over the next two decades.

vi. Methane Emissions and Waste

The BLM must take a hard look, and meaningful action, to address the serious issue of methane ("CH_4") emissions and waste in the oil and gas production process. Such action must include an estimate of the projected methane emission rates from drilling and production activities authorized by the proposed action, as well as detailed analysis of measures employed to mitigate such emissions.

Methane emission rates can differ quite dramatically from one oil and gas field to the next, and, depending on the type of mitigation and emission controls employed, emissions can range anywhere from 1% to 12% of production.[153]

Assuming a lower-bound leak rate of 1%—which is approximately one-third lower than the EPA estimate of methane emissions in the Inventory of U.S. GHG Emissions and Sinks: 1990-2011[154]—methane emissions from gas production by the proposed action could represent a meaningful contribution of emissions over the life of the developed field.[155] Assuming an upper-bound leak rate of 12%, the high end of the rate found in a 2012 study using air sampling over the Uinta Basin,[156] methane emissions from gas could be truly significant indeed. Although there

---

[153] *See, e.g.*, David T. Allen, et. al., *Measurements of methane emissions at natural gas production sites in the United States*, PNAS (Aug. 19, 2013) (finding emissions as low as 1.5% of production at select cites) (attached as Exhibit 66); Anna Karion, et. al., *Methane emissions estimate from airborn measurements over a western United States gas field*, GEOPHYSICAL RESEARCH LETTERS (Aug. 27, 2013) (finding emissions of 6 to 12 percent, on average, in the Uintah Basin) (attached as Exhibit 67). *See also*, Joe Romm, *Study of Best Fracked Wells Finds Low Methane Emissions But Skips Supper-Emitters*, CLIMATE PROGRESS (September 19, 2013), available at: http://thinkprogress.org/climate/2013/09/19/2646881/study-fracked-wells-methane-emissions-super-emitters/. *See also* GAO-11-34 (2010) at 25 (using a conversion factor of .4045 $MMTCO_2e$/Bcf for vented gas) (attached above as Exhibit 47).

[154] *See* U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011* (April 2013) (attached as Exhibit 125).

[155] *See* U.S. Environmental Protection Agency, *Greenhouse Gas Equivalencies Calculator*, available at: http://www.epa.gov/cleanenergy/energy-resources/calculator.html.

[156] *See* Brian Maffly, *Uinta Basin gas leakage far worse than most believe*, THE SALT LAKE TRIBUNE (Aug 05, 2013), available at: http://www.sltrib.com/sltrib/news/56692751-78/basin-carbon-emissions-gas.html.csp ("Between 6 percent and 12 percent of the Uinta Basin's natural gas production could be escaping into the atmosphere.").

is substantial variability between the 1% and 12% emission leak rates—and, even without specific data from the proposed action, we can assume leakage somewhere between these two extremes—even at the low end emissions would not be trivial.

Even setting aside the issue of climate change, every ton of methane emitted to the atmosphere from oil and gas development is a ton of natural gas *lost*. Every ton of methane lost to the atmosphere is therefore a ton of natural gas that cannot be used by consumers. Methane lost from federal leases may also not yield royalties otherwise shared between federal, state, and local governments.

This lost gas reflects serious inefficiencies in how BLM oil and gas leases are developed. Energy lost from oil and gas production—whether avoidable or unavoidable—reduces the ability of a lease to supply energy, increasing the pressure to drill other lands to supply energy to satisfy demand. 40 C.F.R. §§ 1502.16(e)-(f). In so doing, inefficiencies create indirect and cumulative environmental impacts by increasing the pressure to satisfy demand with new drilling. 40 C.F.R. §§ 1508.7, 1508.8(b).

vii. Mineral Leasing Act's duty to prevent waste.

On November 18, 2016, BLM published its final methane waste rule in the Federal Register (Waste Prevention, Production Subject to Royalties, and Resource Conservation) 43 CFR Parts 3100, 3160 and 3170. According to the Preamble to the rule:

> This final regulation aims to reduce the waste of natural gas from mineral leases administered by the BLM. This gas is lost during oil and gas production activities through venting or flaring of the gas, and through equipment leaks. While oil and gas production technology has advanced dramatically in recent years, the BLM's rules to minimize waste of gas have not been updated in over 30 years. The Mineral Leasing Act of 1920 (MLA) requires the BLM to ensure that lessees ''use all reasonable precautions to prevent waste of oil or gas developed in the land,'' 30 U.S.C. 225, and that leases include ''a provision that such rules . . . for the prevention of undue waste as may be prescribed by [the] Secretary shall be observed,'' *id.* at § 187. The BLM believes there are economical, cost effective, and reasonable measures that operators can take to minimize gas waste. These measures will enhance our nation's natural gas supplies, boost royalty receipts for American taxpayers, tribes, and States, reduce environmental damage from venting, flaring, and leaks of gas, and ensure the safe and responsible development of oil and gas resources. 81 CFR 83009

The effective date of the rule is January 17, 2017 and it is now in full force and effect. Compliance dates for many of the requirements of the rule are deferred for one year until January 17, 2018.

In the Preamble, BLM found that there is a significant amount of waste of natural gas on federal lands.

> In 2014, operators vented about 30 Bcf and flared at least 81 Bcf of natural gas from BLM-administered leases, totaling 4.1 percent of the total production from those leases in that year, and sufficient gas to supply nearly 1.5 million households with gas for a year. 81 CFR 83082

The rule was adopted to prevent as much of this waste as possible. The provisions of the rule will cover new leasing and drilling approvals. The rule also applies to existing leases and existing wells within the planning area.

The rule establishes ten requirements for operators to prevent natural gas waste on federal lands. These standards are all designed to prevent methane waste from a particular activity that operators conduct or equipment they utilize in the production of oil and gas. These provisions are:

1. Waste Minimization Plan. §3162.3-1 requires that an operator submitting an APD for a new well or multiple wells on a well pad must simultaneously submit a waste minimization plan. This plan must "set forth a strategy for how the operator will comply with the requirements of 43 CFR subpart 3179 regarding control of waste from venting and flaring, and must explain how the operator plans to capture associated gas upon the start of oil production." While the plan is not enforceable, it must be "complete and adequate" or the APD will denied or disapproved.

2. Ban on venting. §3179.6 prohibits operators from venting natural gas, requiring vented gas to be flared while establishing a narrow set of exceptions.

3. Gas capture percentage requirement. §3179.7 establishes gas capture percentage requirement to reduce the amount of flared gas. Capture percentages decline over time, from 85% in 2018-2019 to 98% after 2026. Operators who fail to meet these percentages must pay royalty on the amount of methane exceeding these percentages and are also subject to production curtailments or other enforcement actions.

4. Ban on venting during drilling and completions. §3179.101 and §3179.102 require operators to capture and sell, flare, use on site, or inject all gas that reaches the surface during these activities.

5. Requirement for replacement of pneumatic devices. §3179.201 and §3179.202 require the replacement of pneumatic controllers and pneumatic pumps that release gas over certain thresholds (i.e., high-bleed and intermediate-bleed devices). Replacement devices must release amounts of gas that are below these limits. Devices with releases that are routed to a flare or processing equipment are exempted from the requirements.

6. Requirement to route storage tank vapor gas to a sales line. §3179.203 requires that storage tanks that release gas over a certain threshold must route the gas to a sales line or, in certain circumstances, to a flare.

7. Requirement to minimize venting during liquids unloading. §3179.204 requires operators to minimize venting during downhole maintenance and liquids unloading by optimizing automated systems or, for wells without automated systems, by considering alternatives to manual purging.

8. Requirements for leak detection and repair. §3179.203 requires that operators inspect sites for leaks at least semi-annually and make repairs to eliminate leaks within thirty days of discovering a leak.

9. Requirements to measure vented and flared gas. §3179.9 requires operators to measure all gas that is vented and flared over 50 Mcf/day, and estimate gas volumes vented and flared below this threshold.

The BLM rule places an obligation on the BLM to take a hard look at natural gas waste from new leasing, drilling, and production. The BLM must consider alternatives to prevent waste, including restricting the timing and location of new leasing and drilling to areas where gas capture infrastructure will be available to enable produced gas to be marketed.

The BLM is also obligated to address implementation of the mandatory waste prevention requirements contained in the rule through, among other mechanisms, lease stipulations and conditions of approval on drilling permits.

Even absent BLM's methane waste rule, existing regulations through NTL-4A direct BLM policy with respect to waste. NTL-4A states unequivocally that "Except as provided in II.C and III above, *gas well gas may not be flared or vented*. The exceptions include emergencies, well purging, initial production testing, and routine well testing." §IV.A With respect to oil well gas, NTL-4A also states that:

> Oil well gas may not be vented or flared unless approved in writing by the Supervisor. The Supervisor may approve an application for the venting or flaring of oil well gas if justified either by the submittal of (1) *an evaluation report* supported by engineering, geologic, and economic data which demonstrates to the satisfaction of the Supervisor that the expenditures necessary to market or beneficially use such gas are not economically justified and that conservation of the gas, if required, would lead to the premature abandonment of recoverable oil reserves and ultimately to a greater loss of equivalent energy than would be recovered if the venting or flaring were permitted to continue or (2) *an action plan* that will eliminate venting or flaring of the gas within 1 year from the date of application. §IV.B [emphasis added]

BLM's implementing regulations—which underlie NTL4a and should inform BLM's revised waste rule—reflect these provisions, providing that "[t]he objective" of its MLA regulations in 43 C.F.R. Subpart 3160 "is to promote the orderly and efficient exploration, development and production of oil and gas." 43 C.F.R. § 3160.0-4. Subpart 3160 specifically requires BLM officials to ensure "that all [oil and gas] operations be conducted in a manner which *protects other natural resources and environmental quality,* protects life and property and

results in the *maximum ultimate recovery of oil and gas with minimum waste and with minimum adverse effect on the ultimate recovery of other mineral resources*." 43 C.F.R. § 3161.2. The lease owner and or operator is similarly charged with "conducting all operations in a manner which ensures the proper handling, measurement, disposition, and site security of leasehold production; which protects other natural resources and environmental quality; which protects life and property; and *which results in maximum ultimate economic recovery of oil and gas with minimum waste and with minimum adverse effect on ultimate recovery of other mineral resources*." 43 C.F.R. § 3162.1(a).

If not replaced by the waste rule, NTL-4A would obligate the BLM to take a hard look at measures to ensure that no gas well gas other than that excepted will be vented or flared from new gas wells. The BLM must also take a hard look at procedures that will ensure that evaluation reports or action plans are required to justify those approvals.

The BLM must also consider the Colorado Air Quality Control Commission's ("AQCC") new regulations on methane emissions.[157] An important focus of the regulations is limiting emissions from venting, flaring, and leaks from oil and gas development, including (1) by requiring controls on compressors, wells, dehydrators, and storage tanks, and (2) by requiring leak detection and repair (LDAR) at compressor stations and well production facilities.[158] This important rulemaking is designed specifically to minimize ozone impacts from natural gas fracking operations.

viii. Methane mitigation measures should be adopted and analyzed.

There are several widely recognized best management practices ("BMPs") for mitigating methane emissions that, as discussed above, must be considered by the BLM in its analysis of the proposed action. We believe that most, if not all of these measures should be considered and adopted, both because they can reduce methane emissions from significant emissions sources and because they have also been shown to have very quick paybacks from the sale of captured methane, even at today's low gas prices. The most important of these measures include:

- Centralized Liquid Gathering Systems and Liquid Transport Pipelines
- Reduced Emission Completions/Recompletions (green completions)
- Low-Bleed/No-Bleed Pneumatic Devices on all New Wells
- Dehydrator Emissions Controls

[157] *See* Colorado Department of Public Health and the Environment, *Revisions to Colorado Air Quality Control Commission's Regulation Numbers 3, 6, and 7: Fact Sheet*, available at: https://www.colorado.gov/pacific/sites/default/files/003_030614-729AM-R3-6-7-fact-sheet-003_1.pdf (attached as Exhibit 211).
[158] *See id.*

- Replace High-bleed Pneumatics with Low-Bleed/No-Bleed or Air-Driven Pneumatic Devices on all Existing Wells; and
- Electric Compression
- Liquids Unloading (using plunger lifts or other deliquification technologies)
- Improved Compressor Wet Seal Maintenance/Replacement with Dry Seals
- Vapor Recovery Units on Storage Vessels
- Pipeline Best Management Practices; and
- Leak Detection and Repair

These and other mitigation measures are included among BMPs that have been identified by BLM, EPA, the State of Colorado, and other organizations, as detailed below.[159] Moreover, Colorado's Comprehensive Air Resources Protection Protocol ("CARPP") is a tool that can provide an important state-of-the-art resource to guide the agency's analysis of GHG mitigation measures applicable to the proposal here. In particular, Table V-I identifies Best Management Practices and Air Emission Reduction Strategies for Oil and Gas Development, which displays some emission reduction measures, their potential environmental benefits and liabilities, and feasibility.

Another area of concern to Citizen Groups is the effectiveness of the mitigation measures adopted to ensure that the methane captured is able to make it to market for sale and the realization of rapid payback. Such considerations must be included in the BLM's NEPA analysis. This includes, *inter alia*, how the BLM will require operators on private and public lands to coordinate development to ensure that centralized liquids gathering and treatment investments are made prior to the appraisal and field development phase when production increases dramatically. The BLM should identify and describe the mechanisms they plan to employ to achieve this desirable outcome.

The second issue is how gas (as opposed to liquids) captured by implementation of the mitigation measures will enter sales gas lines and make it to market, as opposed to simply being flared and wasted. Citizen Groups believe that the BLM should spell out whether all of the gas captured by the mitigation measures adopted is expected to have similar access to a sales line, or whether some or all of it will be sent to flares and wasted. If the latter, we believe that additional mitigation measures should be instituted, comparable to the measure adopted for liquids, requiring planning and timely development of gas gathering and treatment infrastructure to ensure that GHG emissions are reduced, that revenues from gas sales are maximized for the

[159] *See also* BLM, Best Management Practices for Fluid Minerals, available at: http://www.blm.gov/pgdata/etc/medialib/blm/wo/MINERALS__REALTY__AND_RESOURCE_PROTECTION_/bmps.Par.60203.File.dat/WO1_Air%20Resource_BMP_Slideshow%2005-09-2011.pdf (attached as Exhibit 115).

realization of paybacks for operators, royalty payments for the federal and state governments, and that waste of this important resource is minimized.

At the APD stage, the BLM can determine COAs and mitigation measures that must be met prior to proceeding with drilling. Notably, 43 C.F.R.§ 3101.1-2 permits BLM to use "reasonable measures" to minimize adverse impacts to public resources, thereby reserving to BLM the authority to impose COAs on oil and gas leases. The regulation cites various measures that are per se reasonable, but the BLM can implement stricter measures at its discretion, which fall under the agency's "reserved rights" inherent in all modern oil and gas leases. *See Yates Petroleum Corp.*, 176 IBLA 144, 156 (2008). A party challenging a COA, such as a leaseholder, must show "by a preponderance of the evidence that such a requirement is excessive." *Grynberg Petroleum Co.*, 152 IBLA 300, 307 (2000). Thus, so long as the COAs can be characterized as reasonable measures to minimize adverse environmental impacts—such as necessary mitigation measures to reduce methane pollution—the BLM has the authority and, indeed, responsibility, to require these additional measures under 43 C.F.R. § 3101.1-2.

The BLM must also consider and identify the possible use of new nitrogen fracking techniques. The use of nitrogen foam in the fracking process initially results in upwards of 60% nitrogen content in produced gas, which must be flared for an average of 60-90 days until the nitrogen content is reduced to 10% or less before the gas can enter a pipeline. The use of nitrogen creates a problematic tradeoff between water conservation and impacts to air quality and GHG emissions. Moreover, depending on the strength of measures required in BLM's impending methane rulemaking, the use of this technology might, in fact, be prohibited given the necessity for flaring. Regardless, the BLM must disclose the possibility of using this technology—which has been employed in nearby projects—and, if used, take a hard look at the impacts and tradeoffs implicit in nitrogen fracking.

ix. The capture of methane is critical due to its global warming potential.

A report released by NRDC identified that "[c]apturing currently wasted methane for sale could reduce pollution, enhance air quality, improve human health, conserve energy resources, and bring in more than $2 billion of additional revenue each year."[160] The report further identified ten technically proven, commercially available, and profitable methane emission control technologies that together can capture more than 80 percent of the methane currently going to waste. *Id.* Such technologies must be considered in BLM's alternatives analysis.

Preventing GHG pollution and waste is particularly important in the natural gas and oil context, where there is an absence of meaningful lifecycle analysis of the GHG pollution emitted by the production, processing, transmission, distribution, and combustion of natural gas. Although natural gas is often touted as a 'cleaner' alternative to dirty coal, recent evidence

[160] Susan Harvey, et al., *Leaking Profits: The U.S. Oil and Gas Industry Can Reduce Pollution, Conserve Resources, and Make Money by Preventing Methane Waste* (March 2012) (attached as Exhibit 47-1).

indicates that this may not, in fact be the case—and, at the least, indicates that we must first take immediate, common sense action to reduce GHG pollution from natural gas before it can be safely relied on as an effective tool to transition to a clean energy economy[161] (a noted priority of this Administration). A recent report by Climate Central addresses the leak rates estimated by various sources and the impacts of this new information on assertions that natural gas is a cleaner fuel than coal, ultimately concluding that given the losses from oil and gas sources it would be decades before switching electricity generation from coal to natural gas could bring about significant reductions in emissions.[162]

Oil and natural gas systems are the biggest contributor to methane emissions in the United States, accounting for over one quarter of all methane emissions.[163] In light of serious controversy and uncertainties regarding GHG pollution from oil and gas development, the agency's quantitative assessment should account for methane's long-term (100-year) global warming impact and, also, methane's short-term (20-year) warming impact using the latest peer-reviewed science to ensure that potentially significant impacts are not underestimated or ignored. *See* 40 C.F.R. § 1508.27(a) (requiring consideration of "[b]oth short- and long-term effects").

EPA's GHG Inventory—which BLM has historically relied upon for such analysis—assumes that methane is 21 times as potent as carbon dioxide ("CO_2") over a 100-year time horizon,[164] a global warming potential ("GWP") based on the Intergovernmental Panel on Climate Change's ("IPCC") Second Assessment Report from 1996.[165] However, the IPCC recently updated their 100-year GWP for methane, substantially increasing the heat-trapping effect to 36 from fossil fuel sources.[166] A Supplementary Information Report ("SIR"), prepared for BLM's oil and gas leasing program in Montana and the Dakotas, further explains that GWP "provides a method to quantify the cumulative effect of multiple GHGs released into the

---

[161] Robert W. Howarth, *Assessment of the Greenhouse Gas Footprint of Natural Gas from Shale Formations Obtained by High-Volume, Slick-Water Hydraulic Fracturing* (Rev'd. Jan. 26, 2011) (attached as Exhibit 48). *See also* Robert W. Howarth et al., *Venting and Leaking of Methane from Shale Gas Development: Response to Cathles et al.* (2012) (attached as Exhibit 49); Eric D. Larson, PhD, Climate Central, *Natural Gas and Climate Change* (May 2013) (attached as Exhibit 50).

[162] *See* Larson (attached above as Exhibit 50).

[163] *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011* (attached above as Exhibit 125).

[164] *See* 78 Fed.Reg. 19802, April 2, 2013 (EPA proposal to increase methane's GWP to 25 times CO_2).

[165] INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *Second Assessment Report* (1996) (attached as Exhibit 52); *see also* U.S. Environmental Protection Agency, *Methane*, available at: http://www.epa.gov/outreach/scientific.html.

[166] *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *Working Group I Contribution to the IPCC Fifth Assessment Report Climate Change 2013: The Physical Science Basis*, at 8-58 (Table 8.7) (Sept. 2013) (attached as Exhibit 68).

atmosphere by calculating carbon dioxide equivalent (CO_2e) for the GHGs." SIR at 1-2.[167] However, substantial questions arise when you calibrate methane's GWP over the 20-year planning and environmental review horizon used in the SIR and, typically, by BLM. *See* SIR at 4-1 thru 4-45 (discussing BLM-derived reasonably foreseeable development potential in each planning area). Over this 20-year time period, the IPCC's new research has calculated that methane's GWP is 87 from fossil fuel sources[168]—yet another substantial increase from its earlier estimate of 72, which was still over three times as potent as otherwise assumed by the SIR.[169]

However, peer-reviewed science demonstrates that gas-aerosol interactions amplify methane's impact such that methane is actually 105 times as potent over a twenty year time period.[170] This information suggests that the near-term impacts of methane emissions have been significantly underestimated. *See* 40 C.F.R. § 1508.27(a) (requiring consideration of short and long term effects). Further, by extension, BLM has also historically significantly underestimated the near-term benefits of keeping methane emissions out of the atmosphere. 40 C.F.R. §§ 1502.16(e), (f); *id*. at 1508.27. These estimates are important given the noted importance of near term action to ameliorate climate change—near term action that scientists say should focus, *inter alia*, on preventing the emission of short-lived but potent GHGs like methane while, at the same time, stemming the ongoing increase in the concentration of carbon dioxide.[171] These uncertainties necessitate analysis. 40 C.F.R. §§ 1508.27(a), (b)(4)-(5).

Additional, serious, yet unaddressed uncertainties pertain to the magnitude of methane pollution from oil and gas emissions sources. As provided in the most recent EPA Inventory of Emissions and Sinks: 1990-2011, "[f]urther research is needed in some cases to improve the accuracy of emission factors used to calculate emissions from a variety of sources;" specifically citing the lack of accuracy in emission factors applied to methane sources.[172] A lack of data

---

[167] BLM, *Climate Change, Supplementary Information Report, Montana, North Dakota and South Dakota* (2010) available at: www.blm.gov/mt/st/en/prog/energy/oil_and_gas/leasing/leasingEAs.html (attached as Exhibit 53).

[168] *See* IPCC *Physical Science Report* (attached above as Exhibit 68).

[169] *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, Fourth Assessment Report, Working Group 1, Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Ch. 2, p. 212, Table 2.14, available at: www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html (attached as Exhibit 54).

[170] Drew Shindell et al., *Improved Attribution of Climate Forcing to Emissions*, SCIENCE 2009 326 (5953), p. 716, available at: www.sciencemag.org/cgi/content/abstract/326/5953/716 (attached as Exhibit 55).

[171] *See, e.g., Limiting Global Warming: Variety of Efforts Needed Ranging from 'Herculean' to the Readily Actionable, Scientists Say*, SCIENCE DAILY (May 4, 2010), available at: http://www.sciencedaily.com/releases/2010/05/100503161328.htm; *see also*, Ramanathan, et. al., (attached as Exhibit 84).

[172] *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011*, at 1-19 (attached above as Exhibit 125).

reliability has resulted in notable variation in methane emissions reporting from year to year. For example, in a Technical Support Document ("TSD") prepared for EPA's mandatory GHG reporting rule for the oil and gas sector for 2012, EPA determined that several emissions sources were projected to be "significantly underestimated."[173] EPA thus provided revised emissions factors for four of the most significant underestimated sources that ranged from ten times higher (for well venting from liquids unloading) to as many as 3,500 and 8,800 times higher (for gas well venting from completions and well workovers of unconventional wells).[174] When EPA accounted for just these four revisions, it more than doubled the estimated GHG emissions from oil and gas production, from 90.2 million metric tons of CO_2 equivalent ("$MMTCO_2e$") to 198.0 $MMTCO_2e$.[175] However, these emission estimates are based on an outdated GWP of 21. Using the IPCCs new 100-year GWP for methane of 36, that is 339.4 $MMTCO_2e$, and, considering a 20-year GWP of 87, that is 820.3 $MMTCO_2e$—or, respectively, the equivalent emissions from 89 or 215 coal fired power plants that is wasted annually. These upward revisions were based primarily on EPA's choice of data set, here, having replaced Energy Information Administration ("EIA") data with emissions data from an EPA and Gas Research Institute ("GRI") study. In the current year, EPA relied on yet another set of data; this time from an oil and gas industry survey of well data conducted by the American Petroleum Institute ("API") and the American Natural Gas Alliance ("ANGA").[176] The API/ANGA survey was conducted in response to EPA's upward adjustments in the previous GHG inventory, noting that "[i]ndustry was alarmed by the upward adjustment," and focused specifically on emissions from liquids unloading and unconventional gas well completions and workovers.[177] Overall, the survey found that revising emissions from these two sources alone would reduce EPA oil and gas methane emissions estimates, which resulted in reported oil and gas production emissions at 100 $MMTCO_2e$ pursuant to the EPA's GHG Reporting Program.[178]

To provide a specific example of these differing data sets, EPA previously used an emissions factor of 3 thousand standard cubic feet ("Mcf") of gas emitted to the atmosphere per well completion in calculating its GHG inventory. EPA determined that this figure was significantly underestimated and that a far more accurate emissions factor was 9,175 Mcf per well.[179] The API/ANGA study suggested that this emission factor is 9,000 Mcf.[180] However,

---

[173] U.S. Environmental Protection Agency, *Greenhouse Gas Emissions Reporting From The Petroleum And Natural Gas Industry Background Technical Support Document*, at 8, available at: http://www.epa.gov/climatechange/emissions/subpart/w.html (attached as Exhibit 56).
[174] *Id*. at 9, Table 1; *see also Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011* (attached above as Exhibit 125).
[175] *See* EPA, *GHG Emissions Reporting* at 10, Table 2 (attached above as Exhibit 56).
[176] *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011*, at 3-63 (attached above as Exhibit 125).
[177] API/ANGA, *Characterizing Pivotal Sources of Methane Emissions from Natural Gas Production: Summary and Analysis of API and ANGA Survey Responses*, Sept. 2012, at 1 (attached as Exhibit 57).
[178] *See* EPA, Petroleum and Natural Gas Systems: 2011 Data Summary (for 2013 GHG Reporting), at 3 (attached as Exhibit 58).

[179] *See* EPA, *GHG Emissions Reporting* at Appendix B at 84-87 (attached above as Exhibit 56).

these emissions factors are simply broad, generalized estimates for well emissions across the nation, and can vary significantly from one geologic formation to the next. For example, emissions reported in the Piceance Basin are as high as 22,000 Mcf of gas per well.[181]

Despite this variability in methane pollution data, what remains clear is that inefficiencies and leakage in oil and gas production results in a huge amount of avoidable waste and emissions, and, conversely, a great opportunity for the BLM to reduce GHG emissions on our public lands. Many of these uncertainties and underestimates, as EPA has explained, are a result of the fact that emissions factors were "developed prior to the boom in unconventional well drilling (1992) and in the absence of any field data and [do] not capture the diversity of well completion and workover operations or the variance in emissions that can be expected from different hydrocarbon reservoirs in the country." *Mandatory GHG Reporting Rule*, 75 FED. REG. 18608, 18621 (April 12, 2010).

These underestimates are also caused by the dispersed nature of oil and gas equipment—rather than a single, easily grasped source, such as a coal-fired power plant, oil and gas production consists of large numbers of wells, tanks, compressor stations, pipelines, and other equipment that, individually, may appear insignificant but, cumulatively, may very well be quite significant. While dispersed, oil and gas development is nonetheless a massive, landscape-scale industrial operation – one that just happens to not have a single roof. BLM, as the agency charged with oversight of onshore oil and gas development, therefore has an opportunity to improve our knowledge base regarding GHG emissions from oil and gas production, providing some measure of clarity to this important issue by taking the requisite "hard look" NEPA analysis as part of its decision-making here.[182]

Convincing evidence also exists to support the consideration of alternatives that would attach meaningful stipulations to oil and gas development. As a prime contributor to short-term climate change over the next few decades, methane is a prime target for near-term GHG reductions. In fact, there are many proven technologies and practices already available to reduce significantly the methane emissions from oil and gas operations, as detailed above. These technologies also offer opportunities for significant cost-savings from recovered methane gas. Moreover, new research indicates that tropospheric ozone and black carbon ("BC") contribute to

---

[180] *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011,* at 3-69 (attached above as Exhibit 125).

[181] *See, e.g.*, EPA, Natural Gas STAR Program, *Recommended Technologies and Practices for Wells*, available at: www.epa.gov/gasstar/tools/recommended.html; *see also* EPA, Natural Gas STAR Program, *Reduced Emissions Completions*, Oct. 26, 2005, at 14 (attached as Exhibit 59).

[182] In this context, the 2010 SIR, while providing a basic literature review of GHG emissions sources, is merely a starting point for the BLM's responsibility to take a hard look at GHG emissions in the context of foreseeable drilling operations in the geologic formations proposed for leasing.

both degraded air quality and global warming, and that emission control measures can reduce these pollutants using current technology and experience.[183] Employment of these strategies will annually avoid a substantial number of premature deaths from outdoor air pollution, as well as increase annual crop yields by millions of metric tons due to ozone reductions. Indeed, reducing methane emissions is important not only to better protect the climate, but also to prevent waste of the oil and gas resource itself and the potential loss of economic value, including royalties. The BLM should evaluate these technologies, analyzing the benefits of technological implementation versus current agency requirements.

These benefits—as well as the proven, cost-effective technologies and practices that achieve these benefits—are documented by EPA's "Natural Gas STAR" program, which encourages oil and natural gas companies to cut methane waste to reduce climate pollution and recover value and consolidates the lessons learned from industry for the benefit of other companies and entities with oil and gas responsibilities such as BLM.[184] EPA has identified well over 100 proven technologies and practices to reduce methane waste from wells, tanks, pipelines, valves, pneumatics, and other equipment and thereby make operations more efficient.[185] Though underutilized, EPA's Natural Gas STAR suggests the opportunity to reduce GHG pollution dramatically from oil and gas development, *if* its identified technologies and practices were implemented at the proper scale and supported by EPA's sister agencies, such as BLM and the Forest Service. For calendar year 2010, EPA estimated that this program avoided 38.1 million tons CO_2 equivalent, and added revenue of nearly $376 million in natural gas sales (at $4.00/Mcf)—revenue that translates into additional royalties to federal and state governments for the American public.[186] The BLM must identify emission reduction strategies in its NEPA analysis here, both to address impacts of the proposed action, as well as to satisfy the requirements of SO 3226, FLPMA, and the MLA.

---

[183] Drew Shindell, et al., *Simultaneously Mitigating Near-Term Climate Change and Improving Human Health and Food Security*, SCIENCE 2012 335, at 183 (attached as Exhibit 60).

[184] *See generally*, EPA, Natural Gas STAR Program, available at: www.epa.gov/gasstar/.

[185] *See* EPA, Natural Gas STAR Program, *Recommended Technologies and Practices*, available at: www.epa.gov/gasstar/tools/recommended.html.

[186] *See* EPA, Natural Gas STAR Program, *Accomplishments*, available at: www.epa.gov/gasstar/accomplishments/index.html#three (attached as Exhibit 61). The BLM should also take a look at EPA's more detailed program accomplishments to provide a measure of what the BLM could themselves accomplish, and to understand the nature of the problem and opportunities. Also of interest, for calendar year 2008, EPA estimated that its program avoided 46.3 million tons of CO_2 equivalent, equal to the annual GHG emissions from approximately 6 million homes per year, and added revenue of nearly $802 million in natural gas sales. To speculate, the calendar year 2009 declines are likely associated with ongoing economic and financial stagnation and the low price of natural gas that has slowed natural gas drilling and production.

x. The BLM Must Consider Methane Waste and Emissions Mitigation Measures and Best Practices Currently in Use by Industry and Identified in the Literature.

There is a growing body of literature that documents measures and best management practices currently available to and in use by the oil and gas industry to reduce methane waste and emissions, as discussed above. The BLM must take a hard look at these technologies and practices and adopt them as mitigation measures for the wells at issue to reduce waste and emissions. While some methane waste and emissions sources are covered by EPA's 2012 NSPS rule revisions and BLM's methane waste rule,[187] others are not. A partial listing of mitigation measures targeting the methane waste and emissions sources that were identified in the prior section includes:

- Well completions and workovers: reduced emissions completions
- Liquids unloading: plunger lifts
- Compressors: dry seals or replacement rod packing
- Pneumatic devices: no-bleed, low-bleed, instrument air, electric
- Dehydrators: TEG dehydrator emissions controls or dessicant dehydrators
- Storage vessels and tanks: vapor recover units
- Equipment leaks: leak detection and repair programs
- Pipeline maintenance and repair: re-route gas for capture

Sources of information about these and other measures, which are available to the BLM, are detailed above and must be considered.

Given the ready availability of this information, and the fact that these mitigation measures are technically feasible, commercially available, and profitable to implement in most situations, it is incumbent upon the BLM to assess them and require them here. The BLM can and should impose COAs requiring methane waste and emissions mitigation measures as a condition for wells.

xi. The BLM Should Forecast Potential Reductions in Methane Waste and Emissions That Would Result from Adoption of the Mitigation Measures.

The BLM should estimate the waste and emissions reductions that could be achieved by adoption of the mitigation technologies and best practices identified above. Most of the reduction technologies, and the experience of companies deploying them, are described by the EPA Natural Gas Star Program.[188] Moreover, the Leaking Profits study provides a useful summary,

---

[187] *See* EPA, *Oil and Natural Gas Air Pollution Standards*, available at: http://www.epa.gov/airquality/oilandgas/.

[188] *See* EPA, *Natural Gas STAR Program – Accomplishments*, available at: http://www.epa.gov/gasstar/accomplishments/index.html (attached above as Exhibit 61).

based on the Gas Star program, of methane waste and emissions reductions achievable with the adoption of these technologies and best practices.[189] Estimates of potential waste and emissions reductions would provide valuable information about the quantity of the resource that can be preserved that would otherwise be lost, and about the monetary value of this resource and the royalties it could generate.

xii. The BLM should consider and adopt the EPA Natural Gas Gold Star standard for addressing waste and emissions from natural gas produced in association with oil.

The EPA recently launched a new Natural Gas Gold Star Program to recognize leading companies and current best practices in methane control. The program includes proposed protocols for companies to follow to achieve Gold Star status. The protocol established for associated gas is to:

> Recover for beneficial use all associated gas produced from the reservoir, regardless of well type, except for gas produced from wildcat and delineation wells or as a result of system failures and emergencies. Beneficial use does not include flaring.[190]

In addition to the mitigation measures discussed above, the BLM should adopt this protocol to avoid unacceptable levels of methane waste and emissions.

Additionally, capturing methane waste and emissions with mitigation measures is just the first of BLM's obligations. The BLM must also ensure that methane will enter a sales gas line and make it to market or be used beneficially in the field, as opposed to simply being vented or flared and wasted.

In a recently released White Paper[191] on strategies to reduce the flaring of associated gas, the EPA has identified several field uses and other measures to reduce flaring and waste. Much of the information in the White Paper was drawn from the University of North Dakota's Energy and Environmental Research Center. The alternatives to flaring described include small-scale field compression of natural gas for transport, methane re-injection, electric power generation for

---

[189] *See* Harvey, Table 4 at 18 (attached above as Exhibit 47-1).
[190] *See* EPA, Gas STAR Gold Program: Proposed Framework (May 8, 2014), available at: http://www.epa.gov/gasstar/documents/Gas_STAR_Gold_proposedframework.pdf (emphasis added) (attached as Exhibit 132).
[191] EPA, Office of Air Quality Planning and Standards, *Oil and Natural Gas Sector Hydraulically Fractured Oil Well Completions and Associated Gas during Ongoing Production* (April 2014) http://www.epa.gov/airquality/oilandgas/pdfs/20140415completions.pdf (attached as Exhibit 143).

on-site use or connection to the grid, and gas liquefaction. Additional field use of gas includes use as fuel for engines, compressors and other field equipment.[192]

The BLM should review the EPA paper and other sources, assess which alternatives to flaring are appropriate here, and ensure that those alternatives are addressed.

xiii. The BLM Should Consider and Adopt Controls Over the Phasing and Location of Oil and Gas Development to Minimize Methane Waste and Emissions.

The BLM has available additional tools beyond mitigation measures that they can use to minimize methane waste and emissions. The BLM also has the authority to impose controls on the timing, location and pace of development—i.e., "phased development," as further detailed below.

Staged or phased development fulfills the objective to "promote the orderly and efficient exploration, development and production of oil and gas," and should be considered and adopted by the BLM. *See* 43 C.F.R. § 3160.0-4. Specifically, the CARPP, as detailed above, includes reducing the pace of development and requiring phased development as one of the measures available to Field Offices to geographically limit or time the approval of MDPs and APDs to correspond with the ability to use gas in the field or the presence of infrastructure to ensure beneficial use. *See* CARPP at 19 (attached as Exhibit 72).

Such controls, if employed here, can reduce the footprint of oil and gas production infrastructure in the region and thus reduce the number of potential methane pollution and waste sources. Such controls can also help to coordinate and harmonize the BLM's waste prevention efforts with the agency's broader set of responsibilities to protect the climate, ecological health and connectivity, water and air quality, public health, and wildlife. Thus, the BLM should not only take efforts to reduce the footprint of oil and gas development to prevent methane pollution and waste, but also locate and constrain such development to avoid conflicts with other resources. This should, notably, extend beyond public lands to avoid conflicts with private farms, ranches, and communities.

5. Farmlands

The BLM must consider impacts to farmland, including both direct effects, e.g., direct surface-disturbance from roads and well pads, and indirect or cumulative effects, e.g., the effects of air pollution, water shortages, or climate change.

The North Fork Valley is one of the foremost agricultural regions of Colorado, if not the interior West. The Valley is home to farms and ranches, vineyards and orchards. It has "the largest concentration of organic, sustainable growers in the state," and has a thriving agri-tourism

[192] *See, e.g.*, Energy & Environmental Research Center, Center for Oil and Gas, available at: http://www.undeerc.org/Expertise/Center-for-Oil-and-Gas.aspx.

industry—all of which are fundamental to the local economy. *See* Exhibit H. North Fork farmlands maintain the visual landscape, preserve open space, and increase quality of life. Additionally, individual ranchlands and farmlands may be important for heritage value, both culturally and naturally.

BLM must consider prime and unique farmlands in their NEPA analysis, as emphasized in a U.S. Department of the Interior ("DOI") Environmental Statement Memorandum, which provides: "Bureaus and offices will analyze impacts on prime or unique farmlands as an integral part of the NEPA process." DOI Memorandum No. ESM94-7 (August 17, 1994) (Exhibit I). As further guidance on this process, DOI attached an earlier CEQ Memorandum that specifically addressed the analysis of impacts on prime or unique agricultural lands in implementing NEPA, and directed agencies to a set of regulations developed in cooperation with the U.S. Department of Agriculture ("USDA"), codified at 7 C.F.R. § 657. *See* CEQ Memorandum For Heads Of Agencies (August 11, 1980) (Exhibit J). Among other things, these USDA regulations establish an "Important Farmlands Inventory," which defines specific criteria to meet the definition of a "prime" or "unique" farmland. *See id.* at § 657.5(a), (b); *see also* 7 U.S.C § 4201(c)(1)(A), (B) (defining "prime farmland" and "unique farmland"). The purpose of this inventory is provided in 7 C.F.R. § 657.1, which states:

> [Natural Resources Conservation Service ("NRCS")] is concerned about any action that tends to impair the productive capacity of American agriculture. The Nation needs to know the extent and location of the best land for producing food, feed, fiber, forage, and oilseed crops. In addition to prime and unique farmlands, farmlands that are of statewide and local importance for producing these crops also need to be identified.

Congress has also specifically recognized the value that farmlands play in the welfare of people and our communities. The Farmland Protection Policy Act ("FPPA"), 7 U.S.C. §§ 4201-09, instructs all agencies to "minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses." 7 U.S.C. §4201(b). The FPPA, much like NEPA, requires agencies to evaluate their programs and consider alternatives, but with a specific focus on preventing adverse effects on farmland. *Id.* § 4202; 7 C.F.R. § 658. Indeed, regulations provide that "each Federal agency shall use the criteria provided in § 658.5 to identify and take into account the adverse effects of Federal programs on the protection of farmland." 7 C.F.R. § 658.4. While the FPPA does not create a private cause of action, agencies still have the duty under NEPA to evaluate the environmental impact of actions on agricultural lands. *See Town of Norfolk v. U.S. EPA*, 761 F.Supp. 867, 890 (D.Mass. 1991). Notably, this duty extends to all farmlands, not just farmlands classified as prime or unique.

Examples of how the North Fork Valley's prime farmland could be converted into non-agricultural use by the impacts of this project include: water and soil contamination, irrigation water scarcity due to early run-off from warmer temperatures earlier in the season and depletion of stored water in the reservoir mid-season, decline in vegetative growth from ozone, and potential destruction of fruit orchards from climate change and warmer temperatures reducing the number of chill hours for fruit trees. Delta County has 1,250 farms, and 488 irrigation shareholders depend on the East and West Muddy Creek Watershed, and the Hubbard Creek North Fork Gunnison Watershed for their irrigation water.

The BLM must closely scrutinize any action that results in the conversion of farmland to nonagricultural uses or that that undermines a community's welfare and capacity to provide for itself, especially in the face of recognized changes to climate.

6. Managing for Community and Ecosystem Resiliency.

Re·sil·ience is "an ability to recover from or adjust easily to misfortune or change." MERRIAM-WEBSTER COLLEGIATE DICTIONARY (11th ed. 2008). In the context of climate change and the many resultant impacts, such as the alteration to the biosphere and impairments to human health, the resiliency of our landscapes and a community's ability to respond and adapt to these changes takes on a new magnitude.

As noted above, according to the GAO, federal land and water resources are vulnerable to a wide range of effects from climate change, some of which are already occurring. These effects include, among others: "(1) physical effects, such as droughts, floods, glacial melting, and sea level rise; (2) biological effects, such as increases in insect and disease infestations, shifts in species distribution, and changes in the timing of natural events; and (3) economic and social effects, such as adverse impacts on tourism, infrastructure, fishing, and other resource uses."[193] It is critical that the BLM take a hard look at these growing impacts and analyze, as an alternative, employing climate mitigation measures to enable landscape and human resiliency and their ability to adapt and respond to climate change impacts.

However, beyond simply mitigating climate change impacts by reducing contributions of GHG pollution to the atmosphere, the BLM can also help promote ecological resiliency and adaptability by reducing external anthropogenic environmental stresses—like oil and gas development—as a way of best positioning public lands and the communities that rely on those public lands to withstand what is acknowledged ongoing and intensifying climate change degradation. In other words, in order to satisfy the BLM's multiple use mandate and protect the broadest range of public resources, both now and for future generations, it might be necessary to forego additional oil and gas development on public lands altogether—an action that should be considered in the BLM's alternatives analysis. It is crucial for the BLM to close the gap in their decision-making regarding the cumulative contribution of oil and gas development authorized in the proposed action in combination with other oil and gas development in the region, particularly given the conflict between such authorization and the agency's responsibility to manage for healthy, resilient ecosystems. Quite simply, continuing to manage our public lands in a manner that allows for the virtually unabated extraction of mineral resources is incompatible with principals of ecosystem resilience. Agency decision-making must be reflective of the climate challenges we now face.

As noted above, the BLM must consider the resilience of our communities and their ability to adapt and respond to climate change in its NEPA analysis. Although not specifically in

[193] GAO Report (2007) (attached above as Exhibit 35).

the context of climate change, Congress has recognized the value that farmlands play in the welfare of people and our communities. *See* 7 U.S.C.A. §§ 4201(a)(1) ("the Nation's farmland is a unique natural resource and provides food and fiber necessary for the continued welfare of the people of the United States"); (a)(3) ("continued decrease in the Nation's farmland base may threaten the ability of the United States to produce food and fiber in sufficient quantities to meet domestic needs"); and (a)(5) ("Federal actions, in many cases, result in the conversion of farmland to nonagricultural uses where alternative actions would be preferred"). Any action taken that undermines a community's welfare and capacity to provide for itself in the face of recognized changes to climate—such as the largely unabated development of oil and gas resources—fails to realize the BLM's and the Forest Service's multiple use mandates and, further, is indefensible pursuant to BLM's mandate to act as stewards of our public lands.

The myriad impacts that will result from the BLM's decision-making must be considered within the context of resiliency. Although the BLM may recognize the threat of climate change, the BLM's decision-making must also be reflective of this harm and take the many necessary and meaningful steps to ameliorate the impacts to communities, landscapes, species, and our atmosphere. As discussed above, climate change is dramatically altering the relationship between human kind and the environment in which we live. It is incumbent on the BLM not only to take steps to stem the pace of climate change through the practical implementation of mitigation technologies but, also, to position communities in a way that allows them to adjust and recover from the climate change impacts that they are already experiencing. Such critical consideration of agency decisionmaking is required if we are to respond meaningfully to the vast scale of impacts that we face.

7. Hydraulic Fracturing.

Although advances in oil and gas extraction techniques—namely hydraulic fracturing, or "fracking"—have undoubtedly resulted in a growth of domestic production, the wisdom of these advances with regard to other resource values and human health is still very much in question.[194] As described in detail below, there is a wealth of information and reports stressing the dangers of fracking that must be considered in the agency's subject NEPA analysis. Of course, given the national attention and debate that fracking is generating, significant sources of new information and research are being consistently published warning against the dangers and impacts that fracking can produce, which must also be considered by the BLM.

For example, as discussed in more detail below, hydraulic fracturing was identified as one of several causes of methane contamination of drinking water and a subsequent explosion at a home in Bainbridge Township, Ohio. Spills of hydraulic fracturing fluid into the Acorn Fork Creek in Kentucky resulted in a fish kill, including the threatened Blackside Dace. Also, one study modeled that chemically concentrated fracking fluids can migrate into groundwater aquifers within a matter of years – calling into question industry claims that rock layers

[194] *See, e.g.,* A.R. Ingraffea, et. al., *Natural Gas, Hydraulic Fracking and a Bridge to Where?* (April 2011) (attached as Exhibit 62).

separating aquifers are impervious to these pollutants.[195] Claims that there has never been a documented case of groundwater contamination from fracking were challenged by EPA's research in Pavillion, Wyoming. Indeed, a second round of testing in the Pavillion area was recently performed by the U.S. Geological Survey, which supported EPA's preliminary findings that hydraulic fracturing resulted in groundwater contamination.[196] Even in draft form, the Pavillion Report and its troubling findings as well as incidents described above and other evidence of fracking related contamination from around the country underscore the need for thorough analysis to be performed by the BLM here.

The dangers and impacts of fracking can be found at every stage of the oil and gas production process. For example, fracking's waste stream can result in dramatic impacts—requiring onsite waste injection, trucking used frack fluids ("flowback") offsite, and in some cases even the direct release of fracking waste into watercourses—the impacts of which can be compounded by ineffective or nonexistent regulation.[197] As detailed in these comments, natural gas production itself can be inefficient and wasteful—with practices such as the venting of methane,[198] and the use of vast quantities of water in the fracking process.[199] In addition to being wasteful, these practices can also be quite harmful to human health and the environment. For example, the BLM must assess whether the geology of this area is likely to facilitate migration of drilling or fracking chemicals, or methane, from drilling activities or injection wells, into aquifers currently supplying homes and farms.

---

[195] *See*, Abrahm Lustgarten, *New Study Predicts Frack Fluids can Migrate to Aquifers Within Years*, PROPUBLICA, May 1, 2012 (attached as Exhibit 63); Josh Fox, *The Sky is Pink: Annotated Documents* (attached as Exhibit 64).

[196] Peter Wright, et. al., U.S. Geological Survey, *Groundwater-Quality and Quality-Control Data for Two Monitoring Wells near Pavillion, Wyoming*, April and May 2012 (attached as Exhibit 161).

[197] *See* Abrahm Lustgarten, *The Trillion Gallon Loophole: Lax Rules for Drillers that Inject Pollutants Into the Earth*, PROPUBLICA, Sept. 20, 2012 (attached as Exhibit 69); Earthworks, *The Crisis in Oil & Gas Regulatory Enforcement*, September 2012 (attached as Exhibit 163).

[198] Energy Policy Research Foundation, *Lighting up the Prairie: Economic Considerations in Natural Gas Flaring*, Sept. 5, 2012 (attached as Exhibit 164); *see also*, James Hansen, et. al., *Greenhouse gas growth rates*, PNAS, vol. 101, no. 46, 16109-16114, Sept. 29, 2004 (curtailing methane waste is seen as a "vital contribution toward averting dangerous anthropogenic interference with global climate.") (attached as Exhibit 165).

[199] *See* GAO, *Energy-Water Nexus: Coordinated Federal Approach Needed to Better Manage Energy and Water Tradeoffs* (Sept. 2012) (attached as Exhibit 166); Nicholas Kusnetz, *The Bakken oil play spurs booming business – in water*, High Country News, Sept. 5, 2012 (attached as Exhibit 74).

i. Impacts from Hydraulic Fracturing Are Well Documented and Must Be Sufficiently Analyzed.

The potential impacts that may result from hydraulic fracturing are myriad and significant, and include, among others: impacts to water quality and supply, impacts to habitat and wildlife, impacts to human health, as well as impacts to greenhouse gas emissions and air quality.[200] Although industry often asserts that hydraulic fracturing is safe and doesn't result in contamination or harm to people and the environment, a NEW YORK TIMES investigation uncovered a 1987 U.S. Environmental Protection Agency ("EPA") report to Congress which found, among other things, that fracking can cause groundwater contamination, and cites as an example a case where hydraulic fracturing fluids contaminated a water well in West Virginia.[201] The EPA report was further summarized and reviewed in an Environmental Working Group report,[202] and demonstrates the long-known dangers of employing this technology to extract mineral resources.

Fracking fluid is a conglomeration of many highly toxic chemicals and compounds. The Endocrine Disruption Exchange ("TEDX") has documented nearly 1,000 products energy companies inject into the ground in the process of extracting natural gas. Many of these products contain chemicals that are harmful to human health. According to TEDX:

> In the 980 products identified…[for use during natural gas operations], there were a total of 649 chemicals. Specific chemical names and CAS numbers could not be determined for 286 (44%) of the chemicals, therefore, the health effects summary is based on the remaining 362 chemicals with CAS numbers…Over 78% of the chemicals are associated with skin, eye or sensory organ effects, respiratory effects, and gastrointestinal or liver effects. The brain and nervous system can be harmed by 55% of the chemicals. These four health effect categories…are likely to appear immediately or soon after exposure. They include symptoms such as

---

[200] *See, e.g.*, National Wildlife Federation, *No More Drilling in the Dark: Exposing the Hazards of Natural Gas Production and Protecting America's Drinking Water and Wildlife Habitats* (2011), available at: http://www.nwf.org/News-and-Magazines/Media-Center/Reports/Archive/2011/No-More-Drilling-in-the-Dark.aspx (attached as Exhibit167); *see also* United States Forest Service, Chloride Concentration Gradients in Tank-Stored Hydraulic Fracturing Fluids Following Flowback (Nov. 2010), available at: http://nrs.fs.fed.us/pubs/38533/ (last visited Dec. 20, 2011) (attached as Exhibit 168).

[201] *See* U.S. Environmental Protection Agency, Report to Congress, *Management of Wastes from the Exploration, Development, and Production of Crude Oil, Natural Gas, and Geothermal Energy* (Dec. 1987), at Ch. IV, Damages Caused by Oil and Gas Operations (attached as Exhibit 169); *see also* Drilling Down, *Documents: A Case of Fracking Related Contamination*, THE NEW YORK TIMES ONLINE, available at: http://www.nytimes.com/interactive/us/drilling-down-documents-7.html?_r=1&.

[202] *See* Environmental Working Group, *Cracks in the Façade: 25 Years ago, EPA Linked "Fracking" to Contamination* (Aug. 2011) (attached as Exhibit 170).

> burning eyes, rashes, coughs, sore throats, asthma-like effects, nausea, vomiting, headaches, dizziness, tremors, and convulsions. Other effects, including cancer, organ damage, and harm to the endocrine system, may not appear for months or years later. Between 22% and 47% of the chemicals were associated with these possibly longer-term health effects. Forty-eight percent of the chemicals have health effects in the category labeled 'Other.' The 'Other' category includes such effects as changes in weight, or effects on teeth or bones, for example, but the most often cited effect in this category is the ability of the chemical to cause death.[203]

A Congressional Report issued in April 2011 reveals that energy companies have injected more than 30 million gallons of diesel fuel or diesel mixed with other fluids into the ground nationwide in the process of fracking to extract natural gas between 2005 and 2009.[204] In Colorado, 1.3 million gallons of fluids containing diesel fuel were used in fracking wells.[205] The EPA has stated that "the use of diesel fuel in fracturing fluids poses the greatest threat" to underground sources of drinking water.[206] According to Congresswoman Diana DeGette of Colorado, fracking with diesel fuel was done without permits in apparent violation of the Safe Drinking Water Act.[207]

Despite the energy industry's explanation that a thick layer of bedrock safely separates the gas-containing rock layer being fractured from ground-water used for drinking and surface water sources, evidence is emerging that warns that contaminants from gas wells are making their way into groundwater. Evidence suggesting contaminants from drilling and fracking operations have contaminated drinking water includes:

---

[203] TEDX, *Chemicals In Natural Gas Operations* (attached above as Exhibit 3).

[204] U.S. CONGRESS, HOUSE OF REPRESENTATIVES, COMMITTEE ON ENERGY AND COMMERCE, *Chemicals Used in Hydraulic Fracturing* (April 2011), at 10 (attached as Exhibit 171); *see also* Memorandum from Chairman Henry A. Waxman and Subcommittee Chairman Edward J. Markey, to Committee on Energy and Commerce, Examining the Potential Impact of Hydraulic Fracturing (Feb. 18, 2010) (attached as Exhibit 172).

[205] Karen Frantz, *States probe use of diesel fuel*, DURANGO HERALD, February 5, 2011, available at: http://www.durangoherald.com/article/20110206/NEWS01/702069922/-1/s.

[206] David O. Williams, *U.S. House probe alleges Halliburton, others illegally used diesel in gas fracking*, COLORADO INDEPENDENT, February 1, 2011, available at: http://coloradoindependent.com/73593/u-s-house-probe-alleges-halliburton-others-illegally-used-diesel-in-gas-fracking.

[207] Letter from U.S. CONGRESS, HOUSE OF REPRESENTATIVES, COMMITTEE ON ENERGY AND COMMERCE, Representatives Henry A. Waxman, Edward J. Markey, & Diana DeGette, to Lisa Jackson, Administrator, U.S. ENVIRONMENTAL PROTECTION AGENCY (Jan. 31, 2011), available at: http://degette.house.gov/media-center/press-releases/energy-commerce-committee-fracking-investigation-reveals-millions-of (attached as Exhibit 173); *see also* Environment News Service, *Toxic Diesel Fuel Used Without Permits in Fracking Operations*, February 4, 2011, available at: http://www.ens-newswire.com/ens/feb2011/2011-02-04-092.html.

- In March 2004, gas was discovered bubbling up in West Divide Creek. The Colorado Oil and Gas Conservation Commission ("COGCC") took samples of the water and discovered they contained benzene, which was traceable to a seep caused by EnCana while drilling for natural gas. EnCana was subsequently fined $371,000 as a result of contaminating West Divide Creek.[208]

- The COGCC investigated complaints from Weld County, Colorado that domestic water wells were allegedly contaminated from oil and gas development. The COGCC concluded after investigation that the Ellsworth's water well contained a mixture of biogenic and thermogenic methane that was in part attributable to oil and gas development. Ms. Ellsworth and the operator reached a settlement in that case.[209]

- In Pavillion, Wyoming, EPA found 11 of 39 water samples collected from domestic wells were contaminated with chemicals linked to local natural gas fracking operations. The EPA found arsenic, methane gas, diesel-fuel-like compounds and metals including copper and vanadium. Of particular concern were compounds called adamantanes – a natural hydrocarbon found in natural gas – and a little-known chemical called 2-butoxyethanol phosphate, or 2-BEp. 2-BEp is closely related to 2-BE, a substance known to be used in fracking fluids.[210]

- The Pennsylvania Department of Environmental Protection drafted a report that documented cases in two dozen communities where new or operating oil or gas wells led to methane migrating into drinking water wells and streams, as well as more than three dozen more cases where methane contamination of drinking water sources was linked to abandoned wells.[211]

I.

- A house in Bainbridge, Ohio exploded on November 15, 2007. The investigators determined that the well had been improperly constructed, that hydraulic fractures grew out of zone, and pressure was not safely managed after fracturing, allowing gas to migrate into the shallow drinking water aquifer and subsequently into domestic

---

[208] Colo. Oil & Gas Conservation Comm'n, *In the Matter of Alleged Violations of the Rules and Regulations of the Colorado Oil and Gas Conservation Commission by Encana Oil & Gas (USA) Inc., Garfield County Colorado*, Cause No. 1V, Order No. 1V-276 (August 16, 2004), available at: https://cogcc.state.co.us/orders/orders/1v/276.html (attached as Exhibit 196).

[209] Letter from David Neslin, Director, Colorado Oil and Gas Conservation Commission, to Mr. and Mrs. Ellsworth (August 7, 2009) (attached as Exhibit 175).

[210] *See* EPA Draft Report, *Investigation of Ground Water Contamination Near Pavillion, Wyoming* (Dec. 2011) (attached as Exhibit 176).

[211] Pennsylvania Department of Environmental Protection, Bureau of Oil and Gas Management, *Stray Natural Gas Migration Associated with Oil and Gas Wells*, Draft Report (October 28, 2009), available at: http://www.dep.state.pa.us/dep/subject/advcoun/oil_gas/2009/Stray%20Gas%20Migration%20Cases.pdf (attached as Exhibit 177).

water wells, culminating in the explosion. [212] The faulty cement casing of the well developed a crack allowing methane to seep underground and fill a residential basement.

- On January 1, 2009, a water well at a home in Dimock, Township, Susquehanna County, PA, exploded. The Pennsylvania Department of Environmental Protection ("PA DEP") documented elevated levels of methane in numerous drinking water wells near Cabot natural gas wells and concluded that the elevated methane in drinking water was a result of Cabot's failure to properly case and cement several of its gas wells, which allowed methane to migrate from the wells into drinking water.[213]

Other known and suspected adverse effects of drilling and fracking operations include:

- Garfield County, Colorado, Commissioners recently expressed their health and safety concerns regarding natural gas drilling and fracking by stating in a legal filing that, "No agency…can guarantee Garfield County residents that exposures to oil and gas emissions will not produce illness or latent effects, including death." They cited the cases of three people – Chris Mobaldi, Verna Wilson, and Jose Lara – who died after suffering from drilling-related illnesses in Garfield County.[214]

- In April 2008, a nurse at a hospital in Durango, Colorado, became critically ill and almost died of organ failure as a result of second-hand chemical exposure acquired while treating a drill rig worker who had fracking fluid on his clothes.[215]

- In Texas, which now has approximately 93,000 natural-gas wells, up from around 58,000 a dozen years ago, a hospital system in the six counties with some of the

---

[212] *See, e.g.* Ohio Department of Natural Resources, Division of Mineral Resources Management, *Report on the Investigation of the Natural Gas Invasion of Aquifers in Bainbridge Township of Geauga County, Ohio* (September 1, 2008) (attached as Exhibit 178); Bair, E. S., Freeman, D. C., & Senko, J. M. (2010, June). *Expert Panel Technical Report, Subsurface Gas Invasion Bainbridge Township, Geauga County, Ohio*, available at: https://oilandgas.ohiodnr.gov/portals/oilgas/pdf/bainbridge/DMRM%200%20Title%20Page,%20Preface,%20Acknowledgements.pdf (attached as Exhibit 179).

[213] Pennsylvania Department of Environmental Protection. (2009, November 4). Consent Order and Agreement between Cabot Oil and Gas Corporation and the Pennsylvania Department of Environmental Protection, available at: http://files.dep.state.pa.us/oilgas/OilGasLandingPageFiles/FinalCO&A121510.pdf (attached as Exhibit 180) (hereinafter "Cabot Consent Order").

[214] David O. Williams, *GarCo officials blast state gas drilling rules in case requesting more well density*, THE COLORADO INDEPENDENT, January 19, 2011, available at: http://coloradoindependent.com/72246/garco-officials-blast-state-gas-drilling-rules-in-case-requesting-more-well-density.

[215] Eric Frankowski, *Gas industry secrets and a nurse's story*, HIGH COUNTRY NEWS, July 28, 2008, available at: http://www.hcn.org/wotr/gas-industry-secrets-and-a-nurses-story.

> heaviest drilling reported in 2010 a 25 percent asthma rate for young children, more than three times the state rate of about 7 percent.[216]

Abrahm Lustgarten, an investigative reporter with ProPublica, who has won the George Polk Award for Environmental Reporting for his work on the dangers of natural gas drilling, writes:

> Dennis Coleman, a leading international geologist and expert on tracking underground migration, says more data must be collected before anyone can say for sure that drilling contaminants have made their way to water or that fracturing is to blame. But Coleman also says there's no reason to think it can't happen. Coleman's Illinois-based company, Isotech Laboratories, has both the government and the oil and gas industry as clients. He says he has seen methane gas seep underground for more than seven miles from its source. If the methane can seep, the theory goes, so can the fluids.[217]

Important evidence of groundwater contamination from hydraulic fracturing is found in an EPA draft report investigating ground water contamination near Pavillion, Wyoming ("Pavillion Report").[218] Among its findings, the Pavillion Report provides:

> Elevated levels of dissolved methane in domestic wells generally increase in those wells in proximity to gas production wells. Pavillion Report, at xiii.
>
> Detection of high concentrations of benzene, xylenes, gasoline range organics, diesel range organics, and total purgeable hydrocarbons in ground water samples from shallow monitoring wells near pits indicates that pits are a source of shallow ground water contamination in the area of investigation. Pits were used for disposal of drilling cuttings, flowback, and produced water. There are at least 33 pits in the area of investigation. When considered separately, pits represent potential source terms for localized ground water plumes of unknown extent. When considered as whole they represent potential broader contamination of shallow ground water. *Id.* at 33 (emphasis added).
>
> The explanation best fitting the data for the deep monitoring wells is that constituents associated with hydraulic fracturing have been released into the Wind River drinking water aquifer at depths above the current production zone. *Id.* (emphasis added).

---

[216] Ian Urbina, *Regulations Lax as Gas Well's Tainted Waters Hits Rivers*, THE NEW YORK TIMES, February 26, 2011, available at: http://www.nytimes.com/2011/02/27/us/27gas.html?pagewanted=all.

[217] Abrahm Lustgarten, *Hydrofracked? One Man's Mystery Leads to a Backlash Against Natural Gas Drilling*, PROPUBLICA, February 25, 2011, available at: http://www.propublica.org/article/hydrofracked-one-mans-mystery-leads-to-a-backlash-against-natural-gas-drill/single.

[218] EPA Draft Report, Pavillion (attached above as Exhibit 176).

> Although some natural migration of gas would be expected above a gas field such as Pavillion, data suggest that enhanced migration of gas has occurred to ground water at depths used for domestic water supply and to domestic wells. *Id.* at 37 (emphasis added).
>
> A lines of reasoning approach utilized at this site best supports an explanation that inorganic and organic constituents associated with hydraulic fracturing have contaminated ground water at and below the depth used for domestic water supply…. A lines of evidence approach also indicates that gas production activities have likely enhanced gas migration at and below depths used for domestic water supply and to domestic wells in the area of investigation. *Id.* at 39 (emphasis added).

Although the Pavillion Report was never finalized, EPA shared preliminary data with, and obtained feedback from, Wyoming state officials, EnCana, Tribes, and Pavillion residents, prior to release. Even in draft form, the Pavillion Report and its troubling findings – as well as other evidence of fracking related contamination from around the country – satisfies the low threshold for consideration of the impacts described therein in the NEPA analysis for the UFO RMP.[219]

AirWaterGas researchers from the University of Colorado, Boulder found nine chemicals of most concern used in hydraulic fracturing fluid based on their toxicity, mobility, persistence, and frequency of use.[220] Oil and gas wells with surface casing pressure have compromised structural integrity and pose a risk for releasing stray gas into the surrounding aquifer or atmosphere.[221] They also found that deviated wells (wells drilled at an angle but not fully horizontal), and horizontal wells develop surface casing pressure more frequently than vertical wells.[222] Another AirWaterGas study found that insufficient casing or cementing of a wellbore in the Denver-Julesburg Basin of Colorado was the main cause of methane migration from oil and gas wells into water wells.[223] Using publically-available data from the Colorado Oil and Gas Conservation Commission (COGCC), AirWaterGas researchers identified 42 drinking water wells in Colorado that contained thermogenic stray gas originating from underlying oil and gas producing formations.[224]

Agricultural crops are also at risk. According to a Colorado State University study

[219] For the results of a recent investigation of the potential contamination in Pavillion, *see* Dominic DiGiulio and Robert B. Jackson, *Impact to Underground Sources of Drinking Water and Domestic Wells from Production Well Stimulation and Completion Practices in the Pavillion, Wyoming, Field*, Environmental Science and Technology (March 29, 2016), available at: http://pubs.acs.org/doi/pdf/10.1021/acs.est.5b04970.
[220] AirWaterGas Sustainability Research Network, November 2016 at 3 (attached as Exhibit 296).
[221] *Id.* at 3.
[222] *Id.* at 3.
[223] *Id.* at 4.
[224] *Id.* at 4.

published in Environmental Science & Technology titled *Spills of Hydraulic Fracturing Chemicals on Agricultural Topsoil*, spills occur regularly, and the mixture of chemicals from fracking fluid and produced wastewater can interact in a way that leads to soil accumulation of these chemicals, which can then potentially be absorbed by plants.[225]

Historically, BLM has been dismissive of possible impacts to water quality from hydraulic fracturing. However, given the weight of both new and old evidence documenting the risk of water contamination from gas drilling across the country and within the planning area, BLM's approach is becoming increasingly untenable. Indeed, even an industry report prepared for Gunnison Energy Corporation – a major oil and gas developer with leases just south of the UFO – has acknowledged the potential for significant impacts to water resources from fracking.[226] The simple fact of the matter is that natural gas development has the potential for poisoning our water with toxic, hazardous, and carcinogenic chemicals as well as naturally occurring radioactive radium, and BLM must provide a thorough hard look analysis of these potentially significant impacts.

Recent reporting from New Mexico has acknowledged a proliferation of "frack hits," or "downhole communication," where new horizontal drilling for oil is communicating with both historic and active vertical wells.[227] This is a significant development that could result in well blowouts, contamination of resources, and issues over who is responsible for liabilities and costs of such impacts.

Without implementation of a precautionary approach to these risks, BLM will continue to place the health of our community and our environment at risk.

ii. Current Disclosure Rules Are Insufficient.

One basic purpose of NEPA is to assure that the public and policy makers are aware in advance of the potential environmental consequences of proposed actions. 40 C.F.R. § 1500.1(a). Furthermore, the presence of uncertain or unknown risks may compel an agency to prepare a more thorough EIS, in lieu of an EA. 40 C.F.R. § 1508.27(b)(5). Currently, there are significant uncertainties about the different chemicals that are being used in hydraulic fracking, though, as mentioned above, it is clear that toxic, hazardous, and carcinogenic chemicals are used throughout the fracking process. Current disclosure of fracking chemicals, via FracFocus, is

---

[225] Molly C. McLaughlin, Thomas Borch, & Jens Blotevogel, *Spills of Hydraulic Fracturing Chemicals on Agricultural Topsoil: Biodegradation, Sorption, and Co-contaminant Interactions*, Environ. Sci. Technol. 2016, 50, 6071−6078 (attached as Exhibit 292).

[226] *See* Gunnison Energy Corporation, *Analysis of Potential Impacts of Four Exploratory Natural Gas Wells to Water Resources of the South Flank of the Grand Mesa, Delta County, Colorado* (March 2003) at 42, 56 (attached as Exhibit 181).

[227] *See, e.g.*, Gayathri Vaidyanathan, *In N.M., a sea of 'frack hits' may be tilting production*, E&E News, (March 18, 2014) (attached as Exhibit 182); Tina Jensen, *Fracking fluid blows out nearby well*, KQRE (October 19, 2013), available at: https://www.earthworksaction.org/media/detail/fracking_fluid_blows_out_nearby_well#.WBJuhMnN6T9 (attached as Exhibit 183).

insufficient to protect the public adequately from potentially toxic, hazardous, and/or carcinogenic chemicals.[228] In preparing its NEPA analysis here, the BLM must catalog the substances that will be used or are reasonably likely to be used in fracking on the project parcels. In order to make this information accessible to the public, the BLM should categorize these substances as hazardous, toxic, carcinogenic, or benign.

iii. The BLM Must Take a Hard Look at Wastewater Disposal.

The BLM must take a hard look at wastewater disposal, including a comparative analysis of the different alternatives for disposal. The BLM should analyze fully the wastewater disposal methods, without assuming that treatment can and will be adequate and take care of the problem. For example, *see* Brian D. Lutz, *et al*., *Generation, Transport, and Disposal of Wastewater Associated with Marcellus Shale Gas Development*, WATER RESOURCES RESEARCH (February 8, 2013) (attached as Exhibit 157).

> Contrary to current perceptions, Marcellus wells produce significantly less wastewater per unit gas recovered (approximately 35%) compared to conventional natural gas wells. Further, well operators classified only 32.3% of wastewater from Marcellus wells as flowback from hydraulic fracturing; most wastewater was classified as brine, generated over multiple years. *Despite producing less wastewater per unit of gas, developing the Marcellus shale has increased the total wastewater generated in the region by approximately 570% since 2004, overwhelming current wastewater disposal infrastructure capacity. Id.* at 1 (emphasis added).

iv. The BLM Must Consider Traffic Impacts that will Result from Increased Oil and Gas Development.

The BLM must consider impacts from increases in vehicle traffic that authorized development would induce. For example, cases have required NEPA analyses of proposed casino projects to include impacts of increases in vehicle traffic the projects would induce. *See Michigan Gambling Opposition v. Kempthorne*, 525 F.3d 23, 29 (D.C. Cir. 2008); *Taxpayers of Michigan Against Casinos v. Norton*, 433 F.3d 852, 863 (D.C. Cir. 2006). Here, this is critically important as traffic will impact roadways of national significance, such as the West Elk Loop

[228] Kate Konschnik *et al*., *Legal Fractures in Chemical Disclosure Laws: Why the Voluntary Chemical Disclosure Registry FracFocus Fails as a Regulatory Compliance Tool*, Harvard Law School, Envtl. Law Program, Apr. 2013 (attached as Exhibit 89).

Scenic Byway.[229] Moreover, the West Elk Loop crosses the Crystal River, which is eligible for wild and scenic classification.[230]

As noted above, fracking requires huge amounts of water, and consequently a great number of tanker truck trips to transport this water and chemicals to the site and to transport waste from the site. In addition, heavy truck trips result from rig moves, hydraulic fracturing trucks, for well pad and pipeline construction, and for workover drilling and maintenance. Given that fracking can require *thousands* of round trips by heavy trucks when developing *each* well—the impacts of which are compounded exponentially for development of an entire oil and gas field—it is clear that this heavy industrial transport activity will result in dramatic impacts.

This analysis must include the quantification of air quality impacts from increased truck traffic, estimate increased maintenance demands, consider safety costs for increased roadway use, increased traffic accidents and associated medical impacts and burdens on local hospitals, consider burdens on first responders and the criminal justice system, and project where or how many miles of access roads will be constructed.

A recent and comprehensive 2013 study by Boulder County, Colorado of the impacts of fracking-related truck traffic (hereafter "Boulder Study"),[231] concluded that the hydraulic fracturing process for a single well would require an average of 1,400 one-way truck trips just to haul water to and from the site. *See* Boulder Study at 8. Using national data, the study also finds that taking into account the full development process (construction, drilling, and completion), the average fracked well requires 2,206 one-way truck trips. *Id.* at 10. This figure does not include production phase trips, which could add an additional 730 truck trips per year depending on various factors including the success of the well and whether it is re-fracked. *Id.*

The Boulder Study serves as an example of what the BLM should analyze here. The Study uses trip generation data to analyze the impacts of oil and gas development on the county's roadway system and, ultimately, to quantify these impacts in terms of maintenance and safety costs. *Id.* at 4. To establish a baseline, the Study inventoried current roadways including surface conditions, traffic volumes, and shoulder widths. In addition to the number of truck trips, the Study also examined the vehicle classification, load, origin, and destination of the trips. Finally, road deterioration and safety costs are calculated under three development scenarios, resulting in an average cost of $36,800 per well over 16 years. *Id.* at 55. The Boulder Study is just one

---

[229] *See* Colorado Department of Transportation, Travel Center: West Elk Loop, https://www.codot.gov/travel/scenic-byways/southwest/west-elk-loop.

[230] *See* White River National Forest, Final Environmental Impact Statement Volume 3, Appendix F, "Wild and Scenic River Eligibility," available at: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5286435.pdf.

[231] *See* Colorado Public Radio, *Drilling for oil and gas drives Colo. trucking boom* (April 9, 2014) available at: http://www.cpr.org/news/story/drilling-oil-and-gas-drives-trucking-boom (referencing this study by Boulder County, Colorado: *boulder county oil and gas roadway impact study* (Jan 2013), available at: https://www.bouldercounty.org/doc/landuse/dc120003oilgasroadwaystudy20130114.pdf [hereinafter "Boulder Study"] (attached as Exhibit 160)).

example of the type of quantitative analysis of oil and gas related traffic that can be completed with currently available information, and must be included in the BLM's analysis here.

v. The BLM Must Consider Impacts from Pipelines.

Related to the issue of transportation impacts from development of well-sites is the paradoxical relationship this has to pipelines for transporting fracking fluid, flowback, produced water, or condensates, in that as more pipelines are constructed, arguably fewer trucks would be required, and vice versa.

The BLM must provide a clear assessment of what pipelines are required, what pipelines are "feasible," whether they would be limited in what they transport, how many barrels per day they would transport, and how much truck traffic this would displace (if any, since the pipelines ultimately are transferring product to trucks). This should include estimates of how many pipelines will be constructed, how many miles of pipe will be laid, what their diameter would be, how many water-bodies they would cross, or where they will be located. Existing pipelines that would be utilized must also be disclosed, noting their age, diameter, how many barrels per day they do and would transport, water-bodies they cross, location, and what they transport. Relatedly, the BLM must also provide an assessment of the need for new compressors and/or whether additional compression capacity is needed.

However, reducing truck traffic through the installation of pipelines introduces different impacts to the environment that must be accounted for in the BLM's analysis. For example, there is the potential risk of pipeline ruptures, but simply identifying that risk is insufficient. The BLM must quantify and analyze these risks respective to the amount of pipeline projected in the planning area over the life of the project. Further, there exists the potential for contamination of soils, surface water, and groundwater as a result of spills, and there must be analysis concerning the possible spill volumes or consideration of various spill scenarios given pipeline volume, emergency procedures, and mitigation requirements.

vi. Seismic Impacts

The scientific community's recognition of the relationship between hydraulic fracturing and seismic activity is not new. Indeed, the USGS freely admits, "earthquakes induced by human activity have been documented."[232] The largest and perhaps most widely known incident to date resulted from fluid injection at the Rocky Mountain Arsenal near Denver, Colorado, in 1967, where an earthquake of magnitude 5.5 followed a series of smaller earthquakes. Further, in a 1990 report studying the incident, the USGS confirmed, "the link between fracking fluid injection and the earlier series of earthquakes was established.[233]

---

[232] *See* USGS, Earthquakes Hazards Program, FAQs, available at: http://earthquake.usgs.gov/learn/faq/?categoryID=1&faqID=1.

[233] Craig Nicholson and Robert Wesson, *Earthquake Hazard Associated with Deep Well Injection – A report to the U.S. Environmental Protection Agency*, U.S. Geological Survey Bulletin 1951 (1990), at 74 (attached as Exhibit 90) (also citing other well-documented examples of seismic activity induced by fluid injection, including: Denver, Colorado; Rangely,

Recently, "[a] northeast Ohio well used to dispose of wastewater from oil and gas drilling almost certainly caused a series of 11 minor quakes in the Youngstown area since last spring, a seismologist investigating the quakes said."[234] After the latest and largest quake Saturday, December 31, 2011, which registered at 4.0 magnitude, "state officials announced their beliefs that injecting wastewater near a fault line had created enough pressure to cause seismic activity. They said four inactive wells within a five-mile radius of the Youngstown well would remain closed."[235] As Andy Ware, deputy director of the Ohio Department of Natural Resources, which regulates gas drilling and disposal wells, stated, "the state asked on Friday that injection at the well be halted after analysis of the 10th earthquake, a 2.7-magnitude temblor on Dec. 24, showed that it occurred less than 2,000 feet below the well."[236]

The events in Youngstown unfortunately are not isolated. "A string of mostly small tremors in Arkansas, Oklahoma, Texas, British Columbia and other shale-gas-producing areas suggest that [fracking] may lead, directly or indirectly, to a dangerous earthquake."[237] The commonality of circumstances suggests that a strong correspondence between seismic activity and development techniques used by the oil and gas industry does indeed exist. For example, "[t]he number and strength of earthquakes in central Arkansas have noticeably dropped since the shutdown of two injection wells in the area."[238] Scott Ausbrooks, the Geohazards Supervisor for the Arkansas Geological Survey, provided, "[w]e have definitely noticed a reduction in the number of earthquakes, especially the larger ones. It's definitely worth noting."[239]

Moreover, the U.S. Geological Survey ("USGS") has recently released a report that links a series of earthquakes in Oklahoma, in January 2011, to a fracking operation underway there. The USGS determined after analyzing earthquake data that "the character of seismic recordings indicate that they are both shallow and unique."[240] The report continues, providing: "Our

---

Colorado; southern Nebraska; western Alberta and southwestern Ontario, Canada; western New York; New Mexico; and Matsushiro, Japan).

[234] Thomas J. Sheeran, *Ohio Earthquakes Caused by Drilling Wastewater Well, Experts Say*, HUFFINGTON POST, January 2, 2012, available at: http://www.huffingtonpost.com/2012/01/02/ohio-earthquakes-caused-by-wastewater-well-drilling_n_1180094.html.

[235] *Id.*

[236] Henry Fountain, *Disposal Halted at Well After New Quake in Ohio*, THE NEW YORK TIMES, Jan. 1, 2012, available at: http://www.nytimes.com/2012/01/02/science/earth/youngstown-injection-well-stays-shut-after-earthquake.html?scp=3&sq=fracking%20earthquake&st=cse.

[237] *Id.*

[238] Sarah Eddington, *Ark. Quakes Decline Since Injection Well Closures*, HUFFINGTON POST, March 14, 2011, available at: http://www.huffingtonpost.com/huff-wires/20110314/us-arkansas-earthquakes/.

[239] *Id.*

[240] Austin Holland, Oklahoma Geological Survey, Examination of Possibly Induced Seismicity from Hydraulic Fracturing in Eola Field, Garvin County, Oklahoma (Aug. 2011), at 1 (attached as Exhibit 91).

analysis showed that shortly after hydraulic fracturing began small earthquakes started occurring, and more than 50 were identified, of which 43 were large enough to be located. Most of these earthquakes occurred within a 24-hour period after hydraulic fracturing operations had ceased."[241] Dovetailing on this information is the Oklahoma state government's acknowledgement that the scientific consensus is that wastewater disposal wells are to blame for the state's dramatic increase in earthquakes. [242] The state-run Oklahoma Geological Survey even said that it is very likely that these disposal wells are the cause of the majority of the earthquakes that state is experiencing. Oklahoma has experienced significant increases in frequency and intensity of earthquakes—having small temblors around a magnitude of 3 daily and at times experiencing extremely severe earthquakes, as it did in 2011 with a 5.6-magnitude shock.

In August 2011, an earthquake measuring 5.3-magnitude near Trinidad, Colorado, was the largest in more than 40 years.[243] However, seismic activity near Trinidad is not new. Indeed, a September 2001 swarm of earthquakes near Trinidad prompted a U.S. Geological Survey investigation. The USGS report provided, "In recent years, a large volume of excess water that is produced in conjunction with coal-bed methane gas production has been returned to the subsurface in fluid disposal wells in the area of the earthquake swarm;" and later continues, "Because of the proximity of these disposal wells to the earthquakes, local residents and officials are concerned that the fluid disposal might have triggered the earthquakes."[244] The USGS investigation concluded: "the characteristics of the seismicity and the fluid disposal process do not constitute strong evidence that the seismicity is induced by the fluid disposal, though they do not rule out this possibility."[245]

The threat of seismic activity induced from oil and gas development practices must be considered by the BLM. As noted above, Ohio officials placed a five-mile buffer around waste injection wells. Given the recognized correlation between oil and gas development practices and the inducement of earthquakes, taking such a precautionary approach, here, through required stipulations is prudent and would help stem potential future impacts. At the very least, however, the BLM must take a hard look at possible seismicity impacts from the proposed action.

The project area is located in an area of active erosion and unstable slopes:

---

[241] *Id*

[242] Richard Perez-Pena, *U.S. Maps Pinpoint Earthquakes Linked to Quest for Oil and Gas*, NY TIMES, Apr. 23, 2005 available at: http://www.nytimes.com/2015/04/24/us/us-maps-areas-of-increased-earthquakes-from-human-activity.html?_r=0.

[243] Jordan Steffen, *5.3 quake in Trinidad, Colo., area unnerves regions residents*, DENVER POST, August 24, 2011, available at: http://www.denverpost.com/news/ci_18744329.

[244] Mark E. Mermonte, et al., USGS, *Investigation of an Earthquake Swarm Near Trinidad, Colorado, August – October 2001* (2002), available at: http://pubs.usgs.gov/of/2002/ofr-02-0073/ofr-02-0073.html (attached as Exhibit 92).

[245] *Id.*

> [T]he entire North Fork of the Gunnison River corridor . . . has a history of serious and frequent landslide problems along its entire length . . . . The most common factor in causing these landslides is the very steep foot slopes that are often composed of old landslide deposits and colluvial debris, which forms a wedge on the lower valley sides. An additional factor is the percolation of water into the slopes from irrigation conveyance ditches and natural spring seeps on the sides of gravel-capped mesas. *Consequently, these slopes are so potentially unstable that any natural or human-induced changes in soil moisture or slope configuration by construction can trigger serious landsliding.*[246] (emphasis added)

The area has already experienced a few recent earthquakes near Carbondale (2.8 magnitude on January 19th, 2017 28 km S of Carbondale; 1.6 magnitude on January 19th 26 km S of Carbondale) and Paonia (3.5 magnitude on July 23, 2016 7 km NE of Paonia).[247] In an area with such unstable lands, even a low risk of induced seismicity from wastewater injection and hydraulic fracturing could be significant enough to call into question the wisdom of proceeding with drilling operations such as those envisioned by the 35-well proposal.[248] Further, land movements in the area—whether naturally occurring or induced directly or indirectly from drilling and fracking—could create other problems for development in the area. For instance, a rockfall may cause an accident with drilling or fracking related truck traffic on Highway 133, or block the highway and thus the primary access for emergency response personnel should an accident happen at a well site.[249] The natural geology of the area makes it a worrisome place for the location of gas wells and associated infrastructure.

8. Wildlife

The NEPA analysis for the 35-well proposal must consider impacts to wildlife,[250] including the big game animals so prevalent in the North Fork and critical to the local hunting

---

[246] Rogers, William P. Colorado Geologic Survey. Critical Landslides in Colorado, *A Year 2002 Review and Priority List*, Open File Report 03-16 (2005) at 17 (attached as Exhibit 200).
[247] Earthquake Track, Recent Earthquakes Near Paonia, Colorado, United States, http://earthquaketrack.com/us-co-paonia/recent
[248] The BLM should be aware that there have been recent earthquakes in the area. *See* Alex Zorn, Yet Another Earthquake, Garfield County's Biggest in Decade, Hits Silt, POST INDEPENDENT, Jan. 30, 2017, available at: http://www.postindependent.com/news/yet-another-earthquake-biggest-one-lately-hits-silt/.
[249] Such rockfalls are not infrequent. *See* Dennis Webb, *Rockfall Closes Highway South of McClure Pass*, THE DAILY SENTINEL, May 6, 2013, available at: http://www.gjsentinel.com/breaking/articles/rockfall-closes-highway-south-of-mcclure-pass; Jesse Paul, Massive Rock Slide Across Western Colorado Highway Will Have Route Closed for Days, THE DENVER POST, October 20, 2016, available at: http://www.denverpost.com/2016/10/20/massive-rock-slide-colorado-highway-route-closed-for-days/.
[250] Rocky Mountain Wild has developed a screen that shows many of the values that will be impacted by this decision, including wildlife values. *See* Exhibit 335. The values impacted by this project as reflected by this screen must be considered in the NEPA process.

and recreation economies. Of particular concern to Citizen Groups are impacts to mule deer, elk, moose, Canada lynx, Yellow-billed Cuckoo, bald eagle, purple martin, northern goshawk, cutthroat trout, and bluehead sucker. The ecological integrity of the Upper North Fork landscape remains superlatively important to these species. This 35-well project, coupled with the impacts of immediately surrounding energy development proposals, threaten this interconnected landscape and its wildlife. It is imperative that the BLM consider different alternatives (and fewer well pads) to fully explore alternatives that would decrease the negative impacts to wildlife.

i. Elk, Mule Deer, and Moose

The NFMMDP project area is home to robust big game populations. The BLM must consider the project's impact on elk, mule deer, and moose habitat, including crucial winter range and documented migration corridors. While the majority of the NFMMDP is summer or transition range for both elk and mule deer, it also contains over 8,000 acres of a large mapped winter concentration area for elk and approximately 2,100 acres of critical winter range for mule deer.[251] A significant portion of the NFMMDP is mapped as a moose concentration area and smaller portions are mapped as elk production areas.[252] In comments on this project submitted by Colorado Parks and Wildlife on February 21, 2017, the agency states:

> CPW is concerned that the incremental build-out of the NFMMDP will cumulatively add to impacts already occurring to big game populations from existing and approved gas development in the area. In 2016, CPW biologists documented record low numbers of big game in the adjacent Bull Mountain Unit. In addition, CPW has received numerous complaints from landowners, outfitters, and sportsmen regarding low big game numbers and lost hunting opportunities in this developing area."[253]

The proposed North Fork Mancos MDP includes four phase one well pads within CPW-mapped elk winter range, two of which abut or directly impinge on severe winter range and/or winter concentration areas – the areas mapped as necessary for over-winter survival in the harshest winters.[254] Winter range is where elk and deer survive the harshest winters—a place that

---

[251] Colorado Parks and Wildlife, *DOI-BLM-CO-N040-2017-050-EA scoping comments* (Feb. 21, 2017), at 2; Rocky Mountain Wild, Proposed North Fork Mancos Master Development Plan: Important Areas for Game Animals, available at http://www.chc4you.org/wp-content/uploads/2017/02/17-022_NFMMDP_GameAnimals_v2_w_Coal.pdf (attached as Exhibit 293); Rocky Mountain Wild, Proposed North Fork Mancos Master Development Plan: Western Association of Fish and Wildlife Agencies Crucial Habitat Assessment, available at http://www.chc4you.org/wp-content/uploads/2017/03/17-022_NFMMDP_CrucialHabitatAssessment_v1.pdf (attached as Exhibit 294).

[252] *Id.*

[253] *Id.*

[254] Center for Biological Diversity, Map of North Fork Mancos Master Development Plan and Elk Winter Range (2017) (attached as Exhibit 225).

assures survival of a population, not a place where the animals typically spend the most time.[255] Elk are highly susceptible to disturbance on winter ranges and production areas. This project could cause elk to abandon substantial portions of their traditional winter range. This could have serious, long-term consequences for big game health and use of the area. For example, scientists have determined that in areas with limited cover, elk habitat is completely lost at a road density of only 0.8 miles of road per square mile.[256] A study on elk habitat effectiveness in north-central Wyoming found that few elk used areas with road densities higher than 0.5 miles per square mile.[257] The impacts to elk and mule deer from a new, roaded landscape would likely be extreme. Mule deer numbers are declining across Colorado and the West.[258] This pattern of decline is also being experienced by mule deer in the project area and surrounding lands. Oil and gas development within and adjacent to elk and mule deer habitat foreshadows serious impacts for these iconic and economically valuable species.

Residential and energy development has reduced all ungulates across the West. The low-elevation valleys and mountain foothills, once important habitat for ungulates, are filled with cities and towns.[259] The same is true in Colorado, according to CPW's research, particularly on winter ranges.[260] Between 1980 and 2010, western Colorado saw a 37% increase in residential land-use in mule deer habitat, primarily on their winter range.[261] The resulting lack of high-quality winter range is limiting robust mule deer population growth in Colorado.[262]

A dearth of high-quality, long-term, and controlled studies makes it difficult to evaluate with precision the role of oil and gas development in mule deer habitat and population decline.[263] Clearly, mule deer demonstrate avoidance of roads and oil and gas infrastructure, with as-yet

---

[255] Theodore Roosevelt Conservation Partnership, *Mule Deer and Energy: Federal Policy and Planning in the Greater Green River Basin* (Apr. 2011) at 28 (attached as Exhibit 213).
[256] Chris Weller *et al*., *Fragmenting Our Lands: The Ecological Footprint From Oil And Gas Development* (Sept. 2002) at 28 (emphasis added) (attached as Exhibit 212).
[257] *Id*. at 16.
[258] *See* Scott Willoughby, *With Colorado's Mule Deer Population Declining, Wildlife Officials Seek Help*, THE DENVER POST, Aug. 13, 2014 *available at* http://www.denverpost.com/outdoors/ci_26326126/colorado-hunt-mule-deer-population-declining-wildlife-officials-dow; Bruce Finley, *Deer Declining Across Colorado and West*, THE DENVER POST, July 14, 2014 *available at* http://www.denverpost.com/environment/ci_26143275/deer-declining-across-colorado-and-west.
[259] Jean Polfus, *Impacts of Residential Development on Ungulates in the Rocky Mountain West*, Wildlife Society Bulletin 36:647-657 (2012) (attached as Exhibit 226).
[260] Heather E. Johnson, et al., *Increases in Residential and Energy Development Are Associated with Reductions in Recruitment for a Large Ungulate*, Global Change Biology, doi: 10.1111/gcb.13385 (2016) ("Johnson et al. 2016") (attached as Exhibit 227).
[261] Johnson et al. 2016 (attached above as Exhibit 227).
[262] Eric J. Bergman, et al., *Density Dependence in Mule Deer: a Review of Evidence*, Wildlife Biology 21:18-29 (2015) (attached as Exhibit 232); Johnson et al. 2016.
[263] Mark Hebblewhite, *Effects of Energy Development on Ungulates, in Energy Development and Wildlife Conservation in Western North America* 71-94 (2011) (attached as Exhibit 228).

inadequately-understood consequences for migration, energy budgets, adult and fawn survival, and population.[264]

Some of the best available long-term, controlled studies evaluate mule deer population density before and after oil and gas development in the Sublette mule deer heard near Pinedale, Wyoming.[265] The Sublette mule deer study compared mule deer density in control and development zones, and found mule deer densities declined 30% in the development area, as opposed to 10% in the control area.[266] Sawyer and Strickladn found that "the observed decline of mule deer in the treatment area was likely due to gas development, rather than drought or other environmental factors that have affected the entire Sublette Herd unit."[267]

The Sublette example is particularly important when considering energy development's effects on mule deer populations, their winter range, and their migration patterns in western Colorado. Even in its relatively early stages compared to Wyoming, the most recent spatial analysis of already-occuring effects on mule deer in western Colorado finds energy development has the second-largest effect on deer recruitment, exceeded only by residential development.[268]

Although the precise connections between energy development and population-level effects are still imperfectly understood, it is demonstrated that oil and gas development affects mule deer habitat use and migration patterns by causing site avoidance, particularly in daytime,[269] and creating "semi-permeable" barriers to migration routes.[270] CPW is currently engaged in multiple research efforts to evaluate energy development effects on migration, deer response to energy development, and fawn survival in developed and undeveloped areas.[271]

---

[264] Hebblewhite 2011; Hall Sawyer, et al., *A Framework for Understanding Semi-permeable Barrier Effects on Migratory Ungulates*, Journal of Applied Ecology 2013:50, doi:10.1111/1365-2664.12013 (2013) ("Sawyer 2013") (attached as Exhibit 229); Patrick E. Lendrum, et al., *Habitat Selection by Mule Deer During Migration: Effects of Landscape Structure and Natural-Gas Development*, Ecosphere 3(9):82 (2012) (attached as Exhibit 230).
[265] Hall Sawyer, et al., *Sublette Mule Deer Study (Phase II): Final Report 2007* (2009) (attached as Exhibit 231).
[266] *Id*.
[267] *Id.*
[268] Johnson et al. 2016 (attached above as Exhibit 227)
[269] Lendrum 2012 (attached above as Exhibit 230).
[270] Sawyer 2013 (attached above as Exhibit 229).
[271] Charles R. Anderson, *Population Performance of Piceance Basin Mule Deer in Response to Natural Gas Resource Extraction and Mitigation Efforts to Address Human Activity and Habitat Degradation* (2015) ("Anderson 2015") (attached as Exhibit 233); Charles R. Anderson, *Piceance Mule Deer & Energy Development: Demographic Influences and Mitigation*, Colorado Parks and Wildlife Presentation to Garfield County, Colorado (2016), *available at* http://www.garfield-county.com/oil-gas/documents/energy-advisory-board/2016/F-D-EAB%20Chuck%20Anderson_Piceance%20deer-energy%20development_Oct%202016.pdf ("Anderson 2016") (attached as Exhibit 234); Charles R. Anderson & Chad J. Bishop, *Migration Patterns of Adult Female Mule Deer in Response to Energy Development*, Transactions of the 79th North American Wildlife and Natural Resources Conference 47-50 (2014) ("Anderson &

Those studies have thus far documented how individual deer alter their migration speed and timing in response to development.[272] A 2015 Wildlife Research Report published by CPW found that, during an active drilling phase in the Piceance Basin, deer behavior was compromised by 25% (at nighttime) and by 50% (during day time) in critical mule deer winter range.[273]

CPW has also collected data, from 2012 through 2014, in order to evaluate mule deer fawn survival in developed and undeveloped landscapes.[274] This data has not yet been published, but CPW has disclosed preliminary data to Garfield County a strong increase in fawn predation and mortality associated with oil and gas development.[275] The preliminary data disclosed to Garfield County shows 39% predation mortality and 53% total mortality in the undeveloped study area, versus 49% predation mortality and 63% total mortality in the developed study area.

Roads, pads, and infrastructure within and surrounding elk and mule deer winter range all have the potential to severely impact the populations of the Upper North Fork. Roads are one of the most pervasive impacts of human development on natural landscapes. Their greatest impact, by far, lies in the indirect effects of habitat fragmentation and avoidance by wildlife. An extensive literature review was conducted by Rowland in 2005 concerning elk avoidance of roads.[276] Numerous studies document that elk avoid roads and do not use habitat adjacent to roads to its full potential. For example, when road densities are as low as one mile per square mile, elk habitat effectiveness is reduced by 25 percent.[277] In another literature review prepared in 2008, Hebblewhite referenced almost 200 resources relating to this topic. In eight studies that measured the distance of ungulate avoidance from roads, the average "zone" of influence extended approximately 1000 meters from roads and wells.[278] In another study, human access facilitated by road development indirectly resulted in a 43 to 50 percent loss of high-use elk habitat in Wyoming.[279] For example, in the sage-steppe ecosystem of Wyoming's Jack Morrow Hills, elk avoided roads the most during summer months, strongly selecting habitats greater than

---

Bishop 2014") (attached as Exhibit 235); Patrick E. Lendrum et al., *Migrating Mule Deer: Effects of Anthropogenically Altered Landscapes*, PlosOne, 8:5:e64548 (2013) ("Lendrum 2013") (attached as Exhibit 236).

[272] Lendrum 2012 (attached above as Exhibit 230); Lendrum 2013 (attached above as Exhibit 236).

[273] Anderson 2015 (attached above as Exhibit 233).

[274] Anderson 2015 (attached above as Exhibit 233).

[275] Anderson 2016 (attached above as Exhibit 234).

[276] Mary M. Rowland et al., *Effects of Roads on Elk: Implications for Management in Forested Ecosystems* (2005) (attached as Exhibit 214).

[277] Weller *et al.* at 16 (emphasis added) (attached above as Exhibit 212).

[278] Mark Hebblewhite, *A Literature Review of the Effects of Energy Development on Ungulates: Implications for Central and Eastern Montana* (Prepared for Montana Fish, Wildlife and Parks) at 85 (2008) (attached as Exhibit 215).

[279] Clay B. Buchanan et al., *Seasonal Resource Selection and Distributional Response by Elk to Development of a Natural Gas Field*, 67 RANGELAND ECOLOGY AND MGMT. 369, 377 (2014) (attached as Exhibit 202).

2,000 meters from these features. In addition, elk in the study continued to show avoidance of wellsites long after the construction phase had been completed.[280] In a major volume reviewing elk ecology and management, Lyon and Christensen state: "Access—mainly that facilitated by roads—is perhaps the single most significant modifier of elk habitat and a factor that will remain central to elk management on public and private lands. *It is possible that in areas with no cover, road densities less than one mile per square mile may eliminate effective habitat*.[281]

It is well-documented that human development causes direct habitat loss and fragmentation through the construction of infrastructure, and indirect habitat loss through deer avoidance of infrastructure and related activities; these consequences likely reduce the carrying capacity of the landscape.[282] A recent study shows that oil and gas development causes significant habitat loss in the neighboring Piceance Basin of Colorado:

> Energy development drove considerable alterations to deer habitat selection patterns, with the most substantial impacts manifested as avoidance of well pads with active drilling to a distance of at least 800 m. Deer displayed more nuanced responses to other infrastructure, avoiding pads with active production and roads to a greater degree during the day than night. In aggregate, these responses equate to alteration of behavior by human development in over 50% of the critical winter range in our study area during the day and over 25% at night.[283]

Additionally, mule deer may suffer higher mortality rates in developed landscapes because of increased vehicle collisions and accidents (i.e., entrapment in fences); moreover, increased road densities expose mule deer to more hunters, poachers and predatory domestic pets.[284]

For mule deer, there are additional two potential concerns. The North Fork Mancos MDP proposes, in phase one, three wells within less than one-half mile of documented mule deer migration corridors, and an additional well directly adjoining a large area of documented mule deer severe winter range and migration corridors.[285] First, the avoidance or lower probability of use of areas near wells creates indirect habitat losses of winter range that are substantially larger in size than the direct habitat losses incurred when native vegetation is removed during construction of the well pad. Habitat losses, whether direct or indirect, have the potential to

---

[280] Hebblewhite at 23 (attached above as Exhibit 215).
[281] Janice L. Thomson et al., *Wildlife at a Crossroads: Energy Development in Western Wyoming, Effects of Roads on Habitat in the Upper Green River Valley* (Feb. 2005) at 18 (attached as Exhibit 217).
[282] Johnson et al. 2016 (attached above as Exhibit 227).
[283] Northrup, J. M. et al. Quantifying spatial habitat loss from hydrocarbon development through assessing habitat selection patterns of mule deer, Global Change Biology (Aug. 2015), available at http://onlinelibrary.wiley.com/doi/10.1111/gcb.13037/epdf (attached as Exhibit 237).
[284] Johnson et al. 2016 (attached above as Exhibit 227).
[285] Center for Biological Diversity, Map of North Fork Mancos Master Development Plan and Mule Migration Corridors Winter Range (2017) (attached as Exhibit 238).

reduce carrying capacity of the range and result in population-level effects. Second, if deer do not respond by vacating winter ranges, distribution shifts will result in increased density in remaining portions of the winter range, exposing the population to greater risks of density-dependent effects.[286] Lower predicted probabilities of use within 2.7 to 3.7 km of well pads suggested indirect habitat losses may be substantially larger than direct habitat losses.[287] Following three years of gas development in western Wyoming, 41 percent of areas classified as high deer use prior to development changed to medium-low or low-use areas. This change in distribution occurred with only two percent direct habitat loss. Relatively small amounts of direct habitat loss can affect winter distribution patterns of mule deer and the effects of direct habitat loss may be long term for species like mule deer that rely on native shrubs (i.e., sagebrush) because reclamation of native shrubs in arid environments is difficult.[288]

The Sublette mule deers studies, discussed above show that drilling and production of natural gas on crucial winter range significantly affect mule deer, with dramatic decreases in wintering populations within the developed area. In 2007, Sawyer et al. published a report on 8 years of research that attributed 27 percent of the decline in mule deer on the Pinedale Anticline to energy development.[289] Over the course of the Pinedale study, areas that were classified as high quality habitat before development changed to low quality, and vice-versa, showing that mule deer shifted habitats away from favored high-quality habitats because of energy development.[290] Based on the annual estimates, mule deer abundance was 56 percent lower in 2010 compared to 2001. The 12-year (2001-2012) trend in mule deer abundance on the Mesa was negative and indicates an overall decline of 42 percent. This decline was concurrent with documented behavioral changes of mule deer avoiding well pads.[291]

Mule deer also need migration corridors that are protected from human development. An ongoing mule deer study by members of the Wyoming Migration Initiative has found that mule deer migration patterns are altered by human development – herds will move faster, stop less to feed, and detour around developed portions of their route.[292] Moreover, herds that can't migrate in search of the most nutritious grasses just end up smaller in number, plain and simple.[293] As a result, Wyoming Game and Fish Department is working to further protect migration routes in the state, for instance, no more than four oil and gas well pads allowed in a migration corridor and

---

[286] Hall Sawyer et al., *Winter Habitat Selection of Mule Deer Before and During Development of a Natural Gas Field* 70 J. OF WILDLIFE MGMT. 396, 402 (2006) (attached as Exhibit 218).
[287] *Id*. at 396.
[288] Hall Sawyer, *Final Report for the Atlantic Rim Mule Deer Study* (Apr. 2007) at 25 (attached as Exhibit 219).
[289] Sawyer et al. 2006 at 396-403 (attached above as Exhibit 218).
[290] Hebblewhite at 51-52 (attached above as Exhibit 215).
[291] Hall Sawyer & Ryan Nielson, *Mule Deer Monitoring in the Pinedale Anticline Project Area, 2013 Annual Report Update* (Aug. 2013) at 9 (attached as Exhibit 219).
[292] Sawyer 2013 (attached above as Exhibit 229).
[293] Edwards, M., *Mule Deer Struggling To "Surf The Green Wave" Of Migration* (Nov. 20, 2015) available at http://wyomingpublicmedia.org/post/mule-deer-struggling-surf-green-wave-migration.

no development allowed in corridors narrower than a quarter mile. Although initial CPW research suggests that existing Piceance development levels are largely influencing the timing (not the fact) of deer migration,[294] CPW acknowledges that a "threshold in development intensity" may have greater effects on migration behavior.[295]

It is imperative that the BLM take a hard look at the direct, indirect, and cumulative impacts of the project to the local populations of elk and mule deer.

ii. Canada Lynx

There are thousands of acres of suitable and potential lynx habitat in the project area, including lynx denning and winter habitat, at least one lynx analysis unit, and lynx linkage areas.[296] Further, the project area is surrounded by a larger, connected landscape of suitable lynx habitat. The project area is comprised of high elevation sagebrush and mountain shrub communities, as well as other intermixed forested communities that afford potentially important prey resources and habitat connectivity. Importantly, studies show that sagebrush and mountain shrub communities are utilized by lynx, especially near primary habitat or when prey populations are high.[297] In addition, connectivity of lynx habitat has been identified as an important consideration for the southern Rockies, because of the extreme topographic relief juxtaposed with human developments such as highways and residential communities.[298]

Here, the Ragged Mountain LAU overlaps a small portion of the 27,034-acre McClure Pass Lynx Linkage Area at the northern end of the LAU, linking the Huntsman Ridge area with habitats in the Crystal West, Crystal East, and Huntsman Mountain LAU on the White River and Grand Mesa Uncompahgre and Gunnison National Forests. The McClure Pass linkage area is bisected by Highway 133, which is the primary route for access to the project area. The McClure

---

[294] Anderson & Bishop 2014 (attached above as Exhibit 235).
[295] Anderson 2016 (attached above as Exhibit 234); Sawyer 2013 (attached above as Exhibit 229).
[296] *See* Center for Biological Diversity, Canada Lynx Habitat Map, utilizing Colorado Parks and Wildlife Species Activity Data (2017), available at: http://www.arcgis.com/home/group.html?owner=rsacco&title=Colorado%20Parks%20and%20Wildlife%20-%20Species%20Activity%20Data&start=41&q= (attached as Exhibit 223); *see also* Colorado Parks and Wildlife, Wildlife Research Report: Mammals (July 2011), 22-36, available at: http://cpw.state.co.us/Documents/Research/Mammals/Publications/2010-2011WILDLIFERESEARCHREPORT.pdf (attached as Exhibit 224).
[297] Bill Ruediger et al., *Canada Lynx Conservation Assessment and Strategy* (Jan. 2000) (emphasis added) (attached as Exhibit 221).

[298] InterAgency Lynx Biology Team, *Canada Lynx Conservation Assessment and Strategy 3rd Edition*, Forest Service Publication R1-13-19, 54 (2013) (attached as Exhibit 122).

Pass linkage area is vitally significant because it "connects a large area of central Colorado mountains with the Grand Mesa."[299]

Lynx populations may be more constant in the southern Rockies than in more northern ecosystems. Researchers have posited that the lynx survival rate in Colorado, where the species was reintroduced between 1999 and 2006, may be less cyclical than in northern portions of the species' range:

> Slough & Mowat (1996) found mortality in northern lynx populations to be strongly affected by the 10-year snowshoe hare cycle. This makes it difficult to directly compare annual survival rates of lynx across studies without knowing where each population is within this cycle. Further, it is possible the increased habitat fragmentation in the continental United States eliminates or dampens the amplitude of the snowshoe hare cycle in its southern distribution (Strohm & Tyson 2009), subsequently weakening the effect on demography of southern lynx populations.[300]

The Fish and Wildlife Service came to a similar conclusion regarding the amplitude of snowshoe hare cycles as a function of latitude:

> In northern Canada, lynx populations fluctuate in response to the cycling of snowshoe hare (Mowat et al. 2000). Although snowshoe hare populations in the southern portion of the range in the contiguous United States may fluctuate, they do not show strong, regular population cycles as in the north (Hodges 2000). In the contiguous United States, the degree to which regional local lynx population fluctuations are influenced by local snowshoe hare population dynamics is unclear. The southernmost extent of the boreal forest that supports lynx occurs in the contiguous United States in the Northeast, western Great Lakes, northern and southern Rockies, and northern Cascades (Ruediger et al. 2000). Here the boreal forest transitions into other vegetation communities and becomes more patchily distributed. As a result, the southern boreal forests generally support lower snowshoe hare densities, hare populations do not appear to be as highly cyclic as snowshoe hares further north, and lynx densities are lower compared to the northern boreal forest.[301]

While the Service concludes that lower densities equate to poor habitat, in mapping locations of reintroduced lynx in Colorado, the Colorado Division of Wildlife cautioned:

---

[299] USDA Forest Service, *Southern Rockies Lynx Management Direction Final Environmental Impact Statement Volume I C-5* (Oct. 2008) (attached as Exhibit 123).

[22] O. Devineau et al., *Evaluating the Canada Lynx Reintroduction Programme in Colorado: Patterns in Mortality*, Journal of Applied Ecology 47(3): 524-531 (2010) (attached as Exhibit 239).

[301] U.S. Fish and Wildlife Service, *Recovery Outline: Contiguous United States Distinct Population Segment of the Canada Lynx* (2005), available at: http://www.fws.gov/mountain-prairie/species/mammals/lynx/final%20lynx%20recoveryoutline9-05.pdf (attached as Exhibit 240).

> Areas of high use over the 5-year period [1999-2005] were identified by many overlapping points and reflect current areas of high use by surviving lynx. However, areas with few points are not necessarily indicative of poor habitat but might rather reflect low densities of lynx beyond their release locations in southwestern Colorado.[302]

This suggests that even at comparatively low densities, in large part due to the more constant numbers of snowshoe hares than in northern ecosystems inhabited by lynx, in the southern Rockies lynx habitat can serve as an important reservoir of lynx genetic diversity during periods of cyclical snowshoe hare decline elsewhere. However, possible lower lynx densities, at least in the initial stages of recovery in Colorado after reintroduction, do not necessarily indicate lower potential for the habitat to contribute to recovery.

Lynx in Colorado are surviving at a higher rate than in habitats where they were never extirpated, and the reintroduction is considered a success, and no longer an experiment. Researchers have concluded:

> Nonetheless, our estimate of survival within the Colorado reintroduction area (0·9315 ± 0·0325) was higher than estimates obtained for natural, lightly trapped populations of Canada lynx in the Yukon (0·75–0·90, Slough & Mowat 1996; O'Donoghue *et al.* 1997) or in the Northwest Territories (~0·90, Poole 1994), where human disturbances are likely to be lower than in Colorado. Outside the study area, our estimate of survival was within the range estimated for the Kluane lynx population in south-west Yukon (O'Donoghue *et al.* 1997), and similar to the survival estimated for Eurasian lynx while accounting for hunting and poaching (Andrén *et al.* 2006)[303]

Moreover, the Colorado Division of Parks and Wildlife has determined, based on lynx survival, fidelity and recruitment, that the lynx population in the southern Rocky Mountains is viable.[304] This viable, resilient and potentially-connected population of lynx in the southern Rockies is essential to eventual recovery of the species; for without it, lynx in the northern Rockies and possibly elsewhere will be more vulnerable to suffering a genetic bottleneck affect.

Because the lynx is listed as threatened pursuant to the federal Endangered Species Act, and is an endangered species under Colorado State law, the BLM must adequately consider the

---

[302] T. Shenk, *General Locations of Lynx (Lynx canadensis) Reintroduced to Southwestern Colorado from February 4, 1999 through February 1, 2005* (2005), 2, available at: http://wildlife.state.co.us/SiteCollectionDocuments/DOW/WildlifeSpecies/SpeciesOfConcern/Lynx/Reports/LynxLocations_Feb2005.pdf (attached as Exhibit 241).

[303] Devineau et al (2010) (attached above as Exhibit 239).

[304] J. Ivan, *Modeling Canada Lynx in Colorado Using Occupancy Estimation: Initial Implementation in the Core Lynx Research Area*, in Colorado Division of Parks and Wildlife, *Wildlife Research Reports: Mammals Program* (2005), available at: http://wildlife.state.co.us/SiteCollectionDocuments/DOW/Research/Mammals/Publications/2010-2011WILDLIFERESEARCHREPORT.pdf (attached as Exhibit 242).

effects of the project on lynx and its habitat by using the best available science. Compliance with the ESA may require updated consultation under Section 7 of the Act. Indeed, because all Forest Service lands in Colorado are considered occupied lynx habitat, BLM must consult with the U.S. Fish and Wildlife Service about the impacts of this proposal on Canada lynx and lynx habitat. Because the lynx is listed as threatened pursuant to the federal Endangered Species Act (ESA), and is an endangered species under Colorado State law, the BLM must adequately consider the effects (direct, indirect, and cumulative) of the project on lynx and its habitat under NEPA. Compliance with the ESA also requires consultation on lynx and application of the best available science under Section 7 of the ESA. Additional consultation on lynx critical habitat under Section 7 of the Act may also be required, depending on the outcome of the remand issued in *WildEarth Guardian v. U.S. Department of the Interior,* 14-cv-00270-DLC (D. Mont. September 7, 2016).

The agency must do more than simply relying on the Southern Rockies Lynx Amendment (SRLA) Biological Opinion (BiOp) for an analysis of the effects this project will have on Canada lynx and Canada lynx habitat. While it is true that the SRLA does contemplate effects of oil and gas management generally on lynx and lynx habitat, it cannot contemplate, disclose, or analyze the site-specific impacts that this project will have on lynx. Indeed, the SRLA Biological Opinion recognizes that "[e]ffects would be based on site specific conditions and would require subsequent project level . . . consultation with the [U.S. Fish and Wildlife] Service."[305] The BLM should affirmatively post all consultation documents on the internet so that the public is fully informed as to what determinations are being made and the analysis behind them. Alternatively, we respectfully request that BLM provide those documents to us when they are completed.

The BLM should consider alternatives that will protect lynx and important lynx habitat. For example, BLM could consider an alternative that protects areas that contain the Primary Constituent Elements for lynx critical habitat as identified by the U.S. Fish and Wildlife Service in its final revised rule designating critical habitat for lynx (September 2014). The agency could consider an alternative that does not allow disturbance of any lynx habitat. The BLM could consider an alternative that does not result in disturbance of lynx linkage areas. The Forest agency could consider an alternative that does not disturb any areas with a particular amount of dense horizontal cover. The agency could also consider an alternative that ensures protection of abundant and spatially well-distributed patches of mature, multi-storied spruce-fir stands. The agency could also consider an alternative that does not construct any new roads in lynx habitat. The signatory organizations would be thrilled to help BLM develop a "conservation alternative" that it would adequately protect lynx.

The BLM must comply with the recommendations made in the Lynx Conservation Assessment and Strategy ("LCAS"). The LCAS recommends Federal land management agencies take certain actions at the programmatic planning stage to ensure the viability of lynx. These include:

- Map oil and gas production and transmission facilities, mining activities and facilities,

[305] SRLA BiOp at 69 (July 25, 2008).

dams, and agricultural lands on public lands and adjacent private lands, in order to assess cumulative effects;

- Develop and implement a plan to protect key linkage areas on federal lands from activities that would create barriers to movement;
- Barriers could result from an accumulation of incremental projects, as opposed to any one project; and
- Evaluate the potential importance of shrub-steppe habitats in providing landscape connectivity between blocks of lynx habitat."[306]

Given that the project is in close proximity to or overlaps with large areas of suitable lynx habitat and could serve as a linkage area, the BLM has the opportunity and, indeed, responsibility to adhere to these recommendations. This is also important given the anticipated impacts of climate change on lynx.[307]

Further, given the age of many leases within the proposed MDP, BLM and the USFS should use this discretionary decision as an opportunity to ensure that lynx will be adequately protected by any development. The agencies could do this by conditioning approval of any development on management practices that would reduce impacts and protect lynx habitat, and/or conditioning approval on acceptance of new lease stipulations that protect lynx.

As part of the NEPA process, the BLM and USFS must disclose the state of lynx habitat that may be impacted by this decision, including impacts from well pad construction and operation, road construction, increased vehicular traffic, and other effects. As part of this analysis, the agencies must disclose how much of each type of lynx habitat currently exists, and how much of each type of lynx habitat will remain after the project is implemented. This includes not just acreage, but location and geographic distribution on the landscape. In particular, we are concerned about lynx analysis units, lynx linkage areas, lynx foraging habitat, lynx denning habitat, lynx winter habitat (which differs from snowshoe hare winter habitat), and snowshoe hare habitat. In particular, given that the U.S. Fish and Wildlife Service is under a court-ordered obligation to reassess lynx critical habitat in the Southern Rockies, the agencies here should disclose and analyze the existing primary constituent elements in the project area, as well as the anticipated effects to those primary constituent elements.

The Southern Rockies Lynx Amendment (SRLA) includes objectives, standards, and guidelines designed to conserve lynx and lynx habitat in the Southern Rockies region. As part of compliance with the SRLA, the agencies must not just conclude that the project meets all of the objectives, standards, and guidelines, but rather must describe in detail how each will be met, and if a component will not be met, explain why not and the result of that failure to comply. The agencies also cannot neglect their obligations with regards to SRLA guidelines merely because they are guidelines. The SRLA Biological Opinion (July 25, 2008) anticipated that "[g]uidelines would be implemented in most cases," and further anticipated that "[e]ffects would be based on site specific conditions and would require subsequent project level . . . consultation with the

[306] Ruediger et al. at 88 (emphasis added) (attached above as Exhibit 221).
[307] *See* InterAgency Lynx Biology Team (attached above as Exhibit 122).

[U.S. Fish and Wildlife] Service." As such, the Forest Service must explain how and if it is implementing SRLA guidelines, and if not, provide an explanation for why it is not implementing each specific guideline. Again, the agencies cannot just state that they will meet each guideline, but must explain how they will do so. This analysis must be both quantitative and qualitative.

iii. Yellow-billed Cuckoo

The Yellow-billed Cuckoo (*Coccyzus americanus*) is a recently listed federally threatened species whose presence is documented in Gunnison and Delta Counties. Indeed it has historical and present occurrence in Gunnison and Delta Counties. The Rocky Mountain Bird Observatory notes: "Cuckoos were regularly detected as recently as the mid-1980s along the Uncompahgre and Gunnison Rivers near Delta."[308] Further evidence documents that importance of habitat in the North Fork drainage:

> [C]onsistent cuckoo observations in the past decade have been recorded at only two locations within the range of the . . . Yellow-billed Cuckoo in Colorado . . . . At the second location, in the North Fork of the Gunnison River valley near the towns of Hotchkiss and Paonia . . . , cuckoos have been detected annually since 2003. In 2008, during RMBO nest-searching efforts, breeding was confirmed near Hotchkiss. This represents all known Yellow-billed Cuckoo observations for western Colorado since 2000.[309]

> In 2011, cuckoos were detected during broadcast-point count surveys at two locations near Hotchkiss (Delta County) and one location near Grand Junction (Mesa County). One pair of Yellow-billed Cuckoos was reported near the North Fork of the Gunnison River at Hotchkiss throughout the summer. . . . These observations most likely indicate at least two breeding pair in the Hotchkiss area. Breeding was confirmed at the Old Hotchkiss Water Treatment Plant on 12 August when an adult cuckoo was seen carrying food.[310]

The North Fork Valley provides designated critical habitat for this species,[311] and there is a distinct possibility that not all habitat has been mapped. In designating critical habitat, scientists stressed that not all potential habitat in Western Colorado had been evaluated: "There are several drainages that have potential to host small populations and provide important habitat for migrating WYBC in western Colorado where critical habitat is not currently designated.

---

[308] Jason Beason, *2011 Yellow-billed Cuckoo Surveys in Western Colorado* 1 (Jan. 2012) at 1 (attached as Exhibit 124).
[309] *Id*. at 2 (emphasis added).
[310] *Id*. at 5.
[311] *See* U.S. Fish & Wildlife Serv., *Yellow Billed Cuckoo Critical Habitat Unit 56: CO-3 North Fork Gunnison River, Delta County, CO* (June 2014).

Surveys that have been conducted for WYBC covered a low percentage of the available riparian habitat in western Colorado it is very possible that undiscovered populations could exist."[312]

In western Colorado, Yellow-billed Cuckoos have historically occupied extensive Fremont cottonwood (*Populus deltoides*) and narrowleaf cottonwood (*Populus angustifolia*) riparian forests. During surveys in 2008 in western Colorado, cuckoos were located in riparian areas with Fremont and narrowleaf cottonwood-dominated overstory and a dense understory containing both native and exotic shrub species.[313] The primary factor affecting the reproductive success of western yellow-billed cuckoos is the availability and quality of riparian woodland habitat.[314] Loss and degradation of riparian habitats have been widespread in the West and in North America in general.[315]

Because there are nearby documented populations and suitable breeding habitat, the BLM must take a "hard look" at the impacts to this species. This analysis needs to account for impacts such as disturbance, habitat degradation, pesticide use, and predators, as all can affect Cuckoos and are impacts that can be exacerbated by oil and gas development, such as that proposed here.[316] Pesticide application is particularly noted as a problem for yellow-billed cuckoos.[317] Conservation measures that may help to slow the decline in abundance of yellow-billed cuckoos include restricting the use of pesticides in and near riparian woodlands.[318] In the western portion of the range, loss and/or degradation of breeding habitat is the factor most often cited as driving the declines in yellow-billed cuckoos. Aside from simply reducing the available amount of suitable breeding habitat, degradation of riparian habitats may lead to a number of other negative effects: a reduction in the local food supply, an increase in predation at nests, and a lack of suitable dispersal areas for adult and juvenile cuckoos.[319] Given the bird was recently listed, it seems evident that pesticide use is already threatening its survival in the Valley. Increased pesticide use as part of this proposed action stands to further reduce habitat, compounding impacts on this bird.

iv. Bald Eagle

Bald eagle winter forage areas and winter range must be mapped in the project area, and the BLM must analyze impacts to this sensitive species. The BLM should require mitigation

---

[312] Jason Beason, *Review of selected Critical Habitat for Western Yellow-billed Cuckoo in Western Colorado,* 79 Fed. Reg. 158 (August, 15 2014) (attached as Exhibit 124).
[313] Jason Beason, at 2 (attached above as Exhibit 124).
[314] David Wiggins, *Yellow-billed Cuckoo (Coccyzus americanus): a Technical Conservation Assessment* (Mar. 2005) at 25 (attached as Exhibit 222).
[315] *Id.*
[316] *See* Bureau of Reclamation, *Lower Colorado River Multi-Species Conservation Program, Species Accounts for the Lower Colorado River Multi-Species Conservation Program* (Sept. 2008) (attached as Exhibit 126).
[317] *See* David Wiggins (attached above as Exhibit 222).
[318] *Id*. at 3.
[319] *See* David Wiggins at 22 (attached above as Exhibit 222).

measures to protect bald eagles, including nesting surveys, avoidance of surface-disturbing activities within one mile of nests or winter foraging areas, documentation of take of bald eagle habitat associated with the action, and prohibition of loud noises within one mile of active bald eagle nests.

v. Purple Martin and Northern Goshawk

The purple martin (*Progne subis*) is a migratory bird that winters in South America and arrives in Colorado in early June then departs the area by late August.[320] This swallow is recognized as a Forest Service sensitive species and is a Management Indicator Species in Region 2. Additionally, this species is listed as a Priority Species by the Colorado Partners in Flight plan.[321] The purple martin is an obligate secondary cavity nester and that prefers to breed in stands of old growth aspen nesting in cavities excavated by woodpeckers or flickers. The NFMMDP area is known to contain active nest colonies of purple martin.[322] CPW comments:

> "Colonial nesters may be disproportionately impacted by removal of nesting habitat or impacts to active nesting colonies. The proposed Federal 1190 #20 well location and access road is located in an area modeled by the USFS as purple martin habitat (BLM 2016). CPW is concerned that this proposed well location and access road may impact nesting purple martins and suitable nesting habitat for this species."[323]

The NFMMDP area also contains known habitat for northern goshawk (*Accipiter gentilis*), a BLM sensitive species. "CPW is concerned that impacts to individual goshawk nests or nesting territories in the NFMMDP area may have disproportionate impacts to this species."[324]

Due to the presence of suitable habitat and sightings of purple martin and northern goshawk within and adjacent to the project area, effects on these species must be addressed.

vi. Gunnison Sage Grouse

The North Fork Mancos MDP includes a proposal for one well squarely within documented historic habitat for the threatened Gunnison Sage-Grouse.[325] Prior to allowing development within Gunnison Sage-Grouse historic habitat, BLM and the U.S. Fish and Wildlife

---

[320] Colorado Partners in Flight (CPIF). 2013. Physiographic Region 62: Southern Rocky Mountains Purple Martin (*Progne subis*), available at http://www.rmbo.org/pif/bcp/phy62/aspen/puma.htm (attached as Exhibit 244).
[321] David Wiggins, *Purple Martin (Progne subis): A Technical Conservation Assessment* (March 31, 2005) available at http://www.fs.fed.us/r2/projects/scp/assessments/purplemartin.pdf (attached as Exhibit 245).
[322] CPW comments at 3 (attached as Exhibit 246).
[323] *Id.*
[324] *Id.*
[325] Center for Biological Diversity, Map of North Fork Mancos MDP and Gunnison Sage-Grouse Habitat (2017) (attached as Exhibit 247).

Service must consult under Section 7 of the Endangered Species Act, and must consider the effect of this proposed well not only on the survival of the species, but on its prospects for recovery and re-colonization of historic but currently-unoccupied habitat.

The Gunnison sage-grouse was listed as a threatened species under the Endangered Species Act in November 2014. *See* U.S. Fish and Wildlife Service, Threatened Status for Gunnison Sage-Grouse, Final Rule, 79 Fed. Reg. 69,192 (Nov. 20, 2014). Approximately 88 to 93 percent of the species's historical range has been lost since Euro-American settlement, and "[t]his contraction in the birds' range indicates the vulnerability of all the populations to extirpation." Gunnison Sage-Grouse Listing Rule, 79 Fed. Reg. at 69,228. The listing rule found that "the persistence of Gunnison sage-grouse is dependent on large and contiguous sagebrush habitats, that human development and disturbance contribute to the decline of this needed habitat, and that such impacts negatively affect the survival and persistence of Gunnison sage-grouse." *Id.* Numerous activities on BLM land and minerals contribute to loss of these sage-grouse habitats, including road-building, power lines, livestock grazing practices, invasive plants, fire, and leasable minerals (i.e. oil and gas development). Oil and gas development has numerous adverse effects on Gunnison sage-grouse habitat, behavior, and population not acknowledged in the DEIS:

> Energy development impacts sagegrouse and sagebrush habitats through direct habitat loss from well pad construction, seismic surveys, roads, powerlines and pipeline corridors, and indirectly from noise, gaseous emissions, changes in water availability and quality, and human presence. The interaction and intensity of effects could cumulatively or individually lead to habitat degradation and fragmentation (Suter 1978, pp. 6–13; Aldridge 1998, p. 12; Braun 1998, pp. 144–148; Aldridge and Brigham 2003, p. 31; Knick *et al.* 2003, pp. 612, 619; Lyon and Anderson 2003, pp. 489–490; Connelly *et al.* 2004, pp. 7–40 to 7–41; Holloran 2005, pp. 56–57; Holloran *et al.* 2007, pp. 18–19; Aldridge and Boyce 2007, pp. 521–522; Walker *et al.* 2007a, pp. 2652–2653; Zou*et al.* 2006, pp. 1039–1040; Doherty *et al.* 2008, p. 193; Leu and Hanser 2011, pp. 270–271). Increased human presence resulting from oil and gas development can also impact sagegrouse either through avoidance of suitable habitat or disruption of breeding activities (Braun *et al.* 2002, pp. 4–5; Aldridge and Brigham 2003, pp. 30–31; Aldridge and Boyce 2007, p. 518; Doherty *et al.* 2008, p. 194). The development of oil and gas resources requires surveys for economically recoverable reserves, construction of well pads and access roads, subsequent drilling and extraction, and transport of oil and gas, typically through pipelines. Ancillary facilities can include compressor stations, pumping stations, electrical generators and powerlines (Connelly *et al.* 2004, p. 7–39; BLM 2007, p. 2–110). Surveys for recoverable resources occur primarily through loud seismic exploration activities. These surveys can result in the crushing of vegetation. Well pads vary in size from 0.10 ha (0.25 ac) for coal-bed natural gas wells in areas of level topography to greater than 7 ha (17.3 ac) for deep gas wells and multi-well pads (Connelly *et al.* 2004, p. 7–39; BLM 2007, p. 2–123). Pads for compressor stations require 5–7 ha (12.4–17.3 ac) (Connelly *et al.* 2004, p. 7–39). Individually, impacts from well

> pads, infrastructure, and ancillary features may be small; however, the cumulative impact of such development can be significant.
>
> The amount of direct habitat loss within an area of oil and gas development is ultimately determined by well densities and the associated loss from ancillary facilities. Roads associated with oil and gas development were suggested as the primary impact to greater sage-grouse due to their persistence and continued use even after drilling and production ceased (Lyon and Anderson 2003, p. 489). Declines in male greater sage-grouse lek attendance were reported within 3 km (1.9 mi) of a well or haul road with a traffic volume exceeding one vehicle per day (Holloran 2005, p. 40). Because of reasons discussed previously, the effects of oil and gas development to Gunnison sage-grouse are expected to be similar to those observed in greater sage-grouse. Sage-grouse also may be at increased risk for collision with vehicles simply due to the increased traffic associated with oil and gas activities (Aldridge 1998, p. 14; BLM 2003, p. 4–222).
>
> Habitat fragmentation resulting from oil and gas development infrastructure, including access roads, may have greater effects on sage-grouse than habitat loss associated with drill sites. Energy development and associated infrastructure works cumulatively with other human activity or development to decrease available habitat and increase fragmentation. Greater sage-grouse leks had the lowest probability of persisting (40–50 percent) in a landscape with less than 30 percent sagebrush within 6.4 km (4 mi) of the lek. These probabilities were even less in landscapes where energy development also was a factor.[326]

The Fish and Wildlife Service found, in considering the adequacy or inadequacy of existing regulatory mechanisms to safeguard Gunnison sage-grouse, that existing BLM RMPs, including the current Uncompahgre RMP, are inadequate as regulatory mechanisms. Existing "RMPs provide only partial protection for Gunnison sage-grouse in terms of land use allocation decisions specific to the species and its habitat and, therefore, are considered inadequate to protect the species." In particular, with regard to fluid mineral development, "Given the already small and fragmented nature of the populations where future oil and gas leases are likely to occur, additional development within occupied habitat would negatively impact those populations by contributing to further habitat decline."[327]

In part in response to this finding of inadequate regulatory mechanisms for BLM lands and minerals, the Colorado and Utah BLM have undertaken a range-wide RMP Amendment process for Gunnison Sage-Grouse habitat, encompassing the UFO, with a draft RMP Amendment and EIS released in August 2016. This amendment process overlaps the UFO RMP Revision: "If the GUSG RMP Amendment is issued prior to the revised Uncompahgre RMP, then it would amend the existing Uncompahgre Basin RMP (as well as the San Juan/San Miguel RMP) for lands in the Uncompahgre RMP planning area. Analysis from the GUSG EIS would be

[326] Gunnison Sage-Grouse Final Listing Rule, 79 Fed. Reg. at 69,255-256.
[327] Gunnison Sage-Grouse Listing Rule at 69,284.

incorporated by reference into the Uncompahgre Proposed RMP/Final EIS, and decisions made in the GUSG Approved RMP Amendment/ROD would be carried forward to the Uncompahgre Approved RMP/Record of Decision. However, if the revised Uncompahgre RMP is issued first, then the GUSG RMP Amendment could require amendment of the Uncompahgre RMP."[328] To prevent irretrievable commitment of resources that could foreclose the adoption of reasonable and prudent measures to conserve the species, BLM must not authorize any new surface-disturbing development in Gunnison sage-grouse habitat, including historic habitat, prior to the completion of these planning decisions and accompanying ESA Section 7 consultation.

Section 7(a) of the ESA requires that the Secretary of the Interior "shall review all other programs administered by him [sic] and utilize such programs in furtherance of the purposes of the Act." Those purposes include Congress' intent that "all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act."[329] Those purposes are further defined as "provid[ing] a means whereby the eco-systems upon which endangered species and threatened species depend may be conserved."[330] That term "conserve" is defined to mean not only the avoidance of extinction, but to "mean to use and the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary."[331] This includes consideration not merely of preventing the species' immediate extinction, but also of recovery measures sufficient to allow for de-listing.

Based on the established similarities in habitat requirements between the GUSG and the Greater Sage-Grouse, a species that has been exhaustively studied in the context of its own consideration for ESA listing and a series of BLM and U.S. Forest Service range-wide planning amendments across the west, there is a substantial body of high-quality scientific evidence regarding the habitat management measures necessary to recover sage-grouse species. In particular, the 2011 Report on Greater Sage-Grouse Conservation Measures produced by the Sage-Grouse National Technical Team, and the U.S. Geological Survey's 2013 Summary of Science, Activities, Programs and Policies That Influence the Conservation of Greater Sage-Grouse, provide a scientific basis for evaluating the effectiveness of proposed BLM land management actions.[332] Additional, more recent federal scientists' reports and peer-reviewed articles provide substantial additional empirical information on the management measures

[328] BLM, Gunnison Sage-Grouse Rangewide Draft Resource Management Plan Amendment Draft Environmental Impact Statement 1-14.
[329] ESA Section 2(c)(1).
[330] ESA Section 2(b).
[331] ESA Section 3(3).
[332] Daniel J. Manier et al., *Summary of Science, Activities, Programs, and Policies that Influence the Rangewide Conservation of Greater Sage-Grouse (Centrocercus urophasianus)* (2013) (attached as Exhibit 248); Sage-grouse National Technical Team, A Report on Greater Sage-Grouse Conservation Measures (December 21, 2011) (attached as Exhibit 249).

necessary to conserve functional sage-grouse habitats in the face of oil and gas development in particular.[333]

Recent scientific study confirms the established finding that sage-grouse lek attendance is negatively related to oil and gas density, regardless of sagebrush cover and precipitation.[334] Green et al. examined greater sage-grouse lek attendance, oil and gas well, and habitat and precipitation data from Wyoming over the period 1984 to 2008, and, consistent with numerous prior studies, that lek attendance declines are closely associated with the density of oil and gas development:

> Oil and gas development correlates well with sage-grouse population declines from 1984 to 2008 in Wyoming, which is supported by other findings (Doherty et al. 2010b, Harju et al. 2010, Hess and Beck 2012, Taylor et al. 2013, Gregory and Beck 2014). As with other studies, we also found support for 4-year lag effects of oil and gas development on lek attendance (Walker et al. 2007, Doherty et al. 010a, Harju et al. 2010, Gregory and Beck 2014). This result suggests that development likely affects recruitment into the breeding population rather than avoidance of wells by adult males or adult survival. Adult sage-grouse are highly philopatric to lek sites (Dalke et al. 1963, Wallestad and Schladweiler 1974, Emmons and Braun 1984, Dunn and Braun 1985, Connelly et al. 2011a), and males typically recruit to the breeding population in 2–3 years. We would expect a delayed response in lek attendance if development affects recruitment, either by reducing fecundity or avoidance of disturbance by nesting females, as adult males die and are not replaced by young males.
>
> On average, lek attendance was stable when no oil and gas development was present within 6,400m (Fig. 4). However, attendance declined as development increased. [335]

Importantly, Green et al. confirmed that declines in sage-grouse populations may continue even within Wyoming's "core areas," where density of wells is limited to one pad per square mile.

If development of the North Fork Mancos well proposed for Gunnison sage-grouse historic habitat proceeds, significant impacts would result from the permanent loss of sagebrush habitat, which is critical to Gunnison sage-grouse survival and recovery.[336] Recent studies show that sagebrush communities, such as those found within the areas to be leased, are nearly impossible to restore. Drilling sites have not been restored to pre-drilling conditions even after

---

[333] Daniel J. Manier et al., *Conservation Buffer Distance Estimates for Greater Sage-Grouse – A Review* (2014) (attached as Exhibit 250); Adam Green et al., *Investigating Impacts of Oil and Gas Development on Greater Sage-Grouse, Journal of Wildlife Management*, Journal of Wildlife Management (2016), DOI: 10.1002/jwmg.21179 (2016) ("Green et al. 2016") (attached as Exhibit 251).

[334] Green et al. 2016 (attached above as Exhibit 251).

[335] Green et al. 2016 at 9 (attached above as Exhibit 251).

[336] 79 Fed Reg. at 69,208, 69,216.

having 20 or 50 years to recover.[337] Another recent study found that 50 years or more would be required to recover sagebrush on disturbed sites, and that restoring heterogeneous soil conditions with patchy nutrient conditions, was necessary for recovery of large sagebrush and ecosystem resliency.[338]

BLM and USFWS cannot ensure the potential for Gunnison Sage-Grouse to recover without considering historic habitat such as that affected by the North Fork Mancos MDP. As USFWS concluded,

> the species' current potential range includes an estimated 1,621,008 ac in southwestern Colorado and southeastern Utah, comprised of 923,314 ac (57 percent) of occupied habitat and 697,694 ac (43 percent) of unoccupied habitat. Based on these figures, the current potential range of 1,621,008 ac represents approximately 12 percent of the potential historic range of 13,680,640 ac. The estimates above indicate that approximately 88 to 93 percent of the historical range of Gunnison sage-grouse has been lost since Euro-American settlement.[339]

The threat to the continued existence of the Gunnison sage-grouse is extreme, and cannot be alleviated through business as usual on the public lands that comprise a significant share of the species' remaining range. FWS has determined that the Gunnison sage-grouse would become endangered in the "foreseeable future" – which the agency considered to be 40-60 years – even while it acknowledged that six of the species' seven remaining populations are in danger of extinction now and that the seventh, the Gunnison Basin population, has experienced recent declines and faces ongoing threats. Between proposing to list the species as endangered and downgrading it to threatened, FWS now considers one of the seven bird populations (Poncha Pass) to exist only due to the translocation of birds from the Gunnison Basin population. 79 Fed. Reg. at 69,200. Another five of the remaining populations are in decline and considered to be too small to maintain genetic integrity or survive stochastic fluctuations. *Id.* at 69,288, 69,304. The remaining sage-grouse populations are scattered and isolated, and even the largest among them, Gunnison Basin, is not considered to be viable. *Id.* at 69,294-5, 69,303-4. . Cumulatively, population declines and instability, when combined with the changing climate and resulting drought, may cause the Gunnison Basin's population to go extinct in the next 30-58 years. *Id.*

---

[337] Liza Lester, *Sagebrush Ecosystem Recovery Hobbled By Loss Of Soil Complexity At Development Sites,* Ecological Society of America (Jan. 26, 2015), available at http://www.esa.org/esa/sagebrush-ecosystem-recovery-hobbled-by-loss-of-soil-complexity-at-development-sites/ (attached as Exhibit 252).

[338] *Id.*; Tamara J. Minnick & Richard D. Alward, *Plant–Soil Feedbacks and the Partial Recovery of Soil Spatial Patterns on Abandoned Well Pads in a Sagebrush Shrubland*, Ecological Applications, 25(1), 2015, pp. 3–10, available at http://onlinelibrary.wiley.com/doi/10.1890/13-1698.1/full (attached as Exhibit 253).

[339] 79 Fed. Reg. at 69, 228.

It is important to note that USFWS's decision to list the Gunnison sage-grouse as threatened, rather than endangered, was based in part on the assumption that oil and gas development would remain at low levels within the Gunnison Basin Population.[340] The possibility for potentially much higher levels of development activity should Mancos Shale development become a reality in the Gunnison Basin has never been taken into account. Although the current phase one proposal involves only one well within documented Gunnsion sage-grouse habitat, BLM and USFWS must consider the cumulative effects of potentially extensive Mancos Shale drilling on Gunnison Sage-Grouse and its prospects for survival and recovery, both within the Gunnison Basin population and range-wide.

Therefore, prior to authorizing the North Fork Mancos MDP, BLM must both analyze under NEPA, and must consult with USFWS under ESA Section 7, in order to evaluate the effects of the proposed development on Gunnison Sage-Grouse historic habitat, potential for re-colonization, and the species' potential for recovery, both in the Gunnison Basin population and range-wide.

vii. Native Cutthroat Trout and Bluehead Sucker

The North Fork Mancos MDP proposes multiple wells within two miles of streams containing Colorado River Cutthroat Trout habitat, including multiple stretches (Henderson and Roberts Creek) containing populations identified as "conservation populations" in the 2005 status assessment for Colorado River cutthroat trout.[341] Conservation populations are those that are "genetically unaltered (i.e., core conservation populations) or displaying unique life history traits and ecological characteristics in the presence of hybridization (i.e., conservation populations)."[342] The NFMMDP area includes portions of the Clear Fork of Muddy Creek watershed that CPW has identified as strong candidates for cutthroat restoration.[343] The affected watershed also contains Conservation Populations of Colorado River cutthroat trout, and "CPW is concerned that future development could jeopardize this proposed restoration or impact these conservation populations."[344]

Oil and gas developments affect aquatic ecosystems. The overall health of an aquatic habitat derives from the condition of the entire watershed including the uplands, riparian corridor

---

[340] 79 Fed. Reg. at 69,256.
[341] Center for Biological Diversity, Map of North Fork Mancos MDP and Cutthroat Trout Habitat (2017) (attached as Exhibit 254); Christine Hirsch et al., *Range-Wide Status of Colorado River Cutthroat Trout (Oncorhynchus clarkia pleuriticus)* (2005), available at https://www.fws.gov/mountain-prairie/endspp/peerreview/11022006ColoradoRiverCutthroatTroutHirsch2005.pdf (attached as Exhibit 255).
[342] Hirsch 2005 at 6 (attached above as Exhibit 255).
[343] *Id.* at 4.
[344] CPW Comments at 4 (attached as Exhibit 246).

and the stream channel.[345] The decline of native trout is caused primarily by habitat damage (much of it associated with roads, dust, and sedimentation), and the effects of introduced, non-native fish. Roads are a significant cause of trout habitat damage and water quality degradation. In streams where cutthroat share habitat with other non-native salmonids, any habitat degradation is likely to shift the balance to dominance by non-native salmonids.[346] Once non-native trout displace native trout, the situation is almost impossible to reverse.[347]

Roads have many other indirect impacts detrimental to native trout. For example, they provide increased access for overfishing, increased livestock damage to streams, and for stocking of non-native fish; they also provide pathways for pathogens like whirling disease and an increased likelihood of toxic spills.[348]

Recent research has specifically demonstrated that exposure to flowback and produced water resulting from hydraulic fracturing results in multiple adverse biological effects on freshwater fish, specifically rainbow trout.[349] The study was one of the first to directly evaluate the effects of materials used in hydraulic fracturing on aquatic life:

> The lack of available hazard assessment for HF-FPW spills in Canada and the United States hinders environmental impact and risk assessment of hydraulic fracturing activities. Mandatory disclosure of the chemical constituents of fracturing fluids for example, through the chemical disclosure registry, FracFocus, has somewhat improved our understanding but the toxicity data of many chemicals is often missing.The environmental fates of those chemicals are further complicated by potential down-hole reactions and generation of secondary products.Therefore, there exists an obvious need to investigate the toxicity on aquatic organisms. In this study, juvenile rainbow trout (Oncorhynchus mykiss), commonly used as a biologically relevant freshwater model for regulatory science, were used to determine responses to potential spills and leaks of HF-FPW in the aquatic environment. Acute exposures (48 h) were conducted followed by measurements of a variety of endpoints including hepatic and

[345] WY Game and Fish Dep't, *Recommendations for Development of Oil and Gas Resources Within Important Wildlife Habitats* (Apr. 2010) at 11 (attached as Exhibit 128).

[346] Western Native Trout Campaign, *Imperiled Western Trout and the Importance of Roadless Areas* (Nov. 2001) at 12 (attached as Exhibit 129).

[347] *Id.*

[348] *Id*. at 13.

[349] Yuhe He et al., *Effects on Biotransformation, Oxidative Stress, and Endocrine Disruption in Rainbow Trout (Oncorhynchus mykiss) Exposed to Hydraulic Fracturing Flowback and Produced Water*, 51 Environ. Sci. Technol. 940-947 (2017), DOI: 10.1021/acs.est.6b04695 (attached as Exhibit 256).

> ranchial ethoxyresorufin-O-deethylase (EROD) activity, thiobarbituric acid reactive substance (TBARS) formation in various tissues, and mRNA abundance of a battery of genes related to biotransformation, oxidative stress, and endocrine disruption by quantitative real-time polymerase chain reaction (Q-RT-PCR). This is one of the first studies to investigate the physiological responses to HF-FPW exposure in a whole organism.[350]

The results of exposure to flowback and produced water ("HF-FPW") on rainbow trout revealed multiple pathways with potential for adverse effects, including endocrine disruption:

> Adverse effects were observed at high dilutions in both SF and/or S fractions exposure groups, rather than AC fractions exposure groups. This indicates that the organic contaminants rather than the salts per se were the major contributor in acute exposure of diluted HF-FPW in fish. Analysis of multiple biomarkers and gene expression for key markers of adverse effects reveal HFFPW exposure in a biologically relevant fish elicits responses in a variety of pathways, including biotransformation, oxidative stress, and endocrine disruption. Our results further suggest that sediment found in HF-FPW is an important component in causing adverse effects related to biotransformation and oxidative stress pathways, in agreement with our earlier studies. An alternative hypothesis is that the exposure concentration of various contaminants present in HF-FPW was elevated by chemical desorption from sediment particles, thus enhancing the exposure rate. Future study is needed to address the potential adverse effects derived from sediments of HF-FPW, and special attention should be paid to the sediment residues in spill response and the remediation process.[351]

In addition to direct toxicity from hydraulic fracturing fluids and road development facilitated by oil and gas expansion, lack of connectivity to other populations renders greenback cutthroat trout vulnerable in the short term to extirpation from natural disturbances such as fire, post-fire debris torrents, or floods and in the long term to loss of genetic variability and the potential for evolving in response to changing environmental conditions.[352] This lack of connectivity also contributes to the greatest future threat to the persistence of this subspecies—climate change—because model projections suggest some suitable habitats may shift to higher elevations and precipitation patterns imply there may be large declines in late summer flows.[353] the predicted truncation of suitable habitat for cutthroat trout in streams and rivers owing to climate warming, changes in precipitation, and shifts in disturbance regimes must be incorporated into management strategies

[350] *Id.* at 941.

[351] *Id.* at 945-46.

[352] Michael K. Young, *Greenback Cutthroat Trout: a Technical Conservation Assessment* (Feb. 2009) at 3 (attached as Exhibit 130).

[353] *Id.*

to maximize their effectiveness.[354] The BLM must consider the impacts of this project on native cutthroat trout.

Consideration of the effects of the proposed development on native cutthroat trout must also take into account new scientific information, and ongoing scientific and regulatory review, regarding the genetic lineages of native cutthroat trout. Although it was previously assumed that populations in the Gunnison/main-stem Colorado complex of watersheds should be classified as Colorado River Cutthroat Trout, and that the ESA-listed Greenback Cutthroat Trout survived only east of the continental divide, new genetic research published in 2012 has complicated these assumptions.[355] Researchers and Federal and State agencies are still in the process of reviewing this new genetic research and its implications for native cutthroat trout classification, management, and conservation.[356] At a minimum, however, this research raises substantial questions as to whether the various "lineages" of cutthroat trout on the western slope, including the in Gunnison and Colorado watersheds, should be classified as different subspecies, distinct population segments, or otherwise.[357]

Resolution of genetic questions regarding the appropriate classification of west slope cutthroat trout is obviously outside the BLM's area of expertise. Therefore, given the substantial new questions about the status of affected native trout populations, and the risks to native trout and their habitat from oil and gas development and hydraulic fracturing, BLM should avoid authorizing any new development with the potential to affect native trout watersheds and populations. At a minimum, BLM must consult or confer with USFWS prior to authorizing any such activity, against the possibility that the affected native trout populations (a) may constitute greenback cutthroat trout protected under the ESA, or (b) may constitute a subspecies or distinct population segment of Colorado River Cutthroat Trout that may qualify for listing under the ESA.

The NFMMDP project may also potentially impact bluehead sucker (*Catostomus discobolus*), a species of conservation interest to CPW. The West Fork of Muddy Creek is home to this species, and the proposed pad location for DGU 1289 #20-23 is adjacent to Coyote Gulch

---

[354] James Roberts et al., *Consequences of Climate Change for Mountain Lakes and Native Cutthroat Trout* (Jan. 2015) at 3 (attached as Exhibit 131).
[355] *See* Metcalf et al., *Historical Stocking Data and 19th century DNA Reveal Human-Induced Changes to Native Diversity and Distribution of Cutthroat Trout*, Molecular Ecology (2012), doi: 10.1111/mec.12028, http://cmctu.org/wp-content/uploads/2015/11/mec12028_Metcalf_etal_2012.pdf (attached as Exhibit 257).
[356] *See* U.S. Fish and Wildlife Service, Initiation of 5-Year Status Reviews of 21 Species in the Mountain-Prairie Region, 81 Fed. Reg. 33,698 (May 27, 2016); U.S. Fish and Wildlife Service, Final Summary Report: Greenback Cutthroat Trout Genetics and Meristics Studies Facilitated Expert Panel Workshop (May 2014) (attached as Exhibit 258); U.S. Fish and Wildlife Service, Recent Cutthroat Trout Studies in Colorado: Overview of the Endangered Species Act Evaluation Process of Recent Cutthroat Trout Research in Colorado (2012), https://www.fws.gov/coloradoes/Greenback/Cutthroat_Trout_Overview_Fact_Sheet_FINAL.pdf
[357] Greenback Cutthroat Trout Expert Panel Summary at 13-14 (attached above as Exhibit 258).

and Deadman Gulch, two intermittent tributaries to that stream. Map 7 of the Proposed Action shows that a gathering line and access road will be constructed crossing both Deadman and Coyote Gulches. Because of this, "CPW is concerned that construction across these intermittent tributaries could adversely impact bluehead sucker."[358]

viii. Oil and Gas Best Management Practices

As identified herein, oil and gas development can result in serious impacts to the environment and human health. The technology used in oil and gas production has evolved rapidly but, unfortunately, regulation has not kept pace. The BLM's and Colorado's current regulations are insufficient to protect public health and the environment. The use of Best Management Practices ("BMPs") can greatly reduce the risks presented by oil and gas development by incorporating processes and technologies that are readily available.

As an initial matter, BLM must consider risk management in its risk assessment. Risk management has three components 1) risk assessment, 2) risk management plan, 3) risk response. The NEPA process addresses the first component. However, risk assessment is inadequately evaluated if it does not include risk management plans or risk response. Best management practices are often utilized to mitigate risks and should be part of an overall risk management plan. To date, risk response involves physical and mechanical responses to incidents or accidents, for example emergency response. Gunnison County proposes another physical risk response to accidents spills, or leaks in the form of a physical chemical tracer placed in the fracking fluids in order to identify the operator responsible for the spill or leak. This will assist with attributing damages and liability to the responsible party. What's missing in the risk response protocol is a fiscal risk response. Currently, operators are not required to disclose how they will fiscally respond to impacts, which result from their operations, including water quality, air quality, soil quality, asset and property values, etc. In order to assure the agency and the public of the operator's ability to implement its risk management plan and risk response, the operator must demonstrate how it will financially pay for it, including securing insurance, or creating a risk management fund to cover anticipated costs.

NEPA was enacted to promote efforts that will prevent or eliminate damage to the human environment. BMPs help "mitigate" environmental impacts. "Mitigation" is defined in CEQ regulations as measures to help, avoid, reduce or compensate for environmental impacts. 40 CFR 1508.20. The BLM must analyze and implement the following BMPs, which are necessary to account for the inherent risks of development to resources in the planning area:

a. Site Characterization and Corrective Action

Detailed site characterization and planning and baseline testing prior to any oil and gas development are crucial. Site characterization and planning must take into account cumulative impacts over the life of a project or field.

[358] CPW comments at 4 (attached as Exhibit 246).

b. Geologic Suitability

Operators of wells that would be hydraulically fractured must demonstrate to the satisfaction of the regulator that the wells would be sited in a location that is geologically suitable. In order to allow the regulator to determine suitability, the owner or operator must provide:

1. A detailed analysis of regional and local geologic stratigraphy and structure including, at a minimum, lithology, geologic facies, faults, fractures, stress regimes, seismicity, and rock mechanical properties;
2. A detailed analysis of regional and local hydrology including, at a minimum, hydrologic flow and transport data and modeling and aquifer hydrodynamics; properties of the producing and confining zone(s); groundwater levels for relevant formations; discharge points, including springs, seeps, streams, and wetlands; recharge rates and primary zones, and; water balance for the area including estimates of recharge, discharge, and pumping;
3. A detailed analysis of the cumulative impacts of hydraulic fracturing on the geology of producing and confining zone(s) over the life of the project. This must include, but is not limited to, analyses of changes to conductivity, porosity, as well as permeability, geochemistry, rock mechanical properties, hydrologic flow, and fracture mechanics; and
4. A determination that the geology of the area can be described confidently and that the fate and transport of injected fluids and displaced formation fluids can be accurately predicted through the use of models.

Wells that would be hydraulically fractured must be sited such that a suitable confining zone is present. The operator must demonstrate to the satisfaction of the regulator that the confining zone:

1. Is of sufficient areal extent to prevent the movement of fluids to USDWs, based on the projected lateral extent of hydraulically induced fractures, injected hydraulic fracturing fluids, and displaced formation fluids over the life of the project;
2. Is sufficiently impermeable to prevent the vertical migration of injected hydraulic fracturing fluids or displaced formation fluids over the life of the project;
3. Is free of transmissive faults or fractures that could allow the movement of injected hydraulic fracturing fluids or displaced formation fluids to USDWs;
4. Contains at least one formation of sufficient thickness and with lithologic and stress characteristics capable of preventing or arresting vertical propagation of fractures; and
5. The regulator may require operators of wells that would be hydraulically fractured to identify and characterize additional zones that would impede or contain vertical fluid movement.

c. Area of Review

Operators must delineate an “area of review,” which is the immediate area around a well or group of wells that would be hydraulically fractured where USDWs may be endangered. It should be delineated based on 3D geologic and reservoir modeling that accounts for the physical and chemical extent of hydraulically induced fractures, injected hydraulic fracturing fluids and proppant, and displaced formation fluids and must be based on the life of the project. The physical extent would be defined by the modeled length and height of the fractures, horizontal,

and vertical penetration of hydraulic fracturing fluids and proppant, and horizontal and vertical extent of the displaced formation fluids. The chemical extent would be defined by that volume of rock in which chemical reactions between the formation, hydrocarbons, formation fluids, or injected fluids may occur, and should take into account potential migration of fluids over time. The model must take into account all relevant geologic and engineering information including but not limited to:

1. Rock mechanical properties, geochemistry of the producing and confining zone, and anticipated hydraulic fracturing pressures, rates, and volumes;
2. Geologic and engineering heterogeneities;
3. Potential for migration of injected and formation fluids through faults, fractures, and manmade penetrations; and
4. Cumulative impacts over the life of the project.

As actual data and measurements become available, the model must be updated and history matched. Operators must develop, submit, and implement a plan to delineate the area of review. The plan should include the time frame under which the delineation would be reevaluated, including those operational or monitoring conditions that would trigger such a reevaluation.

Within the area of review, operators must identify all wells that penetrate the producing and confining zones and provide:

1. A list of all such wells, including but not limited to wells permitted but not yet drilled, drilling, awaiting completion, active, inactive, shut-in, temporarily abandoned, plugged, and orphaned;
2. A description of each well's type, construction, date drilled, location, depth, record of plugging and/or completion, and any additional information the Division may require;
3. An assessment of the integrity of each well identified;
4. A plan for performing corrective action if any of the wells identified are improperly plugged, completed, or abandoned;
5. An assessment to determine the risk that the stimulation treatment would communicate with each well identified;
6. For each well identified as at-risk for communication, a plan for well control, including but not limited to:

    a. A method to monitor for communication;
    b. A determination of the maximum pressure which the at-risk well can withstand;
    c. Actions to maintain well control;
    d. If the at-risk well is not owned or operated by the owner/operator of the well to be stimulated, a plan for coordinating with the offset well operator to prevent loss of well control;

7. The location, orientation, and properties of known or suspected faults, fractures, and joint sets;
8. An evaluation of whether such features may act as migration pathways for injected fluids or displaced formation fluids to reach protected water or the surface;

9. An assessment to determine the risk that the stimulation treatment will communicate with such features; and
10. If such features may act as migration pathways and are at-risk for communication, the stimulation design must be revised to ensure that the treatment would not communicate with such features or the well must be re-sited.

This information should be provided with the stimulation permit application. Communication between offset wells during stimulation is a serious problem, risking blowouts in adjacent wells and/or aquifer contamination during well stimulation. A New Mexico oil well recently experienced a blowout, resulting in a spill of more than 8,400 gallons of fracturing fluid, oil, and water. The blowout occurred when a nearby well was being hydraulically fractured and the fracturing fluids intersected this offset well.[359] The incident led the New Mexico Oil Conservation Division to request information about other instances of communication between wells during drilling, completion, stimulation or production operations.[360] Incidents of communication between wells during stimulation have been documented in British Columbia[361], Pennsylvania,[362] Texas, and other states across the country.[363]

The Alberta Energy Regulator ("AER"), the oil and gas regulator in Alberta, Canada, recognized that communication between wells during fracturing is a serious risk to well integrity and groundwater after a number of spills and blowouts resulted from communication between wells during fracturing. As a result, AER created requirements to address the risk of communication and reduce the likelihood of occurrence.[364] Similarly, Enform, a Canadian oil and gas industry safety association, published recommended practices to manage the risk of communication.[365] We recommend that the BLM review these rules and incorporate similar requirements.

---

[359] Tina Jensen, *Fracking fluid blows out nearby well; Cleanup costs, competing technologies at issue*, KASA.COM. (Oct. 18 2013).
[360] State of New Mexico, Energy, Minerals and Natural Resources Department, *Aztec District III-Request for information*, n.p., (Oct. 22, 2013).
[361] "BC Oil and Gas Commission, *Safety Advisory 2010-03, May 20, 2010: Communication During Fracture Stimulation*, n.p. (May 20 2010).
[362] *See, e.g.* Scott Detrow, *Perilous Pathways: How Drilling Near An Abandoned Well Produced a Methane Geyser,* State Impact Pennsylvania, NPR (October 9, 2012); Pennsylvania Department of Environmental Protection, Bureau of Oil and Gas Management, *Draft Report - Stray Natural Gas Migration Associated with Oil and Gas Wells* (October 28, 2009).
[363] Gayathri Vaidyanathan, *When 2 wells meet, spills can often follow*, ENERGYWIRE (Aug. 5, 2013).
[364] Alberta Energy Board, *Directive 083: Hydraulic Fracturing – Subsurface Integrity* (May 2013) at 15, available at: http://www.aer.ca/documents/directives/Directive083.pdf (attached as Exhibit 162).
[365] Enform Canada, *Interim IRP 24: Fracture Stimulation: Interwellbore Communication; An Industry Recommended Practice For The Canadian Oil And Gas Industry*, Interim Volume 24, 1st Edition (Mar. 27, 2013).

d. Baseline Water Testing.

Operators must submit to the regulator a statistically significant sample, as determined by the regulator, of existing and/or new geochemical analyses of each of the following, within the area of review:

1. Any and all sources of water that serve as underground sources of drinking water ("USDWs") in order to characterize baseline water quality. This data must be made publically available through an online, geographically-based reporting system. The sampling methodology must be based on local and regional hydrologic characteristics such as rates of precipitation and recharge and seasonal fluctuations. At a minimum, characterization must include:
    a. Standard water quality and geochemistry;[366]
    b. Stable isotopes;
    c. Dissolved gases;
    d. Hydrocarbon concentration and composition. If hydrocarbons are present in sufficient quantities for analysis, isotopic composition must be determined;
    e. Chemical compounds or constituents thereof, or reaction products that may be introduced by the drilling or hydraulic fracturing process. The use of appropriate marker chemicals is permissible provided that the operator can show scientific justification for the choice of marker(s);
    Operators should also consider testing for environmental tracers to determine groundwater age;
2. Any hydrocarbons that may be encountered both vertically and really throughout the area of review;
3. The producing zone(s) and confining zone(s) and any other intervening zones as determined by the regulator. At a minimum, characterization must include:
    a. Mineralogy;
    b. Petrology; and
    c. Major and trace element bulk geochemistry.

The site characterization and planning data listed above does not have to be submitted with each individual well application as long as such data is kept on file with the appropriate regulator and the well for which a permit is being sought falls within the designated area of review.

[366] Including: Turbidity, Specific Conductance, Total Solids, Total Dissolved Solids, pH, Dissolved Oxygen, Redox State, Alkalinity, Calcium, Magnesium, Sodium, Potassium, Sulfate, Chloride, Fluoride, Bromide, Silica, Nitrite, Nitrate + Nitrite, Ammonia, Phosphorous, Total Organic Carbon, Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Bromide, Cadmium, Chromium, Cobalt, Copper, Cyanide, Iron, Lead, Manganese, Mercury, Molybdenum, Nickel, Selenium, Silver, Strontium, Thallium, Thorium, Uranium, Vanadium, Zinc, Cryptosporidium, Giardia, Plate Count, Legionella, Total Coliforms, and Organic Chemicals including Volatile Organic Compounds (VOCs).

e. Water Use and Disposal Planning

Operators must submit to the regulator a plan for cumulative water use over the life of the project. The plan should take into account other activities that would draw water from the same sources, such as agricultural or industrial activities; designated best use; seasonal and longer timescale variations in water availability; and historical drought information. Elements of the plan must include but are not limited to:

1. The anticipated source, timing, and volume of withdrawals and intended use;
2. Anticipated transport distances and methods (e.g. pipeline, truck) and methods to minimize related impacts including, but not limited to: land disturbance, traffic, vehicle accidents, and air pollution;
3. Anticipated on-site storage methods;
4. A description of methods the operator will use to maximize the use of non-potable water sources including reuse and recycling of wastewater;
5. An evaluation of potential adverse impacts to aquatic species and habitat, wetlands, and aquifers, including the potential for the introduction of invasive species, and methods to minimize those impacts; and
6. Anticipated chemical additives and chemical composition of produced water, with particular attention to those chemicals that would hinder the reuse or recycling of wastewater or pose a challenge to wastewater treatment.

Operators must submit to the regulator a proposed plan for handling wastewater, such as flowback and produced fluids. Elements of the plan must include, but are not limited to:

1. Anticipated cumulative volumes of wastewater over the life of the project, reported in three categories: reuse, recycle, and disposal;
2. Anticipated on-site temporary storage methods;
3. Anticipated transport distances and methods (e.g. pipeline, truck) and methods to minimize related impacts including, but not limited to: land disturbance, traffic, vehicle accidents, and air pollution; and
4. An assessment of currently available and anticipated disposal methods, *e.g.* disposal wells, wastewater treatment facilities, etc. This assessment must enumerate the disposal options available and evaluate the ability of those options to handle projected wastewater volumes. In the case of wastewater treatment facilities, the assessment must also evaluate the ability of those facilities to successfully treat the wastewater such that it would not pose a threat to water supplies into which it is discharged.

f. Well Design and Construction

Proper well construction is crucial to ensuring protection of USDWs. The first step to ensuring good well construction is ensuring proper well drilling techniques are used. This includes appropriate drilling fluid selection, to ensure that the wellbore would be properly conditioned and to minimize borehole breakouts and rugosity that may complicate casing and cementing operations. Geologic, engineering, and drilling data can provide indications of potential complications to achieving good well construction, such as highly porous or fractured intervals, lost circulation events, abnormally pressured zones, or drilling “kicks” or “shows.”

These must be accounted for in designing and implementing the casing and cementing program. Reviewing data from offset wellbores can be helpful in anticipating and mitigating potential drilling and construction problems. Additionally, proper wellbore cleaning and conditioning techniques must be used to remove drilling mud and ensure good cement placement. Hydraulic fracturing requires fluid to be injected into the well at high pressure and, therefore, wells must be appropriately designed and constructed to withstand this pressure. The casing and cementing program must:

- Properly control formation pressures and fluids;
- Prevent the direct or indirect release of fluids from any stratum to the surface;
- Prevent communication between separate hydrocarbon-bearing strata;
- Protect freshwater aquifers/useable water from contamination;
- Support unconsolidated sediments;
- Protect and/or isolate lost circulation zones, abnormally pressured zones, and any prospectively valuable mineral deposits.

Casing must be designed to withstand the anticipated stresses imposed by tensile, compressive, and buckling loads; burst and collapse pressures; thermal effects; corrosion; erosion; and hydraulic fracturing pressure. The casing design must include safety measures that ensure well control during drilling and completion and safe operations during the life of the well. The components of a well that ensure the protection and isolation of USDWs are steel casing and cement. Multiple strings of casing are used in the construction of oil and gas wells, including: conductor casing, surface casing, production casing, and potentially intermediate casing. For all casing strings, the design and construction should be based on Good Engineering Practices ("GEP"), Best Available Technology ("BAT"), and local and regional engineering and geologic data. All well construction materials must be compatible with fluids with which they may come into contact and be resistant to corrosion, erosion, swelling, or degradation that may result from such contact.

g. Conductor Casing

Depending on local conditions, conductor casing can either be driven into the ground, or a hole drilled and the casing lowered into the hole. In the case where a hole is excavated, the space between the casing and the wellbore—the annulus—should be cemented to surface. A cement pad should also be constructed around the conductor casing to prevent the downward migration of fluids and contaminants.

h. Surface Casing

Surface casing setting depth must be based on relevant engineering and geologic factors, but be shallower than any hydrocarbon-bearing zones, and at least 100 feet but not more than 200 feet below the deepest protected water. If shallow hydrocarbon-bearing zones are encountered when drilling the surface casing portion of the hole, operators must notify regulators and take appropriate steps to ensure protection of protected water.

Surface casing must be fully cemented to surface by the pump and plug method. If cement returns are not observed at the surface, remedial cementing must be performed to cement the casing from the top of cement to the ground surface.

i. Intermediate Casing

Depending on local geologic and engineering factors, one or more strings of intermediate casing may be required. This would depend on factors including, but not limited to: the depth of the well, the presence of hydrocarbon-or fluid-bearing formations, abnormally pressured zones, lost circulation zones, or other drilling hazards. Casing setting depth must be based on local engineering and geologic factors and be set at least 100 feet below the deepest protected water, anomalous pressure zones, lost circulation zones, and other drilling hazards. Intermediate casing must be set to protect groundwater if surface casing was set above the base of protected water, and/or if additional protected water was found below the surface casing shoe.

When intermediate casing is installed to protect groundwater, the operator shall set a full string of new intermediate casing to a minimum depth of at least 100 feet below the base of the deepest strata containing protected water and cement to the surface. The location and depths of any hydrocarbon strata or protected water strata that is open to the wellbore above the casing shoe must be confirmed by coring, electric logs, or testing, and shall be reported as part of the completion report.

When intermediate casing is set for a reason other than to protect strata that contain protected water, it must be fully cemented to surface unless doing so would result in lost circulation. Where this is not possible or practical, the cement must extend from the casing shoe to 600 feet above the top of the shallowest zone to be isolated (*e.g*. productive zone, abnormally pressured zone, etc.). Where the distance between the casing shoe and shallowest zone to be isolated makes this technically infeasible, multi-stage cementing must be used to isolate any hydrocarbon or fluid-bearing formations or abnormally pressured zones and prevent the movement of fluids. An excess of 25% cement should be mixed unless a caliper log is run to more accurately determine necessary cement volume.

j. Production Casing

If both surface casing and intermediate casing are used as water protection casing, or if intermediate casing is not used, a full string of production casing is required. A production liner may be hung from the base of the intermediate casing and used as production casing as long as the surface casing is used as the water protecting casing, and intermediate casing is set for a reason other than isolation of protected water. When the production string does not extend to the surface, at least 200 feet of overlap between the production string and next larger casing string should be required. This overlap should be cemented and tested by a fluid-entry test at a pressure that is at least 500 psi higher than the maximum anticipated pressure to be encountered by the wellbore during completion and production operations to determine whether there is a competent seal between the two casing strings.

When intermediate casing is not used, production casing must be fully cemented to surface unless doing so would result in lost circulation. If not cemented to the surface, production casing shall be cemented with sufficient cement to fill the annular space from the casing shoe to at least 600 feet above fluid-bearing formations, lost circulation zones, oil and gas zones, anomalous pressure intervals, or other drilling hazards. Where the distance between the casing shoe and shallowest zone to be isolated makes this technically infeasible, multi-stage cementing must be used to isolate any hydrocarbon or fluid-bearing formations or abnormally pressured zones and prevent the movement of fluids. Sufficient cement shall also be used to fill the annular space to at least 100 feet above the base of the freshwater zone, either by lifting cement around the casing shoe or cementing through perforations or a cementing device placed at or below the base of the freshwater zone.

k. General

For surface, intermediate, and production casing, at a minimum, centralizers are required at the top, shoe, above, and below a stage collar or diverting tool (if used), and through all protected water zones. In non-deviated holes, a centralizer shall be placed every fourth joint from the cement shoe to the ground surface or to within one joint of casing from the bottom of the cellar, or casing shall be centralized by implementing an alternative centralization plan approved by the BLM. In deviated holes, the BLM may require the operator to provide additional centralization. All centralizers must meet API Spec 10D (Recommended Practice for Casing Centralizers – for bow string centralizers), or API Spec 10 TR4 (rigid and solid centralizers) and 10D-2 (Petroleum and Natural Gas Industries, Equipment for Well Cementing, Part 2, Centralizer Placement and Stop Collar Testing).

All cemented casing strings must have a uniformly concentric cement sheath of at least 1" (*i.e*. minimum difference of 2" between wellbore diameter and casing outside diameter). An excess of 25% cement should be mixed unless a caliper log is run to more accurately determine necessary cement volume.

For any section of the well drilled through fresh water-bearing formations, drilling fluids must be limited to air, fresh water, or fresh water based mud, and exclude the use of synthetic or oil-based mud or other chemicals.

In areas where the depth to the lowest protected water is not known, operators must estimate this depth and provide the estimate with the application for a permit to drill. This depth should then be verified by running petrophysical logs, such as resistivity logs, after drilling to the estimated depth. If the depth to the deepest protected water is deeper than estimated, an additional string of casing is required. Surface casing must be of sufficient diameter to allow the use of one or more strings of intermediate casing. All instances of protected water not anticipated on the permit application must be reported, including the formation depth and thickness and water flow rate, if known or estimated.

All cement must have a 72-hour compressive strength of at least 1200 psi and free water separation of no more than two milliliters per 250 milliliters of cement, tested in accordance with the current API RP 10B. Cement must conform to API Specification 10A and gas-blocking

additives must be used. Cement mix water chemistry must be proper for the cement slurry designs. At a minimum, the water chemistry of the mix water must be tested for pH prior to use, and the cement must be mixed to manufacturer's recommendations. An operator's representative must be on-site verifying that the cement mixing, testing, and quality control procedures used for the entire duration of the cement mixing and placement are consistent with the approved engineered design and meet the cement manufacturer recommendations, API standards, and the requirements of this section.

Compressive strength tests of cement mixtures without published performance data must be performed in accordance with the current API RP 10B and the results of these tests must be provided to the regulator prior to the cementing operation. The test temperature must be within 10 degrees Fahrenheit of the formation equilibrium temperature at the top of cement. A better quality of cement may be required where local conditions make it necessary to prevent pollution or provide safer operating conditions.

Prior to cementing, the hole must be prepared to ensure an adequate cement bond by circulating at least two hole volumes of drilling fluid and ensuring that the well is static and all gas flows are killed. Top and bottom wiper plugs and spacer fluids must be used to separate drilling fluid from cement and prevent cement contamination. Casing must be rotated and reciprocated during cementing when possible and when doing so would not present a safety risk. Cement should be pumped at a rate and in a flow regime that inhibits channeling of the cement in the annulus. During placement of the cement, operator shall monitor pump rates to verify they are within design parameters to ensure proper displacement efficiency. Throughout the cementing process operator shall monitor cement mixing in accordance with cement design and cement densities during the mixing and pumping.

All surface, intermediate, and production casing strings must stand under pressure until a compressive strength of 500 psi is reached before drilling out, initiating testing, or disturbing the cement in any way. In no case should the wait-on-cement ("WOC") time be less than 8-hours. All surface, intermediate, and production casing strings must be pressure tested. Drilling may not be resumed until a satisfactory pressure test is obtained. Casing must be pressure tested to a minimum of 0.5 psi/foot of casing string length or 1500 psi, whichever is greater, but not to exceed 80% of the minimum internal yield. If the pressure declines more than 10% in a 30-minute test or if there are other indications of a leak, corrective action must be taken.

A formation integrity test ("FIT") must be performed immediately after drilling out of all surface and intermediate casing. The test should demonstrate that the casing shoe will maintain integrity at the anticipated pressure to which it would be subjected while drilling the next section of the well, no flow path exists to formations above the casing shoe, and that the casing shoe is competent to handle an influx of formation fluid or gas without breaking down. If any FIT fails, the operator must contact the BLM and remedial action must be taken to ensure that no migrations pathways exist. The casing and cementing plan may need to be revised to include additional casing strings in order to manage pressure properly.

Cement integrity and location must be verified using cement evaluation tools that can detect channeling in 360 degrees. If fluid returns, lift pressure, displacement and/or other

operations indicate inadequate cement coverage, the operator must: (i) run a radial cement evaluation tool, a temperature survey, or other test approved by the Division to identify the top of cement; (ii) submit a plan for remedial cementing to the Division for approval; and (iii) implement such plan by performing additional cementing operations to remedy such inadequate coverage prior to continuing drilling operations. Cement evaluation logging must be performed on all strings of cemented casing that isolate protected water, potential flow zones, or through which stimulation will be performed.

When well construction is completed, the operator should certify, in writing, that the casing and cementing requirements were met for each casing string.

l. Well Logs

After drilling the well but prior to casing and cementing operations, operators must obtain well logs to aid in the geologic, hydrologic, and engineer characterization of the subsurface. Open hole logs, *i.e.* logs run prior to installing casing and cement, should at a minimum include:

Gamma Ray Logs:

Gamma ray logs detect naturally occurring radiation. These logs are commonly used to determine generic lithology and to correlate subsurface formations. Shale formations have higher proportions of naturally radioactive isotopes than sandstone and carbonate formations. Thus, these formations can be distinguished in the subsurface using gamma ray logs.

Density/Porosity Logs:

Two types of density logs are commonly used: bulk density logs, which are in turn used to calculate density porosity, and neutron porosity logs. While not a direct measure of porosity, these logs can be used to calculate porosity when the formation lithology is known. These logs can be used to determine whether the pore space in the rock is filled with gas or with water.

Resistivity Logs:

These logs are used to measure the electric resistivity, or conversely conductivity, of the formation. Hydrocarbon and fresh water-bearing formations are resistive, *i.e.* they cannot carry an electric current. Brine-bearing formations have a low resistivity, *i.e.* they can carry an electric current. Resistivity logs can therefore be used to help distinguish brine-bearing from hydrocarbon-bearing formations. In combination with Darcy's Law, resistivity logs can be used to calculate water saturation.

Caliper Logs:

Caliper logs are used to determine the diameter and shape of the wellbore. These are crucial in determining the volume of cement that must be used to ensure proper cement placement.

These four logs, run in combination, make up one of the most commonly used logging suites. Additional logs may be desirable to further characterize the formation, including but not limited to Photoelectric Effect, Sonic, Temperature, Spontaneous Potential, Formation Micro-

Imaging (“FMI”), Borehole Seismic, and Nuclear Magnetic Resonance (“NMR”). The use of these and other logs should be tailored to site-specific needs.

m. Core and Fluid Sampling

Operators of wells that would be hydraulically fractured should also obtain whole or sidewall cores of the producing and confining zone(s) and formation fluid samples from the producing zone(s). At a minimum, routine core analysis should be performed on core samples representative of the range of lithology and facies present in the producing and confining zone(s). Special Core Analysis (“SCAL”) should also be considered, particularly for samples of the confining zone, where detailed knowledge of rock mechanical properties is necessary to determine whether the confining zone can prevent or arrest the propagation of fractures. Operators should also record the fluid temperature, pH, conductivity, reservoir pressure, and static fluid level of the producing and confining zone(s). Operators should prepare and submit a detailed report on the physical and chemical characteristics of the producing and confining zone(s) and formation fluids that integrates data obtained from well logs, cores, and fluid samples. This must include the fracture pressure of both the producing and confining zone(s). This data does not need to be gathered for every well but operators should obtain a statistically significant number of samples.

n. Mechanical Integrity

Operators must maintain mechanical integrity of wells at all times. Mechanical integrity should be periodically tested by means of a pressure test with liquid or gas, a tracer survey such as oxygen activation logging or radioactive tracers, a temperature or noise log, and a casing inspection log. The frequency of such testing should be based on-site, with operation specific requirements and be delineated in a testing and monitoring plan prepared, submitted, and implemented by the operator. These tests should be made available to the public.

Mechanical integrity and annular pressure should be monitored over the life of the well. Instances of sustained casing pressure can indicate potential mechanical integrity issues. The annulus between the production casing and tubing (if used) should be continually monitored. Continuous monitoring allows problems to be identified quickly so repairs may be made in a timely manner, reducing the risk that a wellbore problem will result in contamination of USDWs.

o. Operations and Monitoring

Each hydraulic fracturing treatment must be modeled using a 3D geologic and reservoir model, as described in the Area of Review requirements, prior to operation to ensure that the treatment will not endanger USDWs. Prior to performing a hydraulic fracturing treatment, operators should perform a pressure fall-off or pump test, injectivity tests, and/or a mini-frac. Data obtained from such tests can be used to refine the hydraulic fracture model, design, and implementation.

Prior to well stimulation, all casing and tubing to be used by the operator to perform the stimulation treatment must be pressure tested. For cemented completions, the test pressure must

be at least 500 psi greater than the anticipated maximum surface pressure to be experienced during the stimulation operation or the life of the completion operation. For non-cemented completions, the test pressure must be a minimum of: (i) 70% of the lowest activating pressure for pressure actuated sleeve completions; or (ii) 70% of formation integrity for open-hole completions, as determined by a formation integrity test. A failed test is one in which the pressure declines more than 10% in a 30-minute test or if there are other indications of a leak.

In the event of a failed test, the operator must:

1. Orally notify the authorized officer as soon as practicable but no later than 24 hours following the failed test, and;
2. Perform remedial work to restore mechanical integrity.

Stimulation operations may not begin until a successful mechanical integrity test is performed and the results are submitted to the regulator. If mechanical integrity cannot be restored, the well must be plugged and abandoned.

During the well stimulation operation, the operator must continuously monitor and record the pressures in each well annuli, surface injection pressure, slurry rate, proppant concentration, fluid rate, and the identities, rates, and concentrations of all additives (including proppant).

If during any stimulation operation the annulus pressure:

1. Increases by more than 500 pounds per square inch as compared to the pressure immediately preceding the stimulation; or
2. Exceeds 80% of the API rated minimum internal yield on any casing string in communication with the stimulation treatment;

the operation must immediately cease, and the operator must take immediate corrective action and orally notify the authorized officer immediately following the incident. Within one week after the stimulation operations are completed, the operator must submit a report containing all details pertaining to the incident, including corrective actions taken.

If at any point during the hydraulic fracturing operation the monitored parameters indicate a loss of mechanical integrity or if injection pressure exceeds the fracture pressure of the confining zone(s), the operation must immediately cease. If either occurs, the operator must notify the regulator within 24 hours and must take all necessary steps to determine the presence or absence of a leak or migration pathways to USDWs. Prior to any further operations, mechanical integrity must be restored and demonstrated to the satisfaction of the regulator and the operator must demonstrate that the ability of the confining zone(s) to prevent the movement of fluids to USDWs has not been compromised. If a loss of mechanical integrity is discovered or if the integrity of the confining zone has been compromised, operators must take all necessary steps to evaluate whether injected fluids or formation fluids may have contaminated or have the potential to contaminate any unauthorized zones. If such an assessment indicates that fluids may have been released into a USDW or any unauthorized zone, operators must notify the regulator within 24 hours, take all necessary steps to characterize the nature and extent of the release, and comply with and implement a remediation plan approved by the regulator. If such contamination

occurs in a USDW that serves as a water supply, a notification must be placed in a newspaper available to the potentially affected population and on a publically accessible website and all known users of the water supply must be individually notified immediately by mail and by phone.

The use of diesel fuel and related products, BTEX compounds, and 2-BE in well stimulation fluids should be prohibited.

Techniques to measure actual fracture growth should be used, including downhole tiltmeters and microseismic monitoring. These techniques can provide both real-time data and, after data processing and interpretation, can be used in post-fracture analysis to inform fracture models and refine hydraulic fracture design. Tiltmeters measure small changes in inclination and provide a measure of rock deformation. Microseismic monitoring uses highly sensitive seismic receivers to measure the very low energy seismic activity generated by hydraulic fracturing.

Hydraulic fracturing fluid and proppant can sometimes be preferentially taken up by certain intervals or perforations. Tracer surveys and temperature logs can be used to help determine which intervals were treated. Tracers can be either chemical or radioactive and are injected during the hydraulic fracturing operation. After hydraulic fracturing is completed, tools are inserted into the well that can detect the tracer(s). Temperature logs record the differences in temperature between zones that received fracturing fluid, which is injected at ambient surface air temperature, and in-situ formation temperatures, which can be in the hundreds of degrees Fahrenheit.

Operators should develop, submit, and implement a long-term groundwater quality monitoring program. Dedicated water quality monitoring wells should be used to help detect the presence of contaminants prior to their reaching domestic water wells. Placement of such wells should be based on detailed hydrologic flow models and the distribution and number of hydrocarbon wells. Baseline monitoring should begin at least a full year prior to any activity, with monthly or quarterly sampling to characterize seasonal variations in water chemistry. Monitoring should continue a minimum of 5 years prior to plugging and abandonment.

p. Reporting

At a minimum, operators must report:

- All instances of hydraulic fracturing injection pressure exceeding operating parameters as specified in the permit;
- All instances of an indication of loss of mechanical integrity;
- Any failure to maintain mechanical integrity;
- The results of:
  - Continuous monitoring during hydraulic fracturing operations;
  - Techniques used to measure actual fracture growth; and
  - Any mechanical integrity tests;
- The detection of the presence of contaminants pursuant to the groundwater quality monitoring program;

- Indications that injected fluids or displaced formation fluids may pose a danger to USDWs;
- All spills and leaks; and
- Any non-compliance with a permit condition.

The following must be made publically available on a well-by-well basis through an online, geographically based reporting system, a minimum of 30 days prior to a hydraulic fracturing operation:

1. Baseline water quality analyses for all USDWs within the area of review;
2. Proposed source, volume, geochemistry, and timing of withdrawal of all base fluids; and
3. Proposed chemical additives (including proppant coating), reported by their type, chemical compound or constituents, and Chemical Abstracts Service ("CAS") number, and the proposed concentration or rate and volume percentage of all additives.

The following must be made publically available on a well-by-well basis through an online, geographically based reporting system, a maximum of 30 days subsequent to a hydraulic fracturing operation:

1. Actual source, volume, geochemistry and timing of withdrawal of all base fluids;
2. Actual chemical additives used, reported by their type, chemical compound or constituents, CAS number, and the actual concentration or rate and volume percentage of all additives; and
3. Geochemical analysis of flowback and produced water, with samples taken at appropriate intervals to determine changes in chemical composition with time and sampled until such time as chemical composition stabilizes.

q. Emergency and Remedial Response

Operators must develop, submit, and implement an emergency response and remedial action plan. The plan must describe the actions the operator will take in response to any emergency that may endanger human life or the environment—including USDWs—such as blowouts, fires, explosions, or leaks and spills of toxic or hazardous chemicals. The plan must include an evaluation of the ability of local resources to respond to such emergencies and, if found insufficient, how emergency response personnel and equipment will be supplemented. Operators should detail what steps they will take to respond to cases of suspected or known water contamination, including notification of users of the water source. The plan must describe what actions will be taken to replace the water supplies of affected individuals in the case of the contamination of a USDW.

r. Plugging and Abandonment

Prior to plugging and abandoning a well, operators should determine bottom hole pressure and perform a mechanical integrity test to verify that no remedial action is required. Operators should develop and implement a well plugging plan. The plugging plan should be submitted with the permit application and should include the methods that will be used to: determine bottom hole pressure and mechanical integrity; the number and type of plugs that will

be used; plug setting depths; the type, grade, and quantity of plugging material that will be used; the method for setting the plugs; and a complete wellbore diagram showing all casing setting depths and the location of cement and any perforations.

Plugging procedures must ensure that hydrocarbons and fluids will not migrate between zones, into USDWs, or to the surface. A cement plug should be placed at the surface casing shoe and extend at least 100 feet above and below the shoe. All hydrocarbon-bearing zones should be permanently sealed with a plug that extends at least 100 feet above and below the top and base of all hydrocarbon-bearing zones. Plugging of a well must include effective segregation of uncased and cased portions of the wellbore to prevent vertical movement of fluid within the wellbore. A continuous cement plug must be placed from at least 100 feet below to 100 feet above the casing shoe. In the case of an open hole completion, any hydrocarbon or fluid-bearing zones shall be isolated by cement plugs set at the top and bottom of such formations, and that extend at least 100 feet above the top and 100 feet below the bottom of the formation.

At least 60-days prior to plugging, operators must submit a notice of intent to plug and abandon. If any changes have been made to the previously approved plugging plan the operator must also submit a revised plugging plan. No later than 60-days after a plugging operation has been completed, operators must submit a plugging report, certified by the operator and person who performed the plugging operation.

After plugging and abandonment, operators must continue to conduct monitoring and provide financial assurance for an adequate time period, as determined by the regulator, that takes into account site-specific characteristics including but not limited to:

- The results of hydrologic and reservoir modeling that assess the potential for movement of contaminants into USDWs over long time scales; and
- Models and data that assess the potential degradation of well components (*e.g.* casing, cement) over time and implications for mechanical integrity and risks to USDWs.

9. Unregulated Gas Gathering Pipelines.

The BLM must consult agencies with pipeline safety jurisdiction to consider the environmental, public safety, and human health impacts associated with a web of unregulated gas gathering pipelines. Rural gas gathering pipelines are exempt from federal pipeline safety regulations and therefore state regulation. 49 CFR § 192. Unregulated gas gathering pipelines are at higher risk of failure than regulated pipelines. *See* PHMSA Notice of Proposed Rulemaking on Gas Transmission and Gathering Lines 68 Fed. Reg. 20728 (April 8, 2016) (amending 49 CFR Parts 191 and 192). The project estimates .84 mile (4439 feet) of new gathering lines.

BLM must include the following in its risk analysis:

1. The lack of risk management regulations to ensure public safety when it comes to rural gas gathering pipelines.

a. Under current federal and state regulations, the BLM and oil and gas operators have no way of assuring the public that rural gas gathering pipelines will be properly constructed to prevent

risks of failure. Regulatory agencies do not have specific knowledge of the construction of rural gas gathering pipelines because they are largely non-jurisdictional to federal and state oversight.[367]

b. Under current federal and state regulations, oil and gas operators do not have an obligation to disclose incremental failures that may occur or may have occurred on unregulated gas gathering pipelines. All oil and gas operators are only required to report gas leaks that necessitate evacuation of people or closure of a public road, or result in a defined incident.[368]

c. Non jurisdictional pipeline operators are not required to take all practicable measures to protect pipelines from "washouts, floods, unstable soil, landslides, or other hazards that may cause the pipeline to move or to sustain abnormal loads."[369] While Colorado pipeline safety regulators expect "that an operator be able to demonstrate through appropriate documentation that it has addressed its obligations under §192.317... which would include addressing all potential geologic hazards," this is not guaranteed. BLM has not demonstrated that it has taken geologic hazards into consideration from a pipeline safety perspective.

d. The Pipeline Hazardous Materials and Safety Administration (PHMSA) has exclusive jurisdiction over pipeline safety. Intrastate pipelines are delegated to the states via an interagency agreement with PHMSA called a "certification agreement."[370] To our knowledge, no such agreement exists in Colorado.

e. In the current regulatory environment, state and federal pipeline safety inspectors do not specifically keep records on jurisdictional pipeline operator's contractors. Instead, it is expected that the operators themselves have records regarding work performed on the pipeline by contractors so that they have an adequate ability to trace and remedy any issues associated with the contractor's work. Therefore neither BLM, COGCC, nor the state and federal pipeline safety inspectors have visibility into the qualification of contractors or whether the actual work performed was adequate.[371] In addition, existing federal pipeline safety rules do not address or require accurate mapping of gas gathering pipelines. "Due to the sheer mileage of active pipeline in the United States, regulatory agencies rarely keep detailed operator maps."[372]

2. The risks to public safety from unregulated rural gas gathering pipelines.

a. The BLM must consider the cumulative impact and environmental risk currently operational unregulated pipelines and adding an addition .84 mile of unregulated pipelines to the project area. This estimate of gas gathering pipeline mileage assumes 1 mile of gathering pipeline per

[367] *See* Letter from Joe Molloy, Section Chief, COPUC Pipeline Safety Program, to Natasha Leger (October 17, 2016) (attached as Exhibit 305) ("Molloy Letter").
[368] *Id.*
[369] *See id*; 49 CFR 192.317.
[370] *A Regulatory Review of Liquid and Natural Gas Pipelines in Colorado* at 4 (December 2014) (attached as Exhibit 306).
[371] Molloy Letter at 6.
[372] Molloy Letter at 7.

well, a conservative estimate compared to 1.65 miles of gathering pipeline in the Marcellus Shale region.[373] In addition, because the BLM's oil and gas assumptions are based on conventional, not unconventional oil and gas development through hydraulic fracturing and multiwell drilling technologies, these estimates may be significantly underestimated.[374]

b. BLM must consider the impact of extreme weather causing flooding, mudslides and geological instability, which can compromise the integrity of pipelines and result in leaks and potential explosions. The nation's pipeline system faces a greater risk from failure due to extreme weather events such as hurricanes, floods, mudslides, tornadoes, and earthquakes.

i. A 2011 crude oil spill into the Yellowstone River near Laurel, MT, was caused by channel migration and river bottom scour, leaving a large span of pipeline exposed to prolonged current forces and debris washing downstream in the river. Those external forces damaged the exposed pipeline.

ii. In October 1994, flooding along the San Jacinto River led to the failure of eight hazardous liquid pipelines and also undermined a number of other pipelines. The escaping products were ignited, leading to smoke inhalation and burn injuries of 547 people.

iii. From 2003 to 2013, there were 85 reportable incidents in which storms or other severe natural force conditions damaged pipelines and resulted in their failure. Operators reported total damages of over $104M from these incidents.

iv. PHMSA has issued several Advisory Bulletins to operators warning about extreme weather events and the consequences of flooding events, including river scour and river channel migration.[375]

c. BLM must consider the pipeline safety impacts on hikers, campers, hunters, and anglers utilizing the public lands for recreation purposes. On August 19, 2000, a 30-inch-diameter gas transmission pipeline ruptured adjacent to the Pecos River near Carlsbad, NM. The released gas ignited and burned for 55 minutes. Twelve persons who were camping under a concrete-decked steel bridge that supported the pipeline across the river were killed, and their vehicles were destroyed. Two nearby steel suspension bridges for gas pipelines crossing the river were damaged extensively.[376]

d. BLM must consider forest fire risks from pipeline explosions. On December 11, 2012, a 20 inch-diameter gas transmission line ruptured in a sparsely populated area about 106 feet west

[373] Nels Johnson, Tamara Gagnolet, Rachel Ralls, and Jessica Stevens, *Natural Gas Pipelines:Excerpt from Report 2 of the Pennsylvania Energy Impacts Assessment* at 3 (December 16, 2011) (attached as Exhibit 307).
[374] UFO RMP/EIS 4-2; UFO RFD at 61 (attached as Exhibit 40-1).
[375] *See* Notice of Proposed Rulemaking on Gas Transmission and Gathering Lines, 68 Fed. Reg. 20728 (April 8, 2016) (amending 49 CFR Parts 191 and 192).
[376] *Id.* at 20730.

of Interstate 77 (I-77) in Sissonville, West Virginia. An area of fire damage about 820 feet wide extended nearly 1,100 feet along the pipeline right-of-way. Three houses were destroyed by the fire, and several other houses were damaged. Reported losses, repairs, and upgrades from this incident totaled over $8.5 million, and major transportation delays occurred. I-77 was closed in both directions because of the fire and resulting damage to the road surface. The northbound lanes were closed for about 14 hours, and the southbound lanes were closed for about 19 hours while the road was resurfaced, causing delays to both travelers and commercial shipping.[377]

e. BLM must consider lack of pipeline safety inspections. The National Association of Pipeline Safety Representatives, an association representing state pipeline safety officials, produced a compendium of state pipeline regulations showing that most states with delegated authority from PHMSA to conduct intrastate inspections do not have expanded regulations that cover increased oversight of gathering companies building gathering pipelines in rural areas are generally not subject to inspection and do not have to report the location and characteristics of much of the gathering pipelines being installed.[378]

f. BLM must consider the risks associated with undisclosed incremental pipeline failures on wildlife, ground water and surface water contamination, grazing cattle, human health, and uptake of oil and gas chemicals by crops.

In this regard the BLM must take a "hard look" at the subject, and given the lack of regulatory oversight in this area it is incumbent upon BLM to explain how it would ensure animal, human, and environmental safety from unregulated pipelines. 40 C.F.R. § 1502.22.

10. Water Resources.

i. Groundwater Impacts

The oil and gas development authorized through the master development plan could result in significant potential to contaminate groundwater resources in the planning area. Such contamination may result during the following processes: (1) the state of chemical mixing due to spills, leaks, and transportation accidents; (2) during the fracking process due to well malfunctions, migration of fracking fluids or fluids from the fractured formation to aquifers, and mobilization of subsurface materials to aquifers; (3) during flowback due to releases, leakage of on-site storage, and spills from pits (caused by improper construction, maintenance, or closure); and (4) during wastewater disposal due to discharges of wastewater into groundwater, incomplete treatment, and transportation accidents.[379] Fracking chemicals and wastewater may

[377] *Id.* at 20728.
[378] *See* GAO Report, *Oil and Gas Transportation: Department of Transportation Is Taking Actions To Address Rail Safety, But Additional Actions Are Needed To Improve Pipeline Safety* (August 2014) at 27 (attached as Exhibit 308).
[379] *See* U.S. Environmental Protection Agency, *Draft Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources* (Feb. 2011) (attached as Exhibit 110).

also contaminate groundwater supplies as a result of illegal dumping.[380] As discussed above, not all chemical used in fracking have been fully disclosed, but many of those that have been disclosed or discovered are toxic, hazardous, or harmful to human health or welfare. Despite a general lack of adequate oversight of fracking operations, various instances of water pollution from fracking operations have been documented. [381]

Groundwater contamination is among the most serious and consequential impacts of the oil and gas drilling industry, especially where hydraulic fracturing ("fracking") is anticipated. Accordingly, evidence of groundwater contamination from oil and gas operations must be fully analyzed by the BLM. For example, based on the Denver Post account of the Windsor, Colorado spill, mentioned further below, the company responsible for that spill, PDC, reported *two other* spills near Greeley within weeks of the Windsor incident. Both spills contaminated groundwater, according to a state database of spills. A January 22, 2013 spill by PDC released 2,880 gallons of oil and covered 3,900 square feet, leaving groundwater contaminated with benzene at a concentration 128 times higher than the state limit along with toluene and xylene chemicals. About 17 percent of 2,078 oil and gas spills that companies reported in Colorado since January 2008 have contaminated groundwater. Fracking wastewater is one of the most common substances spilled.[382]

BLM must also consider the potential fracking impacts to groundwater from existing models. For example, *see* T. Myers, *Potential Contaminant Pathways from Hydraulically Fractured Shale to Aquifers,* GROUND WATER (April 17, 2012) (attached as Exhibit 153):

> Fracking can release fluids and contaminants from the shale either by changing the shale and overburden hydrogeology or simply by the injected fluid forcing other fluids out of the shale. The complexities of contaminant transport from hydraulically fractured shale to near- surface aquifers render estimates uncertain, but a range of interpretative simulations suggest that transport times could be decreased from geologic time scales to as few as tens of years. Preferential flow through natural fractures fracking-induced fractures could further decrease the travel times to as little as just a few years. *Id.* at 9.

And see, N.R. Warner, *Geochemical evidence for possible natural migration of Marcellus Formation brine to shallow aquifers in Pennsylvania*, PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES, vol. 109, iss. 30. (July 9, 2012) (attached as Exhibit 154):

---

[380] Nicholas Kusnetz, *North Dakota's Oil Boom Brings Damage Along with Prosperity*, PROPUBLICA, July 7, 2012, available at: http://www.propublica.org/article/the-other-fracking-north-dakotas-oil-boom-brings-damage-along-with-prosperi#.

[381] *See, e.g., id.* (reporting on lack of oversight); Western Organization of Resource Councils, *Gone for Good: Fracking and Water Loss in the West* (2013) at 17-18, 31 (attached as Exhibit 111) (noting lack of state oversight).

[382] *See* Bruce Finely, *Water fouled with fracking chemicals spews near Windsor*, THE DENVER POST (Feb. 14, 2013), available at: http://www.denverpost.com/ci_22586154/water-fouled-fracking-chemicals-spews-near-windsor#ixzz2zpeQUnhK (attached as Exhibit 150).

> This study shows that some areas of elevated salinity with type D composition in NE PA were present prior to shale-gas development and most likely are unrelated to the most recent shale gas drilling; however, the coincidence of elevated salinity in shallow groundwater with a geochemical signature similar to produced water from the Marcellus Formation suggests that these areas could be at greater risk of contamination from shale gas development because of a preexisting network of cross- formational pathways that has enhanced hydraulic connectivity to deeper geological formations. *Id.* at 5.

BLM has consistently asserted that there are no documented linkages between hydraulic fracturing and water wells. This overlooks the studies that link the two, and BLM must recognize these and analyze these risks and impacts. In addition to the studies cited in Citizen Groups' comments, *see,e.g.*, S.G. Osborn, *et al*., *Methane contamination of drinking water accompanying gas-well drilling and hydraulic fracturing*, PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES, vol. 108, iss. 20. (May 17, 2011) (attached as Exhibit 155):

> Methane concentrations were detected generally in 51 of 60 drinking-water wells (85%) across the region, regardless of gas industry operations, but concentrations were substantially higher closer to natural-gas wells. Methane concentrations were 17-times higher on average in shallow wells from active drilling and extraction areas than in wells from non-active areas. *Id.* at 8173.

> Although dissolved methane in drinking water is not currently classified as a health hazard for ingestion, it is an asphyxiant in enclosed spaces and an explosion and fire hazard. *Id.* at 8173.

> More research is also needed on the mechanism of methane contamination, the potential health consequences of methane, and establishment of baseline methane data in other locations. *Id.* at 8176.

In addition, *see also*, U.S. EPA, Draft Report, *Investigation of ground water contamination near Pavillion, Wyoming* (December 2011) (attached above as Exhibit 176):

> The presence of synthetic compounds such as glycol ethers, along with enrichments in K, Cl, pH, and the assortment of other organic components is explained as the result of direct mixing of hydraulic fracturing fluids with ground water in the Pavillion gas field. *Id.* at 27.

And, *see also*, U.S. EPA, Report to Congress, *Management of wastes from the exploration, development, and production of crude oil, natural gas and geothermal energy*. Vol. 1. (December 1987) (attached as Exhibit 156):

> During the fracturing process, fractures can be produced, allowing migration of native brine, fracturing fluid, and hydrocarbons from the oil or gas well to a nearby water well. When this happens, the water well can be permanently damaged and a new well must be drilled or an alternative source of drinking water found. *Id.* at IV-22.

> In 1982, Kaiser Gas Co. drilled a gas well on the property of Mr. James Parsons. The well was fractured using a typical fracturing fluid or gel. The residual fracturing fluid migrated into Mr. Parson's water well (which was drilled to a depth of 416 feet), according to an analysis by the West Virginia Environmental Health Services Lab of well water samples taken from the property. Dark and light gelatinous material (fracturing fluid) was found, along with white fibers. (The gas well is located less than 1,000 feet from the water well.) The chief of the laboratory advised that the water well was contaminated and unfit for domestic use, and that an alternative source of domestic water had to be found. *Id.* at IV-22.

Moreover, one of the most significant risks of water resources contamination results from pit impoundments. At a minimum, the BLM should include alternatives that contain stipulations and COAs to protect the environment from pit impoundments. These protections include adequate livestock fencing around the pit, wildlife netting above the pit, increased requirements for liner integrity, requirements for leak detection systems, and a prohibition of siting pits within 50 feet of groundwater, among others.

However, in many cases, closed-loop drilling systems are preferable. In all alternatives, BLM should require that *all* APDs include the following analysis:

- BLM should consider total surface disturbance as a key factor in determining whether or not pits should be allowed.

- As part of the APD process, BLM should require applicants to submit carbon emissions estimates under pit and closed loop scenarios. These estimates should include emissions associated with pit construction, fluid waste trucking requirements, and solid waste trucking requirements.

- All other impacts being equal, BLM should place emphasis on the least-polluting method of development.

- Should a pit be allowed, BLM should require that solid waste collected after evaporation report only to hazardous waste treatment centers or repositories, not municipal landfills.

BLM should make all these analyses publicly available on a per-well basis. This information should be posted online where it is easy to navigate by affected stakeholders. The public should be allowed to comment on the APDs and BLM should allow for legal protests to APDs.

Other fluid waste management issues include:

- Water consumption: through stipulations and COAs, BLM should require process and flowback water recycling to the maximum extent practicable to reduce freshwater consumption and reduce carbon emissions associated with trucking of fluid waste to

injection wells. BLM should require operators to disclose freshwater requirements on a per-well basis, and the data should be publicly available.

- Given the amount of toxins associated with fracking flowback and process water,[383] BLM should require full disclosure of all chemicals contained in pits or in tanks destined for injection wells. This may require additional mandates for water testing on a periodic basis. The testing data should be publicly available online on a per-well basis.

- Naturally occurring radioactive fluids should be assessed and quantified when first encountered, before more fluids are produced. If the projected amounts of radioactive materials would cause management problems and violations of radiation control laws, the drilling operation should cease until the problem is corrected.

- Airborne gasses originating from storage tanks or pit impoundments should be monitored periodically, and data should be made available to the public. If air emissions associated with fluid waste exceed air quality control laws, the operation should cease until the problem is corrected.

The bulk of pit contamination is associated with seeps into shallow groundwater – of the sort that can readily flow into drinking water wells – or as spills and runoff. Similar incidents are occurring across the country.[384] For example, in Pennsylvania, state authorities were forced to quarantine cattle after a pit leaked into their field, leaking into a smelly pool that killed the grass.[385] In Colorado, leaky pits with torn liners spilled more than 6,000 barrels of waste.[386] And in Ohio, compromised pit liners and pit wall failures have sent pollution spilling out into the environment.[387]

Here, in preparing its NEPA analysis, BLM must address the direct, indirect, and cumulative impacts to groundwater, 40 C.F.R. § 1508.25(c), giving particular scrutiny to the potential for contamination of groundwater supplies.

---

[383] *See* Earthworks, Oil & Gas Accountability Project, *The Pit Rule – Good Questions and Honest Answers,* Available at: http://www.earthworksaction.org/files/publications/FS_NM-PitRule-GoodQuestions-webres.pdf (attached as Exhibit 163).
[384] *See, e.g.*, Natural Resources Defense Council, *Petition for Rulemaking to Regulate Oil and Gas Waste* (Sept. 8, 2010) (collecting these incidents) [hereinafter "NRDC Petition"] (attached as Exhibit 147).
[385] Nicolas Kusnetz, *A Fracking First in Pennsylvania: Cattle Quanrantine*, PRO PUBLICA (July 2, 2010), available at: http://www.propublica.org/article/a-fracking-first-in-pennsylvania-cattle-quarantine (attached as Exhibit 148).
[386] *See* Colorado Oil and Gas Conservation Commission, Inspection/Incident Inquiry, Spill Reports Doc. Nos. 1630424, 1630436, 1630427, 1630428, 1630429, 1630430.
[387] *See* NRDC Petition at 20.

ii. Surface Water Impacts

Likewise, the BLM must quantify and address the risk of potentially catastrophic spills and blowouts at well sites, which could impact and degrade surface waters. This is a serious concern because such major spills are not uncommon in natural gas drilling. For instance, a major well blowout in Pennsylvania recently sent thousands of gallons of contaminated fluid coursing into a stream feeding the Susquehanna River.[388] In February of 2013, a major spill occurred in Windsor, Colorado where at least 84,000 gallons of water contaminated with oil and chemicals used in hydraulic fracturing spilled from a broken wellhead and into a field.[389] The BLM has failed to demonstrate that such incidents could not occur on BLM leases. In 2016, there were 509 spills related to oil and gas activities in Colorado, with 58 spills impacting groundwater and 4 impacting surface water. 288 spills occurred within 50 feet of groundwater, and 162 spills occurred within 1000 feet of surface water.[390]

Other data confirms the risk to surface waters from fracking and fracking-related activities.[391]

> Gas well development of any type creates surface disturbances as a result of land clearing, infrastructure development, and release of contaminants produced from deep groundwater (e.g., brines). However, the use of hydraulic fracturing poses additional environmental threats due to water withdrawals and contamination from fracking fluid chemicals. *Id.* at 504.
>
> Elevated sediment runoff into streams, reductions in stream flow, contamination of streams from accidental spills, and inadequate treatment practices for recovered wastewaters are realistic threats. *Id.* at 510.

iii. Antidegradation

Moreover, Section 303 of the Clean Water Act ("CWA"), 33 U.S.C. § 1313, requires each State to institute comprehensive standards establishing water quality goals for all intrastate waters, and requires that such standards "consist of the designated uses of the navigable waters involved and the water quality criteria for such waters based upon such uses." 33 U.S.C. § 1313(c)(2)(A). A 1987 amendment to the CWA makes clear that section 303 also contains an "antidegradation policy"—that is, a policy requiring that state standards be sufficient to maintain existing beneficial uses of navigable waters, preventing their further degradation. 33. U.S.C. § 1313 (d)(4)(B); *see also PUD No. 1 of Jefferson County v. Washington Dept. of Ecology*, 511

---

[388] Associated Press, *Crews Stop Flow of Drilling Fluid from PA Well* (Apr. 22, 2011) (attached as Exhibit 149).
[389] *See* Finley (attached above as Exhibit 150).
[390] Center for Western Priorities, Colorado Toxic Release Tracker 2016 Summary, available at: http://westernpriorities.org/2016-colorado-oil-and-gas-toxic-release-tracker/.
[391] *See, e.g.*, Sally Entrekin, *et al*., *Rapid expansion of natural gas development poses a threat to surface waters*, FRONTIERS IN ECOLOGY, vol. 9, iss. 9. (October 2011) at 503 (attached as Exhibit 151).

U.S. 700, 705 (1994). Accordingly, EPA's regulations implementing the CWA require that state water quality standards include "a statewide antidegradation policy" to ensure that "[e]xisting instream water uses and the level of water quality necessary to protect [those] uses [are] maintained and protected." 40 C.F.R. § 131.12(a)(1). At a minimum, state water quality standards must satisfy these conditions. The CWA also allows States to impose more stringent water quality controls. *See* 33 U.S.C. §§ 1311(b)(1)(C), 1370; s*ee also* 40 CFR § 131.4(a) ("As recognized by section 510 of the Clean Water Act [33 U.S.C. § 1370], States may develop water quality standards more stringent than required by this regulation"). BLM also holds independent authority to protect water quality above and beyond what the CWA may require or authorize. 43 U.S.C. §§ 1701(a)(8), 1702(c), 1732(b).

The water quality standards that Congress required the States to develop must include three elements: (1) first, each water body must be given a "designated use," such as recreation or the protection of aquatic life; (2) second, the standards must specify for each body of water the amounts of various pollutants or pollutant parameters that may be present without impairing the designated use; and (3) third, each state must adopt an antidegradation review policy which will allow the State to assess activities that may lower the water quality of the water body. *See American Wildlands v. Browner*, 260 F.3d 1192, 1194 (10th Cir. 2001) (citing 33 U.S.C. § 1313(c)(2)(A) and 40 C.F.R. §§ 130.3, 130.10(d)(4), 131.6, 131.10, 131.11).

In its NEPA analysis, the BLM must address whether the development of oil and gas resources will affect any high-quality waters or whether it will degrade any existing uses. The BLM may not evade their NEPA duty to consider these impacts by asserting that other agencies may issue discharge permits. 40 C.F.R. §§ 1502.14(f), 1502.16(h). "A non-NEPA document – let alone one prepared and adopted by a state government – cannot satisfy a federal agency's obligations under NEPA." *South Fork Band Council of Western Shoshone of Nevada v. U.S. Department of Interior*, 588 F.3d 718, 726 (9th Cir. 2009) (citing *Klamath-Siskiyou Wildlands Center v. BLM*, 387 F.3d 989, 998 (9th Cir. 2004)) (BLM's argument that it need not consider impacts because a facility operated under a state permit issued pursuant to the Clean Air Act is "without merit"); *Southern Or. Citizens Against Toxic Sprays, Inc. v. Clark*, 720 F.2d 1475 (9th Cir. 1983) (another agency's consideration of environmental impacts does not relieve BLM of its duty to consider effects; "BLM must assess independently [the impacts]"); *see also Calvert Cliffs' Coordinating Comm., Inc. v. U. S. Atomic Energy Comm'n*, 449 F.2d 1109, 1123 (D.C. Cir. 1971) ("Certification by another agency that its own environmental standards are satisfied involves an entirely different kind of judgment.").

iv. Water Quality Standards

Pursuant to CWA section 303(d)(1), 33 U.S.C. § 1313(d)(1), each state is further required to identify those waters that do not meet water quality standards—called the "303(d)(1) list." For impaired waters identified in the § 303(d)(1) list, the states must establish a total maximum daily load ("TMDL") for pollutants identified by the EPA. A TMDL specifies the maximum amount of pollutant that can be discharged or loaded into the waters from all combined sources, so as to comply with the subject water quality standards.

CWA section 1323(a) requires federal agencies to comply with state and local water-quality requirements "in the same manner, and to the same extent as any nongovernmental entity." Congress intended this section to ensure that federal agencies were required to "meet all [water pollution] control requirements as if they were private citizens." S. REP. NO. 92-414 (1971), *as reprinted in* 1972 U.S.C.C.A.N. 3668, 3734. This provision applies to activities resulting in either "discharge or runoff of pollutants." 33 U.S.C. § 1323(a).

Accordingly, any activity undertaken by the BLM in this area—including the approval of drilling of public lands for oil and gas, as contemplated by the APDs here—may degrade potential "outstanding waters." Not only is the BLM mandated to follow antidegradation and water quality standards under the CWA and state law, but they must also take a NEPA "hard look" at any impacts that may be related to these water quality standards as well.

v. Water Quantity

In addition to impacts on water quality, oil and gas development processes, and particularly fracking, may result in significant impacts on water quantity. To frack a single well one time requires 2-8 million gallons.[392] Annually, the EPA estimates that 70-140 billion gallons of water are used to frack wells in the United States—enough to supply drinking water to 40-80 cities of 50,000.[393] This massive use of water is of particular concern in states in the interior West, like Colorado, where water supplies are scarce and already stretched.[394] Indeed, as the Department of Energy has recognized, "[a]vailable surface water supplies have not increased in 20 years, and groundwater tables and supplies are dropping at an alarming rate."[395] Because of the chemicals that are added to fracking water, the water may not be reused.[396] Removing water for fracking can stress existing water supplies by lower water tables and dewatering aquifers, decreasing stream flows, and reducing water in surface reservoirs.[397] This can result in changes to water quality, and it can also alter the hydrology of water systems, and it can increase concentrations of pollutants in the water.

There is also potential for the reductions in water quantity to impact aquatic and riverine species and habitat by affecting water flows and natural river processes: this, in turn, could lead to fish declines, changes to riparian plant communities, and alterations to sediment.[398] Water

---

[392] J. David Hughes, *Will Natural Gas Fuel America in the 21st Century?*, May 2011, at 23 (attached as Exhibit 112).
[393] *See* EPA Draft Plan at 20 (attached above as Exhibit 110).
[394] *See* WORC, *Gone for Good*, at 7-8 (noting water scarcity in west and significant water demands of fracking) (attached above as Exhibit 111).
[395] U.S. Dep't of Energy, *Energy Demands on Water Resources: Report to Congress on the Interdependency of Energy and Water*, Dec. 2012, at 12 (attached as Exhibit 113).
[396] *See* EPA Draft Plan at 20 (attached above as Exhibit 110).
[397] *Id.*
[398] Nat'l Parks Conservation Ass'n, *National Parks and Hydraulic Fracturing: Balancing Energy Needs, Nature, and America's National Heritage* (2013) at 23 (attached as Exhibit 114).

resources in Colorado are in many locations stressed or over-allocated, and oil and gas development has already lead to unpermitted and illegal water withdrawals.[399]

Here, in its NEPA analysis the BLM must closely assess the direct, indirect, and cumulative impacts of oil and gas development on water supplies. 40 C.F.R. §§ 1508.7, 1508.8. This analysis must consider the potential sources of water in the UFO and the GMUG that would be used for oil and gas development, and the impacts of these water withdrawals on water availability for drinking, agriculture, and wildlife. The analysis must further address the impacts to water quantity at different annual, seasonal, monthly, and daily time scales because the impacts of such water withdrawals could be more acute during times, months, and seasons of scarcity. For example, increased withdrawal and irretrievable contamination of waters will be particularly harmful during times—like the present—when much of the state is experiencing drought conditions.[400]

11. Human Health.

As introduced above, emissions from oil and gas development are not limited only to combustion, rather they occur throughout the chain of production—with some of the greatest emissions occurring at the point of extraction. These impacts are a consequence of various stages of oil and gas development—from the drilling and fracking of oil and gas wells, to air quality impacts and the release of hazardous emissions. The BLM must sufficiently address and analyze these impacts in its NEPA analysis.

The implementation of methane waste mitigation technologies, as discussed above, can not only help spur economic benefit, but can also allay some of the harmful health effects of oil and gas development by reducing emissions of NOX, VOCs and other criteria pollutants. Aside from the direct health impacts of NOX and VOCs,[401] these emissions can also result in significant increases in ground-level ozone (i.e., ozone precursors), and, consequently, can have a dramatic impact on human health.[402] For example, ozone has been shown to decrease lung

[399] *See* WORC, *Gone for Good* at 21 (attached above as Exhibit 111).
[400] *See* WORC, *Gone for Good* at 8 (attached above as Exhibit 111).
[401] *See, e.g.,* Colorado Department of Public Health and Environment, *2010 Air Quality Data Report* (2010) (attached as Exhibit 93).
[402] *See, e.g.,* GAO Report, *Oil and Gas: Information on Shale Resources, Development, and Environmental and Public Health Risks* (Sept. 2012) (attached as Exhibit 94); GAO Report, *Unconventional Oil and Gas Development: Key Environmental and Public Health Requirements* (Sept. 2012) (attached as Exhibit 95); Earthworks, *Natural Gas Flowback: How the Texas Natural Gas Boom Affects Health and Safety* (April 2012) (attached as Exhibit 96); Green River Alliance, *Healthy Air Questionnaire Final Report: Clean Air and Healthy Communities* (2011) (attached as Exhibit 209); Lisa McKenzie, Ph.D., et. al., *Human health and risk assessment of air emissions from development of unconventional natural gas resources* (Feb. 2012) (attached as Exhibit 98); Lisa McKenzie, Ph.D., Testimony on: *Federal Regulation: Economic, job, and energy security implications of federal hydraulic fracturing regulation,* May 2, 2012 (attached as Exhibit 99); Earthworks, *Gas Patch Roulette: How Shale Gas Development Risks Public Health in Pennsylvania,* October 2012 (attached as Exhibit 100).

function – particularly in adolescents and young adults—as well as increase the risk of death from respiratory causes.[403]

The EPA is currently proposing standards to reduce air pollution from oil and natural gas drilling operations. According to the EPA, the oil and gas industry is "the largest industrial source of emissions of volatile organic compounds (VOCs), a group of chemicals that contribute to the formation of ground-level ozone (smog)."[404] Moreover, "[e]xposure to ozone is linked to a wide range of health effects, including aggravated asthma, increased emergency room visits and hospital admissions, and premature death."[405] The oil and natural gas industry is also "a significant source of emission of methane," as well as an emitter of "air toxics such as benzene, ethylbenzene, and n-hexane," which are "pollutants known, or suspected of causing cancer and other serious health effects."[406] The EPA reports that the oil and gas industry:

> emits 2.2 million tons of VOCs, 130,000 tons of air toxics, and 16 million tons of greenhouse gases (methane) each year (40% of all methane emission in the U.S.). The industry is one of the largest sources of VOCs and sulfur dioxide emissions in the United States.[407]

The rapid development of high volume/horizontal drilling in conjunction with hydraulic fracturing has driven expansion of new sources resulting in increased emissions—a change that requires consideration by the BLM.

Many of the impacts to human health have already been documented in communities subject to industrial scale oil and gas development. For example, in Garfield County, Colorado, residents have experienced health effects they believe to be caused from oil and gas development. "Community concerns range from mild complaints such as dizziness, nausea, respiratory problems, and eye and skin irritation to more severe concerns including cancer."[408]

---

[403] *See* Ira B. Tager, et. al., *Chronic Exposure to Ambient Ozone and Lung Function in Young Adults*, EPIDEMIOLOGY, Vol. 16, No. 6 (Nov. 2005) (attached as Exhibit 101); Michael Jarrett, Ph.D., et. al., *Long-Term Ozone Exposure and Mortality*, THE NEW ENGLAND JOURNAL OF MEDICINE, 360: 1085-95 (2009) (attached as Exhibit 102).
[404] EPA, *Oil and Natural Gas Pollution Standards: Basic Information, Emissions from the Oil & Natural Gas Industry* (2011), available at: http://www.epa.gov/airquality/oilandgas/basic.html; *see also* Cally Carswell, *Cracking the ozone code – Utah's gas fields*, HIGH COUNTRY NEWS, Sept. 4, 2012 (attached as Exhibit 103).
[405] *See id.*, EPA, *Pollution Standards*.
[406] *Id.*
[407] Letter from American Lung Association, American Public Health Association, American Thoracic Society, Asthma and Allergy Foundation of America, and Trust for America's Health to Lisa Jackson, Administrator, U.S. Environmental Protection Agency (Nov. 30, 2011), at 4 (attached as Exhibit 104).
[408] U.S. Department of Health and Human Services, Agency for Toxic Substances and Disease Registry ("ATSDR"), *Health Consultation: Garfield County, Public Health Implications of*

Additionally, the community has "environmental concerns related to noise, odors, dust, and 'toxic' chemicals in water and air."[409] After a thorough review of ambient air data across Garfield County, ATSDR determined that, "considering both theoretical cancer risks as well as non-cancer health effects and the uncertainties associated with the available data, it is concluded that the exposures to air pollution in Garfield County pose an indeterminate public health hazard for current exposures."[410] ATSDR further provided that "estimated theoretical cancer risks and non-cancer hazards for benzene [in the community], which is within the oil and gas development area, appear significantly higher than those in typical urban and rural area, causing some potential concern," and later concluded that "[t]hese elevated levels are an indicator of the increased potential for health effects related to benzene exposure . . . in the oil and gas development area.[411]

Unfortunately, impacts to human health are not limited only to gas emissions, but can result from exposure to chemicals necessary for gas extraction—namely, the hundreds of chemicals used in hydraulic fracturing.[412] Indeed, "[b]etween 2005 and 2009, the 14 oil and gas service companies [analyzed by Congress] used more than 2,500 hydraulic fracturing products containing 750 chemicals and other components. Overall, these companies used 780 million gallons of hydraulic fracturing products – not including water added at the well site – between 2005 and 2009."[413] Chemical components include BTEX compounds—benzene, toluene, xylene, and ethylbenzene—which are hazardous air pollutants and known human carcinogens. As the BLM proceed with approval of the APDs, they must consider the human health impacts associated with these extractive practices.

Leading doctors and scientists studying these issues recognize the unknown risks inherent to fracking. "We don't know the chemicals that are involved, really; we sort of generally know," Vikas Kapil, chief medical officer at National Center for Environmental Health, part of the U.S. Centers for Disease Control and Prevention, said at a conference on hydraulic fracturing.[414] "We don't have a great handle on the toxicology of fracking chemicals."[415] Christopher Portier, director of the CDC's National Center for Environmental Health and Agency for Toxic

---

Ambient Air Exposures to Volatile Organic Compounds as Measured in Rural, Urban, and Oil & Gas Development Areas (2008), at 1 (attached as Exhibit 105).

[409] *Id.*

[410] *Id.*

[411] *Id.*

[412] *See* Theo Colborn, et. al., *Comments to the Bureau of Land Management, Uncompahgre Field Office*, THE ENDOCRINE DISRUPTION EXCHANGE, April 20, 2012 (attached as Exhibit 106); Theo Colborn, et. al., *Natural Gas Operations from a Public Health Perspective*, HUMAN AND ECOLOGICAL RISK ASSESSMENT, 17: 1039-1056 (2011) (attached as Exhibit 107).

[413] UNITED STATES HOUSE OF REPRESENTATIVES, COMMITTEE ON ENERGY AND COMMERCE, *Chemicals Used in Hydraulic Fracturing* (April 2011) (attached as Exhibit 171).

[414] Alex Wayne, *Fracking Moratorium Urged by U.S. Doctors Until Health Studies Conducted*, BLOOMBERG NEWS, January 9, 2012, available at: http://www.bloomberg.com/news/2012-01-09/fracking-moratorium-urged-by-u-s-doctors-until-health-studies-conducted.html.

[415] *Id.*

Substances and Disease Registry further provided that "additional studies should examine whether wastewater from wells can harm people or the animals and vegetables they eat."[416] "We do not have enough information to say with certainty whether shale gas drilling poses a threat to public health."[417]

Indeed, a new study demonstrates that animals, especially livestock, are sensitive to the contaminants released into the environment by drilling and by its cumulative impacts.[418] Because animals often are exposed continually to air, soil, and groundwater and have more frequent reproductive cycles, animals can be used to monitor potential impacts to human health—they are fracking's "canary in the coalmine." The study evaluated all available fracking-related reports on sick or dying animals. Although secrecy surrounds the fracking industry, "a few 'natural experiments' have provided powerful evidence that fracking can harm animals."[419] For example:

> Two cases involving beef cattle farms inadvertently provided control and experimental groups. In one case, a creek into which wastewater was allegedly dumped was the source of water for 60 head, with the remaining 36 head in the herd kept in other pastures without access to the creek. Of the 60 head that were exposed to the creek water, 21 died and 16 failed to produce calves the following spring. Of the 36 that were not exposed, no health problems were observed, and only one cow failed to breed. At another farm, 140 head were exposed when the liner of a wastewater impoundment was allegedly slit, as reported by the farmer, and the fluid drained into the pasture and the pond used as a source of water for the cows. Of those 140 head exposed to the wastewater, approximately 70 died and there was a high incidence of stillborn and stunted calves. The remainder of the herd (60 head) was held in another pasture and did not have access to the wastewater; they showed no health or growth problems. These cases approach the design of a controlled experiment, and strongly implicate wastewater exposure in the death, failure to breed, and reduced growth rate of cattle.[420]

The health problems and uncertainties that proliferate in communities where oil and gas development takes place warrants the further collection of data and research, as contemplated under NEPA, before such development can be made possible through the authorization of

---

[416] Alex Wayne and Katarzyna Klimasinska, *Health Effects of Fracking for Natural Gas Need Study, Says CDC Scientist*, BLOOMBERG NEWS, January 4, 2012, available at: http://www.bloomberg.com/news/2012-01-04/health-effects-of-fracking-for-natural-gas-need-study-says-cdc-scientist.html.

[417] *Id.*

[418] Michelle Bamberger and Robert E. Oswald, *Impacts of Gas Drilling on Human and Animal Health*, NEW SOLUTIONS, VOL. 22(1) 51-77 (2012) (attached as Exhibit 109).

[419] *See* Peter Montague, *Why Fracking and Other Disasters Are So Hard to Stop*, HUFFINGTON POST, Jan. 20, 2012, available at: http://www.huffingtonpost.com/peter-montague/why-fracking-and-other-di_b_1218889.html (last visited Jan. 23, 2012).

[420] *See* Bamberger at 60 (attached above as Exhibit 109).

development through the October 2014 lease sale. NEPA requires a hard look at these impacts.

C. The BLM Must Sufficiently Analyze All Reasonable Alternatives.

Incumbent on the BLM in any NEPA process is a robust analysis of alternatives to the proposed action. Consideration of reasonable alternatives is necessary to ensure that the agency has before it and takes into account all possible approaches to, and potential environmental impacts of, a particular project. NEPA's alternatives requirement, therefore, ensures that the "most intelligent, optimally beneficial decision will ultimately be made." *Calvert Cliffs' Coordinating Comm., Inc. v. U.S. Atomic Energy Comm'n*, 449 F.2d 1109, 1114 (D.C. Cir. 1971).

"[T]he heart" of an environmental analysis under NEPA is the analysis of alternatives to the proposed project, and agencies must evaluate all reasonable alternatives to a proposed action." *Colorado Environmental Coalition*, 185 F.3d at 1174 (quoting 40 C.F.R. § 1502.14). An agency must gather "information sufficient to permit a reasoned choice of alternatives as far as environmental aspects are concerned." *Greater Yellowstone*, 359 F.3d at 1277 (citing *Colorado Environmental Coalition*, 185 F.3d at 1174); *see also Holy Cross Wilderness Fund v. Madigan*, 960 F.2d 1515, 1528 (10th Cir. 1992).

Of critical importance is that the BLM consider an alternative that properly balances the permanent protection of certain critical areas from the pressures of oil and gas development by industry interests.

The ecological and economic threat posed by oil and gas development is very real. In communities where such development is occurring, the fossil fuel industry is releasing hazardous pollutants into the air and water, is using hydraulic fracking extensively, and threatening the very lifeblood of our communities, as well as public health, as detailed above. Moreover, oil and gas development also threatens the planning area's abundant wildlife, and could fragment and destroy increasingly scarce habitat and wildlife corridors. Such unfettered development also threatens tourism based on wildlife viewing, fishing, and hunting.

The elevation of oil and gas development above competing priorities would have myriad impacts on the other uses and resource values, as well.

While certain lands may indeed be appropriate for responsible fossil fuel resource development, it is equally evident that there are lands where other resource values should prevail. FLPMA affords BLM great authority to appropriately balance these competing interests, which expressly includes the responsibility to "preserve and protect certain public lands in their natural condition." 43 U.S.C. § 1701(a)(8). Moreover, FLPMA further delegates BLM authority to permanently withdraw lands from consideration. *See* 43 U.S.C. § 1714. This ability authorizes the Secretary to "make, modify, extend, or revoke withdrawals." *Id.* In either event, the BLM cannot continue the public lands management practice of prioritizing oil and gas development above the other resource values at stake.

The Forest Service also has a similar mandate: "the national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes . . .[and] [i]n the administration of the national forests due consideration shall be given to the relative values of the various resources in particular areas." 16 U.S.C. § 528; 16 U.S.C. § 529. Notably, under the Forest Service's multiple use mandate, it is to have a "harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output." 16 U.S.C. § 531(emphasis added). Should the Forest Service not update the 1993 Oil and Gas Amendment, it must, at the very least, comply with its requirements that a range of protective measures such as no surface occupancy requirements, timing limitations, controlled surface use, and other conditions of approval. This necessarily requires a robust alternatives analysis to identify and explore how impacts to other natural resources can be avoided, minimized, or mitigated.

CEQ regulations require agencies to "[r]igorously explore and objectively evaluate all reasonable alternatives" to a proposed action in comparative form, so as to provide a "clear basis for choice among the options." 40 C.F.R. § 1502.14. Accordingly, the BLM should consider and compare the following reasonable alternatives in its NEPA analysis for the 35-well project:

(1) An alternative that analyzes and applies the best available information and science through stipulations aimed to protect federally listed species and their habitats.

In the nearby Bull Mountain MDP EIS, BLM included only general and perfunctory measures that were incapable of protecting Endangered Species Act ("ESA") listed species. As there, such an approach with this project is untenable. "Mitigation measures must be reasonably specific, certain to occur, and capable of implementation; they must be subject to deadlines or otherwise-enforceable obligations; and most important, they must address the threats to the species in a way that satisfies the jeopardy and adverse modification standards." *Center for Biological Diversity v. Rumsfeld,* 198 F.Supp.2d 1139, 1152 (D.Ariz. 2002); *see also Natural Resources Defense Council v. Kempthorne,* 506 F. Supp.2d, 322, 355 (E.D.Cal, 2007) (providing that a laundry list of possible mitigation measures, without specificity, are merely suggestions).

Conservation Groups agree with earlier comments submitted by U.S. FWS to BLM regarding the August 2012 Lease Sale—which is analogous and directly related to this action—where FWS concluded that "the proposed stipulations do not provide specific or adequate protection … [and do] not identify the means to avoid or minimize effects on listed species or habitat and, therefore, provide[] no assurances that those resources will be protected." Memorandum from U.S. FWS, Comments on August 2012 Lease Sale (Feb. 8, 2012), at 5 ("FWS Comments") (Exhibit 142). Accordingly, BLM must rigorously explore and objectively evaluate an alternative that applies best available information and science through stipulations aimed at protecting federally listed species and their habitats.

(2) An alternative that analyzes and applies best available methane reduction technologies as a stipulation attached to all development within the proposal.

The BLM should include in their analysis an alternative that applies a stipulation that mandates the use of best available methane reduction technologies to all development associated with the 35-well project. Recent research has demonstrated that the use of ten technically proven and commercially available methane emissions reduction technologies can together capture more than 80 percent of the methane currently going to waste in the oil and gas sector's operations. *See* Harvey Report (attached above as Exhibit 47-1). These technologies include:

1. **Green Completions** to capture oil and gas well emissions;
2. **Plunger Lift Systems** or other well deliquification methods to mitigate gas well emissions;
3. **Tri-Ethylene Glycol (TEG) Dehydrator Emission Controls** to capture emissions from dehydrators;
4. **Desiccant Dehydrators** to capture emissions from dehydrators;
5. **Dry Seal Systems** to reduce emissions from centrifugal compressor seals;
6. **Improved Compressor Maintenance** to reduce emissions from reciprocating compressors;
7. **Low-Bleed or No-Bleed Pneumatic Controllers** used to reduce emissions from control devices;
8. **Pipeline Maintenance and Repair** to reduce emissions from pipelines;
9. **Vapor Recovery Units** used to reduce emissions from storage tanks; and
10. **Leak Monitoring and Repair** to control fugitive emissions from valves, flanges, seals, connections and other equipment.

Id. at 5. In addition to reducing emissions, these "[m]ethane control technologies provide economic, health, safety, and environmental benefits for both operators and the public. These control technologies reduce not only greenhouse gas emissions, but also potentially explosive vapors, hazardous air pollutants, and volatile organic compounds (VOC), improving worker safety and limiting corporate liability." *Id.* Accordingly, the BLM must rigorously explore and objectively evaluate an alternative that requires the implementation of these 10 technologies through stipulations that attach to all APDs associated with the 35-well project.

(3) An alternative that applies best management practices for oil and gas development as stipulations that attach to all lease parcels.

The BLM's NEPA process should include analysis of an alternative that applies existing and new BMPs as mandatory stipulations applied to all oil and gas development proposed as part of the 35-well project. For example, The Intermountain Oil and Gas BMP Project, which is maintained by the Natural Resources Law Center at the University of Colorado Law School, provides supplemental information, including construction specifications, illustrations, pictures, maps, monitoring reports, and evaluations of the potential of the practice for mitigating impacts of development. *See* Intermountain Oil and Gas BMP Project, available at: http://www.oilandgasbmps.org/ (last visited March 27, 2012). Among other resources, the

Intermountain Oil and Gas BMP Project maintains a database that addresses a variety of resources and issues, including:

- Air Quality and Emissions
- Aquatic and Riparian Values
- Community
- Cultural/Historic
- Grazing and Agriculture
- Human Health and Safety
- Land Surface Disturbance
- Noise
- Soils (Conservation, Pollution, Reclamation)
- Vegetation
- Visual Aesthetics
- Water Quality and Pollution
- Water Quality and Rights
- Wildlife

Each individual resource contains hundreds of additional BMPs aimed at developing oil and gas reserves in a manner that protects the many human and environmental resources at stake. The BLM should evaluate these BMPs thoroughly, including their efficacy, in light of a hard look at impacts and include stipulations mandating use of these BMPs in its alternatives analysis.

In addition to the BMPs listed above, BLM should consider an alternative that ensures all roadless areas are protected with NSO stipulations that adequately protect important roadless values in the area.

(4) A phased development alternative.

Although it is possible that "some or all of the environmental consequences of oil and gas development may be mitigated through lease stipulations, it is equally true that the purpose of NEPA is to examine the foreseeable environmental consequences of a range of alternatives *prior* to taking an action that cannot be undone." *Montana Wilderness Ass'n v. Fry*, 310 F.Sup.2d 1127, 1145 (D.Mont., 2004) (citation omitted) (emphasis added); 40 C.F.R. § 1501.2. To mitigate impacts from heavy truck traffic, reduce the potential for water contamination, minimize air and noise pollution, and protect wildlife, we recommend a phased development alternative.

Staged or phased development clusters drilling geographically to maintain open areas; i.e., concentrated development that proceeds in stages in smaller areas rather than all at once. Such an alternative could include limitations on the number of drilling rigs operating in the Project Area at any one time, as well as interim surface reclamation measures to restore each site "to a pastoral landscape" before drilling a new site. *See BioDiversity Conservation Alliance v. Bureau of Land Mgmt.*, 608 F.3d 709, 713 (10th Cir. 2010); *Theodore Roosevelt Conservation P'ship v. Salazar*, 661 F.3d 66, 71 (D.C. Cir. 2011). Operators would be allowed to develop production in one geographic area at a time and, when complete, be permitted to move on to

another area. *W. Org. of Res. Councils v. Bureau of Land Mgmt.*, 591 F. Supp. 2d 1206, 1288 (D. Wyo. 2008). In certain instances, corridors could be left undeveloped to allow for wildlife management. *Id.*

Courts have agreed that BLM's failure to consider a phased development alternative violates NEPA, and can render an EIS inadequate. *See N. Cheyenne Tribe v. Norton*, 503 F.3d 836, 841 (9th Cir. 2007); *N. Plains Res. Council v. Bureau of Land Mgmt.*, 2005 WL 6258093 at *1 (D. Mont. 2005). Moreover, failure to consider such an alternative in the past was sufficient to warrant an injunction on development until BLM completed a revised EIS that considered a phased development alternative. *N. Cheyenne Tribe*, 503 F.3d at 841.

Here, the BLM's consideration of a phased development alternative is not only reasonable but, given critical resource values at stake, entirely necessary. *See Colorado Environmental Coalition*, 185 F.3d at 1174 (quoting 40 C.F.R. § 1502.14) ("agencies must evaluate all reasonable alternatives to a proposed action."). The proposed project's location is in the headwaters of the North Fork of the Gunnison River, is home to critical big game winter habitat, and is an important recreational area and economic driver for the area.

Phasing in development could limit new well drilling and fracking to a rate similar to the historical rate for the area. According to Colorado Oil & Gas Conservation Commission data, Gunnison County has seen an average of two new wells drilled per year from 1997 to 2014. Colorado Oil & Gas Conservation Commission, Jan. 2015 Staff Report. By phasing in development, the BLM could require that only one drilling and fracturing job occur at any given time. Instead of operating numerous drilling rigs and numerous fracking operations, the BLM can require interim surface reclamation before an operator proceeds with developing new well pad sites. This would help reduce pollution and traffic, while preserving open space for wildlife.

II. Endangered Species Act

A. BLM Must Analyze the Project's Effects on Endangered Fish and Consult Over These Effects Pursuant to ESA Section 7

A foreseeable cumulative impact from oil and gas development occurring within the project area is Colorado River water withdrawals necessary for fracking and horizontal drilling techniques. Indeed, millions of gallons of water are withdrawn from the Colorado River for oil and gas extraction. BLM must analyze the effects of the massive water demand resulting from relatively new horizontal drilling techniques in the Upper Colorado River Basin (the "Upper Basin") which would impact watersheds in the Uncompahgre planning area, including (1) the significant cumulative impacts on local water supplies and the Colorado River endangered fish under NEPA and (2) the cumulative impacts of water depletion effects on the Colorado River endangered fish under Section 7 of the Endangered Species Act.

The project would have significant effects on survival and recovery of the endangered Colorado pikeminnow, razorback sucker, humpback chub, and bonytail (collectively, "endangered fish"). The loss of adequate flows in the endangered fishes' habitat within the Upper Colorado River Basin is so serious that the Service has determined that *any* depletion of

Upper Basin stream flows adversely affects and jeopardizes the endangered fish.[421] Because the project is within the Upper Colorado River Basin and will involve horizontal drilling of up to 35 new wells near tributaries of the Gunnison River, the project is reasonably certain to result in water depletion and water contamination impacts on the endangered fish, compelling consultation under Section 7. BLM cannot proceed with the project at issue until it has analyzed the project's water depletion and water pollution impacts on the endangered fish and consulted with Fish and Wildlife Service regarding the project's impacts on the endangered fish. To the extent BLM intends to rely on the Programmatic Biological Opinion for the Fluid Mineral Program's water depletions[422] (PBO) to comply with its Section 7 duties such reliance is misplaced in light of new information revealing that water depletions from oil and gas development may affect listed species and their critical habitat in a manner or to an extent that was not considered in the PBO.

1. Background on ESA Section 7

Congress enacted the ESA to provide "a program for the conservation of . . . endangered species and threatened species." 16 U.S.C. § 1531(b). Section 2(c) of the ESA establishes that it is "the policy of Congress that all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act." 16 U.S.C. § 1531(c)(1). The ESA defines "conservation" to mean "the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this [Act] are no longer necessary." 16 U.S.C. § 1532(3). Section 7(a)(1) of the ESA explicitly directs that all federal agencies "utilize their authorities in furtherance of the [aforesaid] purposes" of the ESA. 16 U.S.C. § 1536(a)(1).

Section 7 of the ESA requires BLM, in consultation with the Fish and Wildlife Service ("FWS"), to insure that any action authorized, funded, or carried out by the agency is not likely to (1) jeopardize the continued existence of any threatened or endangered species, or (2) result in

---

[421] U.S. Bureau of Land Management, White River FEIS at 3-71 (2015) ("The FWS has determined that any federally authorized depletion from the Upper Colorado River Basin has an adverse effect on listed Colorado River fishes.") (attached as Exhibit 310); Biological Opinion for BLM Resource Management Plan (RMP), Price Field Office (PFO), 138 (Oct. 27, 2008) ("The USFWS determined that any depletion will jeopardize their continued existence and will likely contribute to the destruction or adverse modification of their critical habitat (citing USDI, Fish and Wildlife Service, Region 6 Memorandum, dated July 8, 1997), available at http://www.blm.gov/style/medialib/blm/ut/price_fo/Planning/rod_approved_rmp.Par.2742.File.dat/Price%20Biological%20Opinion.pdf (attached as Exhibit 311); Biological Opinion for BLM Resource Management Plan (RMP), Vernal Field Office (VFO), 113 (Oct. 23, 2008) (same), available at http://www.blm.gov/style/medialib/blm/ut/vernal_fo/planning/rod_approved_rmp.Par.4719.File.dat/VernalBiologicalOpinion.pdf (attached as Exhibit 312).

[422] U.S. Fish and Wildlife Service, Programmatic Biological Opinion for Water Depletions Associated with Bureau of Land Management's Fluid Mineral Program within the Upper Colorado River Basin in Colorado (Dec. 19, 2008) ("PBO") (attached as Exhibit 87).

the destruction or adverse modification of the critical habitat of such species. 16 U.S.C. § 1536(a)(2). For each proposed federal action, BLM must request from FWS whether any listed or proposed species may be present in the area of the agency action. 16 U.S.C. § 1536(c)(1); 50 C.F.R. § 402.12. If listed or proposed species may be present in such area, BLM must prepare a "biological assessment" to determine whether the listed species may be affected by the proposed action. Id.

If BLM determines that its proposed action may affect any listed species or critical habitat, the agency must engage in formal consultation with FWS. 50 C.F.R. § 402.14. To complete formal consultation, FWS must provide BLM with a "biological opinion" explaining how the proposed action will affect the listed species or habitat. 16 U.S.C. § 1536(b); 50 C.F.R. § 402.14. If FWS concludes that the proposed action will jeopardize the continued existence of a listed species, or result in the destruction or adverse modification of critical habitat, the biological opinion must outline "reasonable and prudent alternatives." 16 U.S.C. § 1536(b)(3)(A).

BLM's proposed master development project is an agency action under the ESA. Action is broadly defined under the ESA to include all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies, including the granting of leases, and actions that will directly or indirectly cause modifications to the land, water, or air. 50 C.F.R. § 402.02

Agencies are required to reinitiate ESA consultation if (1) the amount or extent of taking specified in the incidental take statement is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the action is modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the identified action. 50 C.F.R. § 402.16.

2. BLM and FWS Must Reinitate Consultation over the Programmatic Biological Opinion Governing Fluid Mineral Development Water Depletions

The project would foreseeably entail significant water depletions within the Upper Colorado River Basin. While the PBO is designed to address any depletions resulting from oil and gas development within the Uncompahgre Field Office and other western Colorado field offices, BLM cannot rely on that consultation for its Section 7 compliance, because it is outdated and inadequate.

The PBO does not take into account the enormous water depletion effects of horizontal drilling and other unconventional well development techniques. The PBO is also unreliable in numerous other respects due to significant new information revealing that the Fluid Mineral Program may have effects on the endangered fish in a manner or to an extent not previously considered. This includes new information about (a) the potential for increased oil and gas development and horizontal drilling within emerging shale plays, including the Mancos shale play in the Piceance Basin, and the Gothic Shale Gas Play in southwest Colorado's Paradox

Basin; (b) climate change effects on Upper Colorado River Basin stream flows; (c) long-term drought and increased water demand which have drastically reduced water supplies; (d) mercury and selenium pollution effects on the endangered fish; (e) declining humpback chub and Colorado pikeminnow populations and failure to meet these populations' recovery targets; (f) the Recovery Program's failure to meet recommended stream flows necessary for recovery of the endangered fish; and (f) BLM's failure to adequately monitor and track actual water use and depletions in the Upper Colorado River Basin, which could result in higher water use and greater depletions in the project area, Gunnison River Basin, and throughout the Upper Basin than anticipated in the PBO.

i. New Drilling, Fracking, and Horizontal Drilling Will Require Greater Water Depletions Than Previously Anticipated.

The PBO did not consider the likely increase in horizontal drilling and other unconventional drilling practices that deplete enormous amounts of water to develop the Mancos Shale Play in the Uncompahgre, Grand Junction, Little Snake, White River, Gunnison and Colorado River Valley Field Offices. Nor did it consider the use of these water-intensive practices throughout the rest of the programmatic action area, including Gothic Shale Gas Play (GSGP) and the Paradox Basin.[423]

The PBO Fails to Consider Increased Horizontal Drilling Within the Piceance Basin and Mancos Shale Play.

Water use within the Upper Colorado River Basin have been grossly underestimated in the PBO, because it fails to take into account increased horizontal drilling that could be used to develop the Mancos/Mowry and Niobrara shale plays. These increased water depletion impacts throughout the entire Upper Basin could alter the Service's analysis of the Fluid Mineral Program's depletion effects on the endangered fish, as all BLM-authorized fluid mineral development activity within the Basin is part of a single programmatic action that impacts the endangered fish.

For example, in the White River planning area, the PBO projects that new vertical wells would consume 2.62 acre-feet per well, while in the Grand Junction planning area, vertical wells would require require 0.77 acre-feet of water per well. But BLM water depletion logs indicate that between FY2011 and FY2015, the average depletion for horizontal wells in BLM's western Colorado field offices was 26.45 acre-feet of water per well in the field offices covered by the PBO.[424] Indeed, in FY2015 horizontal drilling in the Grand Junction Field Office resulted in a violation of the PBO's Incidental Take Statement (ITS) water depletion limit in the Colorado River sub-basin—under the ITS, water depletions are a surrogate for take. In FY2015, an

[423] BLM Instruction Memorandum CO-2011-022 (April 1, 2011) ("All of the estimates in the PBO were based on using conventional vertical drilling technology.") (attached as Exhibit 314).
[424] *See* Water Depletion Logs, attached as Exhibits 259-265, which are completed, pursuant to requirements within the PBO, on an annual basis by the BLM to estimate water depletion resulting from fluid minerals development on BLM lands in western Colorado.

operator drilled eight horizontal wells in the Grand Junction Field Office, which consumed a total of 620.87 acre-feet of water.[425] The total amount of water depleted in the Colorado River sub-basin by all horizontal and vertical wells was 691.09 acre-feet of water, which exceeds the 379 acre-feet annual projection for this sub-basin by 1.8 times.[426]

This drastic increase in the use of water-intensive horizontal drilling techniques was not considered in the PBO, nor in BLM's consultations over the recent White River, Kremmling, Little Snake, and Grand Junction RMP amendments or revisions, which only relied on the PBO regarding the RMPs' water depletion effects.

Moreover, recently, on June 8, 2016, the U.S. Geological Survey published a report re-assessing the total technically recoverable reserves in the Mancos shale play in the Piceance Basin, including the Niobrara strata of the play.[427] According to the report, the Mancos shale play's total technically recoverable natural gas reserves are over 40 times greater than the USGS's 2003 estimate and is the second-largest in the U.S., behind the Marcellus shale.[428] Specifically, 66.3 trillion cubic feet of natural gas, 74 million barrels of oil and 45 million barrels of natural gas liquids are potentially recoverable.[429] While tight gas in the younger, shallower Mancos shale intervals is produced primarily from vertical and directional wells in which the reservoirs have been hydraulically fractured, the tight gas and continuous oil and gas in the older and deeper intervals of the Mancos shale are produced mostly from horizontal wells that have been hydraulically fractured.[430] These reserves underlie large areas of the Grand Junction, White River, Royal Gorge, Colorado River Valley, Uncompahgre, and Gunnison Field Offices, all of which fall under the PBO.[431]

Increasing interest in the Mancos Shale Play should therefore be expected given its enormous production potential. Water depletions throughout the entire Upper Colorado River Basin could therefore exceed projected water use estimates in the PBO. Indeed, since the 2003 USGS assessment, more than 2,000 wells have already been drilled and completed in one or more intervals of the study area.[432] A review of BLM oil and gas projects in western Colorado

---

[425] *Id.*
[426] *Id.*
[427] Assessment of Continuous (Unconventional) Oil and Gas Resources in the Late Cretaceous Mancos Shale of the Piceance Basin, Uinta-Piceance Province, Colorado and Utah (2016) ("USGS 2016"), available at http://pubs.usgs.gov/fs/2016/3030/fs20163030.pdf (attached as Exhibit 197).
[428] *See id.*
[429] *Id.*
[430] *Id.*
[431] Center for Biological Diversity, Map of Mancos Shale relative to BLM Field Offices (2016) (attached as Exhibit 266).
[432] *Id.*

indicates that operators are planning a number of projects involving horizontal drilling, which would most likely target the Mancos shale.[433]

Accordingly, Mancos shale drilling projects could increase within the Upper Basin, including the UFO, but the PBO does not take into account this expansion in new development potential. Because the RMPs for the Uncompahgre Field Office and other Piceance Basin field offices overlapping the Mancos shale play do not limit total new wells that may be drilled, and actually, the UFO draft RMP anticipates greater oil and gas leasing within the planning area and adopts this vision at the agency's preferred alternative in the draft RMP, the greater amount and availability of technically recoverable oil and gas reserves could result in the development of many more new wells in the Upper Basin than assumed in the RMPs and the PBO.

The proposed Bull Mountain Unit Master Development Plan illustrates the higher water use that can be anticipated in the Uncompahgre Field Office than projected in the PBO. The Bull Mountain plan's Final Environmental Impact Statement (FEIS) anticipates the development of 146 new gas wells, half of which are assumed shale wells including horizontal drilling in the northwest portion of Gunnison County, within the UFO.[434] The preferred alternative's water use in the Bull Mountain FEIS would exceed levels contemplated in the PBO. The FEIS estimates that construction, drilling, dust abatement, and completion of the 146 gas wells for the preferred alternative would require 2,480.2 acre-feet of water, of which 744.1 acre-feet would be fresh water.[435] Per well fresh water use, then, would amount to just over five acre-feet, nearly five times greater than the PBO's projections for vertical well depletions in the Gunnison River sub-basin.[436] The anticipated life of the project is six years, with an average of 27 wells drilled per year.[437] Total fresh water depletions divided by the six year duration of the project amounts to 124 acre feet of fresh water depleted annually. As noted above, the PBO estimated total *annual* water depletions from the Gunnison sub-basin at 16 acre-feet—given the preferred alternative's proximity to tributaries of the Gunnison River, water would likely be taken from the Gunnison River sub-basin, although the Bull Mountain FEIS fails to clearly state the project's water source.[438] The preferred alternative, then, would likely lead to annual water depletions from the Gunnison River sub-basin of over seven times greater than projected in the PBO. Even if water were drawn from the Colorado River sub-basin, the 124 acre-feet required annually by the preferred alternative alone would amount to nearly one third of all allowable annual depletions for the Colorado River sub-basin under the 2008 PBO.

---

[433] *See* Center for Biological Diversity, Spreadsheet of Horizontal Well Projects in Colorado (listing horizontal well projects listed in BLM's NEPA register and projected water use) (attached as Exhibit 220).

[434] Bull Mountain Unit Master Development Plan Final Environmental Impact Statement (FEIS) (January, 2015), DOI -BLM-CO-S050-201 3-0022-EIS, at ES-1, available at http://www.blm.gov/style/medialib/blm/co/information/nepa/uncompahgre_field/13-22_bull_mountain.Par.23863.File.dat/Bull_Mtn_DEIS_Jan2015_508_reduced.pdf (attached as Exhibit 267).

[435] Bull Mountain FEIS, at ES-8 Table ES-1, ES-10-11 (attached above as Exhibit 267).

[436] *Id.*

[437] *Compare id.* at, ES—7 with Water Depletion Logs, attached as Exhibits 259-265.

[438] Bull Mountain FEIS at 3-31, Figure 3-4 (attached above as Exhibit 267).

Similarly, the Reasonably Foreseeable Development Scenarios for the Colorado River Valley and White River RMPs did not take into account Mancos shale drilling (other than exploratory wells) and thus such drilling is not considered in the PBO.[439] Further, a substantial portion of new wells would be horizontal wells, as the lower strata of the Mancos formation would likely be accessed via horizontal drilling, but again, the PBO does not take into account the extraordinarily higher water use for horizontal wells. Water depletions in the Gunnison river sub-basin and throughout the entire Upper Colorado River Basin could therefore exceed projected water use estimates in the PBO.

In addition, the NEPA analysis for the project must analyze the project's water depletions in connection with other projects in the Gunnison River sub-basin and Upper Basin, including the Bull Mountain project, in compliance with NEPA's cumulative impacts analysis requirements. To the extent that this analysis would rely on the PBO, such reliance is arbitrary and cannot constitute BLM's Section 7 or NEPA compliance.

New Information Reveals the Potential for Horizontal Drilling and Fracking in the Paradox Basin and their Greater Water Depletion Effects.

Increased water use and horizontal drilling throughout the Dolores River sub-basin of the Upper Basin will also impact the endangered fish and requires reinitiation on the PBO. BLM's Programmatic Biological Assessment (PBA) which informed the PBO estimated very low average water use per well within the Dolores River Basin. The PBA assumed that 1.1 acre-feet per well would be used to develop a single conventional well within the San Juan Public Lands Center, which includes the Dolores River Basin, and that a total of 700 wells would be developed over a 15-year period within this sub-watershed of the Upper Colorado River Basin.[440]

The Tres Rios RMP-EIS--published in 2013, five years after the PBO was adopted--however, reveals the potential for water use within the Dolores River Basin that could be many times higher than this amount:

---

[439] *See* White River RMP FEIS at K-358 ("Development of the Mancos and Niobrara outside the Rangely Field in Rio Blanco County in the WRFO are not [] currently well defined and are exploratory in nature. This development is in the initial stages of the exploration phase to determine of the maturity of the reservoir and the potential viability of the Niobrara within the WRFO.") (attached as Exhibit 310); *see also* Colorado River Valley RMP FEIS at 4-576 ("To date, use of horizontal drilling in relation to the deep marine shales [i.e., Niobrara, Mancos, and Eagle Basin formations] has been limited and is considered experimental. As a result, the development intensity, timing, and location of development of the deep marine shales was considered too speculative for quantitative impact analysis in connection with this planning process.") (attached as Exhibit 343).

[440] BLM, Programmatic Biological Assessment for BLM's Fluid Minerals Program in Western Colorado re: Water Depletions and effects on the Four Endangered Big River Fishes: Colorado Pikeminnow, humpback chub, bonytail, and razorback sucker, 8 (Nov. 3, 2008) (attached as Exhibit 339).

> Substantial quantities of water are projected to be used in the drilling, fracturing, and completion process for both the [Gothic Shale Gas Play] and Paradox conventional development (Table 3.5.4). The major river basins affected by the projected development in the PLAA are the Dolores and San Juan River Basins. [Gothic Shale Gas Play] gas wells in the Paradox Basin would use approximately 7.9 to 13.1 acre-feet of water per well in the drilling and completion process. This level of water consumption is 6 to 11 times the amount of water used to drill and complete a conventional gas well and 11 to 18 times the amount of water used to drill and complete a CBM gas well. Paradox conventional gas wells would use 3.3 acre-feet of water per well in the drilling and completion process. This level of water use is 2.5 times the amount of water used to drill and complete other conventional wells and five times the amount of water used to drill and complete a CBM well.[441]

These increased per well water depletions are attributable to the increased water demand of new oil and gas development techniques such as multi-stage fracking and horizontal drilling that were not previously taken into account in the PBO.[442] Accordingly, the Tres Rios RMP-EIS estimates the total amount of water depletions within the Dolores River Basin under existing and future leases over a 15-year period to be between 7,555 and 8,840 acre-feet, or approximately 503 acre-feet to 589 acre-feet per year.[443] This annual depletion rate is approximately ten times the amount of depletions that the PBA projected would occur in the Dolores River Basin (54 acre-feet per year). Moreover, depletions could be much higher as the RMP-EIS did not estimate stream depletions resulting from removal of interconnected groundwater, which operators would likely pump out to facilitate gas extraction.[444]

However, despite that projected depletions for oil and gas development in the Tres Rios planning area far exceed the PBO's depletion limit for the Dolores River sub-basin, BLM and FWS did not consider this increased water use in their consultation over the Tres Rios RMP, but simply "tiered to" and relied on the PBO.[445] In the absence of a valid consultation over Fluid Mineral Program water depletions in the Tres Rios planning area and Dolores River sub-basin, BLM and FWS must also take into account these much higher water depletions in a reinitiated PBO.

BLM and FWS must reinitiate consultation over the increased water depletion effects of horizontal drilling and increased oil and gas development potential of the Gothic and Mancos shale plays.

ii. Climate Change Is Reducing Stream Flows in the Upper Colorado River Basin.

[441] Tres Rios RMP-EIS at 244 (attached as Exhibit 342).
[442] *See* Tres Rios RMP-EIS at 19, 491-92 (attached above as Exhibit 342).
[443] *Id*. at 245.
[444] *Id*.
[445] Tres Rios RMP-EIS, Appendix Y, Conference Opinion at 3.

The PBO does not analyze or even mention climate change and its potential to reduce stream flows in the Upper Basin, which could amplify the effects of water depletions on the endangered fish and reduce the effectiveness of the Endangered Fish Recovery Program (e.g., by reducing the availability of water to supplement natural flows in dry years). The best available scientific data indicate that climate change is resulting in higher temperatures in the Colorado River Basin, reduced snowpack, diminished runoff, and more frequent and intense droughts, which have already reduced and will continue to reduce stream flows in the Basin. As shown in the Center's attached literature review (Exhibit 336), ample studies document these effects and predict continuing flow declines.[446]

In the Colorado River basin, temperatures have increased roughly by 2° F, and "additional decades of warming are 'locked in' regardless of any behavioral changes that may or may not be implemented by the world's governments"—roughly an additional 5° F of warming can be expected in the basin by 2050.[447] Recently, researchers for the first time used historical data to show temperature-driven stream flow declines in the Upper Basin. As described in the Center's attached literature review (Exhibit 336):

> An empirical study of the influence of precipitation, temperature, and soil moisture on upper Colorado River basin streamflow over the past century found that warmer temperatures have already resulted in flows less than expected based on precipitation levels (Woodhouse et al. 2016). Consistent with past research, the study found that cool season precipitation explains most of the variability in annual streamflow. However, temperature was highly influential in determining streamflow under certain conditions. The study concluded that "[s]ince 1988, a marked increase in the frequency of warm years with lower flows than expected, given precipitation, suggests continued warming temperatures will be an increasingly important influence in reducing future UCRB water supplies." The researchers warned that "streamflow forecasts run the risk of overprediction if warming spring and early summer temperatures are not adequately considered."[448]

According to the study's press release it is the "first to examine the instrumental historical record to see if a temperature effect [on stream flows] could be detected."[449] The study's lead author highlighted its significance: "If we have a warmer spring, we can

---

[446] Shaye Wolf, Ph.D., *Impacts of Climate Change on the Colorado River Basin*, Center for Biological Diversity (March 10, 2016) (attached as Exhibit 336).
[447] Colorado River Research Group, Climate Change and the Colorado River: What We Already Know (Oct. 2016), available at http://www.coloradoriverresearchgroup.org/uploads/4/2/3/6/42362959/crrg_climate_change.pdf (attached as Exhibit 268).
[448] *Id*. at 2.
[449] American Geophysical Union, Colorado River Flows Reduced by Warmer Spring Temperatures (March 9, 2016), available at http://news.agu.org/press-release/colorado-river-flows-reduced-by-warmer-spring-temperatures/.

anticipate that the flows will be less relative to the amount of snowpack[.]….What we're seeing is not just the future – it's actually now. That's not something I say lightly."[450]

Under a business-as-usual GHG emissions scenario, the risk of mega-drought in the southwest would increase to 70-99% by the end of the century.[451] This substantial risk of mega-drought would exist regardless of how or whether precipitation changes.

In addition to reducing the overall amount of water in the Upper Colorado River Basin, these climate change effects would worsen effects from toxic spills by increasing the concentration of pollutants and toxic contaminants. Climate change is also likely to exacerbate mercury and selenium pollution effects on the Colorado pikeminnow. Mercury deposited into soil from coal burning and selenium will increasingly run off into streams with increased heavy rainfall events.[452] More frequent and severe wildfire events will result in increased charring of soil, releasing mercury and selenium that can wash off into streams.[453] Warmer water conditions will hasten the conversion of mercury into toxic methylmercury.[454]

BLM and the Service must reinitiate consultation on the Fluid Mineral Program in light of new evidence that climate change and warming temperatures are reducing Colorado River stream flows and may affect the endangered fish and its critical habitat in a manner and to an extent not previously considered.

iii. Persistent Drought Conditions and Increasing Water Demand Have Reduced Water Supply

Compounding this threat to the endangered fish are persistent drought conditions that have diminished natural flows in the Colorado River Basin and reduced water storage that is needed to supplement Upper Basin flows. The period from 2000 to 2015 was the lowest 16-year period for natural flow in the last century, and one of the lowest 16-year periods for natural flow in the past 1,200 years, according to paleorecords.[455] As a result, water storage in the Colorado River system reservoirs have declined "from nearly full to about half of capacity," and led to local shortages in the Upper Colorado's sub-basins.[456]

---

[450] *Id*.
[451] Toby R. Ault, et al., *Relative Impacts of Mitigation, Temperature, and Precipitation on 21st-Century Megadrought Risk in the American Southwest*, Science Advances: Vol. 2, no. 10, e1600873 (2016), DOI: 10.1126/sciadv.1600873 (attached as Exhibit 269).
[452] National Wildlife Federation, Swimming Upstream: Freshwater Fish in a Warming World, 19 (2013), available at http://www.nwf.org/~/media/PDFs/Global-Warming/Reports/NWF-Swimming%20Upstream-082813-B.ashx (attached as Exhibit 121).
[453] *Id*.
[454] *Id*.
[455] Bureau of Reclamation, Managing Water in the West: SECURE Water Act Section 9503(c) Report to Congress, Chapter 3, Colorado River Basin at 3-64 (2016) (Chapter 3) (attached as Exhibit 270).
[456] *Id*.

Further, population growth will increase water demand for agriculture and municipal uses, making it increasingly difficult to ensure sufficient water availability for the endangered fish, which rely on the release of stored water, especially in dry years.[457] An ever widening gap between water supply and water demand is weakening the Colorado River water supply system's reliability and ability to buffer the system in dry years.[458] According to the U.S. Geological Survey, "increased water demand and declining water availability make the restoration of endangered fish habitat extremely challenging."[459] This growing gap between supply and demand in the Upper Colorado River Basin must be taken into account in a reinitiated consultation.

iv. Mercury and Selenium Are Adversely Impacting the Endangered Fish

New scientific information regarding (a) mercury and selenium effects on fish reproduction and population viability, (b) mercury and selenium concentrations in Upper Colorado and White River fish, (c) the potential role of oil and gas development in mercury contamination levels in the White River, (d) the potential for development of the Mancos shale play to increase selenium pollution, and (e) the relationship between climate change and mercury and selenium toxicity constitutes new information revealing that the Fluid Mineral Program may have effects on the endangered fish to an extent that was not considered in the PBO, and requires reinitiation of consultation over the Fluid Mineral Program.[460]

Mercury Contamination Is Harming Colorado Pikeminnow Populations.

The PBO's discussion of the environmental baseline for, and threats to, the Colorado pikeminnow and razorback sucker contains no discussion whatsoever of environmental and tissue mercury contamination or the resulting toxicity and reproductive impairment to the endangered fish. Significant new research since the 2008 PBO has demonstrated that elevated levels of mercury in Colorado pikeminnow muscle tissue, including within the Upper Colorado River Basin, are at concentrations likely to cause reproductive and behavioral impairment to the fish.[461]

---

[457] *See id*. at 3-7, 3-8.
[458] *Id*. at 3-10, 3-12.
[459] USGS, Effects of Climate Change and Land Use on Water Resources in the Upper Colorado River Basin, 5 (2010), available at https://pubs.usgs.gov/fs/2010/3123/pdf/FS10-3123.pdf (attached as Exhibit 271).
[460] 50 C.F.R. § 402.16(b).
[461] USFWS, Upper Colorado River Endangered Fish Recovery Program, Colorado pikeminnow (*Ptychocheilus lucius*), 5-Year Review: Summary and Evaluation 21 (2011) ("[T]he recovery goal revision needs to consider the impacts of mercury. . . the majority (64 %) of Colorado pikeminnow may be experiencing some reproductive impairment through mercury exposure.") ("Colorado Pikeminnow 5-year Review") (attached as Exhibit 309); USFWS, Biological Opinion for the Four Corners Power Plant and Navajo Mine Energy Project at 76 & Table 3 (April 8, 2015) ("Four Corners Biological Opinion") (attached as Exhibit 137).

Mercury is a potent neurotoxin shown to cause numerous reproductive and endocrine impairments in fish in laboratory experiments, including effects on production of sex hormones, gonadal development, egg production, spawning behavior, and spawning success.[462] Concentrations of mercury in Colorado pikeminnow in the Upper Basin are documented to be well in excess of the thresholds for reproductive impairment and population-level impacts.[463] 2008-2009 muscle tissue averages were 0.60 mg/Kg Hg for Colorado pikeminnow in the Upper Colorado basin and 0.95 mg/Kg Hg for Colorado pikeminnow in the White River – well above the 0.2 mg/kg threshold of concern.[464]

Mercury deposition and accumulation in critical habitat is attributable to a number of local and global factors, including air emissions from coal-fired power plants both in the immediate region and around the world.[465] In addition, because of discrepancies in mercury concentrations between pikeminnow in the Yampa and White Rivers, research suggests that "[i]t is possible that there is some localized sources of mercury contamination into the White River drainage connected with oil and gas exploration and development."[466]

Once mercury is deposited on land or water, it is converted into a biologically available form, methylmercury (MeHg) by bacteria. Methylmercury "bioaccumulates in food chains, and particularly in aquatic food chains, meaning that organisms exposed to MeHg in their food can build up concentrations that are many times higher than ambient concentrations in the environment."[467] Once it accumulates, mercury is a potent neurotoxin, affecting fish in many ways, including brain lesions, reduced gonadal secretions, reproductive timing failures, reduced ability to feed, suppressed reproductive hormones, reduced egg production, reduced reproductive success, and transfer of mercury into developing eggs.[468] Although the precise effects vary with

---

[462] USFWS, Draft 2014-2015 Assessment of Sufficient Progress Under the Upper Colorado River Endangered Fish Recovery Program in the Upper Colorado River Basin, and of Implementation of Action Items in the December 20, 1999, 15-Mile Reach Programmatic Biological Opinion and December 4, 2009, Gunnison River Basin Programmatic Biological Opinion, 10 (Oct. 7, 2015) ("Sufficient Progress Assessment") (attached as Exhibit 272).
[463] *See* Barb Osmundson & Joel Lusk, Field Assessment of Mercury Exposure to Colorado Pikeminnow Within Designated Critical Habitat (May 5, 2011) ("Osmundson & Lusk 2011") (attached as Exhibit 273).
[464] *See* Four Corners Biological Opinion at 76 & Table 3 (attached above as Exhibit 137); *see generally* Beckvar, N., T.M. Dillon, and L.B. Reads, Approaches for linking whole-body fish tissue residues of mercury or DDT to biological effects threshold, Environmental Toxicology and Chemistry 24:2094-2105 (2005) (attached as Exhibit 274).
[465] *See* Four Corners Biological Opinion at 73-74 (attached above as Exhibit 137); Osmundson & Lusk 2011 at 9-10 (attached above as Exhibit 273).
[466] *Id*. at 29.
[467] Four Corners Biological Opinion at 73 (attached above as Exhibit 137).
[468] *See* Joel D. Lusk, *USFWS, Mercury (Hg) and Selenium (Se) in Colorado Pikeminnow and in Razorback Sucker from the San Juan River*, 17 (2010), available at https://www.fws.gov/southwest/sjrip/pdf/DOC_Evaluation_Hg_Se_SJR_pikeminnow%20or_razorback_SJRIP_BC_2010.pdf (attached as Exhibit 275).

relative concentrations, mercury and selenium may have synergistic toxic effects at certain ratios.[469]

The Service has acknowledged that its recovery planning for the Colorado pikeminnow needs updating to reflect this new information regarding mercury:

> In addition, the recovery goal revision needs to consider the impacts of mercury. Beckvar et al. (2005) associated studies involving survival, growth, reproduction, and behavior and recommended that 0.2 mg/kg in whole fish be viewed as protective, while adverse biological effects are more likely at higher concentrations. Based on this threshold, the majority (64 %) of Colorado pikeminnow may be experiencing some reproductive impairment through mercury exposure. Management strategies for controlling anthropogenic mercury emissions are necessary as atmospheric pollution can indirectly affect this endangered species, its critical habitat, and its recovery by ambient air exposure, deposition into aquatic habitat and bioaccumulation in diet and in fish tissues.[470]

Moreover, the Service's 2015 Sufficient Progress Assessment for the Recovery Program acknowledges that population viability studies show that mercury- and selenium-related reproductive impairment is likely to influence population levels in the San Juan Basin,[471] but no comparable analysis has yet been done for the higher levels of contamination present in Upper Colorado River Basin fish.

The significant difference in mercury concentrations in fish found in the neighboring Yampa and White Rivers also offers significant new information potentially relevant to the effect of BLM-authorized oil and gas development. Osmundson and Lusk found very high (average 0.95 mg/Kg WW) mercury concentrations in Colorado pikeminnow and in the White River, and lower (0.49 mg/Kg) concentrations in the neighboring Yampa.[472] Based on this discrepancy, they noted:

> The Yampa and White rivers are relatively close geographically in northwestern Colorado. Because of this proximity, it is interesting that the Yampa River had the lowest mercury concentrations in Colorado pikeminnow while the White River had the highest mercury concentrations. If most of the mercury was from aerial wet and dry deposition, the two drainages should be similar. This difference may indicate a localized source/s of mercury contamination into the White River drainage. There are currently >2,600 gas and oil wells in Rio Blanco county. It is possible that there is some localized sources of mercury contamination into the White River drainage connected with oil and gas exploration and development.[473]

---

[469] Four Corners Biological Opinion at 103 (attached above as Exhibit 137).
[470] Colorado Pikeminnow 5-year Review at 21 (attached above as Exhibit 309); *see also* Significant Progress Assessment at 10-11 (attached above as Exhibit 272).
[471] Sufficient Progress Assessment at 10-11 (attached above as Exhibit 272).
[472] Osmundson & Lusk 2011 at 21 & Table 2 (attached above as Exhibit 273).
[473] *Id.* at 29 (citations omitted).

Although site-specific information for the Upper Basin planning areas appears scarce, there is scientific as well as circumstantial evidence that oil and gas operations can contribute to mercury contamination.[474] The PBO does not consider the effect of oil and gas development within the White River watershed on the threat to Colorado pikeminnow and razorback sucker from mercury toxicity.

Nor does the PBO give any consideration to the multiple ways in which climate change will exacerbate mercury and selenium contamination and toxicity. Climate change can foreseeably be predicted to increase heavy rainfall events and ensuing runoff, increase pollutant concentrations due to reduced flows during low-flow periods, and contribute to increased methylmercury conversion due to higher temperatures.

Selenium Pollution Is Harming the Endangered Fish.

Selenium harms the endangered fish and other aquatic species through bioaccumulation in the food chain. Concentrations of 3µg/g in the food chain have been found to cause gill and organ damage in certain fish and may lead to death.[475] These bioaccumulative effects resulting in direct toxicity to juvenile and adults are known as "Type 1" effects. Moreover, selenium bioaccumulation can result in maternal transfer of selenium to fish egg yolks and lead to developmental abnormalities, known as "Type 2 effects."[476] Waterborne concentrations of selenium in the 1-5 µg/L range can bioaccumulate and lead to Type 1 and/or Type 2 effects.[477]

Recent studies reveal significant exposures of the endangered fish to selenium. In one study analyzing selenium concentrations of 26 fish specimens collected from designated critical habitat in the Gunnison River, one Colorado pikeminnow specimen exhibited concentrations in muscle plugs that exceeded the 8 micrograms per gram dry weight toxicity guideline for selenium in fish muscle tissue.[478] Several species, including the razorback sucker and Colorado

---

[474] *See* U.S. EPA, National Risk Management Research Laboratory, Mercury in Petroleum and Natural Gas: Estimation of Emissions from Production, Processing, and Combustion, EPA/600/SR-01/066 (Oct. 2001) (attached as Exhibit 276); Visvanathan, C., Treatment and Disposal of Mercury Contaminated Waste from Oil and Gas Exploration Facilities (1993) available at http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.549.9515&rep=rep1&type=pdf (attached as Exhibit 277).

[475] A.D. Lemly, Appalachian Center for the Economy & the Environment and Sierra Club, *Aquatic Hazard of Selenium Pollution from Mountaintop Removal Coal Mining*, 3 (2009) ("Lemly 2009") (attached as Exhibit 278).

[476] Lemly 2009 at 3 (attached above as Exhibit 278); S.J. Hamilton, *Review of Residue-Based Selenium Toxicity Thresholds for Freshwater Fish*, Ecotox. Environ. Saf. 56: 201-210 (2003) (attached as Exhibit 279).

[477] *See id.*

[478] Thomas W. May & Michael J. Walther, USGS, *Determination of Selenium in Fish from Designated Critical Habitat in the Gunnison River, Colorado, March through October, 2012*, Open-File Report 2013-1104, 2 (2013) (attached as Exhibit 280).

pikeminnow, exhibited selenium exposures in excess of the critical concentration at which Type 1 health effects begin to occur.[479]

In the Lower Gunnison River Basin, 2014 data indicated a range of dissolved selenium (chronic values) from 0.97 µg/L to 16.7 µg/L along the Uncompahgre River. Out of 18 sites in the lower Gunnison that were considered, the Colorado water-quality standard for chronic dissolved selenium of 4.6 µg/L was exceeded at two sites.[480] In regards to acute values, the range measured was from 1.1 µg/L for a portion of the Uncompahgre River to 125 µg/L along a portion of Loutzenhizer Arroyo, with 125 µg/L being well in excess of any criteria for instantaneous selenium measurements.[481] In another 2015 study, mean concentrations of selenium in various fish species in the lower Colorado River Basin exceeded the risk for maternal transfer to eggs, while selenium concentrations in various species of macroinvertebrate prey exceeded the risk value for larval fishes.[482] Average selenium concentrations in the studied fish species were found to be 2- to 4-fold higher than the risk threshold for piscivorous (fish-eating) wildlife, with samples exceeding this threshold in 81-100% of cases depending on the species. The risk value for larval fishes, who either absorb selenium via maternal transfer to eggs or through invertebrate diet, was exceeded in 56-100% of cases depending on the adult species (with risk posed to larvae due to maternal transfer), and 86-100% of cases among invertebrates (with risk posed to larval fishes through diet). Thus, the transfer of selenium toxicity from invertebrates to fish to piscivores is readily observable.[483]

Natural erosion and runoff, as well as selenium leaching into irrigation runoff, are the primary sources of this toxic pollutant. The weathering of Cretaceous marine shales can produce high selenium soils, which are present in many areas of the western U.S.[484] Most notable of these Cretaceous shales is the Mancos Shale, which is found in Colorado, Utah, Wyoming, New Mexico, and Arizona. Irrigation of selenium-rich soils for crop production in arid and semi-arid regions can mobilize selenium and move it off-site in surface water runoff or via leaching into groundwater.

v. Population Numbers of the Endangered Fish Are Declining

Colorado pikeminnow populations are in decline throughout the Green River and Colorado River Basin, indicating that the Recovery Plan for the endangered fish has not been

---

[479] *Id.*
[480] M. F. Henneberg, *2014 Annual Summary of the Lower Gunnison River Basin Selenium Management Program Water-Quality Monitoring, Colorado*, U.S. Geological Survey Open-File Report 2016–1129, 25 p. (2016), http://dx.doi.org/10.3133/ofr20161129 (attached as Exhibit 281).
[481] *Id.*
[482] David M. Walters, et al., *Mercury and Selenium Accumulation in the Colorado River Food Web, Grand Canyon, USA*, Environmental Toxicology and Chemistry, 34(10):2385-2394, 2390 (2015) (attached as Exhibit 282).
[483] *Id.*
[484] A.D. Lemly, *Guidelines for Evaluating Selenium Data from Aquatic Monitoring and Assessment Studies*, Environ. Monitor. Assess. 28(1):83-100 (1993) (attached as Exhibit 283).

effective and that the impacts of water depletions may be more severe than previously anticipated.

According to the Fish and Wildlife Service, the latest 2014 Colorado River sub-basin population number of 501 is "cause for great concern," and catch of sub-adults and adults in 2013 and 2014 "were near lowest observed in the history of the project."[485] 2015 catch numbers are within the same range, which suggests that the population estimate for 2015 will be similar to the 2014 estimate.[486] FWS's latest Sufficient Progress Assessment for the Endangered Fish Recovery Program, which includes the latest population estimates for 2015, show endangered fish populations have continued to decline.[487] In the Colorado River sub-basin, Colorado pikeminnow populations have steadily declined since 2005.[488] The long-term and short-term population estimates of 596 and 446 adults fall far short of the downlisting criteria of 700 adults.[489] Recruitment rates "may not be frequent enough to support stability in the adult populations in the long term."[490] Data from 2015 showing the absence of pikeminnow smaller than 300 mm "suggests spawning success and/or recruitment has been poor the previous three years."[491] Nonnative predation and competition are a major threat to the Colorado pikeminnow population in this sub-basin.[492]

In the Green River sub-basin, pikeminnow populations have dropped since 2000.[493] The overall pattern of population declines strongly suggests a failure to meet the Recovery Program's downlisting criteria that adult point estimates for the middle Green River and lower Green River do not decline significantly over a 5-year period, and that each estimate for the Green River Subbasin exceeds 2,600 adults.[494] "The most recent interpretation (Bestgen et al. 2016; in review) of the estimates collected in 2006-2008 and 2011-2013 revealed a gradual but persistent decline in the adult population," which is "clearly negative."[495] The average of the three most

---

[485] Sufficient Progress Memo (attached above as Exhibit 272).
[486] *See* USFWS, Monitoring the Colorado Pikeminnow Population in the Mainstem Colorado River via Periodic Population Estimates, p. 3 (Nov. 2015), available at http://www.coloradoriverrecovery.org/documents-publications/work-plan-documents/arpts/2015/rsch/127.pdf (showing similar capture rates of pikeminnow in 2014 and 2015) (attached as Exhibit 284).
[487] USFWS, 2015-2016 Assessment of Sufficient Progress Under the Colorado River Endangered Fish Recovery Program in the Upper Colorado River Basin, and Implementation of Action Items in the January 10, 20015, Final Programmatic Biological Opinion on the Management Plan for Endnagered Fishes in the Yampa River Basin, 4-14 (Dec. 20, 2016) ("2016 Sufficient Progress Memo") (attached as Exhibit 285).
[488] *Id*. at 4.
[489] *Id*. at 4, 6.
[490] *Id*. at 4.
[491] *Id*. at 8.
[492] *See id*. at 7.
[493] *Id*. at 4.
[494] *See id.* at 10.
[495] *Id*. at 8, 10.

recent population estimates (2011-2013) is 1,999 adults, well below the delisting criterion of 2,600 adults.[496]

The Recovery Program has also failed to meet the downlisting criteria that recruitment of age-6, naturally-produced fish equal or exceed mean annual adult mortality. The abundance of adult recruits has failed to exceed annual adult mortality "in most years" and "appears insufficient to offset overall adult mortality since 2000."[497] Compounding this problem, population densities of age-0 fish in the middle Green River from 1994 to 2008 were "precariously low."[498] New research reveals that the "mechanisms driving frequency and strength of recruitment events was likely the strength of age-0 Colorado pikeminnow production in backwater nursery habitats.[499] Further, "multiple consecutive years of age-0 densities" are important to the strength of adult populations seven to ten years later.[500] Research by Bestgen and Hill (2015) shows that declines in summer base flows in August and September were correlated with declining densities of age-0 Colorado pikeminnow in the lower and middle reaches of the Green River.[501] The researchers recommended increased base flow magnitudes to support increased age-0 production (1,700 and 3,000 cfs in the middle Green River and 1,700 and 3,800 cfs in the lower Green River).

In 2015, releases from Flaming Gorge Dam resulted in base flow levels within these ranges, and "a significant increase in fall recruitment was observed, underscoring the value of manipulating Flaming Gorge Dam releases as a main recovery action to benefit Colorado pikeminnow recruitment in the Green River."[502] However, it is unclear to what extent Bureau of Reclamation or other water users have committed to these base flow increases, and whether they will be sustained as water supplies dwindle with increased water demand and climate change effects on stream flows. The Sufficient Progress Assessment only notes that "Reclamation's summer base flow releases [from Flaming Gorge Dam] now target a preferred flow range to improve survival of young Colorado pikeminnow."[503]

The Yampa River portion of the Green River sub-basin population also "remains low and may be in further decline."[504] Recent studies show that Colorado pikeminnow declines in the Yampa River are linked to "persistent high densities of nonnative predators (e.g., smallmouth bass and northern pike [])," and that northern pike are outnumbering Colorado pikeminnow by three to one.[505] The weakening of the Yampa River portion of the sub-basin population makes it even more critical to ensure that habitat for the Green River portion of the Green River sub-basin population is not degraded and remains a stronghold for the species. Bestgen et al. 2016 (in

---

[496] *Id*. at 10.
[497] 2016 Sufficient Progress memo at 4 (attached above as Exhibit 285).
[498] *Id*.
[499] *Id*. at 11.
[500] *Id*.
[501] *Id*.
[502] *Id*. at 11-12.
[503] *Id*. at 41.
[504] 2015 Sufficient Progress Memo at 7 (attached as Exhibit 272).
[505] *Id*. at 8; 2016 Sufficient Progress Memo at 12 (attached above as Exhibit 285).

review), however, "now report that the decline in adult and subadult Colorado pikminnow has spread though the entire Green River Subbasin."[506]

Humpback chub numbers are also low. The U.S. Fish and Wildlife Service is "concerned that wild populations of humpback chub in Black Rocks and Westwater Canyon of the Colorado River (near the Colorado-Utah state line) have not recovered from declines detected in the late 1990's. The reason for those population declines is uncertain."[507] After this steep reduction, the Black Rocks/Westwater population continued to decline.[508] In 2008, the population "dropped below the population size downlist criterion (MVP = 2,100 adults) for the first time."[509] In 2011 and 2012, the core population estimates were 1,846 and 1,718, respectively.[510] "Colorado State University's recent robust population analysis more clearly indicated that declines in the Westwater and Black Rock humpback chub populations are due to lapses in recruitment."[511]

The Desolation/Gray Canyons population—which inhabits the Green River—has also not met the population-size downlist criterion, and was observed to be "trending downward" based on 2006-2007 population estimates.[512] This trend has been attributed to "increased nonnative fish abundance and habitat changes associated with dry weather and low river flows."[513] The 2014 estimate is 1,863 adults, while the average of 7 point estimates collected since 2001 is 1,711, substantially below the 2,100-adults recovery criterion.[514] Captures of recruits have been low in recent years.[515]

These declining numbers not only show that the endangered fish may be more sensitive to water depletion and other oil and gas development effects than previously assumed, but they strongly suggest that the Endangered Fish Recovery Program is not achieving recovery targets nor adequately offsetting water depletion effects as intended.

vi. The Recovery Program Is Failing to Meet Recommended Flows

A consistent pattern of failing to meet recommended flows in the Colorado River's 15-Mile Reach requires BLM and the Service to reinitiate consultation over the Fluid Mineral Program.

---

[506] *Id*. at 12.
[507] 2015 Sufficient Progress Memo at 36 (attached above as Exhibit 272).
[508] *Id*. at 13.
[509] *Id*.
[510] *Id*. at 13-14; *see also* 2016 Sufficient Progress Memo at 15 (confirming numbers remain "below core criteria level" and average of 5 estimates since 2004 is 1,426 adults compared to average of 2,490 adults since 1998) (attached above as Exhibit 285).
[511] *Id*. at 20.
[512] 2015 Sufficient Progress Assessment at 12 (attached above as Exhibit 272).
[513] *Id*. at 23.
[514] *Id*. at 12; 2016 Sufficient Progress Assessment at 15 (attached above as Exhibit 285).
[515] 2016 Sufficient Progress Assessment at 15 (attached above as Exhibit 285).

The Recovery Program establishes minimum recommended flows within various segments of the Upper Colorado River Basin that should be maintained to ensure recovery of the endangered fish.[516] The PBO's effects analysis assumes that, at the very least, the minimum recommended flow of 810 cubic feet per second (cfs) for dry years will be maintained within the 15-Mile Reach of the Colorado River within Colorado's Grand Valley in the Grand Junction Field Office.[517] The 15-Mile Reach extends from the confluence of the Gunnison River in Grand Junction to Palisade, Colorado, fifteen miles upstream.[518] According to the Service, when flows drop below 810 cfs, "habitat becomes compromised to the point that adult pikeminnow likely vacate the 15-Mile Reach to points downstream where flows increase either due to tributary input from the Gunnison River or irrigation return flow."[519] The 15-Mile Reach is one of the most important habitats to the Colorado pikeminnow and razorback sucker,[520] providing important spawning grounds for both species and year-round habitat for the Colorado pikeminnow.[521]

In its discussion of the environmental baseline, the PBO notes various recommended flows for the Colorado River sub-basins, including minimum flows for wet years, wet-average years, dry-average years, and dry years.[522] The PBO notes that in some recent years, recommended flows have not been met in the 15-Mile Reach.[523] However, the PBO's effects analysis assumes that the lowest recommended flow for dry years (810 cfs) will be maintained; this minimum flow is the baseline by which the PBO determined the Fluid Mineral Program's depletion effects on the Colorado pikeminnow.[524]

---

[516] *See* PBO at 41; USFWS, Final Programmatic Biological Opinion for Bureau of Reclamation's Operations and Depletions, Other Depletions, and Funding and Implementation of Recovery Program Actions in the Upper Colorado River above the Confluence with the Gunnison River, 54 (Dec. 1999) ("Colorado River PBO"), available at http://www.coloradoriverrecovery.org/documents-publications/section-7-consultation/15mile/FinalPBO.pdf (attached as Exhibit 286).

[517] PBO at 42, 48.

[518] PBO at 4.

[519] *See* 2015 Sufficient Progress Assessment at 34-35 (attached above as Exhibit 272); Douglas B. Osmundson & Patrick Nelson, USFWS, *Relationships Between Flow and Rare Fish Habitat in the '15 Mile Reach' of the Upper Colorado River Final Report*, 6 (1995), available at http://www.coloradoriverrecovery.org/documents-publications/technical-reports/isf/OsmundsonNelson1995.pdf ("Osmundson 1995") (attached as Exhibit 287).

[520] PBO at 36, 42; Colorado River PBO at 25, 32, 45; Osmundson 1995 at 6.

[521] PBO at 36; Colorado River PBO at 31-32.

[522] PBO at 41-44.

[523] *See id*. at 42-44 (e.g., "Since the publication of the spring flow recommendations in 1991, peak 1-day average flows through the 15-mile reach have been below 12,900 cfs approximately one-third of the years through 2006 and these targets have not been met."); *id*. at 42 ("Mean monthly flows have…dropped below 810 cfs [the minimum flow for drought years] for at least one of the summer-time months during 7 of the last 17 years (1991-2007).").

[524] *Id*. at 48.

The Endangered Fish Recovery Program's 2015 Sufficient Progress Assessment indicates that recommended flows for dry years in the 15-Mile Reach of the Colorado River were not met in 2012 and 2013.[525] Flows also fell short of recommended levels in 2015, despite it being a dry-average precipitation year. In April, May, August and October 2015, the 15-Mile Reach missed the recommended minimum average flows for those months for dry-average precipitation years.[526] This average year shortfall (following a "wet-average" year) strongly suggests that minimum recommended flows for later dry years will almost certainly not be met when water will be scarcer, and as declining stream flows overall due to climate change weaken the Recovery Program's ability to supplement natural flows in dry years.[527] Indeed, in the period since the PBO was adopted, between 2009 and 2015, the Recovery Program has failed to meet mean monthly recommended flows in the 15-Mile Reach in over half of all months.[528] According to the 2016 Sufficient Progress Assessment, "[t]he Recovery Program still struggles to meet flow recommendations in drought years. The Service emphasizes the importance of meeting the flow recommendation. Some of these recommendations have not been met historically and may be unattainable."[529]

This new information strongly suggests that critical habitat within the 15-Mile Reach is likely to be unsuitable for the Colorado pikeminnow and razorback sucker in dry years, and that flow depletions from oil and gas development will only exacerbate these unsuitable conditions and reduce these species' chances of recovery.

The Recovery Program's continuing pattern of failing to meet recommended flows is new information revealing that the Fluid Mineral Program may have effects on the endangered fish to an extent that was not considered in the PBO or any of the RMPs that rely on the PBO.

3. Approval of the Project While BLM Evaluates New Information Concerning the Endangered Fish Violates BLM's Consultation Duties and Risks Violation of ESA Section 7(d).

Recently, in BLM's response to the Center and Sierra Club's protest of the Colorado State Office's Grand Junction Field Office December 8, 2016 lease sale, BLM stated its intent to

---

[525] *See* 2015 Sufficient Progress Assessment at 34 (noting average monthly flows significantly below 810 cfs in 15-mile reach in 2012 and 2013) (attached above as Exhibit 272); *id*. at 31 (recognizing need to reduce the amount of time flows drop below 810 cfs in the 15-Mile Reach).
[526] *Compare* Colorado River PBO at 40-41 (recommended mean monthly stream flows for 15-Mile Reach) *with* U.S. Geological Survey, Surface Water Monthly Statistics (1991 - 2016) & Email from Tom Chart, FWS, Director, Upper Colorado River Endangered Fish Recovery Program to Wendy Park (July 15, 2016) (chart indicating dry, average, and wet precipitation years) (attached as Exhibit 288).
[527] *See* n. 446 above & accompanying text (noting ability to buffer Colorado River system will become more difficult as streamflows decrease).
[528] *See* Center for Biological Diversity's comparison of USGS monthly mean flow data to recommended flow (spreadsheet showing 15-Mile Reach flows and months with shortfall) (attached as Exhibit 337).
[529] 2016 Sufficient Progress Assessment at 38 (attached as Exhibit 285).

prepare a new programmatic biological assessment on the Fluid Mineral Program, while at the same time allowing the December lease sale to go forward. BLM has since confirmed that it intends to formally reinitiate consultation with FWS on the 2008 biological opinion, in light of this new information, and that these issues cannot be addressed by amending the biological opinion.[530] BLM, however, cannot have it both ways—relying on the PBO to support new approvals, while also revising its analysis. Under these circumstances, proceeding with new leasing, or new projects like the proposed master development plan, violates BLM's obligations to consult before its proposed action and insure against jeopardy.

As an initial matter, BLM's protest response asserts that the "2008 PBO is still suitable to support the decision to lease parcels in the Upper Colorado River Basin area," on the flawed basis that the PBO's overall basin-wide depletion threshold had not been exceeded.[531] This ignores the fact that the PBO's Colorado River sub-basin depletion threshold was exceeded in FY2015, in violation of the PBO. BLM's implicit position that the PBO does not establish sub-basin depletion limits (in contrast to its prior suggestion)[532] is contrary to common sense and the PBO. Depletions in a particular sub-basin may significantly affect local endangered fish populations; otherwise, there would be no reason for the PBO to analyze the effects of depletions at the sub-basin level, or to require BLM to track and report depletions to FWS by sub-basin, as it does.

More troublingly, BLM's assertion that the 2008 PBO still validly supports its leasing decision does not square with BLM's recognition, in the same decision, of "the need to consider new information and re-evaluate changing conditions on the Upper Colorado River" and to "prepar[e] an updated Programmatic Biological Assessment (PBA)."[533] The PBA, BLM notes, "may consider information about new drilling techniques and re-examine the extent and location of fluid mineral reserves by river basin. The PBA will also evaluate how climate change and contaminants (specifically selenium and mercury) are affected by water depletions associated with BLM's fluid mineral program."[534] As the foregoing section shows, all of these factors are important considerations on the long-term viability of the endangered fish, which must be considered *before* any new depletions are allowed. And given FWS's finding that any water depletion is likely to jeopardize the endangered fish, BLM cannot dismiss the effects of any depletions resulting from its leasing decision, master development plans, or other site-specific projects. New depletions could result in significant adverse effects on the fish before BLM and

[530] Tel. comm. between Jay Thompson, BLM Colorado State Office, and Wendy Park, Center for Biological Diversity (Jan. 27, 2017).
[531] BLM, Protest Decision on December 2016 Oil and Gas Competitive Lease Sale, 13 (Dec. 7, 2016) ("December Protest Decision") (attached as Exhibit 340).
[532] *See* BLM, Protest Decision on Center for Biological Diversity's Protest of May 12, 2016 Competitive Oil & Gas Lease Sale (May 12, 2016) ("Moreover, consistent with the 2008 PBO, average annual depletions, regardless of the drilling technology employed, would not be allowed to exceed 369 acre-feet [i.e., Little Snake Field Office's projected water depletion] without further BLM and Fish and Wildlife Service analysis and reinitiated Section 7 consultation.") (attached as Exhibit 341).
[533] December Protest Decision at 13 (attached above as Exhibit 340).
[534] *Id*.

FWS have had a chance to evaluate their potential effects in light of these significant new circumstances. In addition, BLM has never consulted over the depletion and spill effects from oil and gas development in the particular areas at issue. New oil and gas development here could have localized effects on endangered fish downstream which have not been considered in any prior consultation, given the much higher water depletion effects and increased surface water contamination risks that could result from increased fracking, horizontal drilling, and wastewater and frack fluid transport and storage in the project area.

In the absence of a valid Section 7 consultation covering the Fluid Mineral Program and the project, BLM would be in violation of its Section 7 duties to both consult over the project's depletion effects on the endangered fish and to insure against jeopardy to the species, before approving the project. 16 U.S.C. § 1536(b). Waiting until the APD stage to consult violates BLM's duty to initiate consultation "at the earliest possible time," when meaningful consultation is possible now. *See* 50 C.F.R. § 402.14(a) ("Each Federal agency shall review its actions at the earliest possible time to determine whether any action may affect listed species or critical habitat."); *The Wilderness Society v. Wisely*, 524 F. Supp. 2d 1285, 1302 (D. Colo. 2007) (requiring Section 7 consultation before BLM's decision to resume oil and gas leasing where it was "possible… to engage in meaningful conference"); *Colorado Envtl. Coal. v. Office of Legacy Mgmt*., 819 F. Supp. 2d 1193, 1223 (D. Colo. 2011) (requiring same for uranium leasing decision).

Indeed, the law is clear that, in the context of oil and gas leasing, "agency action" under the ESA includes not just the legal transaction of lease issuance, but also all resulting post-leasing activities from exploration, through production, to abandonment:

> we hold that agency action in this case entails not only leasing but leasing and all post-leasing activities through production and abandonment. Thus, section 7 of the ESA on its face requires the FWS in this case to consider all phases of the agency action, which includes postleasing activities, in its biological opinion. Therefore the FWS was required to prepare, at the leasing stage, a comprehensive biological opinion assessing whether or not the agency action was likely to jeopardize the continued existence of protected species, based on "the best scientific and commercial data available." 16 U.S.C. § 1536(a)(2).

Conner v. Burford, 848 F.2d 1441, 1453 (9th Cir. 1988). The same would hold true for the master development plan at issue here—all post-planning activities must be asessed in a Section 7 consultation .

The Ninth Circuit's decision in *Conner v. Burford* is similarly clear that the consultation requirement is not obviated by uncertainty about the precise location and extent of future drilling: "Although we recognize that the precise location and extent of future oil and gas activities were unknown at the time, extensive information about the behavior and habitat of the species in the areas covered by the leases was available."[535]

[535] *Id.* at 1453.

BLM should not move forward with project approvals until an adequate consultation on the Fluid Mineral Program and proposed project has been completed.

4. BLM Must Analyze and Consult over the Project's Water Pollution and Contamination Effects on the Endangered Fish.

The risk of spills, leaks, and sedimentation contaminating and degrading endangered fish critical habitat will increase with the addition of up to 35 new oil and gas wells in the North Fork Gunnison River watershed. Contamination of surface and groundwater from oil and gas activities commonly occurs within the Upper Basin. Between January 2008 and July 2014, operators reported at least 135 spills or leaks that resulted in releases to surface or groundwater in the Upper Basin – many of these from facilities under BLM's jurisdiction.[536] The contamination of streams from oil and gas activities is therefore real and not hypothetical.

The potential for spills to move from tributaries into endangered fish critical habitat within main-stem rivers was shown by a 2014 spill into the Green River. On the night of May 20, 2014 an oil well operated by SW Energy on lands administered by BLM "blew out," leaking an estimated 100 barrels per hour of crude oil and production water into Salt Wash which leads to the Green River. SW Energy did not shut-in the well until 1:20 p.m. on May 22, at least 36 hours later. On May 24, flooding from a thunderstorm "overcame prevention measures" washing an unknown quantity of oil and produced water 1.5 miles from Salt Wash into the Green River and critical habitat for endangered fish.[537] The U.S. Fish and Wildlife Service's recent Biological Opinion for the Gasco Energy Inc. Field Development Project anticipates these events and the potential for more frequent spills given expanded drilling:

> There is a greater potential for impacts from pollutants, if a pipeline, well pit, or other source were to inadvertently release contaminated fluids into waterways at points near the Green and White Rivers. Through direct or indirect discharge, these pollutants could reach the Green River and negatively impact water quality to the point of affecting native fish populations. Direct impacts will result from a discharge from a pipeline or well pit reaching the Green River in its original form or within a single release event. Indirect effects occur when discharges are released to the ground and are later released to the river after being carried by an erosion event or carried by rain or snowmelt runoff. As more well and pipeline development occurs in the project area the chance of pollutants reaching the Green River increases, thus increasing the potential of harm to native fish populations.[538]

---

[536] Spills Data (all Upper Basin tab) (Exhibit 126-1).
[537] BLM. 2014. Update: Salt Wash Oil Spill, available at http://www.blm.gov/ut/st/en/fo/moab/SaltWashSpill.html (attached as Exhibit 338).
[538] Fish and Wildlife Service, Biological Opinion for the Gasco Energy Inc. Field Development Project ("Gasco BO"), Dec. 2011, p. 26, available at

Like the above Green River incident, some spills or leaks are not detected until long after they have started.[539]

Spills occurring in close proximity to the Gunnison River or its tributaries could expose endangered fish to potentially lethal levels of toxic substances. The project area appears to encompass or neighbor stretches of several creeks. Given this risk and declining populations of endangered fish, which could be severely crippled by a single catastrophic event, it would only take one spill within the project's 30-year lifespan to detrimentally harm the endangered fish. The potential for a blowout to result in a large spill like the Salt Wash incident, and harm critical habitat, should be addressed.

It is also possible that large volumes of chemical substances escape undetected until reaching surface sediments or waters, which could result in chronic sub-lethal effects. The Gasco Biological Opinion explains that this is especially possible with smaller leaks:

> The effects of smaller leaks that may cause chronic, sub-lethal effects to fish populations may be more prevalent. While the oil and gas industry has a wide variety of methods available to detect substantial leaks or integrity breeches, the technology for detection of small "pinhole" leaks is not as advanced. This creates a significant problem in that the current available methodology may allow small leaks to go undetected for extended periods of time often evading detection until they are manifested on the surface sediments or water.[540]

The potential for leaks and spills of condensate, crude oil, fracking chemicals, and produced water must be analyzed in the EA. Produced waters are essentially highly saline waters that rise to the surface from deep underground after completion of a well, and must be disposed. Many recent spills in the Upper Basin involve spillage of produced water. If spilled, the effects of produced water or brine can be more severe and longer-lasting than oil spills, because salts do

---

http://www.blm.gov/style/medialib/blm/ut/vernal_fo/planning/gasco_eis/gasco_rod.Par.56176.File.dat/Gasco%20ROD%20Attachment%205%20BO.pdf (attached as Exhibit 289).

[539] *See* James MacPherson, *ND Wants Answers on Ruptured Pipeline Inspections*, AP, Oct. 16, 2013, available at http://bigstory.ap.org/article/experts-question-north-dakota-oil-spill-estimates (spill released from quarter-inch pipeline hole contaminated wheat field the size of seven football fields); Nathan Vanderklippe, *Spill Sends 22,000 Barrels of Oil Mix into Alberta Muskeg*, The Globe and Mail, May 30, 2012, available at http://www.theglobeandmail.com/globe-investor/spill-sends-22000-barrels-of-oil-mix-into-alberta-muskeg/article4219809/ (22,000-barrel wastewater pipeline spill not detected until after it had reached surface waters and was spotted by aircraft); Nathan Vanderklippe, *Toxic Waste Spill in Northern Alberta Biggest of Recent Disasters in North America*, The Globe and Mail, June 12, 2013, available at http://www.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/apache-pipeline-leaks-60000-barrels-of-salty-water-in-northwest-alberta/article12494371/ (9.5 million liter spill of produced water from pipeline suspected to be "longstanding" given the extent of damage over 42 hectares).

[540] Gasco BO, p. 27 (attached above as Exhibit 289).

not biodegrade or break down over time. The only way to deal with them is to remove them.[541] Increased levels of total dissolved solids in surface waters are associated with higher rates of fish mortality.[542] Further, produced waters can contain copper, iron, lead, manganese, arsenic, cadmium, nickel, zinc, chromium, selenium, and sodium bicarbonate at levels above thresholds that are harmful to aquatic organisms, including fish.[543] The project may result in the spillage of large volumes of produced waters, wastewaters, fracking fluids, or other chemicals which may be transported to or from the project site via trucks and pipelines, or stored onsite in tanks and pits.

In addition, significant oil and gas activity, coal mining, and other development is occurring or expected to occur in this area, including the development of the Bull Mountain Development project, North Fork Coal Area, and many surrounding oil, gas and coal leases. The EA must discuss baseline environmental conditions regarding the existing risk of spills from all past and present projects, as well as any foreseeable risks of spills from state and private future projects. According to BLM's analysis of oil and gas spills in Colorado, spills can travel as far as 1,800 feet before contaminating surface water.[544]

BLM and the Service must formally consult over the risk of spills and leaks from oil and gas activities on the endangered fish. BLM must also formally consult regarding the project's sedimentation impacts on the endangered fish.

III. FLPMA: Unnecessary and Undue Degradation

Pursuant to the Federal Land Policy and Management Act ("FLPMA"), 43 U.S.C. § 1701 *et seq.*, "[i]n managing the public lands," the agency "shall, by regulation or otherwise, take any action necessary to prevent unnecessary or undue degradation of the lands." 43 U.S.C. § 1732(b). Written in the disjunctive, BLM must prevent degradation that is "unnecessary" and degradation that is "undue." *Mineral Policy Ctr. v. Norton*, 292 F.Supp.2d 30, 41-43 (D. D.C. 2003). This protective mandate applies to agencies planning and management decisions, and should be considered in light of its overarching mandate that the FFO employ "principles of multiple use and sustained yield." 43 U.S.C. § 1732(a); *see also, Utah Shared Access Alliance v. Carpenter*, 463 F.3d 1125, 1136 (10th Cir. 2006) (finding that BLM's authority to prevent degradation is not limited to the RMP planning process). While these obligations are distinct, they are interrelated and highly correlated. The BLM must balance multiple uses in its management of public lands,

---

[541] Pamela King, *Limited Study Supports Findings on Bigger Brine Spill Risks*, E&E News (Nov. 4, 2015).
[542] Ross Tuckwiller, *Annotated Bibliography: Potential Impacts of Energy Development on Fisheries in the Rocky Mountain West Prepared for Theodore Roosevelt Conservation Partnership Fish, Wildlife, & Energy Working Group* at 17, available at http://www.trcp.org/documents/ANNOTATED_BIB.pdf (attached as Exhibit 290).
[543] *Id*. at 21-22 (extremely elevated chromium concentrations in fish exposed to produced waters), p. 23 (fish showing lesions and kidney damage after exposure to sodium bicarbonate).
[544] BLM, Grand Junction Resource Management Plan Final EIS at 6-271 (2015), available at http://www.blm.gov/co/st/en/fo/gjfo/rmp/rmp/docs.html (attached as Exhibit 344).

including "recreation, range, timber, minerals, watershed, wildlife and fish, and [uses serving] natural scenic, scientific and historical values." 43 U.S.C. § 1702(c). It must also plan for sustained yield – "control [of] depleting uses over time, so as to ensure a high level of valuable uses in the future." *Norton v. S. Utah Wilderness Alliance,* 542 U.S. 55, 58, 124 S.Ct. 2373, 159 L.Ed.2d 137 (2004).

"Application of this standard is necessarily context-specific; the words 'unnecessary' and 'undue' are modifiers requiring nouns to give them meaning, and by the plain terms of the statute, that noun in each case must be whatever actions are causing 'degradation.' " *Theodore Roosevelt Conservation Partnership v. Salazar*, 661 F.3d 66, 76 (D.C. Cir. 2011) (citing *Utah v. Andrus,* 486 F.Supp. 995, 1005 n. 13 (D. Utah 1979) (defining "unnecessary" in the mining context as "that which is not necessary for mining"—or, in this context, "for oil and gas development"—and "undue" as "that which is excessive, improper, immoderate or unwarranted.")); *see also Colorado Env't Coalition,* 165 IBLA 221, 229 (2005) (concluding that in the oil and gas context, a finding of "unnecessary or undue degradation" requires a showing "that a lessee's operations are or were conducted in a manner that does not comply with applicable law or regulations, prudent management and practice, or reasonably available technology, such that the lessee could not undertake the action pursuant to a valid existing right.").

Here, that action is oil and gas drilling and production as authorized by the master development plan. The inquiry, then, is whether the agency has taken sufficient measures to prevent degradation unnecessary to, or undue in proportion to, the development the proposed action permits. *See Theodore Roosevelt Conservation Partnership,* 661 F.3d at 76. For example, methane waste and pollution may cause "undue" degradation, even if the activity causing the degradation is "necessary." Where methane waste and pollution is avoidable, even if in the process of avoiding such emissions lessees or operators incur reasonable economic costs that are consistent with conferred lease rights, it is "unnecessary" degradation. 43 U.S.C. § 1732(b).

Therefore, drilling activities may only go forward as long as unnecessary and undue environmental degradation does not occur. This is a *substantive* requirement, and one that the BLM must define and apply in the context of oil and gas development authorized through the lease sale. In other words, the BLM must define and apply the substantive UUD requirements in the context of the specific resource values at stake.

Further, these UUD requirements are distinct from requirements under NEPA. "A finding that there will not be significant impact [under NEPA] does not mean either that the project has been reviewed for unnecessary and undue degradation or that unnecessary or undue degradation will not occur." *Ctr. for Biological Diversity*, 623 F.3d at 645 (quoting *Kendall's Concerned Area Residents,* 129 I.B.L.A. 130, 140 (1994)). In the instant case, BLM must specifically account for UUD in its NEPA analysis, which is distinct from its compliance under NEPA, and is also actionable on procedural grounds.

IV. Conclusion

The Citizen Groups appreciate your consideration of the information and concerns addressed herein, as well as the information included in the attached exhibits.

Should you have any questions, please do not hesitate to contact us.

Sincerely,

Laura King
Western Environmental Law Center
103 Reeder's Alley
Helena, Montana 59601
406.204.4852
king@westernlaw.org

Kyle Tisdel
Western Environmental Law Center
208 Paseo del Pueblo Sur, Unit 602
Taos, New Mexico 87571
575.751.0351
tisdel@westernlaw.org

On behalf of:

Peter Hart, Staff Attorney
Wilderness Workshop
PO Box 1442
Carbondale, CO 81623
970.963.3977 (office)
peter@wildernessworkshop.org

Jeremy Nichols
Climate & Energy Program Director
2590 Walnut Street
Denver, CO 80205
303.437.7663
jnichols@wildearthguardians.org

Diana Dascalu-Joffe
Senior Attorney, Public Lands
Center for Biological Diversity
Denver, CO
720.925.2521
ddascalujoffe@biologicaldiversity.org

Natasha Leger
Interim Executive Director
Citizens for a Healthy Community
P.O. Box 291
Hotchkiss, CO 81419
970.399.9700
natasha@chc4you.org

Matt Reed
Public Lands Director
High Country Conservation Advocates
P.O. Box 1066
Crested Butte, CO 81224
303.505.9917
matt@hccacb.org

Juli Slivka
Planning Specialist
The Wilderness Society
1660 Wynkoop St. Ste. 850
Denver, CO 80202
303.650.1179
jslivka@tws.org

Matthew Sandler
Staff Attorney
Rocky Mountain Wild
1536 Wynkoop St., Suite 900
Denver, CO 80202
303.579.5162
matt@rockymountainwild.org

From:	Mohsen, Ahmed
To:	Cheryl Meier
Cc:	Christopher Merritt; Dennis Willis; Nathan Thomas; Nancy Brown; Lohman, Nicole; amy_cole@nthp.org; beecherllc@aol.com; David Yoder; Jerry Spangler; jpatterson@montarch.com; kristinecurry@utah.gov; lynx@xmission.com; mhyde@duchesne.utah.gov; troyscotter@gmail.com; yaxche@aol.com; Amber M Koski; Brian Barton; Don Stephens; Donny Worthington; George Bradley; Heidi Essex; J. Michael Hansen; Kelly Buckner; Lola Bird; Matthew Deveau; Megan Crandall; Mike Angus; Pam Miller; Rex Sacco; Steve Bloch; Tim Riley; Elizabeth Hora; Gary Torres; Stephanie Howard; Deborah (Deej) Brown; Betsy Merritt
Subject:	Re: Nine Mile Canyon PA Update/Coordination Meeting
Date:	Tuesday, March 28, 2017 2:59:49 PM
Attachments:	24Oct2016-PA-status-update.pdf 13_10_28_nine_mile_draft_interp_plan.doc

---

Attachments include the 2012 interp plan and table with stipulations completed - which we will discuss today

Ahmed Mohsen

Field Manager

BLM Price Field Office-Utah

(435) 636-3637 Desk

On Tue, Mar 28, 2017 at 12:07 PM, Cheryl Meier <cmeier@uintah.utah.gov> wrote:

> Ahmed,
>
> Are you still planning on E-mailing the presentation before the meeting today? I will be calling in from Uintah County.
>
> Thanks
>
> On Mon, Mar 27, 2017 at 4:14 PM, Christopher Merritt <cmerritt@utah.gov> wrote:
>
> > Hi all,
> > I won't be able to make it down tomorrow, no cars available, sorry for the inconvenience.
> > Rest assured I will be on the phone and eager for healthy conversation!
> >
> > Chris
> >
> > On Sun, Mar 26, 2017 at 11:53 AM, Christopher Merritt <cmerritt@utah.gov> wrote:
> >
> > > Hello all,
> > > I see a vigorous conversation on Nine Mile as very important. Both Dennis and Nate make excellent points, but I feel that given Nine Mile is a critical area with many projects on the horizon, a new PA could lay out some clear ways that the BLM will handle its Section 106 responsibilities.
> > >
> > > I think the BLM has been making a lot of vague statements towards viewing their responsibilities at a landscape level. This new idea for a PA would address this important area in a more holistic manner and consistent with this National direction.
> > >
> > > Further, the old PA can exist until its satisfied but was not implemented for a holistic

management of the Canyon and its resources and the array of potential projects. I believe this new PA could be written to:
a) give the BLM flexibility and streamlining in some aspects of their management,
b) create expectations and responsibilities of the consulting parties and agreed upon standards of how consultation will occur and when,
c) outline a holistic management practices (id strategies, lit searches, effects calls) for the entire system,
d) manage both the Price and Vernal ends of the canyon the same way in regards to cultural resources,
e) allow any proponents a clear understanding of expectations for their proposed actions,
f) get rid of the baggage of the old West Tav agreement and build a positive new relationship.

I urge the BLM to think carefully before dismissing this thoughtful approach to resource management. I love a proactive approach, versus waiting for the next big thing.

Happy Sunday all,
C

On Sunday, March 26, 2017, Dennis Willis <willis-works@emerytelcom.net> wrote:

> Thank you, Nate for your good observations and perspective.
>
> We totally agree the emphasis should be on fulfilling the stipulations in the West Tavaputs PA. For whatever reason that has not been going so well, especially; stewardship, the update of the activity plan and the implementation of interpretation in the canyon. It is possible part of the reason for these stipulations being five years behind schedule is BLM entertaining every proposal to come down the pike. This creates confusion with regard to the PA; is the proposed project covered by the PA or not? There is also a very inconsistent approach to consultation. The right of way for condensate tanks at Water Canyon, there was no consultation at all. For Gate Canyon Road Improvement, we were invited to consult only on the mitigation of adverse effects. For the December 2016 Oil and Gas Lease we were invited to comment, not consult, on the determination of No Adverse Effect only after the EA was released and the determination was made, also after the EA was completed. These projects obviously consume considerable BLM resources. It is also difficult for a small non-profit, like the Nine Mile Canyon Coalition to deal with, especially with such an inconsistent approach to consultation. It is also difficult for us because each new project is being treated as if it is a whole new thing and we are starting from scratch in Nine Mile Canyon. We see things like proposed mitigation projects for the Gate Canyon Road that are already committed mitigation for the West Tavaputs drilling project. If the desire of the BLM is to completely implement the West Tavaputs PA, we are totally in support that effort. Let's complete the mitigation and development of project one, before moving onto projects 2,3,4,5.... Whether or not the West

Tavaputs PA gets implemented (it would be a crying shame if it is not) we need a consistent approach to development projects in the canyon, not two field offices operating totally independently, looking at individual projects in a vacuum.

Whether this can be accomplished via an amendment to the current PA or whether a separate PA is desirable is an unresolved question for us. We are most interested in seeing a comprehensive, landscape level approach to the management of the canyon regardless of the agreements are structured.

Dennis Willis
President, Nine Mile Canyon Coaliton

From: Nathan Thomas
Sent: Saturday, March 25, 2017 11:45 AM
To: Dennis Willis
Cc: Mohsen, Ahmed ; Nancy Brown ; Lohman, Nicole ; amy_cole@nthp.org ; beecherllc@aol.com ; David Yoder ; Jerry Spangler ; jpatterson@montarch.com ; kristinecurry@utah.gov ; lynx@xmission.com ; mhyde@duchesne.utah.gov ; troyscotter@gmail.com ; yaxche@aol.com ; Amber M Koski ; Brian Barton ; Don Stephens ; Donny Worthington ; George Bradley ; Heidi Essex ; J. Michael Hansen ; Kelly Buckner ; Lola Bird ; Matthew Deveau ; Megan Crandall ; Mike Angus ; Pam Miller ; Rex Sacco ; Steve Bloch ; Tim Riley ; Elizabeth Hora ; Gary Torres ; Stephanie Howard ; cmerritt@utah.gov ; cmeier@uintah.utah.gov ; Deborah (Deej) Brown ; Betsy Merritt
Subject: Re: Nine Mile Canyon PA Update/Coordination Meeting

Good day Dennis,

I'm relatively new to the West Tavaputs PA meetings, but I have noticed that they have been veering away from discussing the stipulations in the PA. In the programmatic agreement it states: *During the development phase, the Signatories and Concurring Parties will meet annually in* ***October to discuss the fulfillment of the stipulations contained within this Agreement****. If determined necessary by the majority of the Signatories, these meetings will continue during the production and abandonment phases***.** When I read this, I believe the purpose of these meetings is not be discuss new undertakings/activities that are not related to the stipulations in the PA.

Furthermore, as a relative newcomer I also have heard from consulting parties that they are disappointed that BLM has been slow to meet the stipulations in the PA. In this "extra" PA meeting that the Price Field Office (PFO) has so graciously arranged, I believe the PFO should focus everyone's precious time on the stipulations of the PA. I will be the first to admit that we need to finish these West Tavaputs PA stipulations. I feel the more we discuss items not related to this PA, less time will be spent on finishing these stipulations. In addition, the undertakings you have listed have their own seperate and concurrent consulting party process. For example, the PFO and Vernal Field Office (VFO) have already had meetings on the Gate Canyon Project, 3 or 4 meetings for the Price Class I, 3 meetings for the last oil and gas lease sale and I'm sure there will be meetings on the upcoming oil and gas lease sales. I guess what I'm trying to say is that I believe you will have an opportunity to provide input on these undertakings outside of the upcoming West Tavaputs PA meeting.

In regards to your comment on the expiration date of the PA, the PA states: *Any Signatory or Concurring Party to the Agreement may request that it be amended, whereupon the Signatories will consult to consider such amendment. An amendment will go into effect upon written agreement by all Signatories.*

I would expect that the Signatories would like to know if this is a formal request? If so the PA states that the Signatories will consider such an amendment. The PA does not state that the request would be discussed at the Annual Meeting or with concurring parties. It's my opinion that any discussion on this request would first be had by the Signatories and not at our upcoming meeting.

Again, I think it is important that BLM focuses on it's current commitments and that we follow the purpose of the meeting as outlined in the PA.

To be clear, the above thoughts were just my opinions and I defer to Ahmed Mohsen as the agency official for this PA.

Thanks for hearing me out and talk to you next week.

Nate Thomas
Deputy Preservation Officer, BLM-Utah

Sent from my iPad

On Mar 25, 2017, at 9:27 AM, Dennis Willis <willis-works@emerytelcom.net> wrote:

> Another item for discussion at the PA meeting:
>
> The current West Tavaputs PA expires in January 2020. It is not too early to consider its replacement and succession management. The Nine Mile Canyon Coalition would like to recommend a new PA to cover all of Nine Mile Canyon, just not the West Tavaputs Drilling Project. The current PA contains many useful, valuable items and we would want those retained. The current PA is serving poorly because it was developed specifically for the West Tavaputs Drilling project. It does not cover any lands in Nine Mile Canyon below Cottonwood Canyon. There is also some confusion over which projects proposed for the canyon properly fit within the West Tavaputs PA. For example; the Gate Canyon road improvement, Vernal Field Office oil and gas leasing, construction of transmission pipelines not related to West Tavaputs gas field development. We would envision a PA that covers the entire canyon and any BLM actions occurring within the boundary. The PA should further spell out when, where and what circumstances require additional consultation, stewardship, project monitoring, mitigation, and the like. This new PA could be developed immediately and run concurrently with the West Tavaputs PA.
>
> Thank you for your consideration,
>
> Dennis Willis
> President, Nine Mile Canyon Coalition
> (435) 650-0850
>
> **From:** Mohsen, Ahmed
> **Sent:** Monday, March 20, 2017 1:57 PM
> **To:** Nancy Brown ; Dennis Willis ; Lohman, Nicole ; <amy_cole@nthp.org> ; <beecherllc@aol.com> ; David Yoder ; Jerry Spangler ; <jpatterson@montarch.com> ; <kristinecurry@utah.gov> ; <lynx@xmission.com> ; <mhyde@duchesne.utah.gov> ;

<troyscotter@gmail.com> ; <yaxche@aol.com> ; Amber M Koski ; Brian Barton ; Don Stephens ; Donny Worthington ; George Bradley ; Heidi Essex ; J. Michael Hansen ; Kelly Buckner ; Lola Bird ; Matthew Deveau ; Megan Crandall ; Mike Angus ; Nate Thomas ; Pam Miller ; Rex Sacco ; Steve Bloch ; Tim Riley ; Elizabeth Hora ; Gary Torres ; Stephanie Howard ; <cmerritt@utah.gov> ; cmeier@uintah.utah.gov ; Deborah (Deej) Brown
Subject: Nine Mile Canyon PA Update/Coordination Meeting

Happy 1st day of Spring!

As promised in our October meeting, the Price Field Office will update you on current implementation actions on **Tuesday, March 28th between 1-3pm** at the Price Field Office Conference Room.

The proposed agenda:

1. PA Stipulations update and other activities in Nine Mile Canyon;

2. SRMA scoping and EA update and presentation;

3. Open Discussions;

4. Next steps; and set next meeting in October.

Note: The presentation will be sent to you all prior to the meeting.

If you are unable to join us and would like to call-in, here is the #

1-866-709-1340
Passcode 6990429

Talk to you soon.

Ahmed Mohsen

Field Manager

BLM Price Field Office-Utah

(435) 636-3637 Desk

--
****
Christopher W. Merritt, Ph.D., RPA
Deputy SHPO, Antiquities Section Coordinator
Utah Division of State History
Phone: (801) 245-7263
Email: cmerritt@utah.gov

--
****
Christopher W. Merritt, Ph.D., RPA
Deputy SHPO, Antiquities Section Coordinator
Utah Division of State History
Phone: (801) 245-7263
Email: cmerritt@utah.gov

--
Cheryl Meier
Uintah County
Public Lands Specialist
(435)781-5483
cmeier@uintah.utah.gov

BLM UPDATE-2016

West Tavaputs Plateau Programmatic Agreement (PA) Status October 24, 2016			
Commitment	**Location**	**Timing**	**BLM Obligations/ Responsibilities**
Native American Consultation	PA Stipulation 3	Ongoing action	Consultation with the four interested Tribes has occurred on all undertakings (e.g. construction of well pads, roads, pipelines, and ancillary facilities). Communication is ongoing.
Class II Cultural Resource Inventories	PA Stipulation 5.B	Begin development of site location model within 3 months of first APD 18 months- complete site location model 5 years-complete Class II inventories	Montgomery Archaeological Consultants were selected as the contract Archaeologist for the project area. A research design was developed and reviewed by the Class II Cultural Resource Inventory Committee. There are ( ) acres completed in the Class II Cultural Resource Inventories in 2016. Of those acres, xxx acres are in canyon bottoms, and ( ) acres in upland areas. The Class II inventories have a total of ( ) acres competed. The survey is ( ) complete with a goal of 3700 acres total to be surveyed.
Class III Inventories	PA Stipulation 5.C	Ongoing action	Inventories are conducted as required by this agreement and by Section 106.
NRHP Nomination	PA Stipulation 5.D	Complete	The BLM has prepared cover documentation in support of Multiple Property Submission (MPS) for Nine Mile Canyon, including historic, rock art, and West Tavaputs Adaptations contexts. As of October 24, 2016 ( ) sites have been nominated to the National Register of Historic Properties. Per the WTPA, "…the BLM is to annually submit 100 recorded individual sites on BLM lands…over the next 5 years or until all previously

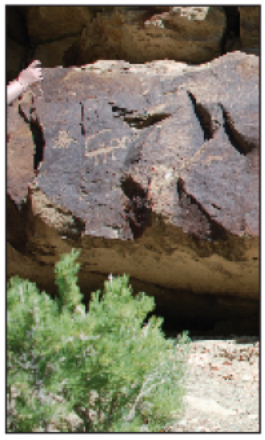
			recorded eligible sites are listed."
Cultural Resources Monitoring Plan	PA Stipulation 6.A	Ongoing action/complete?	NMC road is paved. Focus on hiring a rock art conservator?
Conservation Treatments	PA Stipulation 6.B.i	Select rock art conservator within 9 months of ROD.	Systems for removing dust from panels that have been affected by past oil and gas development will be developed and tested by a rock art conservator...A committee consisting of the Operator(s) and three representative Concurring parties or signatories will recommend sites for conservation treatment to the BLM. Action items (1) Organize committee (2) Select sites for conservation (3) Draft SOW (4) Anticipate funding opportunities
Site Interpretation	PA Stipulation 11.A	Revise SRCMA Plan and complete interpretive plan within 24 months of signing agreement Develop 2 sites annually until 9-11 sites have been interpreted	The Price Field Office is working on revising the SRCMA. A draft interpretative plan was made available for review (October 2012). Based on received comments, the interpretive plan will be developed in coordination with the SRCMA plan to remain consistent. The BLM PFO worked with a land scape architect from the State Office on site development opportunities located in NMC at those sites identified for interpretation in the WTPA. Comments have been received and incorporated. The BLM PFO was awarded funding to support the development and provide for a public outreach/education event located at Cottonwood Village. The BLM PFO is working with MOAC, CPAA, Prehistoric Museum and Arizona State, and coordinating with the Ute, local schools and consulting parties. A kickoff meeting is scheduled for November 8, 2016.

			Public Lands Solutions was contracted by the BLM to help facilitate the development of alternatives reflective of potential recreation opportunities located in the greater SRCMA plan boundary.
Site Stewardship Program	PA Stipulation 11.B	Complete	The BLM submitted the draft site stewardship manual to the group for review. No comments received to date.
Personnel Training	PA Stipulation 13	Ongoing action	Ongoing training for Enervest and XTP employees, vendors, and contractors continues. Employees from WW Clyde, Jones & DeMille, and Carbon County and others have received the training as well.
Annual Programmatic Agreement Meetings	PA Stipulation 14	Ongoing action	Next meeting scheduled for October ( ), 2017 in Price, Utah.
Other	In addition to	Ongoing action	NMC is a Hand's on the Lands Outdoor Classroom. School groups and educational opportunities are provided on an annual basis. The BLM PFO coordinates with Project Discovery on an annual basis. The BLM PFO hosted 60 students at the Cottonwood Glenn National Public Lands Day project in September, 2016. The BLM VFO hosted a volunteer project at

Draft

NINE MILE CANYON

INTERPRETIVE PLAN



BLM

U.S. Department of the Interior, Bureau of Land Management, Green River District, Price Field Office - October 2012

The Bureau of Land Management is responsible for the balanced management of the public lands and resources and their various values so that they are considered in a combination that will best serve the needs of the American people.

Management is based upon the principles of multiple use and sustained yield; a combination of uses that takes into account the long-term needs of future generations for renewable and non-renewable resources.

These resources include recreation, range, timber, minerals, watershed, fish and wildlife, wilderness, and natural scenic, scientific and cultural values.

It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

DRAFT

Table of Contents

Chapter 1: Introduction

1. Executive Summary
2. Significance of Nine Mile Canyon
3. BLM Utah's Interpretation and Stewardship Goals
    a. BLM's National Interpretation Program
    b. BLM Price Field Office Resource Management Plan Goals
    c. BLM's Commitments in West Tavaputs Plateau Programmatic Agreement

Chapter 2: Interpretation in Nine Mile Canyon

1. Existing Interpretive Resources
2. Interpretive Theme
3. Interpretive Goals and Objectives
4. Interpretive Site Development
    a. Site Development Principles
    b. Potential Interpretive Site Inventory Index

Chapter 3: What's Next?

1. Interpretive Media Development
2. Nine Mile Canyon Special Recreation and Cultural Area Management Plan

Appendices

1. References
2. BLM Price Field Office Approved Resource Management Plan Decisions Affecting Interpretation in Nine Mile Canyon
3. West Tavaputs Programmatic Agreement

DRAFT

Chapter 1: Introduction

1. Executive Summary

The Bureau of Land Management (BLM) Utah, Price Field Office (PFO) is pleased to present the draft Nine Mile Canyon Interpretive Plan (NMCP), to serve as a planning tool for the canyon's interpretive program development. This comprehensive approach considers the purpose and significance of each site and its interpretive themes. The plan identifies interpretive themes, goals, and objectives, describes desired visitor experience goals and futures, and recommends a variety of interpretive services, media, programs, and outreach activities to communicate efficiently and effectively the site's purpose, significance and possible issues. The West Tavaputs Programmatic Agreement (WTPA) and through public scoping, the following priority sites are currently listed for interpretation:

- Walker's Service Center,
- Historic Mine Site,
- First site,
- Owl Panel,
- Cottonwood Glenn,
- Freight and Military Road Remnant (Gate Canyon historic road),
- Rasmussen Cave,
- Daddy Canyon,
- Cottonwood Complex (i.e., Cottonwood Village, Great Hunt Panel, Big Buffalo).

The Purpose of the NMCP is to nurture a stewardship ethic for heritage resources and to offer a profound experience for visitors to the canyon.

The function of this draft is to facilitate the collaboration of interested Nine Mile Canyon stakeholders and to further develop interpretive opportunities within the canyon.

2. Significance of Nine Mile Canyon

Known for its scenic beauty and long history of human occupation, Utah's NMC contain, what some speculate to be the United States' highest concentration of prehistoric and historic rock drawings. Left behind by the Archaic, Fremont, Ute and cowboy cultures of the American west, these images continue to endure and enlighten our knowledge about past cultures. Spanning Carbon, Duchesne and Uintah Counties, the expansiveness of NMC and its tributaries are experienced through a rich tapestry of culture, wildlife, and inspired scenery. Present day use of the canyon includes ranching, recreation, and mineral development. As a Scenic Backcountry Byway, NMC offers visitors a thrilling journey into the history of native cultures, early travelers, and the fast-disappearing rural lifestyle of Utah. The BLM remains committed to working with all interested partners to further the development and interpretation of these outstanding educational, heritage opportunities.

DRAFT

NMC is topographically located in the Book Cliff-Roan subdivision of the Colorado Plateau physiographic region. With an average elevation between 4,600 and 8,200 feet, the canyon is a critical riparian resource that has enabled the long history of human occupation here. The climate is semi-arid and situated in the Upper-Sonoran life zone. NMC supports a pinyon-juniper woodland and desert shrub vegetation community, and is home to hundreds of terrestrial faunal species.

NMC is recognized for its concentration of prehistoric archaeological resources. Most recorded prehistoric sites are rock drawing panels in the Numic, Fremont, Barrier Canyon, and Archaic style. Remains of prehistoric habitation include cliff granaries, slab storage cists, semi-subterranean pit houses, retaining walls, rock shelters and masonry towers. Hundreds of archaeological sites have been recorded in the canyon and several are currently listed on the National Register of Historic Places (NRHP). Although 400 + sites have been nominated to the NRHP, less than 10 percent of the canyon has been inventoried for cultural resources. Many questions still remain about the prehistoric cultures that lived in central Utah.

NMC also contains numerous historic resources that help to tell the story of the United States' westward expansion and Utah's pioneer settlement. Historic inscriptions are found throughout the canyon. The U.S. military in 1886 built a supply road through the canyon that became known as the "lifeline to the Uintah Basin," and brought the people, supplies, and communications needed by the early settlements, forts, and Native American reservations in northeastern Utah (Spangler 2003). Historic structures dating from the early 1900's are still a common sight in the canyon today, including stage coach stations, settler cabins, iron telegraph poles, and examples of unique Utah ranching developments.

NMC visitors participate in a wide range of recreational activities, including scenic driving, heritage tourism, day hiking, mountain biking, photography, horseback riding, and wildlife viewing. Recreational visitation throughout the canyon primarily occurs along Nine Mile Canyon Road and three connecting recreational loop trails. Nine Mile Canyon Road, which the BLM has designated as a Back Country Byway, receives a majority of the visitors coming for scenic driving and heritage tourism opportunities, and off-highway vehicle riders, mountain bikers, horseback riders, and hikers are the primary visitors to the loop trail systems.

The NMCP provides a road map for land managers and canyon partners for the management of this special resource. This document is critical for the long-term success of developing high-quality, consistent and sustainable heritage tourism opportunities throughout this extraordinary landscape.

3. BLM Utah's Interpretation Goals

Developing high quality interpretation to support heritage tourism opportunities within NMC supports a wide variety of the BLM's commitments to protect cultural resources and provide for high quality outdoor recreation opportunities on the public lands. These commitments range from overarching direction included through the BLM's national interpretation program and other national initiatives, to very specific on-the-ground obligations made through the BLM Price Field Office's Approved Resource Management Plan and the WTPA.

a. BLM's National Commitments

BLM –administered public lands within Nine Mile Canyon are managed in accordance with the Federal Land Policy and Management Act of 1976, which formally recognizes outdoor recreation management and the protection of archaeological and historic resources as components of the BLM's multiple-use mission. Numerous national-level initiatives and programs support the development of interpretive opportunities within Nine Mile Canyon.

America's Great Outdoors Initiative. In April 2010, President Obama launched the America's Great Outdoors Initiative to develop a 21st century conservation and recreation agenda. Further developing and promoting interpretive opportunities in Nine Mile Canyon in collaboration with interested partners would support numerous recommendations of the initiative, which were summarized in a February 2011 report to the President (*America's Great Outdoors*, 2011), including:

- Cultivate stewardship and appreciation of America's natural, cultural, and historic resources through innovative awareness-raising partnership initiatives and through education.
- Promote and support replicable programs that teach about and connect children and families with their natural and cultural heritage.
- Advance national, regional, and community-supported efforts to preserve and enhance unique landscapes, natural areas, historic sites, and cultural areas while ensuring openness and transparency in any land designations.
- Protect America's historic and cultural resources.
- Provide financial and technical support to states and local communities, tribes, and private sector organizations for historic preservation and cultural resources protection.
- Continue to protect and interpret historic sites and cultural landscapes on federal lands.

BLM's National Interpretation Program. The BLM's interpretive program supports all aspects of the agency's multiple-use mission by communicating how the BLM manages resources and provides opportunities for public use, and fostering an understanding of the relationships between people and the public lands.

b. BLM Price Field Office's Resource Management Plan Goals

The Price Field Office Approved Resource Management Plan outlines the following commitments for heritage stewardship.

- Preserve and protect significant cultural resources and ensure that they are available for appropriate uses by present and future generations (FLPMA Sections 103(c), 201 (a); National Historic Preservation Act [NHPA] Section 110(a); Archaeological Resource Protection ACT [ARPA] Section 14(a).
- Identify priority geographic areas for new field inventory, based on a probability for unrecorded significant resources, to reduce imminent threats from natural or human-caused deterioration or potential conflict with other resource uses (ARPA Section 14(a); NHPA Sections 106 and 110).

DRAFT

As reported in the October 2008 Price Field Office Record of Decision and Approved Management Plan the approved (RMP) maintains that; "The cultural relevant and important values will be protected by BLM's compliance with laws, policies and regulations" (Table R-4, p. 47). The BLM will "Continue to manage and maintain developed recreation sites" like Daddy Canyon (REC-9, p.104); and the BLM will "Develop new sites in response to user demand, amenity values, and critical resource protection needs" (REC-10; p. 104).The Price RMP specifies the need to protect cultural resources found within the Price Field Office resource area and provides a protocol for methodology and monitoring and are summarized below (Appendix 2, p. 4).

- Cultural sites that have been previously identified as being impacted (e.g., from vandalism, erosion, or other)
- Cultural sites identified on maps, brochures, or other media that bring the site into public awareness.
- Sites that are known to be popular for public visitation (e.g., public use sites).
- A representative sample of sites known to be prone to impacts from predictable sources (e.g., vandalism, recreation, grazing, or development).
- Resources eligible for the NRHP at a national level of significance that have not been fully inventoried.
- Cultural resources sites identified for public use.

A representative sample of significant cultural sites will be monitored at least once every three years (1-3 years), and a mitigation plan based on the results of this monitoring will be developed if necessary. Major sites will be periodically inspected to document any damage and identify future stabilization needs. Assistance from institutions will be encouraged. The approved RMP provides a comprehensive framework for the ethical management of heritage resources.

c. BLM's Commitments in the West Tavaputs Plateau Programmatic Agreement

The BLM's most specific obligations to further develop interpretive opportunities within Nine Mile Canyon were made in the 2010 *Final Programmatic Agreement Regarding the West Tavaputs Plateau Natural Gas Full Field Development Plan in Carbon and Duchesne Counties, Utah*. The final agreement represents a precedent-setting compromise between a diverse coalition of stakeholders to provide for both the development of fossil fuel resources and the long-term protection of archaeological and historic resources in and near NMC, including the BLM, State of Utah, Carbon and Duchesne Counties, Utah State Historic Preservation Office, the Advisory Council on Historic Preservation, Utah School and Institutional Trust Lands Administration, and the Bill Barrett Corporation. In addition, numerous other parties were formally consulted with during the development of the agreement, including the National Trust for Historic Preservation, Nine Mile Canyon Coalition, Utah Rock Art Research Association, Utah Professional Archaeological Council, Colorado Plateau Archaeological Alliance, Utah Statewide Archaeological Society, Barrier Canyon Style Project, Southern Utah Wilderness Alliance , and the Ute Indian Tribe.

Section 11 of the final programmatic agreement outlines the BLM's site interpretation and stewardship commitments in Nine Mile Canyon. These obligations include working with canyon stakeholders to

DRAFT

ensure the development of visitor and interpretation sites, and the agreement identifies the Owl Panel, Cottonwood Complex, Rasmussen Cave, Daddy Canyon, and the Gate Canyon historic road as priority sites for development. The agreement also directs the BLM to seek easements from willing private property owners in order to develop two to four additional interpretive sites, including the Long Neck Sheep and Balanced Rock sites. After the completion of the interpretive plan, the agreement purposes that two visitor use sites be developed each year until a total of 9 to 11 sites have been interpreted.

DRAFT

Chapter 2: Interpretation in Nine Mile Canyon

1. Existing Interpretive Resources

Past Planning Efforts: The NMC Interpretive Plan has been in draft form since the release of the Nine Mile Canyon Special Recreation and Culture Management Plan (SRCMA) (BLM 1995). The purpose of this plan was to outline and describe the significance of NMC as a Backcountry Byway. During public scoping it was determined that an increase in canyon visitation was degrading the NMC experience. Three impacts were identified; an increase in vandalism to archaeology sites, concern for the public well-being, and an unsatisfactory visitor experience. In response to these concerns the SRCMA was proposed by the Price River Resource Area of the BLM (Moab District) and the Diamond Mountain Resource Area (Vernal District) to provide guidance for the management of cultural and recreational values in NMC for ten years. The cultural significance of NMC was derived from the "numerous rock art …and habitation sites, and by the BLM's attempt at nominating NMC as an archaeological district in 1972 (BLM 1995)." Management objectives sought to allocate archaeological site types, to develop approximately 5 miles of recreation and interpretive trails at selected sites, and too develop a facility in NMC to interpret, and control use of the areas.

In Chapter Three of the SRCMA it discusses what cultural sites should be developed and interpreted, how the BLM will manage these sites and the visitor experience and how to best interpret the significance of Nine Mile Canyon. It was suggested that archaeology sites "be first excavated in order to provide interpretive information and to define the extent of the site". It was assumed that baseline data could be collected to aid in the administration of a site monitoring program (p. 37-50.)". Although several site locations have been identified as possible interpretive locations the purpose of this document is to expedite the fulfillment of commitments made by the BLM in the WRPA towards the stewardship of archaeological resources in NMC.

NMCP remains as a working document to provide programming development, conform to the desired visitor experience, and support the established interpretive themes and goals outlined in this document. In 2001, John Veverka & Associates developed the, "Nine Mile Canyon Interpretive Plan" for the College of Eastern Utah Prehistoric Museum. The planning team included NMC stakeholders and managers. An outside interpretive planner facilitated the meetings. Based on input from a focus workshop of NMC stakeholders, the following was suggested as the main interpretive theme for Nine Mile Canyon. "*Nine Mile Canyon is a 40 mile long museum exhibiting the lives of ancient and historic Native Americans, explorers, trappers, military, freighters, ranchers, farmers, and travelers over thousands of years*". Suggested sub-themes include; "*the esthetic and spiritual values of the canyon are unique, a combination of dynamic geologic forces that provided the setting for long occupation and use by a variety of people*, and *Nine Mile Canyon illustrates stories of conflict and resolution over its long history."*

2. Interpretive Theme

The primary theme that emerged from the Veverka & Associates Nine Mile Interpretive Plan (2001) has been articulated in several other documents, including (Nine Mile Canyon [SRCMA] 1995; The Approved Price Field Office Resource Management Plan 2008; & the West Tavaputs Programmatic Agreement 2010). In addition to this recognition, NMC has had over 200 archaeological sites nominated to the NRHP. Specifically, the Canyon's significance is based on its potential to provide important information about the prehistory and history of NMC and its embodiment of distinctive prehistoric and historic characteristics. As adapted from Veverka & Associates' 2001 plan, the following themes are suggested:

Nine Mile Canyon Interpretive Theme: *From the prehistoric through the historic periods, NMC has been occupied and served as an important gathering place for people who have contributed to our knowledge about the past.*

Sub-theme 1a*: The esthetic and spiritual values of the canyon are unique and are a combination of dynamic geologic forces that provided the setting for long occupation and use by a variety of people.*

Sub-theme 1b*: NMC illustrates stories of conflict and resolution over its long history.*

Sub-theme 1c: People have contributed to a visual chronology of (NMC'S) development and evolution.

Sub-theme 1d: NMC is a prime example for multiple uses of public lands and BLM's multiple land use mandate.

Interpretive Goals

3. Goal 1: Getting Visitors to the Canyon

Some claim that this is the greatest concentration of prehistoric rock art sites in the world can be seen in Utah's Nine Mile Canyon, and the Nine Mile Canyon Back Country Byway takes visitors through "The Longest Art Gallery in the World."

Interpretive Objective 1A: Potential visitors have an increased awareness of the world-class rock art-viewing opportunities available along the Nine Mile Canyon Back Country Byway.
Interpretive Objective 1B: Potential visitors have a firm understanding of the vehicle, supply, and equipment needed to safely navigate the 80-mile long back country byway.
Interpretive Objective 1C: Potential visitors have an increased awareness of the goods and services available in the gateway communities near Nine Mile Canyon.
Interpretive Objective 1D: Potential visitors are introduced to the basic principles of responsible rock art viewing ethics.
Interpretive Objective 1E: All visitors are provided access to critical information materials that facilitate the effectiveness of interpretive media, such as maps, visitor rules of conduct, and rock art viewing ethics, prior to entering Nine Mile Canyon.

DRAFT

Goal 2: Providing Canyon Visitors with a Meaningful Experience

Humans have an 8,000-year old history of benefitting from Nine Mile Canyon's unique geography and resources, and the canyon continues to serve as a culturally and economically significant landscape in the present day.

Interpretive Objective 2A: Visitors see and understand that Nine Mile Canyon has a long history of unique occupation and use that continues in the present day.
Interpretive Objective 2B: Visitors respect the cultures and rights of all people who have lived in the canyon from prehistoric, historic, and present times.
Interpretive Objective 2C: All visitors understand that they may not touch or remove any of the canyons archeological and historical artifacts and that they must respect the rights of private property owners who live in the canyon today.
Interpretive Objective 2D: Visitor facilities and services within Nine Mile Canyon facilitate the goals of Nine Mile Canyon's interpretation and stewardship programs by protecting sensitive cultural, historical, natural, and scenic resources; promoting respect for private property rights; and providing for public safety.
Interpretive Objective 2E: Visitors learn that Nine Mile Canyon's rock art was created during a span of four to five thousand years, and the back country byway's interpretive sites and media convey the importance of the canyon's rock art to the Fremont and other culture's history.
Interpretive Objective 2F: Visitors understand the canyon's pre- historical to present day importance as a travel conduit, and the back country byway's interpretive sites and media expose visitors to the canyon's long and diverse history of human occupation and use, including the rise and decline of pre-historical communities, fur trade and exploration, farming, ranching, stage coach stops, historic communication lines, and Civilian Conservation Corps efforts.
Interpretive Objective 2G: Visitors understand that the presence of water has enabled such a long history of human habitation, and appreciate the need to protect Nine Mile Canyon's riparian resources.
Interpretive Objective 2H: Visitors have an increased awareness of the BLM's multiple-use mandate, the importance of the West Tavaputs Programmatic Agreement, and the partners involved in the agreement's implementation.
Interpretive Objective 2I: Interpretive facilities and media recognize the contributions of Nine Mile Canyon partners who are supporting heritage tourism along the back country byway.
Interpretive Objective 2J: Is fire an issue? If so, add something about wildland fire education.

Goal 3: Instilling a Stewardship Ethic in Canyon Visitors

Sustainable heritage tourism is good for America's public lands and economy, and there are ways you can get involved to help conserve America's Great Outdoors.

Interpretive Objective 3A: Visitors leave feeling that Nine Mile Canyon is a special landscape that needs to be taken care of for future generations.
Interpretive Objective 3B: Visitors leave believing cultural resources are worth conserving and protecting, and are aware of federal archeological protection laws.

DRAFT

Interpretive Objective 3C: Visitors are able to share basic principles of rock art viewing ethics with friends.
Interpretive Objective 3D: Visitors are made aware of the diversity of partners involved in supporting heritage tourism and archaeological preservation in Nine Mile Canyon.
Interpretive Objective 3E: Visitors are provided with access to information about volunteer and research opportunities within Nine Mile Canyon and at other cultural resource sites in the region.

Goal 4: Make Interpretation Accessible: Every attempt will be made to provide full access to interpretive media and programs to ensure people with physical and mental disabilities have access to the same information necessary for safe and meaningful visits. This is in compliance with the BLM's guiding principles:

- **Equal opportunity** – Provide an equal opportunity for participation in programs and activities.
- **Independence** – Provide for independent and safe participation through the highest level of accessibility.
- **Dignity** – Ensure the dignity of the participant. Access is the concept of choice, but it is choice with dignity.
- **Integration** – Provide for the integration of people of all levels and abilities; not segregation with separate activities.
- **Compliance** – Comply with the "spirit" of accessibility legislation and regulations, as well as the "letter" of the law.
- **Universal Design** – Adhere to the principles of Universal Design in all planning, design, and construction activities.
- **Comprehensive** – All education and interpretation will follow general standards for accessibility.

Goal 5: Visitor Experiences will be Authentic and Tell the Full Story of the Canyon

- *Visitors have the opportunity to be exposed to carefully researched and well documented information.* This is facilitated by the excavation and analysis of primary source material by a professional historian or archaeologist, and synthesized within the greater auspices of available literature. All tours and interpretive programs should be properly footnoted with citations, demonstrating evidence of progress toward this goal.
- *Visitors are given a variety of choices that reflect multiple perspectives to increase their knowledge with the opportunity to explore (NMC) resources and themes.* The Nine Mile Interpretive Plan acknowledges the need to research current and desired visitor groups, including diverse groups, to understand their needs and interests and identify ways to attract a more diverse population. The Nine Mile Canyon Site Stewardship program could facilitate a partnership with other thematically-related sites and organizations in an effort to connect with other potential visitor groups. An expanded website could provide potential visitors with the opportunity for virtual tours, and information about Nine Mile Canyon partnerships before their visit to the Canyon.
- *Visitors are introduced to sustainable heritage tourism, and ways to participate in the conservation of America's Great Outdoors.* Visitors will understand what vehicle, supply, and equipment need's they will have to safely navigate the 80-mile long back country. They will also be provided critical

DRAFT

information materials that emphasize the importance of archaeological and recreational site stewardship.

- *Visitors have the opportunity to appreciate and understand the significance of Nine Mile Canyon and its prehistory and history by experiencing the real spaces, artifacts, open spaces, and rock art* Canyon tours, special-interest programs and tours, finding aids, on-going conversion of paper records to computer-based, new web site, printed publications (proposed Nine Mile Canyon periodical) or web media provide visitors with opportunities to learn about the significance of the site and its history. Propose the implementation of an active research fellowship program sponsored by local colleges and interest groups.

4. Interpretive Site Development

a. Site Development Principles

All future interpretive site development will be prioritized based on commitments included in Section 11.A of the *West Travaputs Programmatic Agreement*. Site development will also be contingent upon additional environmental analysis and interagency consultation required under the National Environmental Policy Act, the National Historic Preservation Act, and any other applicable laws and regulations. The development of new sites and the redevelopment of existing sites will also conform to all applicable BLM policies and guidance, including, but not limited to the BLM's Visual Resource Management system and the BLM's *Guidelines for a Quality Built Environment*. In general, this BLM guidance promotes the development of safe and accessible recreational facilities, using sustainable materials and consistent designs that complement the surrounding landscape. The environmental analysis for future site development would ideally be comprehensively addressed through the mandated revision of the *Nine Mile Canyon Special Recreation and Cultural Management Area Plan*.

DRAFT

b. Potential Interpretive Site Inventory Index

Potential Site Number #: NMC-01, Walker Service Station – orientation kiosk

Potential Site Location and Land Status: At the junction of Highway 6 and Nine Mile Canyon, located on private property.

Interpretive Significance*:* Orientation for potential visitors to Nine Mile Canyon.

The greatest concentration of prehistoric rock art sites in the world can be seen in Utah's Nine Mile Canyon, and the Nine Mile Canyon Back Country Byway takes visitors through "The Longest Art Gallery in the World."

Site interpretive objectives:

- Visitors have an increased awareness of the world-class rock art-viewing and heritage recreation opportunities available along the Nine Mile Canyon Back Country Byway.
- Visitors have a firm understanding of the vehicle, supply, and equipment needed to safely navigate the 80-mile long backcountry byway.
- Visitors have an increased awareness of the goods and services available in the gateway communities near to Nine Mile Canyon.
- Visitors are introduced to the basic principles of responsible rock art viewing ethics.
- All visitors are provided access to critical information materials that facilitate the effectiveness of interpretive media, such as maps, visitor rules of conduct, and rock art viewing ethics, prior to entering Nine Mile Canyon.

Site Development Potential or Redevelopment Needs:

- Upgrade kiosk and interpretive signage.
- Discuss with local business owners the potential to distribute or sell Nine Mile Canyon self-guiding interpretive materials.
- Address safety concerns.

Site's Outdoor, Print and Web-based Media Needs:

- Outdoor interpretation for this site are 2 kiosk panels (36" x 48").
- Printed interpretive information about Nine Mile Canyon.
- A web site for accessing current safety conditions and information about the canyon.

Estimated Site Development Costs:

- $10,000

DRAFT

Potential Site Number #: NMC-02, Historic Mine Site – Potential kiosk and bike station

Potential Site Number #: NMC-02, First Site – Potential kiosk, fencing and trail

Site Location and Land Status: See site index map.

Interpretive Topic: "Vandalism" What does rock art mean to you? What did rock art mean to ancient people? Rock art viewing ethics.

Interpretive Significance*:* First encounter with rock art for potential visitors.

- What is rock art?
- Why should we protect it? The case of the "*First site*" vandalism.

Site interpretive objectives:

- Potential visitors should understand how to care for rock art.
- Potential visitors should feel curious about the prehistoric and historic contexts of the canyon.
- Potential visitors will have an increased understanding of why we protect heritage resources.

Site Development Potential or Redevelopment Needs:

- Two low profile interpretive panels (36" x 24").
- Fencing.
- Wheel chair accessible trail.
- Development of additional parking and trails.

Site's Outdoor, Print and Web-based Media Needs:

- Outdoor interpretation for this site are two kiosk panels (36" x 48").
- Printed interpretive information on a self-guiding booklet.
- A web application for "virtual tours" of Nine Mile Canyon, upload potential is available for several mobile devices.

Estimated Site Development Costs:

- $500.00 for "safer" walkway entry re-design.
- $2000.00 to develop interpretive panels and pad for this site.

DRAFT

Potential Site Number #: NMC-04, Owl Panel – Potential kiosks and trail

Potential Site Location and Land Status: See site index map.

Interpretive Topic: *Who is Owl?* What is oral tradition?
Sub-topic: Native plant use.

Interpretive Significance*:* Excellent example of rock art that may be accessed by wheel chair.

- How symbols like "*Owl*" can mean many different things.
- What are native plants used for? How has plant life changed in Nine Mile Canyon?

Site interpretation objectives:

- Potential visitors should be curious about who made the rock art and for what purpose.
- Potential visitors should understand how to care for rock art.
- Potential visitors should feel curious about the prehistoric and historic contexts of the canyon.
- Potential visitors will have an increased understanding of why we should protect heritage resources.

Site Development Potential or Redevelopment Needs:

- One low profile interpretive panels at the trail head (36" x 24").
- Two additional low profile interpretive panels located on trail route.
- Wheel chair accessible.

Site's Outdoor, Print and Web-based Media Needs:

- Outdoor interpretation for this site include three kiosk panels (36" x 24").
- Printed interpretive information on a self-guiding booklet.
- A web application for a "virtual tour" of Nine Mile Canyon, upload potential is available for several mobile devices.

Estimated Site Development Costs:

- $3000.00 for three trail kiosks (36" x 24").
- $5000.00 to develop a trailhead area and wheelchair accessible trail to the rock art sites.

DRAFT

Potential Site Number #: NMC-04, Cottonwood Complex – Potential kiosks and trails

Potential Site Location and Land Status: See site index map.

Interpretive Topic: Archaic hunters and the cattlemen of Nine Mile Canyon.
Subtopic: Archaic and historic diets, building on the aforementioned description of native and historic plant use in Nine Mile Canyon.

Interpretive Significance*:* One of the most famous petroglyph panels in Utah.

- What is the difference between petroglyphs and pictographs, do they reflect cultural adaptation?
- How have people adapted to Nine Mile Canyon over time?

Site interpretation objectives:

- Potential visitors should understand how rock drawings/cultures change overtime.
- Potential visitors should understand that environments change overtime.
- Potential visitors should understand the differences and similarities between the archaic and the 'western frontier' in Nine Mile Canyon.

Site Development Potential or Redevelopment Needs:

- One low profile interpretive panel located at the Cottonwood site (18" x 12").
- One low profile interpretive panel (36" x 24") located at *the Big Buffalo* site.
- Develop trails to rock art sites.

Site's Outdoor, Print and Web-based Media Needs:

- Outdoor interpretation includes a small interpretive panel (18" x 12") to direct visitor traffic, and additional low profile interpretation panels (36" x 24") at the *Big Buffalo* site.
- Printed interpretive information on a self-guiding booklet.
- A web application for a "virtual tour" of Nine Mile Canyon, upload potential is available for several mobile devices.

Estimated Site Development Costs:

- $1800.00 for one small interpretive panel (18" x 12") at the *Cottonwood* site and one interpretive panel (36" x 24") for the *Big Buffalo* site.
- $2000.00 to develop a trail head area and cut trail to the rock art sites.
- $9000.00 for the development of a three (36" x 48") panel interpretive kiosk.

DRAFT

Potential Site Number #: NMC-05, Daddy Canyon Complex Site – Potential kiosks and trails

Potential Site Location and Land Status: Rasmussen cave is located on private property. See site index map.

Interpretive Topic: "By design**"** what rock art can tell us about the past.

- What can rock art design, image, and content tell us about the *artist*.
- What can rock art tell us about prehistoric life-ways?

Interpretive Significance*:* Nine Mile Canyon has been inhabited for thousands of years.

Site interpretation objectives:

- Potential visitors should understand and respect that the *Rasmussen site* is privately owned.
- Potential visitors will learn about land status and its implications for heritage management.
- The idea of "change over time" will be reinforced.

Site Development Potential or Redevelopment Needs:

- Develop a two panel (36" x 24") interpretive kiosk for the trailhead.
- Develop a rock art viewing trail.
- Develop a low profile (18" x 12") interpretive panel for the Ute panel.

Site's Outdoor, Print and Web-based Media Needs:

- Outdoor interpretation includes three interpretive panels.
- Printed interpretive information on a self-guiding booklet.
- A web application for a "virtual tour" of Nine Mile Canyon, upload potential is available for several mobile devices.

Estimated Site Development Costs:

- $9000.00 to develop a trailhead entry kiosk with interpretive panels.
- $2000.00 to develop a trail from the parking area to the rock art sites.

DRAFT

Chapter 3: What's Next

1. Interpretive Media Development

There is the potential to develop a wide variety of interpretative media for a diversity of audiences within Nine Mile Canyon. All types of media will be developed with consistent formatting and design principles, and will also seek to promote consistency between the BLM and its partners outreach materials regarding Nine Mile Canyon.

Research:

- Nine Mile Canyon Site Stewardship Program to focus on the preservation of rock art sites.
- Support all aspects of research which can result in theme-based tours and special programs

Interpretive Programming:

- Continue development of interpretive sites based on sound science.

Education Programming:

- Launch Jr. Site Interpreter Program with a focus on youth in the great outdoors.

Staffing

- Expand interpretive positions to include a GS-05-07-09 seasonal visitor use park ranger for interpretation and administrative support.

2. Nine Mile Canyon Special Recreation and Cultural Area Management Plan

In accordance with the commitments the BLM has already made in the *BLM Price Field Office Approved Resource Management Plan* and the final *West Tavaputs Plateau Programmatic Agreement*, the BLM must also revise the 1995 BLM *Nine Mile Canyon Special Recreation and Cultural Management Area Plan*. The management plan will be the most critical next step in the development of interpretive opportunities within Nine Mile Canyon because it will serve as the primary environmental analysis for the potential development of interpretive sites. This publicly-reviewed management plan will also provide all Nine Mile Canyon stakeholders to collaborate on addressing particular challenges related to interpretive development in the area, including obtaining easements for facilities on private property and improving public safety and resource protection at particular locations as needed.

Commented [AC1]: See earlier comments of SRCMA

Appendices

1. References

Bureau of Land Management (BLM). 1995. Recreation and Cultural Management Plan for Nine Mile Canyon Special Recreation and Culture Management Area. January 4, 1995.

Bureau of Land Management (BLM). Approved Price Field Office Resource Management Plan. October, 2008.

DRAFT

Bureau of Land Management (BLM). 1999. Interpretive Strategy: Interpretation is the Voice of the Resources. 1999.

Bureau of Land Management (BLM). 2010. Guidelines for a Quality Built Environment. December, 2010.

Spangler, J. 2003. Horned Snakes and Axle Grease. Uinta Publishing, Salt Lake City, Utah

Veverka, John. 2001. Nine Mile Canyon Interpretive Plan. July, 2001.

DRAFT

2. **BLM Price Field Office Approved Resource Management Plan Decisions Affecting Interpretation in Nine Mile Canyon**
   - **REC-57:** The Nine Mile Canyon SRMA will be managed in coordination with the Vernal Field Office according to the 1995 Special Recreation and Cultural Area Management Plan except as modified by the management alternative listed below. Such changes include VRM objectives.
   - **REC-58:** The Nine Mile Canyon SRMA will be created as indicated on Map R-14 (24,300 Acres).
   - **REC-59:** The purpose of the Nine Mile Canyon SRMA will be to manage recreation and interpretive activities related to the cultural and historic resources and landscapes in the area.
   - **REC-61:** Development will be required to meet VRM II and III objectives (Map R-5).
   - **REC-62:** ROS class semi-primitive non-motorized areas will be closed to OHV use. No facilities will be located in these areas.
   - **REC- 63:** The remainder of the area will be limited to designated routes, including all BLM and county system roads.
   - **REC-64:** ROS roaded natural (RN) class areas will contain visitor facilities, directional signage, interpretive materials, and infrastructure to support visitor health and safety, visitor appreciation of cultural resources, and resource protection.
   - **REC-65:** Private enterprise on private lands in support of public visitation within RN class areas will be encouraged by the BLM.
   - **ACEC-10:** Rationale: This area holds significant prehistoric archaeological resources. Nine Mile Canyon is known to contain the country's highest concentration of rock art panels, remnants of the prehistoric Archaic, Fremont, and Ute cultures. About 80 percent of the known sites are rock art. This ACEC is within the BLM Vernal and Price Field Offices.
   - **TRA-12:** Manage the Nine Mile Canyon State Scenic Backway/BLM Backcountry Byway to protect and preserve the prehistoric and historic values that contribute to the landscape for which the byway was established.

DRAFT

BLM Price Field Office Approved Resource Management Plan Table R9.9: Nine Mile Canyon Special Recreation Management Area		
Market Strategy	Destination	
Market	International, national, regional, and local visitors seeking readily accessible heritage tourism experiences in scenic landscapes via street legal vehicle access for primarily day trips.	
Niche	Nine Mile Canyon is internationally significant for its concentration of archaeological sites. Most prevalent are the rock art and structural sites left by the Fremont people. In Nine Mile the visitor can experience more than 8,000 years of human interaction with a distinct, natural landscape. A succession of cultures has used the canyon as a storehouse of natural resources and a transportation corridor. In addition to the Indian cultures, the canyon is significant for its history. It is a microcosm for the settlement of the west including military history, ranching and settlement, relationship of the government with native cultures, and energy extraction. It also contains important family heritage resources for Carbon County and the Uinta Basin.	
Management Goals	Maintain the natural character of the canyon. Protect the scientific value of cultural resources while allowing for their enjoyment. Provide quality interpretation to increase the appreciation and protection of cultural resources. Reduce conflicts between visitors and private land owners and energy development in the canyon.	
Management Objectives	Continue management under the 1995 Special Recreation and Cultural Management Area (SRCMA) Plan. Continue dialog with Native American Tribes over tribal concerns and viewpoints.	
TARGETED OUTCOMES		
Primary Activities Rock art viewing Archaeological site visitation Driving for pleasure Historic site visitation Hiking Mountain biking Social gathering Historical reenactments Recreational learning Wildlife viewing	**Experiences** Achievement/stimulation Autonomy—enjoying exploring on one's own Family togetherness Learning about nature Enjoyment of natural settings Introspection—contemplating human relationship with the land Exercise/physical fitness Escape physical pressure Escape personal/social pressures	**Benefits** ***Personal:*** Psychological (mental health maintenance) Personal development and growth Greater respect for cultural resources and wild places Improved appreciation and awareness of different cultures ***Household and Community:*** Greater household awareness of and appreciation for cultural heritage including landscape heritage Enhanced lifestyle ***Economic:***

DRAFT

	Teaching others Sense of place and history Self-awareness and reliance Nostalgia/family heritage	Positive contributions to local-regional economic stability Increased local job opportunities Greater diversification of local job offerings Increased local tourism revenue Reduced visitor damage to private land resources ***Environmental:*** Reduced looting and vandalism of historic and prehistoric sites Greater protection of cultural resources Sustaining community's cultural heritage Increased awareness and protection of natural landscapes Conservation of entire sustainable ecosystems Reduced human impacts such as litter, social trails, and vegetation trampling Increased awareness of human interaction with natural landscapes

DRAFT

From:	Spotts, Richard
To:	Phil Hanceford; scott@suwa.org; Terri Martin; Dave Pacheco; davidr@suwa.org; kim@grandcanyonwildlands.org; kelly@grandcanyonwildlands.org; Katie Davis; mark.clemens@sierraclub.org; utah.chapter@sierraclub.org; Michael Kellett; (b) (6) - Steve Erickson; wildutah@xmission.com; Utah Native Plant Society; joro.walker@westernresources.org; Roger Clark; eaumack@grandcanyontrust.org; Tim Peterson; mobrien@grandcanyontrust.org; Kieran Suckling; rspivak@biologicaldiversity.org; Rob Mrowka; Susan Crook; Tom Butine; Jane Whalen; Arthur Haines; bluesage10@yahoo.com; Dave Ribacchi; utahsmalls@msn.com; Kathleen Harcksen; eyork@tnc.org; lisar@bajabb.com; Chris Gorzalski; Iris Picat; alicyn.gitlin@sierraclub.org; Christine Albano; friendsofgoldbutte@gmail.com; Tony Barron; nada_culver@tws.org; Sandy Bahr; Sara Vickerman Gage; Samantha Hammer; admin@sonorandesert.org; RRomero@biologicaldiversity.org
Subject:	FYI - National Monuments: Legal experts argue Trump has power to abolish sites & Grijalva baits Bishop on Antiquities Act
Date:	Wednesday, March 29, 2017 5:02:16 PM

FYI - If you have not already seen them, you may find the two related articles below of interest. RS

NATIONAL MONUMENTS

Legal experts argue Trump has power to abolish sites

Jennifer Yachnin, E&E News reporter

Published: Wednesday, March 29, 2017

Conservative legal scholars today released an analysis arguing that President Trump has the authority to abolish large national monuments. Photo by Phil Taylor.

President Trump could move to abolish national monuments — including the recently created

Bears Ears site in southeastern Utah — if his administration determines the areas are "illegally large," according to a new analysis of the Antiquities Act unveiled today by conservative scholars.

The Pacific Legal Foundation's Todd Gaziano and American Enterprise Institute legal scholar John Yoo are scheduled to review their new paper, "Presidential Authority to Revoke or Reduce National Monument Designations," at an event in the Dirksen Senate Office Building tonight.

In the 26-page analysis, Yoo and Gaziano also seek to break down past legal advisories that found that while the Antiquities Act of 1906 permits presidents to designate national monuments to protect scientific or historic artifacts, it does not allow commanders-in-chief to revoke the status of monuments.

"An attorney general opinion in 1938 concluded that the statutory power granted to the president to create national monuments does not include the power to revoke prior designations," the duo wrote. "We think this opinion is poorly reasoned; misconstrued a prior opinion, which came to the opposite result; and is inconsistent with constitutional, statutory, and case law governing the president's exercise of analogous grants of power."

Echoing a *Wall Street Journal* op-ed the pair wrote in late December, just days after President Obama established the 1.35-million-acre Bears Ears National Monument, Yoo and Gaziano assert that the president maintains a "general discretionary revocation power."

"The Antiquities Act of 1906 grants the president the power to designate national monuments in order to protect historic landmarks and structures," the pair wrote. "We are confident that, pursuant to this power to designate, a president has the corresponding power to revoke prior national monument designations, although there is no controlling judicial authority on this question."

In their conclusion, the pair added: "This power is at its height when prior designations were made illegally or in contravention of the act's mandate that designations be reasonable in size."

Although past presidents have reduced the size of some monuments, no commander-in-chief has ever sought to repeal the designation of one of his predecessors.

Utah Rep. Rob Bishop (R), chairman of the House Natural Resources Committee and a vocal opponent of the Bears Ears monument who has urged Trump to rescind its status, has highlighted the reduction of the Navajo National Monument in 1912 as an example of the president's authority (*Greenwire*, March 20).

But conservationists have argued that even though older reductions, such as cuts in the size of the Olympic National Monument or Grand Canyon II National Monument, have never been challenged in court, a move by Trump to do so would likely spur legal action.

Yoo and Gaziano argue, however, that even if a president does not have a "general discretionary revocation power," Trump could seek to revoke monuments by declaring them overly large.

"The Congress that enacted the Antiquities Act did not intend monuments of that size to be established by presidential designation," the pair wrote, asserting that early monuments tended to be 5,000 acres or less.

They later added: "If a president makes a credible determination, based on the facts and a reasonable interpretation of the act, that some former monuments are illegally large relative to the original 'object' supposedly being protected, he could declare that the initial designation was void, especially if there is no easy way to make it lawful by severing discrete parcels of land."

But Arizona Rep. Raúl Grijalva, the top Democrat on the House Natural Resources panel, offered a pre-emptive rebuttal to Yoo and Gaziano's arguments yesterday, pointing to an analysis published earlier this month by the firm Arnold & Porter.

"The Antiquities Act and subsequent legislation reserved to Congress, which has Constitutional authority over public lands, the sole power to revoke such a designation," the analysis says (*E&E Daily*, March 29).

Twitter: @jenniferyachnin Email: jyachnin@eenews.net

NATIONAL MONUMENTS

Grijalva baits Bishop on Antiquities Act

Jennifer Yachnin, E&E News reporter

Published: Wednesday, March 29, 2017

Arizona Rep. Raúl Grijalva, the top Democrat on the House Natural Resources Committee, is challenging Chairman Rob Bishop to introduce legislation to reform the Antiquities Act, accusing the Utah Republican of attempting to dismantle national monuments via "a behind-the-scenes legal strategy."

In a statement issued yesterday, Grijalva took aim at his counterpart, who has been a vocal critic of the 1906 law that allows presidents to designate land as monuments to protect objects of historic or scientific interest.

Along with other members of Utah's all-GOP delegation, Bishop has argued that the Antiquities Act can be used both to create and dismantle such sites, including the recently created 1.35-million-acre Bears Ears National Monument in southeast Utah.

Both Bishop and Sen. Mike Lee (R-Utah) are set to speak at an event in Washington, D.C., tonight hosted by the Pacific Legal Foundation and American Enterprise Institute on that subject.

The event, titled "Presidential Authority to Revoke or Reduce National Monument Designations," will focus on a new paper by AEI legal scholar John Yoo and PLF's Todd Gaziano.

In his statement, Grijalva criticized the GOP-aligned briefing and noted that the Natural Resources Committee has not held a hearing on the status of any monuments since Bishop became chairman in 2015.

"We can disagree about whether our federal lands should be protected or turned over to extraction industries, but let's do our jobs and have that debate with our colleagues about real legislation," Grijalva said.

Although Bishop has previously sponsored or co-sponsored measures that would prevent new national monuments in Utah or require congressional approval for such monuments, he has yet to do so in this session. Bishop did, however, author a change to the House rules this year that designates federal land transfers as cost-free (*E&E Daily*, Jan. 6).

"Chairman Bishop has the power to introduce a bill that puts his ideas into practice, discuss its merits and hold a vote whenever he chooses," Grijalva continued. "Rather than trying to convince a small handful of people to support a behind-the-scenes legal strategy, let's see what happens when he asks our colleagues to vote against our country's public lands when the cameras are rolling."

A committee spokesman declined to comment on Grijalva's statements.

Although Congress may opt to abolish monuments via legislation, it has done so fewer than a dozen times. It has, however, converted about 50 national monuments to national parks or preserves (*Greenwire*, Feb. 8).

While both state and federal GOP lawmakers from Utah have criticized the Bears Ears monument — as well as the older Grand Staircase-Escalante National Monument created by President Clinton — their aim has largely been to urge President Trump to rescind the designations for those sites or reduce their size.

A handful of monuments have been reduced by previous commanders in chief, but to date, no president has sought to undo a monument's status. Conservationists also suggest that any move by Trump to reduce a monument's boundaries would spark a legal challenge, asserting that the president does not have authority to amend monuments, but only to create them.

But in a December op-ed in *The Wall Street Journal*, published shortly after President Obama designated the Bears Ears site, Yoo and Gaziano argued that because Congress has granted power to presidents to create monuments, that means a commander in chief can undo those designations.

"After studying the president's legal authority, we conclude that he can rescind monument designations — despite the cursory but contrary view of Attorney General Homer Cummings in 1938," Yoo and Gaziano wrote. "While Congress could limit it further, the law's text and original purposes strongly support a president's ability to unilaterally correct his predecessors' abuses."

The duo point to Congress' ability to rescind regulations issued by the executive branch, as well as a president's ability to remove appointed officials even after they have been approved by the Senate.

"Similarly, presidents have the constitutional authority to terminate a treaty, even though they need Senate advice and consent to make it," Yoo and Gaziano wrote.

The pair's new paper on whether Trump can amend or rescind monuments is under embargo until this evening's event.

But Grijalva pointed to an analysis published earlier this month by law firm Arnold & Porter that argues presidents have not been given authority to undo monuments.

"The Antiquities Act and subsequent legislation reserved to Congress, which has Constitutional authority over public lands, the sole power to revoke such a designation," the analysis states.

The analysis highlights the Federal Land Policy and Management Act, enacted in 1976, which reserved for Congress "the authority to modify and revoke withdrawals for national monuments," while also arguing that removing monuments included in the National Park System would violate federal laws that prohibit derogation of the park system.

The firm also criticized Yoo and Gaziano's interpretation of the Antiquities Act, writing that allowing a president to rescind a monument would be equivalent to "a usurpation of congressional powers by the Executive Branch."

Twitter: @jenniferyachnin Email: jyachnin@eenews.net

From:	Michael Saul
To:	sagebrush_withdrawals@blm.gov
Subject:	DEIS Comments of Center for Biological Diversity
Date:	Thursday, March 30, 2017 12:48:44 PM
Attachments:	CBD SFA Withdrawal DEIS comments.pdf

Dear Mr. Mankiewicz:

Please find attached the comments of the Center for Biological Diversity regarding the Draft EIS for proposed mineral withdrawals in crucial sage-grouse habitat.

Sincerely,

Michael Saul

Senior Attorney, Public Lands

Center for Biological Diversity

Denver, CO

phone/text 303-915-8308

msaul@biologicaldiversity.org

This email may contain material that is confidential, privileged and/or attorney work product for the sole use of the intended recipient. Any review, reliance or distribution by others or forwarding without express permission is strictly prohibited. If you are not the intended recipient, please contact the sender and delete all copies.

CENTER for BIOLOGICAL DIVERSITY

March 30, 2017

Mark Mackiewicz
Bureau of Land Management (BLM) WO
c/o Price Field Office
125 South 600 West
Price, Utah 84501

Via email to sagebrush_withdrawals@blm.gov

Dear Mr. Mackiewicz:

The Center for Biological Diversity hereby joins and endorses the comments of Western Watersheds Project on the Draft EIS for the Proposed Withdrawal from Mineral Entry in Sagebrush Focal Areas ("DEIS"). The BLM must consider the following key points and incorporate these provisions into the final Decision regarding this mineral withdrawal:

1. All Sagebrush Focal Areas as designated in the Greater Sage-Grouse Approved Resource Management Plan Amendments ("ARMPAs") should be withdrawn from mineral entry, leasing, or sale. We oppose reduction of these areas to accommodate state preferences that would exclude areas where risk of environmental exploitation is greatest.
2. The withdrawal area should be expanded to include all lands identified by the U.S. Fish and Wildlife Service ("USFWS") as "strongholds," delineated on attached maps as "Identified Areas of GrSG Landscape Significance," and described as "a subset of priority habitat most vital to the species persistence" in the October 27, 2014 memorandum titled, "Greater Sage-Grouse: Additional Recommendations to Refine Land Use Allocations in Highly Important Landscapes."
3. The mineral withdrawal should apply to locatable mineral entry, non-energy leasable minerals, fluid mineral leasing, and salable minerals in order to protect sage grouse habitat from destruction by all forms of mining and mineral extraction.
4. The U.S. Fish and Wildlife Service explicitly relied upon this mineral withdrawal in its 2015 finding that the greater sage grouse was "not warranted" for Endangered Species Act listing.

The mineral withdrawal derives its purpose and need in part from the need to address the March 2010 'warranted, but precluded' Endangered Species Act ("ESA") determination for the greater sage grouse, the 2013 Conservation Objectives report, and the USFWS memorandum of October 27, 2014 referenced above. DEIS at iv. Importantly, "the USFWS found that current application of BLM and Forest Service regulatory authorities falls short of meeting the conservation needs of the species." *Id.*

Reductions in Sagebrush Focal Area Withdrawals Should Not be Permitted

Several of the action alternatives would reduce the areal extent of the proposed withdrawal to less than the Sagebrush Focal Areas as designated in the ARMPAs.

Under the "State of Nevada Alternative," Sagebrush Focal Areas would be reduced in Nevada by 486,376 acres to exclude lands that "Have high mineral potential or limited sage-grouse habitat." DEIS at vii. The primary purpose of these boundary changes would be to "reduce the potential social and economic impact of the proposed withdrawal to the state of Nevada…." *Id.* , and see 2-3. This is expected to result in one additional mine and 16 additional exploration projects within SFA over the proposed action. Compare Tables 2-5, 2-8.

The "High Mineral Potential" alternative is explicitly designed to exempt Sagebrush Focal Areas with high potential for industrial development from the mineral withdrawal, reducing the area of withdrawal by 558,918 acres. DEIS at viii, 2-3. This is expected to result in 5 additional mines and 34 additional exploration projects within SFA over the proposed action. Compare Tables 2-5, 2-11.

Under the "State of Idaho Alternative," 538,639 acres of Sagebrush Focal Area in Idaho would be excluded from the mineral withdrawal because these areas have high or even moderate potential for mineral development. DEIS at viii, 2-3. This is expected to result in 4 additional mines and 10 additional exploration projects within SFA over the proposed action. Compare Tables 2-5, 2-14.

The areas with highest mineral development are necessarily the areas with the greatest risk of habitat destruction through this industrial development. BLM notes, "One of several major threats to public lands identified in the LUP amendments is the fragmentation of 36 greater sage-grouse habitat due to mineral exploration and development related to hard rock mining." DEIS at 1-14. It violates the Purpose and Need of this EIS to fail to withdraw the sage grouse habitats at greatest risk for destruction at the hands of the minerals industry.

The Purpose and Need is Unreasonably Narrow

NEPA implementing regulations require agencies to describe the underlying purpose and need to which the agency is responding when proposing alternatives. 40 C.F.R. § 1502.13. When writing this purpose and need statement, the agency may not so narrowly construe the purpose and need that it restricts otherwise reasonable alternatives. As the court in *Nat'l Parks and Conservation Ass'n v. BLM* explained, BLM may not define the purpose and need so narrowly that is forecloses a consideration of a reasonable range of alternatives, nor in such a way that only one alternative would accomplish the goals of the agency action. 606 F.3d 1058, 1070-72 (9th Cir. 2010). *See also Davis v. Mineta*, 302 F.3d 1104, 1119–20 (10th Cir. 2002) (reasoning that although an agency may reject alternatives that do not meet the purpose and need of a project, it may not define the project so narrowly that it foreclosed a reasonable consideration of alternatives); *Simmons v. U.S. Army Corps* 120 F.3d 664, 669 (7th Cir. 1997) (an agency cannot narrowly write the purpose and need so as to define away competing reasonable alternatives).

The Purpose and Need of this EIS is unreasonably constrained by limiting it to "the withdrawal of these approximately 10 million acres of land identified as SFA in Priority Habitat Management Area" and limiting the withdrawal to protecting sage grouse and its habitat from "reasonably foreseeable locatable mineral development." DEIS at 1-1, 1-14. In so defining the Purpose and Need, BLM draws the bounds of the EIS prescriptively in such a narrow manner that withdrawal of minerals other than locatable minerals, and applying the withdrawal to lands outside designated SFAs, would fall outside the Purpose and Need. As BLM points out, "The proposed withdrawal does not apply 18 to saleable [*sic*] and leasable minerals such as coal, oil, natural gas, and sand and gravel." DEIS at 1-2. This also is an unreasonable narrowing of the Purpose and Need.

Delineation of the Withdrawal Area

The USFWS delineated its "strongholds" based on sage grouse breeding density maps (Doherty 2010), areas identified as essential for the conservation and persistence of the species (Knick and Hanser 2011), and Geographic Information System ("GIS") mapping of vegetation and habitat resilience in the face of invasive weeds and large-scale disturbance (Chambers et al. 2014). See Attachment 1. In this letter, USFWS stated that "**Strong, durable, and meaningful protection of federally administered lands in these areas will provide additional certainty and help obtain confidence for long-term sage-grouse persistence**" (bold in original).

However, the "strongholds" so designated excluded key areas equally deserving of this level of protection due to the at-risk nature of these populations. These include Parker Mountain in Utah; Powder River Basin, Laramie Plains and Jackson Hole in Wyoming; the Arapaho National Wildlife Refuge and surrounding lands in northwestern Colorado; and the Dakotas. These areas should have been included in "stronghold" designations and should be included in the mineral withdrawal. This is a reasonable alternative and should have been fully considered in the EIS.

The DEIS Fails to Examine a Range of Reasonable Alternatives

The maximum extent of the proposed withdrawal is the SFA lands designated in the ARMPAs. Importantly, an examination of the grouse population density data in Doherty et al. (2016) indicates that many if not all of these excluded lands have the highest class of sage grouse population density.

BLM Fails to Consider Withdrawal of All USFWS Strongholds

In previous comments, conservation groups sought mineral withdrawal across all of the "stronghold" areas designated by the USFWS in their memo of Oct. 27. 2014. In its DEIS, BLM states, "The SFAs (also identified by the USFWS as stronghold areas essential for greater sage-grouse survival) are specific areas that have been identified within PHMA." This is an erroneous statement, indicative of a failure to take a hard look at USFWS recommendations. The SFAs were designated by BLM through the ARMPAs, and are different from and smaller than the stronghold areas designated by USFWS.

In October of 2014, the U.S. Fish and Wildlife Service identified approximately 12 million acres of "stronghold" areas that possess some of the highest sage grouse densities remaining. *See* Attachment 3. These lands were identified by the Service as "a subset of priority habitat most vital to the species [*sic*] persistence, within which we recommend the strongest level of protection." We agree with the Service memo noting that "[s]trong, durable, and meaningful protection of federally administered lands in [Sagebrush Focal Areas] will provide additional certainty and help obtain confidence for long-term sage-grouse persistence." Most of these were subsequently designated as Sagebrush Focal Areas under the greater sage grouse plan amendments and revisions, but a major acreage of "stronghold" areas was not designated as SFA under the plans, and some of the acreage that indeed did become SFA has not been proposed for mineral withdrawal under the Interior Department's proposal. There is no circumstance under which it is appropriate to exclude lands from the mineral withdrawal that were designated either as "stronghold" areas by the U.S. Fish and Wildlife Service or as SFAs under the BLM planning process; all of the aforementioned categories of top-concern sage grouse habitats need to be withdrawn from future mineral location and development.

A WildEarth Guardians GIS-based analysis comparing the acreage of land under all ownerships falling within the "stronghold" areas to those that were designated as Sagebrush Focal Areas under the plans, and found that some 3.3 million acres of sage grouse habitats of all ownerships had been excluded from the boundaries of SFAs designated by the BLM. All of these excluded lands and minerals should also be withdrawn from future location, leasing, or sale.

Federal lands and minerals administered under different agencies or authorities that fall within the bounds of sage grouse "strongholds" identified by the Service should also be fully included in the proposed mineral withdrawal. These include Craters of the Moon National Monument and Preserve in Idaho, Charles M. Russell and UL Bend National Wildlife Refuges and the UL Bend Wilderness in Montana, Sheldon National Wildlife Refuge in Nevada, Hart Mountain Antelope Refuge in Oregon, and the Seedskadee and Cokeville Meadows National Wildlife Refuges in Wyoming. Some of these lands were explicitly included in "stronghold" maps (*see* Attachment 3) and many were referenced by name as anchors for the protective designation as recommended by the Service in their October 27, 2014 memorandum. These lands are already managed for conservation as a primary mission, so withdrawal of the federal minerals that underlie them should be non-controversial and should assist the managing agencies in better achieving their conservation missions.

Because the Lander Resource Management Plan was finalized before the U.S. Fish and Wildlife Service made its 'stronghold' recommendations, no Sagebrush Focal Areas were designated for elevated protection in the greater sage grouse plan amendment process, and no federal minerals in the Lander BLM Field Office have been proposed for withdrawal according to the agency's published maps. USFWS-proposed "stronghold" habitats in the Lander Field Office face major threats from uranium mining and oil and gas development, as well as lesser threats from jade prospecting and mining and sand and gravel pit development. This area is the heart of the sage grouse range, and merits the strongest degree of protection from mineral development.

In Wyoming, the proposed withdrawal also excludes the designated Sagebrush Focal Areas that are at the greatest risk of destruction and degradation due to hard-rock mining and other types of mineral development. Uranium mining is underway in the Greater South Pass

PHMA, which also has been designated as a Sagebrush Focal Area, with mines under development in the Sheep Mountain and Lost Creek areas south of Green Mountain, and also in the Gas Hills area, a part of the Sagebrush Focal Area that has seen considerable uranium exploration and mining in decades past. These lands are unaccountably excluded from the proposed mineral withdrawal. Portions of the South Pass Historic Landscape, designated for elevated protection by the BLM, are SFA lands excluded from the proposed mineral withdrawal, and have been subject to gold prospecting and speculation in recent years. The Upper Green River Valley, which has experienced intensive oil and gas development and associated gravel mining to support thousands of miles of gravel road construction, also is excluded from the SFA mineral withdrawals. These sensitive sage grouse habitats must all be withdrawn from future mineral entry. In total, hardly any of the Sagebrush Focal Areas designated for Wyoming are included in the proposed mineral withdrawal, a slap in the face of sage grouse conservation given that almost 40% of the remaining sage grouse live in Wyoming, a state facing some of the most severe threats from the minerals industry. Excluding from protection the very Sagebrush Focal Areas that are at the greatest risk of mineral development makes a mockery of the agency's effort to protect the most important sage grouse habitats.

BLM Fails to Consider and Alternative Withdrawing All Minerals

Nowhere, it seems, does BLM even consider including an alternative that would also withdraw non-energy leasable minerals, fluid minerals, or salable minerals (mineral materials sales) from being offered, even though the Secretary also has full authority to include these types of minerals in a withdrawal. Such an alternative is not included in the Alternatives Considered but Eliminated from Detailed Analysis (DEIS at 2-34 *et seq.*), nor does the EIS include a finding that such an alternative is in any way unreasonable. Indeed, BLM's own sage grouse experts (NTT 2011) concluded that all Priority Habitats should be closed to or withdrawn from these types of mineral development.

The BLM's National Technical Team (2011) conducted an expert review of the available science, and concluded, "There is strong evidence from the literature to support that surface-disturbing energy or mineral development within priority sage-grouse habitats is not consistent with a goal to maintain or increase populations or distribution." *See* Attachment 1. The Secretary of Interior has full authority to withdraw the public lands not only from locatable mineral entry, but also from fluid mineral leasing, non-energy minerals leasing, mineral materials sales, and coal leasing. Section 204 of the Federal Land Policy and Management Act of 1976 (43 U.S.C. § 1714) provides that "the Secretary is authorized to make, modify, extend, or revoke withdrawals" of public lands. "withholding an area of Federal land from settlement, sale, location, or entry, under some or all of the general land laws, for the purpose of limiting activities under those laws in order to maintain other public values in the area or reserving the area for a particular public purpose or program."[1] Although "leasing" is not mentioned in FLPMA's definition of "withdrawal," the courts, analyzing the use of "withdrawal" in other statutes and the structure and goals of FLPMA, have concluded that "[i]t would be unreasonable to hold that the emergency withdrawal contemplated by section 204(e) was not intended to give the congressional committees and the Secretary the power to preserve these values by withdrawing the land from disposition

[1] 43 U.S.C. § 1702(j).

under the mineral leasing laws."[2] This interpretation is further supported by the Secretary's pre-FLPMA authority to withdraw minerals from not just location and patenting but also leasing under the Mineral Leasing Act.[3]

FLPMA plainly authorizes the Secretary to withdraw public land from the operation of any or all of the "general land laws: – not only the General Mining Law but also the Mineral Leasing Act.[4] The Secretary should exercise this authority to protect these sage grouse habitats of elevated significant from all types of future mineral development; the sage grouse habitats protected from hard-rock mining will be worth nothing to the conservation and recovery of these birds if they are subsequently converted into oil and gas fields, gravel pits, or potash mines.

Hard-rock mining can have significant negative impacts on sage grouse. This is perhaps best illustrated by the construction of the Lost Creek In Situ Uranium Mine, which was built in 2012. Several leks were within two miles of this facility, and the main haul roads running east and west of the mine site passed within one mile of two leks or lek complexes. All of the leks within two miles of the mine site have experienced major population declines since the onsite of mine construction, and these declines have continued over the past two years even as sage grouse leks throughout Wyoming have experienced a significant population rebound.

The BLM's National Technical Team (2011:24) recommended for locatable minerals in all priority habitats that the BLM "[p]ropose withdrawal from mineral entry based on risk to the sage-grouse and its habitat from conflicting locatable mineral potential and development." To the extent that the lands proposed for withdrawal represent a minority of the lands designated as Priority Habitat Management Areas in the federal sage grouse planning process, the proposed mineral withdrawal from locatable mineral entry is consistent with the agency's own expert recommendations for these lands.

Oil and gas development is arguably having the greatest impact on sage grouse populations of any human-caused stressor in the Rocky Mountain region. This type of industrial development fragments and degrades sage grouse habitat and displaces sage grouse from key habitat areas, resulting in heavy impacts to sage-grouse populations have been documented where these stipulations have been applied (Holloran 2005, Walker et al. 2007, Walker 2008, Doherty et al. 2008, Holloran et al. 2007, Holloran et al. 2010, Holloran et al. 2015). The BLM's National Technical Team (2011:22) recommended that the agency "[c]lose priority sage-grouse habitat areas to fluid mineral leasing" under both of its recommended scenarios. Withdrawing the lands in question from future oil and gas leasing satisfies this biological

---

[2] *Pacific Legal Foundation v. Watt*, 529 F.Supp. 982, 995 (D. Mont. 1981). *Pacific Legal Foundation*'s holding on Congressional termination of withdrawals is no longer good law, *see INS v. Chadha*, 462 U.S. 919 (1983) (Constitution prohibits Congress from bypassing separation of powers); *Yount v. Salazar*, 933 F. Supp.2d 1215 (D. Ariz. 2013) (holding Section 204(c) of FLPMA's legislative veto, which provided that Congress could block withdrawals in excess of 5,000 acres through resolution of both houses, unconstitutional), but its reasoning on inclusion of mineral leasing remains persuasive.

[3] *See Mecham v. Udall*, 369 F.2d 1, 2-3 (10th Cir. 1966) (holding that enactment of Mineral Leasing Act did not exclude leasable minerals from prior executive withdrawal authority); *United States v. Midwest Oil Co.*, 236 U.S. 459 (upholding pre-MLA authority to withdraw oil and gas) (1915)

[4] *See Mecham v. Udall*, 369 F.2d 1, 2-3 (10th Cir. 1966) (holding that enactment of Mineral Leasing Act did not exclude leasable minerals from prior executive withdrawal authority); *United States v. Midwest Oil Co.*, 236 U.S. 459 (upholding pre-MLA authority to withdraw oil and gas) (1915)

imperative.

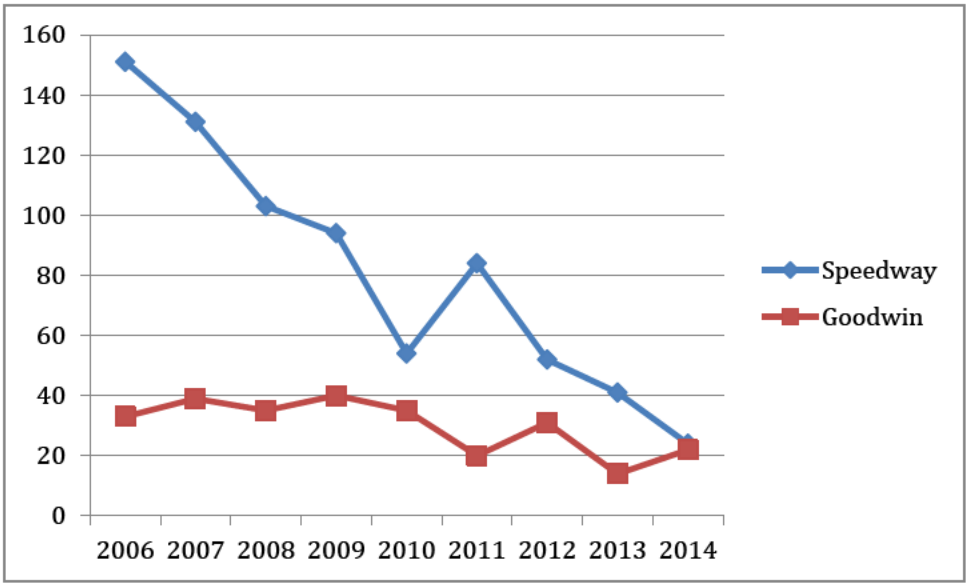
Braun (1986) and Remington and Braun (1991) documented significant impacts from coal mine-related activities on sage grouse populations. In addition, underground coal mining comes with the necessity of ventilator fans, which typically emit levels of constant noise that exceed thresholds causing significant impacts to sage grouse. *See* Attachment 5. For coal development in priority habitats, the BLM's National Technical Team (2011:24) recommended, "Find unsuitable all surface mining of coal under the criteria set forth in 43 CFR 3461.5," and for underground mining, "Grant no new mining leases unless all surface disturbances (appurtenant facilities) are placed outside of the priority sage-grouse habitat area." Withdrawing the lands in question from future coal leasing protects these important sage grouse habitats from the same impacts as would be expected under locatable minerals development.

Non-energy leasable minerals include leases to permit mining for potash, sodium, phosphate, sulfur, and gilsonite. The BLM's National Technical Team (2011:25) made the following recommendations for management of these mineral resources in priority sage grouse habitats:

> Close priority habitat to non-energy leasable mineral leasing. This includes not permitting any new leases to expand an existing mine.

The mining of these minerals can occur in the form of strip-mining or underground mining, just like locatable minerals, and the impacts to sage grouse and their habitats are no different as a result of the different minerals targeted for extraction. These sensitive habitats should therefore also be withdrawn from future non-energy mineral leasing as well.

Sand and gravel pits are regulated under the auspices of mineral materials sales. Their extraction involves strip mining on a small scale and involves the surface disturbance, heavy machinery, noise, vehicle traffic, and human activity that impact greater sage grouse known to impact sage grouse distribution and habitat use and degrade sage grouse habitat quality. These problems are illustrated by the McMurry gravel pit permitted near Boulder, Wyoming. Mining began in 2008 as a pit less than 10 acres, with mining continuing through 2009. Despite exceeding the 5% disturbance cap for the Goodwin lek and having main haul roads with over 300 truck trips per day over one 3-month period on a road located within ¼ mile of the Goodwin lek, and the Speedway lek is even closer to the road (in violation of the state's 1.9-mile restriction on such roads), the State of Wyoming permitted a new and expanded gravel mine at this site. This radically larger operation includes 335-acre permitted pit with a limit of 32 acres actively being mined at any one time, approved on July 11, 2013; an alternative to use access roads farther than 2 miles from the sage grouse leks in question was ignored. According to the testimony of Mary Flanderka of the Wyoming Game and Fish Department before the state Environmental Quality Council, "there would be no declines in sage grouse populations, provided [McMurry] compl[ies] with [its] worksheet and the way that the permit was applied for." But even the much smaller, previously permitted gravel pit in this location appears to have caused a significant decline of birds on neighboring leks, based on State of Wyoming lek counts:



This example provides an indicator of why it is imperative to include mineral material sales (indeed, all forms of mineral development) in the withdrawal.

Importantly, the withdrawal of federal mineral estate should be undertaken not only for minerals underlying federally-owned surface estate, but also for all federal minerals underlying state or private lands. According to the recommendations of the National Technical Team (2011:25), "Where the federal government owns the mineral estate, and the surface is non-federal ownership, apply the conservation measures applied on public lands."

The DEIS Fails to Consider Withdrawals for Bi-State or Columbia Basin Sage Grouse

Sage grouse occupied habitats in the Columbia Basin (Washington) population and the Mono Basin (Bi-State) population fell outside the scope of Sagebrush Focal Area designations under greater sage grouse ARMPAs, as well as the Service's "stronghold" recommendations. These populations are so small and their survival is so tenuous that all occupied and potential habitats associated with their populations should be added to the mineral withdrawals already proposed by the Interior Department.

The Columbia Basin sage grouse population is restricted to as many as four populations divided by an interstate highway and multiple transmission lines (two populations to the north, two to the south, WHCWG 2010), with limited connectivity and dispersal between them (Shirk et al. 2015). Each of these populations occupies highly fragmented habitats (*see, e.g.*, Schroeder and Robb 2003). By 1996, more than half of Washington's shrubsteppe habitat has been lost to agricultural conversion, and that which remains is heavily fragmented (Dobler et al. 1996). As a result, sage grouse have decreased to approximately 8% of their original occupied range (Schroeder et al. 2000). As of 2011, the Washington statewide population of greater sage grouse was estimated at 1165 birds (WHCWG 2012). According to Stinson et al. (2004: 22),

> The two remaining populations in Washington are too small to be considered viable, so the persistence of sage-grouse in Washington is likely to depend on

> recovery efforts. Small populations are affected by loss of genetic variability, inbreeding, and predation pressure, and are at risk from random events such as extreme weather or fires.

Clearly, the withdrawal of occupied and potential habitats of the Columbia Basin sage grouse population would remove a potential threat to this population's survival.

The Bi-State Distinct Population Segment of greater sage grouse occupies the Mono Basin and surrounding habitats, which are isolated from the rest of the sage grouse populations in the range. Populations in the six Population Management Units ("PMUs") are uniformly low, with trends that are stable or decreasing (Bi-State TAC 2012). Four of the six PMUs have populations that are in immediate threat of extirpation within the next 30 years. Coates et al. (2014) found that trends in males counted per lek for the Bi-State populations have been relatively stable since 2003, but this analysis excluded Population Management Units with the steepest declines and sparsest grouse populations. Aldridge et al. (2008) found that the single greatest factor predicting sage grouse extirpation was human population density in 1950, and that counties with population densities greater than 4 people per square kilometer had increased likelihood of extirpation. Sage grouse habitats in the Bi-State area face some of the most extensive threats from exurban development in the species' range. Roads and associated habitat fragmentation are also a major threat. According to USFWS (2013:42),

> Our analysis of the best available data in the Bi-State area documents that all known leks are within 3 km (1.8 mi) or less of an existing road and between 35 and 45 percent of annually-occupied leks are within 5 km (3.1 mi) of highways (Service 2013, unpublished data).

USFWS (2013) correctly notes that hard-rock mining was extensive across much of the Bi-State area during the 1800s, and that current claims and mining activity are ongoing. For the Mount Grant PMU, the Bi-State TAC (2012: 36) pointed out,

> On-going mining and potential geothermal development pose relatively high risks in the Mount Grant PMU. Existing activities associated with the current ore processing facility at Aurora have already contributed to the development of additional transmission lines and increased vehicle traffic in portions of the PMU that are important to sage-grouse.

The vast areal extent of existing claims, and the lack of a regulatory mechanism to reduce their number and extent, mean that this principal threat to sage grouse persistence will go unameliorated by current sage grouse protections. Withdrawing all areas within identified sage grouse habitat from mineral entry is therefore necessary to address the weaknesses in current and pending sage grouse protections for this population.

The DEIS Fails to Take a Hard Look at Impacts to Sage Grouse

BLM states, "Within these LUP documents, the SFAs have been determined to be the locations most vital to the greater sage-grouse's persistence as a species." DEIS at 1-1. This statement conflicts with the October 27, 2014 USFWS determination that the locations most vital include vast acreages of lands that were excluded from SFA designations under the Greater Sage Grouse ARMPAs. BLM correctly concludes that "at the individual future

mining operation scale could result in moderate to major impacts." DEIS at 4-87. But importantly, the agency neglects to estimate the comparative impacts, direct and cumulative, of mineral development on sage grouse and their habitats in and near SFA for each alternative.

Failure to Consider the Agency's Own Analysis of Impacts (Including Mining)

Shockingly, the BLM's own National Technical Team (2011) report is referenced nowhere in the DEIS. The National Technical Team (2011: 6) wrote that the BLM's National Sage-Grouse Planning Strategy ushered in a "New Paradigm" under which

> Land uses, habitat treatments, and anthropogenic disturbances will need to be managed below thresholds necessary to conserve not only local sage-grouse populations, but sagebrush communities and landscapes as well. Management priorities will need to be shifted and balanced to maximize benefits to sage-grouse habitats and populations in priority habitats.

The BLM convened a National Technical Team ("NTT") comprised of federal agency experts (including BLM, USFWS, NRCS, USGS, and state agencies) to assess the threats to greater sage grouse in the context of this planning process and recommend conservation measures that would address the threats to the species. This has been recognized by BLM in its NEPA analyses: "To ensure BLM management actions are effective and based on the best available science, the National Policy Team created the NTT in August 2011." Oregon Greater Sage-grouse RMP Amendment DEIS at ES-14. For Wyoming, the BLM expressed the same sentiment, worded slightly differently: "The National Policy Team created the NTT in August of 2011 specifically to develop conservation measures based on the best available science." Wyoming Greater Sage-grouse RMP Amendment DEIS at 1-7. The fact that the NTT report reflects the best available science and the official opinion of agency sage grouse experts has been elucidated in great detail during these NEPA processes:

> The conservation measures identified for consideration were developed by the NTT, a group of resource specialists, land use planners, and scientists from the BLM, state fish and wildlife agencies, USFWS, the Natural Resources Conservation Service, and the US Geological Survey (USGS). The report provides the latest science and best biological judgment to assist in making management decisions relating to the GRSG [greater sage grouse].

Oregon Greater Sage-grouse RMP Amendment DEIS at 1-2. According to the National Technical Team (2011:4) itself, "To ensure BLM management actions are effective and based on the best available science, the National Policy Team created a National Technical Team (NTT) in August of 2011." The National Technical Team described its purpose as follows:

> The National Greater Sage-Grouse Planning Strategy Charter charged the NTT to serve as a scientific and technical forum to:

- Understand current scientific knowledge related to the greater

sage-grouse.

- Provide specialized sources of expertise not otherwise available.
- Provide innovative scientific perspectives concerning management approaches for the greater sage-grouse.
- Provide assurance that relevant science is considered, reasonably interpreted, and accurately presented; and that uncertainties and risks are acknowledged and documented.
- Provide science and technical assistance to the Regional Management Team (RMT) and Regional Interdisciplinary Team (RIDT), on request.
- Articulate conservation objectives for the greater sage-grouse in measurable terms to guide overall planning.
- Identify science-based management considerations for the greater sage-grouse (e.g., conservation measures) that are necessary to promote sustainable sage-grouse populations, and which focus on the threats (75 FR 13910) in each of the management zones.

Id. at 4. According to the National Technical Team (2011:5), "This document provides the latest science and best biological judgment to assist in making management decisions." In short, this document represents the expert opinion of the Bureau of Land Management regarding measures necessary to address the inadequacy of regulatory mechanisms that has been identified by the USFWS, and the best available science regarding this topic. Of all of the subsequent science that has emerged since the December 2011 release of the National Technical Team's recommendations, none contradicts its findings. Manier et al. (2014) is a USGS publication that provides a more recent analysis of the available science on lek buffers, and also represents agency scientific expertise; the recommendations of the National Technical Team are consistent with this review article.

Importantly, the List of Preparers for this DEIS includes no sage grouse experts. While not all National Technical Team members (including both federal and state wildlife officials) were sage grouse experts or even credentialed scientists, at least six team members were published in the sage grouse scientific literature. The National Technical Team Report therefore continues to represent the BLM's authoritative expert opinion on sage grouse conservation and the magnitude and mitigation of human-caused impacts to sage grouse populations and habitats.

The EIS references a study by Doherty et al. (2016) that provides current spatial analysis of sage grouse population density. These are GIS data that could (and should) be compared against the withdrawal areas identified under each alternative, to see what percentage of sage grouse populations would be encompassed by mineral withdrawal under each alternative. This analysis has been done for lek locations (*see, e.g.,* DEIS at Figure 3-18), and should be done for population density as well as this layer would be much more information-rich and informative than simple lek locations. Authors of this study include federal scientists Kevin Doherty (USFWS) and Peter Coates (USGS), so these GIS data should be readily available to

BLM through a simple request to a sister federal agency. BLM can address this important deficiency by performing the requisite spatial analysis in the Final EIS.

The DEIS Fails NEPA's Cumulative Impact Analysis Requirements

As BLM correctly notes, "Currently, sagebrush communities and greater sage-grouse continue to be at risk from multiple sources across multiple scales (Manier et al. 2013)." DEIS at 3-157. All of the different types of impacts noted have a potentially significant individual and cumulative impacts. Sagebrush Focal Areas are predominantly grazed by livestock, which can have a major negative impact on sage grouse, particularly through reducing grass height below the 7" threshold that sage grouse require for optimal nest survival, and by causing and spreading cheatgrass infestations. Transmission lines cause avoidance of surrounding habitats and artificially increase raptor predation. Oil and gas development has a variety of negative impacts, disturbing and displacing birds from lands near roads and wellpads. Road networks similarly disturb and displace sage grouse from adjoining habitats. Insecticides and herbicides sprayed aerially can kill or sicken sage grouse. Cheatgrass infestations lower habitat productivity almost to zero for sage grouse and can result in frequent range fires that eliminate the sagebrush requisite for grouse survival.

Despite all of these multiple cumulative impacts, there is no analysis of how these factors act together within SFAs to suppress sage grouse populations or prevent their recovery to healthy populations levels, less still any analysis of how the exploration and mining activity associated with each alternative would interact with these existing impacts within SFAs to provide a comparative assessment of sage grouse survival and recovery by alternative. *See* DEIS at 4-105. BLM concedes that the various alternatives will entail different number of mines and exploration projects, and that at the project scale these can have a significant impact on sage grouse. BLM must therefore provide analysis combining the direct impacts of different alternatives with the impacts of other ongoing or reasonably foreseeable impacts to sage grouse so that the comparative prognosis for sage grouse and their habitats can be compared between alternatives.

Conclusions

The USFWS specifically relied on the withdrawal of the SFA lands from mineral development in its decision to find the species "not warranted" for Endangered Species Act listing. 80 Fed. Reg. 59857. It is therefore imperative that the Department of Interior follow through on the SFA mineral withdrawals in an equal or greater measure compared to those on which the USFWS relied to make their listing determination. We support a mineral withdrawal for important sage grouse habitats that is as strong, comprehensive, and geographically extensive as is necessary to guarantee the maintenance and recovery of sage grouse in the most densely occupied remaining habitats.

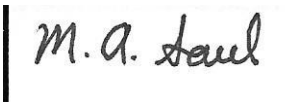
In order to fully come into compliance with the recommendations of the BLM's own National Technical Team (2011), the mineral withdrawal should apply to all forms of mineral location, leasing, and sales. The scope of the mineral withdrawal should not be limited to the 10 million acres proposed in the Federal Register notice, but should be expanded to include all "stronghold" areas identified by the U.S. Fish and Wildlife Service in its memorandum to the BLM of October 27, 2014, and all Sagebrush Focal Areas designated under the federal

planning effort. The withdrawal should encompass all forms of federal mineral location, leasing, and sales, and not be limited to locatable minerals only.

In addition, federal agencies should require that all existing federal mining claims and mineral leases falling within the boundaries of the proposed mineral withdrawal be examined for validity before permitting any surface-disturbing activity to occur on them, as part of this decision-making process. There is little doubt that many mining claims and mineral leases in the important sage grouse habitats in question have not had the due diligence performed by their respective holders to maintain them in a legally valid state. Such legally invalid claims and leases should be eliminated from existence.

Thank you for the opportunity to comment, and we will look forward to having the concerns raised in these comments addressed in detail in the response to comments for this EIS.

Respectfully yours,



Michael Saul

Center for Biological Diversity

From:	Laura King
To:	blm_wo_foia@blm.gov
Cc:	"Shannon Hughes"; "Jeremy Nichols"; "Erik Schlenker-Goodrich"; "Brian Sweeney"
Subject:	Freedom of Information Act Request: SO 3349
Date:	Tuesday, April 25, 2017 5:40:28 PM
Attachments:	FOIA Request_Zinke SO BLM WO_FINAL.pdf

Dear Mr. Witt:

On behalf of WildEarth Guardians, I submit the attached request for information relating to Secretarial Order 3349. The attached document also includes a fee waiver request. Please do not hesitate to contact me if I can provide any clarification or assistance to BLM as the agency responds to this request. This request will also be arriving by certified mail.

Thank you.

Best,

Laura

Laura King

Staff Attorney

Western Environmental Law Center

103 Reeder's Alley

Helena, MT 59601

(406) 204-4852 (tel.)

king@westernlaw.org

www.westernlaw.org

Western Environmental Law Center

Headquarters
1216 Lincoln Street
Eugene, Oregon 97401
(541) 485-2471
info@westernlaw.org

Offices
Helena, Montana
Santa Fe, New Mexico
Taos, New Mexico
Portland, Oregon
Seattle, Washington

Defending the West www.westernlaw.org

April 25, 2017

Sent via Email and USPS Certified Mail Return Receipt Requested

Ryan Witt, FOIA Officer
Bureau of Land Management
IRM Governance Division
Attn: FOIA, Washington Office Coordinators
MS-WO-640
1849 C Street, NW
Washington, DC 20240
blm_wo_foia@blm.gov

FREEDOM OF INFORMATION ACT REQUEST

Dear Mr. Witt:

This is a request under the Freedom of Information Act (FOIA), 5 U.S.C. § 552, as amended. I make this request on behalf of WildEarth Guardians ("Guardians"). This FOIA request is related to the FOIA request submitted by Guardians on April 11, 2017 requesting all records relating to SO 3348 and 3349. This FOIA request, which seeks BLM records related to specific portions of SO 3349, is new and is submitted now in light of deadlines contained in SO 3349.

REQUESTED RECORDS

I. Guardians requests all "agency records" of the Bureau of Land Management associated with:

> Section 5(c)(ii) of Secretary of the Interior Ryan Zinke's Secretarial Order 3349 ("SO 3349"), ordering the Director of the Bureau of Land Management ("BLM") to "review the final rule entitled, 'Waste Prevention, Production Subject to Royalties, and Resource Conservation,' 81 Fed. Reg. 83008 (January 17, 2017), and report to the Assistant Secretary – Land and Minerals Management on whether the rule is fully consistent with the policy set forth in Section 1 of the March 28, 2017 E.O."

The request in (I) includes, but is not limited to, the following agency records:

- The final report(s) or briefing(s) and any drafts thereof prepared by the BLM Director or his staff members pursuant to Section 5(c)(ii) of SO 3349.
- Intra-agency records within the BLM (between or among any BLM employee(s), staff member(s), official(s), or consultant(s)) regarding or associated with the direction in Section 5(c)(ii) of SO 3349.
- Intra-department records within the Department of the Interior ("DOI"), including records between or among any DOI employee(s), staff member(s), official(s), or consultant(s), as well as between or among DOI and BLM employee(s), staff member(s), official(s), or consultant(s) regarding or associated with the direction in Section 5(c)(ii) of SO 3349.
- Inter-agency or inter-department records between or among BLM or DOI employee(s), staff member(s), official(s), or consultant(s) and any other government agency or department or its employee(s), staff member(s), official(s), or consultant(s) regarding or associated with the direction in Section 5(c)(ii) of SO 3349.
- Records between or among any Executive Office of the President (e.g., the White House Office, the Office of the President, the Office of the Vice President) and any BLM or DOI employee(s), staff member(s), official(s), or consultant(s) regarding or associated with the direction in Section 5(c)(ii) of SO 3349.
- External records between or among any BLM or DOI employee(s), staff member(s), official(s), or consultant(s) and any non-government entity (e.g., consultants, members of the public, or outside companies, organizations, or groups) regarding or associated with the direction in Section 5(c)(ii) of SO 3349.
- Records between or among any BLM or DOI employee(s), staff member(s), official(s), or consultant(s), including Secretary Zinke, and the United States Senate, any United States Senator(s), or any United States Senate Committee regarding or associated with the direction in Section 5(c)(ii) of SO 3349.

II. Guardians requests all "agency records" of the Bureau of Land Management associated with:

> Section 5(c)(v) of SO 3349, ordering that "[w]ithin 21 days, each bureau and office head shall provide to the Deputy Secretary, through their Assistant Secretary, a report that identifies all existing Department Actions issued by their bureau or office that potentially burden (as that term is defined in the March 28, 2017 E.O.) the development or utilization of domestically produced energy resources, with particular attention to oil, natural gas, coal, and nuclear resources."

The request in (II) includes, but is not limited to, the following agency records:

- The final report(s) or briefing(s) and any drafts thereof prepared by the BLM Director or his staff members pursuant to Section 5(c)(v) of SO 3349.
- Intra-agency records within the BLM (between or among any BLM employee(s), staff member(s), official(s), or consultant(s)) regarding or associated with the direction in Section 5(c)(v) of SO 3349.
- Intra-department records within the Department of the Interior ("DOI"), including records between or among any DOI employee(s), staff member(s), official(s), or consultant(s), as well as between or among DOI and BLM employee(s), staff member(s),

official(s), or consultant(s) regarding or associated with the direction in Section 5(c)(v) of SO 3349.

- Inter-agency or inter-department records between or among BLM or DOI employee(s), staff member(s), official(s), or consultant(s) and any other government agency or department or its employee(s), staff member(s), official(s), or consultant(s) regarding or associated with the direction in Section 5(c)(v) of SO 3349.
- Records between or among any Executive Office of the President (e.g., the White House Office, the Office of the President, the Office of the Vice President) and any BLM or DOI employee(s), staff member(s), official(s), or consultant(s) regarding or associated with the direction in Section 5(c)(v) of SO 3349.
- External records between or among any BLM or DOI employee(s), staff member(s), official(s), or consultant(s) and any non-government entity (e.g., consultants, members of the public, or outside companies, organizations, or groups) regarding or associated with the direction in Section 5(c)(v) of SO 3349.
- Records between or among any BLM or DOI employee(s), staff member(s), official(s), or consultant(s), including Secretary Zinke, and the United States Senate, any United States Senator(s), or any United States Senate Committee regarding or associated with the direction in Section 5(c)(v) of SO 3349.

III. Guardians requests all "agency records" of the Bureau of Land Management associated with:

> Section 5(b)(i) of SO 3349, ordering that "[w]ithin 14 days of the date of this Order, each bureau and office head shall provide to the Deputy Secretary, through their Assistant Secretary, all Department Actions they have adopted, or are in the process of developing, relating to the Presidential Actions, reports, and guidance that are rescinded by the March 28, 2017 E.O. . . ."

The request in (III) includes, but is not limited to, the following agency records:

- The list of all actions related to climate change policies, and any other final document(s) or briefing(s) and any drafts thereof, prepared by BLM pursuant to Section 5(b)(i) of SO 3349.
- Intra-agency records within the BLM (between or among any BLM employee(s), staff member(s), official(s), or consultant(s)) regarding or associated with the direction in Section 5(b)(i) of SO 3349.
- Intra-department records within the Department of the Interior ("DOI"), including records between or among any DOI employee(s), staff member(s), official(s), or consultant(s), as well as between or among DOI and BLM employee(s), staff member(s), official(s), or consultant(s) regarding or associated with the direction in Section 5(b)(i) of SO 3349.
- Inter-agency or inter-department records between or among BLM or DOI employee(s), staff member(s), official(s), or consultant(s) and any other government agency or department or its employee(s), staff member(s), official(s), or consultant(s) regarding or associated with the direction in Section 5(b)(i) of SO 3349.
- Records between or among any Executive Office of the President (e.g., the White House Office, the Office of the President, the Office of the Vice President) and any BLM or

DOI employee(s), staff member(s), official(s), or consultant(s) regarding or associated with the direction in Section 5(b)(i) of SO 3349.

- External records between or among any BLM or DOI employee(s), staff member(s), official(s), or consultant(s) and any non-government entity (e.g., consultants, members of the public, or outside companies, organizations, or groups) regarding or associated with the direction in Section 5(b)(i) of SO 3349.
- Records between or among any BLM or DOI employee(s), staff member(s), official(s), or consultant(s), including Secretary Zinke, and the United States Senate, any United States Senator(s), or any United States Senate Committee regarding or associated with the direction in Section 5(b)(i) of SO 3349.

For purposes of this request, "agency records" is consistent with the meaning of the term under FOIA. This includes, but is not limited to, documents of any kind including electronic as well as paper documents, emails, writings (handwritten, typed, electronic or otherwise produced, reproduced, or stored), correspondence, letters, memoranda, reports, consultations, notes, recordings, telephone conversation recordings, voice mails, telephone logs, messages, instant messages, G-chats, text messages, chats, telefaxes, photographs, videos, meeting notes or minutes, and electronic and magnetic recordings of meetings. All of the foregoing is included in this request if it is in BLM's possession and control. If such recordings are no longer under the control of BLM but were at any time, please refer this request to the relevant federal agency or agencies.

This request is not meant to exclude any other records that, although not specially requested, are reasonably related to the subject matter of this request. Please provide responsive records in digital format whenever possible.

*** * ***

Please identify and inform us of all responsive or potentially responsive records within 20 working days as required by FOIA, 5 U.S.C. § 552(a)(6)(A)(i), and the basis of any claimed exemptions or privilege, including the specific responsive or potentially responsive records(s) to which such exemption or privilege may apply. *See Citizens for Responsibility and Ethics in Washington v. Federal Election Com'n*, 711 F.3d 180, 182-183 (D.C. Cir. 2013) (holding that the agency must identify the exemptions it will claim with respect to any withheld documents within the time frame prescribed by FOIA). The Supreme Court has stated that FOIA establishes a "strong presumption in favor of disclosure" of requested information, and that the burden is on the government to substantiate why information may not be released under FOIA's limited exemptions. *Department of State v. Ray*, 502 U.S. 164, 173 (1991). Congress affirmed these tenets of FOIA in legislation as recently as December 2007, stating that government remains accessible to the American people and "is always based not upon the 'need to know' but upon the fundamental 'right to know.'" Public Law 110-175, 121 Stat. 2524, 2525 (Dec. 31, 2007).

If your office takes the position that any portion of the requested records is exempt from disclosure, we request that you provide us with an index of those records as required under *Vaughn v. Rosen*, 484 F.2d 820 (D.C. Cir. 1973), with sufficient specificity "to permit a reasoned judgment as to whether the material is actually exempt under FOIA." *Founding Church of*

Scientology v. Bell, 603 F.2d 945, 959 (D.C. Cir. 1979). A *Vaughn* index must (1) identify each document or portion of document withheld; (2) state the statutory exemption claimed; and (3) explain how disclosure of the document or portion of document would damage the interests protected by the claimed exemption. *See Citizens Comm'n on Human Rights v. FDA*, 45 F.3d 1325, 1326 n.1 (9th Cir. 1995). "The description and explanation the agency offers should reveal as much detail as possible as to the nature of the document," in order to provide "the requestor with a realistic opportunity to challenge the agency's decision." *Oglesby v. U.S. Dept. of Army*, 79 F.3d 1172, 1176 (D.C. Cir. 1996). Such explanation will be helpful in deciding whether to appeal a decision to withhold documents and may help to avoid unnecessary litigation.

In the event that some portions of the requested records are properly exempt from disclosure, please disclose any reasonably segregable, non-exempt portions of the requested records. *See* 5 U.S.C. §552(b). If it is your position that a document contains non-exempt segments and that those non-exempt segments are so dispersed throughout the documents as to make segregation impossible, please state what portion of the document is non-exempt and how the material is dispersed through the document. *See Mead Data Central v. U.S. Department of the Air Force*, 455 F.2d 242, 261 (D.C. Cir. 1977). Claims of non-segregability must be made with the same detail as required for claims of exemption in a *Vaughn* index. If a request is denied in whole, please state specifically that it is not reasonable to segregate portions of the record for release.

FOIA requires federal agencies to make their records "promptly available" to any person who makes a proper request for them. 5 U.S.C. § 552(a)(3)(A) (as amended by OPEN Government Act of 2007, Pub. L. No. 110-175, 121 Stat. 2524).

Presumption of Openness and "Foreseeable Harm" Standard

On his first full day in office President Obama demonstrated his commitment to the ideals of transparency and openness by issuing a Memorandum to the heads of all Executive Branch Departments and agencies by calling on them to "renew their commitment to the principles embodied in FOIA." *See* Presidential Memorandum for Heads of Executive Departments and Agencies Concerning the FOIA, 74 Fed. Reg. 4683 (Jan. 21, 2009). The President directed all agencies to administer the FOIA with a clear presumption in favor of disclosure, to resolve doubts in favor of openness, and to not withhold information based on "speculative or abstract fears." *Id.* In addition, the President called on agencies to ensure that requests are responded to in "a spirit of cooperation," that disclosures are timely made, and that modern technology is used to make information available to the public even before a request is made. *Id.*

In accordance with the President's directives, on March 19, 2009, Attorney General Holder issued new FOIA guidelines, calling on all agencies to reaffirm the government's "commitment to accountability and transparency." Memorandum from Att'y Gen. Eric Holder for Heads of Executive Departments and Agencies (Mar. 19, 2009), *available at* http://www.justice.gov/ag/foia-memo-march2009.pdf. The Guidelines stress that the FOIA is to be administered with the presumption of openness called for by the President. *Id*. at p. 1.

The Attorney General "strongly encourage[d] agencies to make discretionary disclosures

of information." *Id*. He specifically directed agencies not to withhold information simply because they may do so legally and to consider making partial disclosures when full disclosures are not possible. *Id*. He also comprehensively addressed the need for each agency to establish effective systems for improving transparency. *Id*. at p. 2. In doing so he emphasized that "[e]ach agency must be fully accountable for its administration of the FOIA." *Id*.

In issuing these new guidelines, Attorney General Holder established a new "foreseeable harm" standard for defending agency decisions to withhold information. Under this new standard, the U.S. Department of Justice will defend an agency's denial of a FOIA request "only if (1) the agency reasonably foresees that disclosure would harm an interest protected by one of the statutory exemptions, or (2) disclosure is prohibited by law." *Id*. As a result, "agencies must now include the 'foreseeable harm' standard as part of the FOIA analysis at the initial request stage and the administrative appeal stage." Department of Justice Guide to the FOIA (2009), p. 25, available at http://www.justice.gov/oip/foia_guide09.htm.

Request for Fee Waiver

FOIA was designed to grant a broad right of access to government information, with a focus on the public's "right to be informed about what their government is up to," thereby "open[ing] agency action to the light of public scrutiny." *U.S. Dep't of Justice v. Reporters Comm. for Freedom of Press*, 489 U.S. 749, 773-74 (1989) (internal quotation and citations omitted). A key component of providing public access to those records is FOIA's fee waiver provision, 5 U.S.C. § 552(a)(4)(A)(iii), which provides that "[d]ocuments shall be furnished without any charge or at a [reduced] charge . . . if disclosure of the information is in the public interest because it is likely to contribute significantly to public understanding of the operations or activities of the government and is not primarily in the commercial interest of the requester."

FOIA's fee waiver requirement is to be "liberally construed." *Judicial Watch, Inc. v. Rossotti*, 326 F.3d 1309, 1310 (D.C. Cir. 2003); *Forest Guardians v. U.S. Dept. of Interior*, 416 F.3d 1173, 1178 (10th Cir. 2005). The fee waiver amendments of 1986 were designed specifically to provide organizations such as Guardians access to government documents without the payment of fees. As one Senator stated, "[a]gencies should not be allowed to use fees as an offensive weapon against requesters seeking access to Government information . . ." 132 Cong. Rec. S. 14298 (statement of Senator Leahy). Indeed, FOIA's waiver provision was intended "to prevent government agencies from using high fees to discourage certain types of requesters and requests, in clear reference to requests from journalists, scholars, and . . . non-profit public interest groups." *Better Gov't Ass'n v. Dep't of State*, 780 F.2d 86, 93-94 (D.C. Cir. 1986) (quoting *Ettlinger v. FBI*, 596 F. Supp. 867, 876 (D. Mass. 1984)).

Guardians, a non-commercial and public-interest requester, hereby requests a waiver of all fees associated with this request because disclosure "is likely to contribute significantly to public understanding of the operations or activities of the government and is not primarily in the commercial interest of the requester." 5 U.S.C. § 552(a)(4)(A)(iii); *see also* 43 C.F.R § 2.45. This request satisfies both statutory and regulatory requirements for granting a fee waiver,

including fees for search, review, and duplication.[1] Below, stated first in bold, are the criteria the BLM considers in assessing requests for fee waivers, followed by an explanation of Guardians' satisfaction of those requirements. *See* 43 C.F.R § 2.48.[2] Fee waiver requests must be evaluated based on the face of the request. *See Citizens for Responsibility & Ethics in Washington v. U.S. Dep't of Justice,* 602 F. Supp. 2d 121, 125 (D.D.C. 2009).

(1) The subject of Guardians' request concerns identifiable operations or activities of the Federal Government:

The subject matter of the requested records directly and specifically concerns identifiable operations or activities of the federal government, with a connection that is direct and clear, not remote. Guardians requests documents related to Secretarial Order 3349, which was designed to implement the directive in the Executive Order of March 28, 2017 (E.O. 13783), to, *inter alia,* "review all existing regulations, orders, guidance documents, policies, and any other similar agency actions . . . that potentially burden the development or use of domestically produced energy resources."

The Department of Justice Freedom of Information Act Guide expressly concedes that "in most cases records possessed by a federal agency will meet this threshold" of identifiable operations or activities of the government. *See* Department of Justice Guide to the FOIA (2009), p. 25. This requirement is clearly met in this case.

(2) How disclosure is likely to contribute to public understanding of those operations or activities:

Disclosure of these records is likely to contribute to public understanding of the operations and activities of the federal government. BLM "must not make value judgments about whether the information at issue is 'important' enough to be made public; it is not the bureau's role to attempt to determine the level of public interest in requested information." 43 C.F.R. § 2.45(f).

(i) How the contents of the records are meaningfully informative:

The requested records are meaningfully informative about government operations or activities and are likely to contribute to an increased public understanding of those operations or activities. The records requested will provide Guardians with the ability to communicate to the public about the activities of the BLM, and, more broadly, of the federal government. The documents will give Guardians, and therefore the public, crucial insight into the way the federal

---

[1] Pursuant to FOIA, 5 U.S.C. § 552(a)(4)(A)(iv), no fee may be charged for the first two hours of search time or for the first one hundred pages of duplication.

[2] *See also* Department of Justice Fee Waiver Guidance to Agency Heads From Stephan Markman, Assistant Att'y Gen. (Apr. 2, 1987) (advising agencies of factors to consider when construing fee waivers), *available at* http://www.justice.gov/oip/foia_updates/Vol_VIII_1/viii1page2.htm.

government intends to manage energy development on public lands. Regarding this issue, the actions and assessments of the BLM, and the actions and assessments of other branches of the federal government which would be revealed by records in the possession of BLM, are of concern to the public. Disclosure of the requested records will enhance the public's knowledge of this issue and support public oversight of federal agency operations.

These documents are not currently in the public domain. Their release is "likely to contribute" to better public understanding of federal government's management of public lands. The public is always well served when it knows how government activities, particularly matters touching on legal and ethical questions, have been conducted. *See Judicial Watch*, 326 F.3d at 1314 ("[T]he American people have as much interest in knowing that key [agency] decisions are free from the taint of conflict of interest as they have in discovering that they are not.").

(ii) The logical connection between the content of the records and the operations or activities:

The requested records directly concern the operations or activities of the federal government.

(iii) How disclosure will contribute to the understanding of a reasonably broad audience of persons interested in the subject, as opposed to your individual understanding:

The public currently does not have the ability to fully evaluate the actions or inactions of the federal government regarding the management of public lands. Disclosure of these records will contribute to the understanding of a reasonably broad audience of persons interested in the subject because we will disseminate the information we receive to a large audience of interested persons. Once the information is made available, it will be analyzed and presented to the public in a manner that will meaningfully enhance the public's understanding of this issue.

(iv) Your identity, vocation, qualifications, and expertise regarding the requested information and information that explains how you plan to disclose the information in a manner that will be informative to the understanding of a reasonably broad audience of persons interested in the subject, as opposed to your individual understanding:

WildEarth Guardians is a nonprofit organization dedicated to environmental protection. WildEarth Guardians protects and restores wild places, wildlife, and wild rivers in the American West. Through its Climate and Energy Program, Guardians works to sustain a transition from fossil fuels to clean energy in order to safeguard the American West.

WildEarth Guardians regularly utilizes FOIA to obtain, analyze, and disseminate information and data regarding BLM actions and policy. For example, WildEarth Guardians has utilized FOIA to obtain records related to BLM's federal coal leasing activities in Wyoming and has disseminated this information through the media, its own website, and through other forms of public commentary. Guardians most recently utilized FOIA to obtain and disseminate

information regarding BLM management of oil and gas resources in New Mexico. This information was related to the agency's decision to abruptly change the location of a planned oil and gas lease sale. The responsive FOIA documents have been shared with the media and have been reported on in various news stories.

Further, WildEarth Guardians regularly utilizes FOIA to obtain, analyze, and disseminate information and data regarding other federal agency actions and is consistently granted fee waivers from these agencies. Just in the last five years, Guardians has been granted fee waivers in conjunction with FOIA requests to the U.S. Environmental Protection Agency, U.S. Office of Surface Mining Reclamation and Enforcement, U.S. Forest Service, U.S. Fish and Wildlife Service, and U.S. Bureau of Reclamation. In granting WildEarth Guardians' requests for fee waivers, these agencies have acknowledged Guardians' ability to obtain, analyze, and disseminate information to a reasonably broad audience.

(v) Your ability and intent to disseminate the information to a reasonably broad audience of persons interested in the subject (for example, how and to whom do you intend to disseminate the information):

Guardians has the ability and intention to disseminate the information requested to the public and its many members and supporters. Therefore, the disclosure of the requested documents will contribute to the understanding of a reasonably broad audience of persons interested in the subject.

Guardians plans to disseminate the information it obtains pursuant to this FOIA request in various effective ways, including through its website, newsletter, press releases, Facebook page, public education events, comments on proposed agency actions, and other public interest advocacy. Guardians' staff will first analyze and digest the documents. The information will then be disseminated to Guardians' members and supporters, members of other conservation organizations, as well as other interested members of the public.

(3) How disclosure is likely to significantly contribute to the understanding of a reasonably broad audience of persons interested in the subject, as opposed to your individual understanding:

(i) Whether the information being requested is new:

The information being requested is new. Although the full contents of the requested records are currently unknown to us, Guardians does not request any records previously provided to us by the Government.

(ii) Whether the information would confirm or clarify data that has been released previously:

The information Guardians requests has not, to our knowledge, been released previously.

(iii) How disclosure will increase the level of public understanding of the

operations or activities of the Department or a bureau that existed prior to disclosure:

Because this information is not currently in the public domain, disclosure of these records will increase the level of public understanding of the operations or activities of DOI and BLM that existed prior to disclosure. Guardians will disseminate the information obtained from this FOIA request to a large public audience, as explained above, and will help the public understand the information in a simple and informative way.

(iv) Whether the information is already publicly available:

The information Guardians requests is not, to our knowledge, publicly available. The Government may omit sending us requested records that are available in publicly accessible forums such as on the internet or that are routinely available at public or university libraries. However, please provide us with adequate references and/or website links so that we may obtain these materials on our own.

(4) How the public's understanding of the subject in question will be enhanced to a significant extent by the disclosure:

The public's understanding of the federal government's management of public lands will be enhanced to a significant extent by the disclosure of these records. The directives in Secretarial Order No. 3349 have the potential to create a dramatic shift in the way the Department of the Interior manages energy development on public lands. For example, depending on which policies or actions are deemed to "burden" energy development, public access, wildlife, and a range of public land recreation activities could be at risk. The public currently does not have the ability to evaluate the actions or inactions of DOI or BLM regarding management decisions on public lands as directed by Secretarial Order No. 3349.

Guardians' dissemination of the information obtained pursuant to this FOIA request will enhance the public's understanding of this issue because this information is not currently available to the public. *See Federal CURE*, 602 F. Supp. 2d at 205 (the existing public availability of the information is weighed when determining the degree of significance that will be derived from the disclosure of the information) (citing *Forest Guardians*, 416 F.3d at 1181). As described above, Guardians will disseminate the information it obtains pursuant to this FOIA in various effective ways, including through its website, newsletter, press releases, Facebook page, and public education events. Furthermore, the information obtained through this FOIA request will be used to contribute to one or more of the following: public interest litigation, petitions, newsletters, public presentations, e-mail and postal mail publications, press releases, and local and national news stories.

Given Guardians' positions and abilities, disclosure will lead to a significant enhancement of the public's understanding of the Government operations and activities at issue.

(5) Any commercial interest that would be furthered by the requested disclosure:

Guardians has no commercial, trade, or profit interest that would be furthered by the requested disclosure. Guardians is a tax-exempt organizations under section 501(c)(3) of the Internal Revenue Code. As such, Guardians has no commercial interests. The requested records will be used in the furtherance of Guardians' mission as an education and advocacy group to protect and restore the natural environment.

Guardians, a non-profit organization, has no commercial interests and will realize no commercial benefit from the release of the requested information. Therefore, no assessment of the magnitude of the interest is required. *See* 43 C.F.R. § 2.48(b)(2)-(3).

Conclusion

Given Guardians' demonstrably successful efforts at educating the public on environmental issues, and the fact that their education programs have significantly contributed to an understanding of Government operations and activities, it is clear that Guardians is entitled to a fee waiver. *See* 43 C.F.R § 2.48. In the event that your agency denies Guardians a fee waiver, please send a written explanation for the denial along with a cost estimate. Please contact us for authorization before incurring any costs in excess of $50.

I look forward to your determination on this FOIA request within twenty days, as required by FOIA, 5 U.S.C. § 552(a)(6)(A)(i). The twenty-day statutory deadline is also applicable to Guardians' fee waiver request. *See*, *e.g.*, *Judicial Watch, Inc. v. Rossotti*, 326 F.3d 1309, 1310 (D.C. Cir. 2003) (finding where an agency "fails to answer the [fee waiver] request within twenty days," judicial review is appropriate).

Please direct all correspondence and responsive records to counsel for WildEarth Guardians:

Laura King, Staff Attorney
Western Environmental Law Center
103 Reeder's Alley
Helena, Montana 59601
king@westernlaw.org

Thank you for your attention to this request. If you have any questions about the requested documents or the requested fee waiver, please do not hesitate to contact me at the phone number or email address below.

Sincerely,

Laura King, Attorney
Western Environmental Law Center
103 Reeder's Alley

Helena, Montana 59601
Email: king@westernlaw.org
Phone: (406) 204-4852

Attorney for WildEarth Guardians